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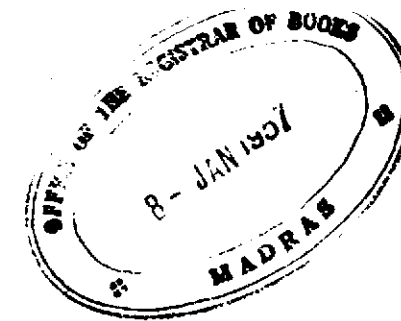
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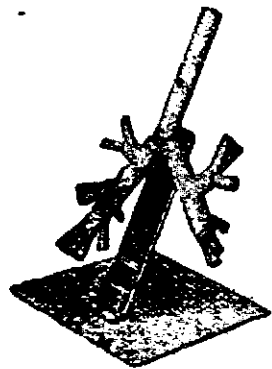


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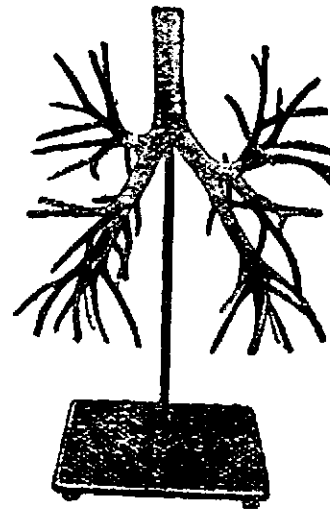
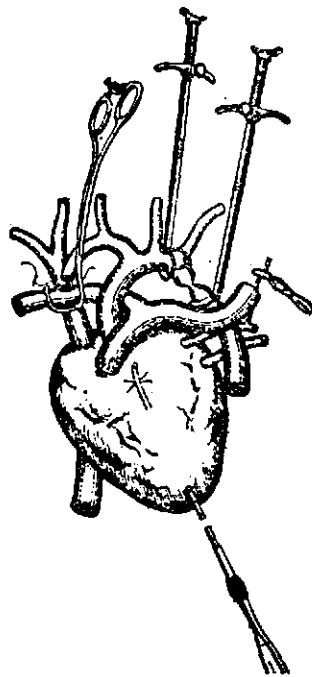
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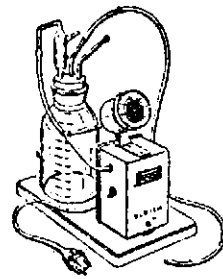
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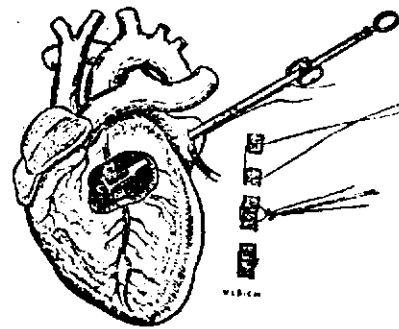


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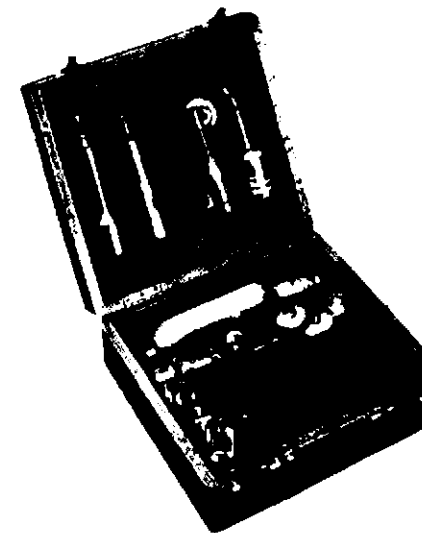
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On Page 336 of the Aug. 1956 issue of the Indian Journal of Surgery, in the article on "A method of trans-abdominal, trans-diaphragmatic vagotomy in the dog", the author wishes the following correction made:—

Pp. 336 (in the Addendum) in lines 14 of paragraph 1 and in lines 3, 6 and 13 of paragraph 2: please read "bursa" instead of "fossa".

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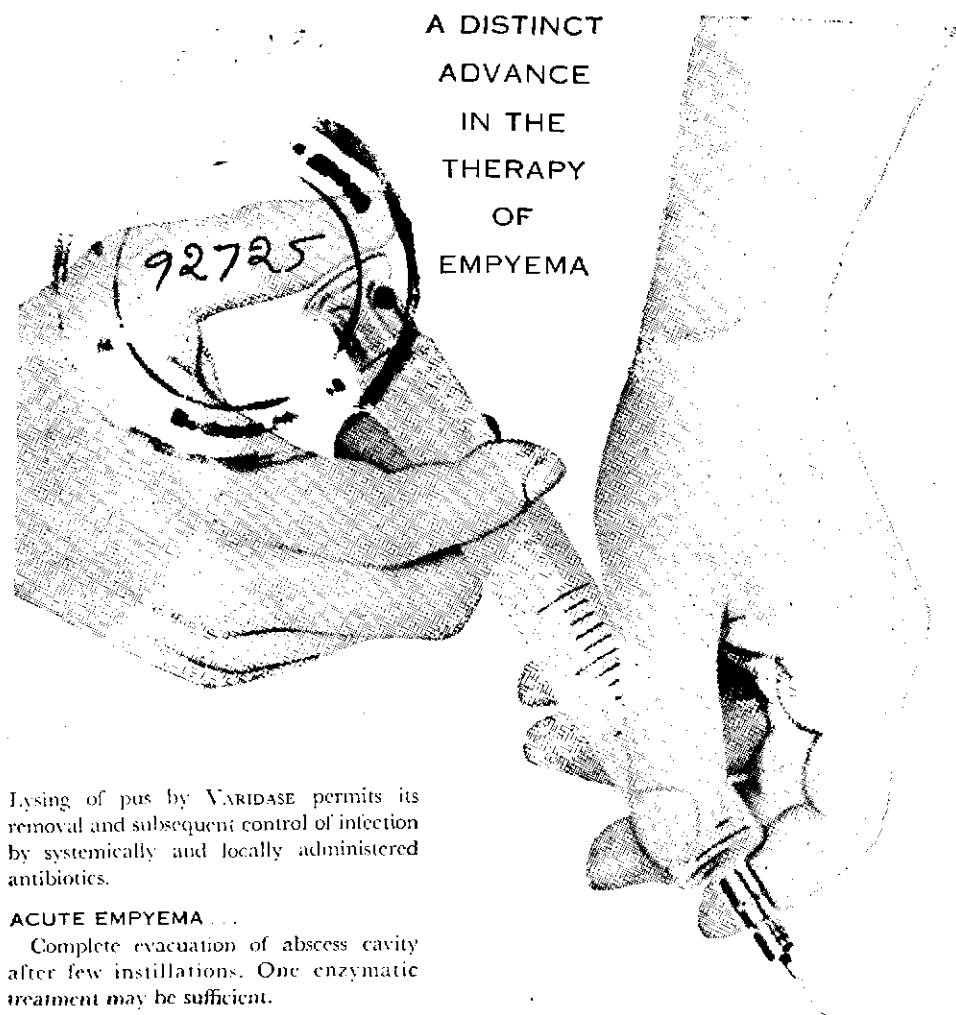
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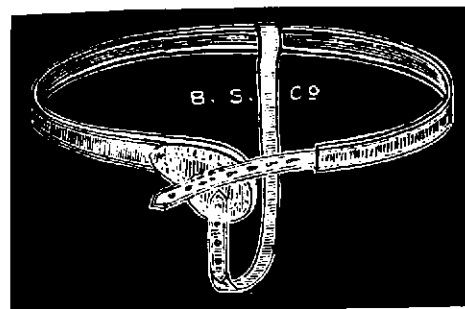


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NOTICE TO CONTRIBUTORS

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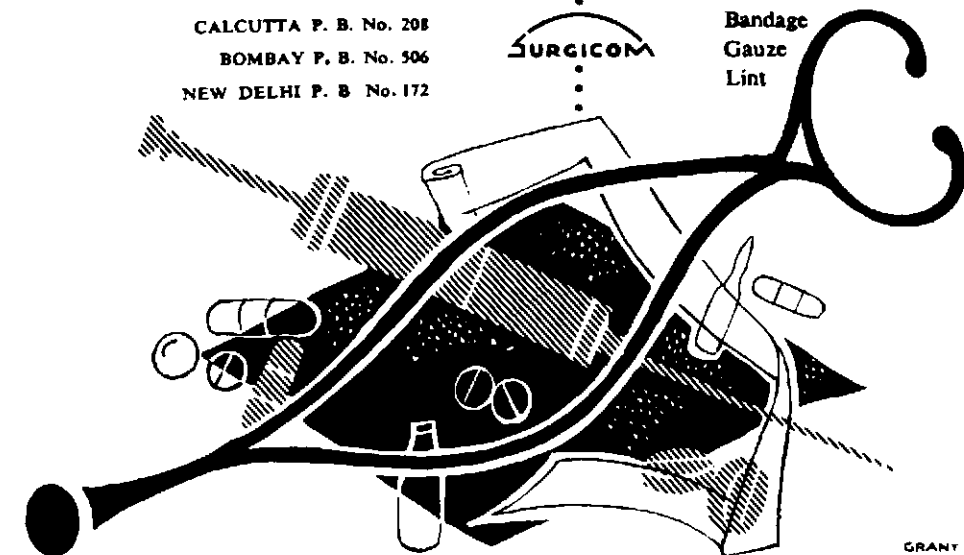
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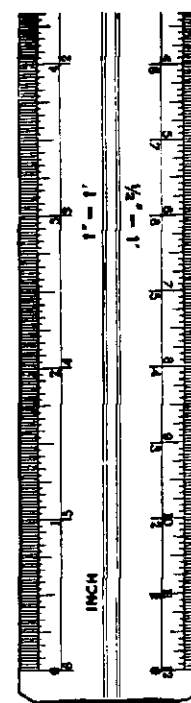
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THE INDIAN JOURNAL OF SURGERY

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OCTOBER 1956

No. 5

SURGICAL TREATMENT OF BRONCHIECTASIS*

(A report on 50 consecutive cases)

by YUDHVEER SACHDEVA, R. L. MANCHANDA, K. C. SARONWALA
and J. R. TALWAR, Amritsar.†

Surgery has established itself as a radical cure for many of the chest diseases. Bronchiectasis is one of them. Extirpation of the involved portions of the lungs and leaving behind enough healthy tissue to carry on the normal function of the body cures the patient of troublesome cough and stinking sputum and gives him a new lease of life. While conservative treatment alleviates the more distressing symptoms and perhaps prolongs life, in many instances it must be emphasized that a prospect of complete cure can be offered only to those patients in whom the diseased area of the lung has been successfully resected. Many studies particularly those of Roles and Todd¹, Perry and King² and Bradshaw et al³ leave no doubt that the prognosis of bronchiectasis without surgical treatment is poor indeed.

The object of this paper is to report our method in dealing with cases of bronchiectasis by operation, (pneumonectomy, lobectomy or segmental resection)—and to assess the results with particular reference to post-operative morbidity, mortality and follow up studies.

PART I — MATERIAL AND METHODS

The material covers all cases of bronchiectasis which have been operated upon during the last five years since the start of thoracic surgery in the department of Clinical Surgery, Medical College, Amritsar. It represents the results of team work.

* Paper read at the 17th Annual Conference of the Association of Surgeons of India at Amritsar, Dec. 1955.

† From the Department of Clinical Surgery, Medical College, Amritsar.

This consists of 50 consecutive resections for bronchiectasis. Most of the patients have been referred to us from the medical unit of this hospital. Suitable cases are selected out of a large number of patients attending the chest clinic. However, some patients are also referred to us by physicians from outside Amritsar.

Age and Sex:

Table I shows the age groups. The youngest patient in the series was 5 years old and the oldest 49 years. Majority of the patients were between 10—30 years of age at the time of admission.

Out of 50 patients, 41 were males and 9 females. Chesterman³ reports 114 cases of bronchiectasis out of which 66 were males and 48 females while Lindskog and Hubbell⁵ report 215 cases out of which 124 were males and 91 females.

TABLE I
AGE OF PATIENTS

Age in years	At onset No. of cases	At admission No. of cases
0 — 10	23	3
10 — 20	15	16
20 — 30	8	22
30 — 40	2	6
40 — 50	2	3

Causation:

A detailed examination of case records and operation notes of patients revealed a few important findings. As to how far these are related to pathogenesis of the

disease is difficult to assess. Table No. II shows the various factors noticed.

TABLE II
SHOWING PATHOGENESIS

i. Pneumonia (Lobar and broncho)	
In childhood	19
A few years ago (in adult age)	3
ii. Whooping cough (in infancy and childhood)	3
iii. Chicken pox (in childhood)	1
iv. Foreign body	2
v. Insidious onset without any obvious cause (Having started with cough and expectoration, preceded occasionally by fever or upper respiratory)	19
vi. Lung abscess	2
vii. Hydatid cyst	1

Segmental distribution of bronchiectasis :

Betts¹ observes that bronchiectasis tends to be found in a certain bronchial pattern. According to him, the most commonly involved are the basal segments of the lower lobe, left more than the right, then the lingula of left upper lobe and the middle lobe.

Segmental distribution of bronchiectasis presented in table III is based on a critical review of the bronchograms and operative findings.

TABLE III
SHOWING SEGMENTAL DISTRIBUTION OF BRONCHIECTASIS

Right Lung Lobes	Left Lung Lobes
Upper : Apical 3) Anterior 3) 10 Posterior 4)	Upper : Apicoposterior 17) 32 Anterior 15)
Middle : Lateral 7) 14 Medial 7)	Lingula : Superior 29) 59 Inferior 30)
Lower : Superior 7) Medial 7) Anterior 7) 35 Lateral 7) Posterior 7)	Lower : Superior 31) Antero-medial 36) 143 Lateral 38) Posterior 38)
Total 59	234

In this series out of the 293 segments involved, 234 segments were on the left side, out of which 143 segments were in the left lower lobe. Involvement of lingular segments alone or in combination with other segments stands second in this list. Superior segment of the lower lobe was diseased in majority of cases in which the lower lobe was involved.

In the series presented by Lindskog and Hubbel⁵ superior segment was free of disease in majority of cases.

Pre-operative management :

Many of our patients were young, fairly vigorous individuals who nevertheless had distressing, disagreeable symptoms ; but off and on there was a patient who came in a moribund state because of attacks of pneumonitis or development of secondary abscesses.

All the patients were put on a strict regime of postural drainage, controlled respiratory exercises and high protein diet for at least two weeks before being subjected to operative treatment. In some, antibiotics were given after sensitivity tests of the bacterial flora of the sputum had been made. It was sometimes remarkable to see a patient who came in a miserable state, having been reduced to skin and bones and coughing incessantly, becoming a vigorous individual with the aid of these methods.

Every case was examined by the E.N.T. specialist for sepsis. No attempt was made to eradicate the same before undertaking operation except when there was gross infection, the aim being to establish a clear air-way.

Bronchography :

Selection of bronchiectatic patients for surgical treatment can be done only on the basis of complete and adequate bronchographic studies. Although it is frequently possible to predict on plain roentgenograms of the chest that certain lobes are bronchiectatic, yet one cannot be certain which lobes or segments are not affected except

by complete mapping of the bronchial tree with radio-opaque medium. It is more important to outline the uninvolved portions than the involved ones.

Technique :

Bronchography was done under topical anaesthesia by instilling radio-opaque iodine solution through a Magill's endotracheal tube introduced under direct vision.

Usually one lung at a time was outlined, but in some of the cases both sides were outlined in one sitting. Metras catheters were used only when a single lobe was to be outlined.

In this series lipoidal has been used in 33 and Iodouron B in 2 and Dionosil (Aqueous) in 15 cases.

In order to determine the operative risk and ultimate prognosis we have not been able to undertake elaborate lung function studies, but have depended upon estimation of vital capacity, breath holding time and exercise tolerance index. In older individuals cardiovascular system had been properly investigated.

Operative procedure :

In our series we have throughout followed the technique advocated by Overholt⁶. On the day of operation early in the morning postural drainage is carried out to make the patient as dry as possible.

Intratracheal intubation in these cases is done under topical anaesthesia which helps in removing the secretions from the bronchi. The co-operation of the patient is utilized for putting him in prone position. The head and chest of the patient rests on an improvised stand while the pelvis is supported on an ordinary operation table. In our later operations we have supported the chest and pelvis separately on rubber cushion pillows on the operation table without using a stand.

TABLE IV
TYPES OF OPERATIONS DONE

	Right	Left
Pneumonectomy	3	13
Lobectomy - Upper lobe	1	2
Middle lobe	3	2
Lower lobe	4	11
		Lower lobe plus lingula 9
		Basal segment plus lingula 1
		Basal segments only 2
Total	11	40

(done on 50 patients)
One patient was operated on, twice.

Out of 51 resections, 40 were done on the left lung and 11 on the right one. Left lower lobe alone was involved in 11 cases and lower lobe with lingula in 9 cases. In one case lingula and basal segments were resected, the superior segment of the lower lobe was healthy.

In one case bronchiectasis was found in a sequestered portion of lung comprising basal segments only.

There were a few cases in our series where the lung was practically free of adhesions except in a small segment, while on the other hand in some cases the adhesions were so thick and firm that we had to spend a lot of time in separation of adhesions alone and some of them were so vascular that there was profuse bleeding. Thick adhesions were met with in cases where there had been secondary abscesses on bronchiectatic lesions. It has been observed that even where there were dense adhesions, mediastinal surface was comparatively free. In two patients after the separation of lung, the patients' condition did not allow any further progress of the operation and it had to be abandoned. Subsequently after four days the chest was

again opened and the rest of the operative procedure carried out without much difficulty. These patients did remarkably well in the second post-operative period.

The lung is palpated thoroughly to find out the involved areas. Pilcher⁸ lays stress on palpation of the lung and points out its great value on recognition of diseased segments which has sometimes revealed small segments of disease not outlined on the bronchogram. We are in full agreement with him.

It may be worthwhile mentioning here that majority of patients of the present series were "wet", and a large quantity of secretion had to be evacuated by the anaesthesiologist. We feel that prone position is a real help in the management of these patients.

The bronchial closure was done in all operations with interrupted cotton and the stump was covered with a flap of pleura in 14 cases only.

PART II — COMPLICATIONS AND RESULTS OF THERAPY

The following sections will be concerned with the incidence of various post-operative complications and their aetiology, operative mortality, late results of surgery and rehabilitation of these patients.

Post-operative management and complications:

In the post-operative care same measures are undertaken as after any major surgical procedure under general inhalation anaesthesia.

There are two problems, the one of keeping the air passages clear and the other of obliteration of the space created by excision of lung tissue.

The first is achieved by making the patient cough out the secretions. Because of pain the patients are very reluctant to cough but with encouragement, and assisting the patients by keeping light pressure on the operated area the sputum can be delivered out and passages kept clear.

Bronchoscopy may be needed to aspirate the secretions if the above mentioned measures fail, tracheotomy may have to be resorted to in desperate cases. We had to resort to bronchoscopic aspiration in only one case. In no case was tracheotomy done.

Complications:

Shock: Operative shock was encountered in three patients of this series. In each there was a different causative factor which is being briefly discussed.

In patient (G.S.4) the causative factor was the Thomson endobronchial blocker which got displaced and blocked the trachea resulting in cyanosis with consequent anoxia and shock. The removal of the blocker did not improve the patient enough to continue the operation, hence the chest was closed. In this case pulmonary artery had been already ligated before this complication occurred but the pulmonary vein and bronchial arteries were still intact. After closure of the chest wound and with further resuscitative measures the patient improved and was sent to the wards. He was operated upon four days later and this time the operation was completed without any incident and the patient made an uneventful recovery.

In the second patient (T.R.32) in whom pneumonectomy had to be done, the systolic blood pressure fell to 70 mm. There was a fairly large amount of blood lost owing to very dense adhesions. In spite of the resuscitative measures and stoppage of the operation for about half an hour the condition of the patient did not improve and ultimately the chest was closed with a drainage tube. This patient was operated upon four days later and pneumonectomy was completed.

In the third patient (B.S.3) the operative shock was of a transitory nature when the hilum of the lung was being dissected. This was most likely due to vagal reflex. The condition of the patient improved with resuscitative measures when lower lobe lobectomy was completed. This was one

of our earlier cases in this series and since then procaine is given intravenously at the time of this procedure whenever required and there has been no trouble since then.

Incidentally the first two cases mentioned above clearly point out the advantage of a two stage operation, when it is thought inadvisable to continue the operation. Persisting in efforts to finish the operation at the same sitting might result in a disastrous consequence.

Haemorrhage:

Usually there is some trickle of blood from the drainage tubes for a few hours after lobectomy or segmental resection. The usual collection in the drainage bottles is 200-300 c.c.s. which is replaced. However, in one of our patients in this series (J.S.28) there was massive loss of blood from the drainage tube in the immediate post-operative period. Within a short time the drainage bottle got filled and blood pressure fell to 85/60 mm. and pulse rate rose to 140 per minute. This blood loss was combated with transfusion and 4200 c.c. of blood was given to the patient which was run partly under pressure. Bleeding continued nearly for 20 hours although after eight hours the loss of blood became very much less and a total of 1875 c.c. of blood was lost in the drainage bottles. The only possible explanation in retrospect that we can put forth is that the bleeding occurred from the intercostal vessel which got injured during insertion of the posterior drainage tube through the intercostal space. This has come to our mind because in one of the later cases we discovered rather profuse bleeding from the injured intercostal vessel while the tube was being inserted, which was, however, caught in time and ligated.

Consolidation of Lung:

Consolidation of the lung of the same side was noticed in one case. The patient (S.S.24) developed signs of consolidation in the right upper lobe after middle lobe lobectomy which also cleared up with antibiotics. The patient however, reported for

follow up on many occasions and complained of some residual cough with expectoration and bronchography done later showed cystic cavities in the posterior segment of the upper lobe. He has been re-operated on and diseased portions removed.

Hyperpyrexia:

Three of our patients developed high temperature of over 104°F in the post-operative period, one (S.24) eight hours after, the second (M.S.33) seventeen hours after and the third (J.K.27) fifteen hours after the operation. The total white cell counts in these cases were within normal limits. This hyperpyrexia was controlled by hydrotherapy. These hyperpyrexia cases occurred during the summer months and now we keep these patients in an air conditioned room in the post-operative period.

Atelactasis:

In the post-operative period lobar atelactasis was detected in one case on the same side. The patient (D.L.S.14) developed dyspnoea and the breath sounds were distant. The patient was made to cough and Haight's⁴ method of aspiration was used.

Mental symptoms:

One patient (I.D.6) developed mental symptoms in the immediate post-operative period. The symptoms abated in a couple of weeks and he became normal. No definite cause could be ascribed for this complication.

Empyema and Broncho-pleural fistula:

In three of these cases there was a broncho-pleural fistula. All these cases were cured after drainage. In one case post-pneumonectomy thoracoplasty was also done.

Acute dilatation of stomach:

This was noticed in one patient (K.C.9) in whom the left basal segments were removed. A Ryle's tube was introduced and 3 pints of brownish fluid as well as large quantity of air was aspirated. The

condition of the patient improved and the gastric suction was continued for 24 hours through the indwelling tube. Further post-operative period was uneventful.

Oedema Lung :

Marked oedema lung with consequent dyspnoea was noticed in one case (I. S. 37). It was frequent and recurrent, patient being relieved for 8-10 hours after injection of atropine, oxygen inhalation and aided cough which brought out large quantity of frothy sputum. This state of affairs lasted for 5 days, when the symptoms abated. In three other patients (I.D. 6), (P.C. 9) and (J.K. 21) moderate degree of oedema of the lungs was also noticed but was controlled easily with the same measures.

Embolism :

One patient (G. S. 12) was found to have developed left homonymous hemianopia. This obviously resulted from an embolus which settled in the occipital region of the brain during the operative procedure. There was no improvement in his condition.

Results :

These cases are presented not for comparison with a larger and better series of others previously reported in the literature. We simply want to record our experience during the early period of development of this speciality in our department and to point out the difficulties and complications that were encountered.

The first pulmonary resection of this series was undertaken on 28th October, 1949 and since then we have been doing these cases in larger numbers. Luckily the operative mortality in our series has been nil. No doubt there has been no mortality, but the morbidity and hospital stay has been unusually prolonged in some of the cases. The main reason for this has been the run down condition of the patients who were economically very low and who had suffered from toxæmia and symptoms for a very long period. It takes quite a long

time to make them fit for operation; in some cases the patients have been in the wards for a couple of months before being subjected to operation. In spite of this handicap the patients have stood the operation very well after proper improvement in their health by physio-therapy and proper nourishment.

We have been very much impressed by the posture of the patients at the time of discharge and that has been due to the fact that physiotherapy was started from the third day of the operation and continued until discharge from the hospital. In the beginning corrective posture is maintained or the posture is corrected in the bed and later on arm exercises are also given. The patients had full movement of their upper extremity at the time of discharge from the hospital.

Follow up :

All the cases have been followed up in our follow up clinic.

TABLE V
PERIOD OF FOLLOW UP

Period for which followed	Number
For 5 years	1
For 4 years	3
For 3 years	10
For 2 years	14
For 1 year	8
Below one year	14
Total	50

TABLE VI
LATE RESULTS OF TREATMENT

Late Results	
1. Asymptomatic	40
2. Symptoms persisting	5
3. Deaths	3
4. Untraceable	2

Chestermann³ believes that the major cause of late post-operative morbidity is

spread of bronchiectasis to new areas of the lung. This, in his opinion, is more usual on the operated side but it may occur on the opposite side or both sides. In his series of 105 patients operated upon, bronchiectasis has recurred in 10 cases. In this series there is one instance where spread occurred to right upper lobe after middle lobe lobectomy. The cause was pneumonitis in the post-operative period.

Rosemond et al¹⁰ report persistence of cough in 41 cases in a series of 159 operated on for bronchiectasis. In all such cases residual pulmonary disease was the causative factor. In this series 5 cases are still complaining of cough with expectoration.

One (I. D. 6) died 1½ years after pneumonectomy due to lobar pneumonia. This was confirmed on post mortem examination. The second (K. R. 16) died 1½ years after right pneumonectomy. The third (K.P.S.37) died suddenly 6 months after a left lower lobe lobectomy. The deaths in these cases do not seem to be related to the operation.

Rehabilitation :

Rehabilitation is still a major problem of our country which requires a great deal of effort. Struggle for existence is very acute and it is extremely difficult for people who are handicapped to adjust themselves in the present set up. There are no special

TABLE VII
SYMPTOMS PERSISTING

Name	Symptoms	Cause	Remarks
1. O. P. 2	Slight Cough	Minimal bronchiectasis on the contralateral side.	
2. G. S. 12	Slight Cough	do.	
3. S. S. 23	Cough with expectoration upto 1½ oz. daily	Spread of disease to upper lobe after middle lobe lobectomy	Operated on again and Right upper lobe lobectomy done
4. J. S. 28	Cough & Expectoration	Disease in the left upper lobe.	Advised operation
5. J. L. 31	Cough with expectoration present	Disease on the contralateral side	

Keloid formation in scar was seen in 6 cases who had some itching and pain over the operation scar. Superficial X-ray exposure made them asymptomatic, and scars became thin and supple.

At the time of discharge and at subsequent follow up examinations, no obvious postural deformity was detected in any of the cases. Indeed it is gratifying to note that the patients are still maintaining their habit of taking breathing exercises after a lapse of 3-4 years after the operation.

Table VIII shows the later deaths in this series. There are three patients who died 6 months to 1½ years after the operation.

TABLE VIII
LATE DEATHS
(UNRELATED TO OPERAT)

Name	Period (After operation)	Cause
I. D. 6	1½ years	Lobar pneumonia on the other side as revealed on post-mortem examination.
K. R. 16	1½ years	Died suddenly while working. He was asymptomatic upto that time.
K. P. S. 16	6 months	Died suddenly. He was asymptomatic till his death.

jobs where handicapped individuals can get fruitful occupations.

An attempt is made here to bring out the various ways in which those patients who were leading a miserable life and were very severely handicapped got themselves rehabilitated after the operation.

There was no problem for women because they got adjusted to their home life after operation, having been relieved of stinking sputum and cough with recurrent attacks of fever.

As regards men, most of them returned to their previous occupations while the rest changed their profession. There are 6 men who are in active Government service who had come on leave for the operation and have rejoined and are doing full work. They report that now they have not to go on leave frequently because of their illness and have got adjusted very well. Two of this series are police constables and have rejoined and are now leading the strenuous life without any difficulty. There are six farmers who are doing their work to their satisfaction. Four of the present series are shop-keepers and have taken to their work. One of them when interrogated, informed us that now he is earning twice as much as what he used to do before being a petty shop-keeper, his work was often interrupted by bouts of fever and cough and he could not lift heavy weights, while now he can easily carry a maund load. This patient had a left pneumonectomy.

One case of this series is working as a domestic servant and has served well in the home of one of the authors. One patient (H.L.) who had left pneumonectomy has been employed in the physiotherapy department of this unit and helps the physiotherapy sister in carrying out her work. There are nine young boys and

girls in the series who have taken to their studies.

SUMMARY

A report on 50 consecutive surgically treated patients of bronchiectasis is presented.

The important causative factors in these cases are described.

Pre-operative management of these cases is given, with an account of the method of bronchography followed in our unit.

The operative procedure followed in these cases is described. All the cases were operated on in the face down position and in spite of the fact that some patients were very 'wet' there was no difficulty in dealing with the secretions by the Anaesthesiologist. Two patients were operated on in two stages with very satisfactory end results.

The operative mortality in this series is nil. The complications met with in these cases, have been: shock in three cases, massive haemorrhage in one, consolidation of the lung in one case, hyperpyrexia in three, atelectasis in one, acute dilatation of the stomach in one, embolism in occipital region of the brain in one and empyema and bronchopleural fistula in four cases.

Follow up study is presented and attempt has been made to give some facts about rehabilitation of these cases.

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TABLE IX

Case No. Name	Lobes or segments involved	Lobes or segments removed	Date of operation	Complications	Present Clinical Status
1. P. S. 23	Left lower lobe	Left lower lobe	28-10-49	Nil	Untraceable
2. O. P. 22	Right lower lobe and anterior segment left lower lobe.	Right lower lobe	24-1-51	Nil	Symptoms persisting
3. B. S. 19	Left lower lobe	Left lower lobe	4-5-51	Operative shock resuscitated	Untraceable 8 months after operation
4. G. S. 27	Left lower lobe	Left lower lobe	2-11-51	Operative shock, Operated 2nd stage	Asymptomatic
5. J. K. 19	Left lower lobe	Left lower lobe	9-11-51	Nil	Asymptomatic
6. I. D. 20	Left upper lobe	Left upper lobe	4-2-52	Became mental	Later died of pneumonia on contralateral side
7. G. L. 20	Middle lobe	Middle lobe	15-3-52	Nil	Asymptomatic
8. S. K. 11	Left lung	Left lung	28-3-52	Nil	Asymptomatic
9. K. C. 34	Left lower lobe basal segments (sequestration)	Left lower lobe Basal segments	12-4-52	Acute Dilatation Stomach	Asymptomatic
10. H. L. 16	Left lung	Left lung	23-4-52	Nil	Asymptomatic
11. G. S. 45	Left lung	Left lung	2-5-52	B. P. F.*	Asymptomatic
12. G. S. 25	Left lung and right lower lobe (Posterior segment).	Left lung	24-9-52	Homonymous Hemianopia	Cough and sputum upto 1/2 ounce
13. S. S. 16	Left lower lobe	Left lower lobe	31-10-52	Nil	Asymptomatic
14. D. L. S. 30	Left lower lobe (Basal segment)	Left lower lobe (Basal segments)	7-11-52	Atelactasis right upper lobe	Asymptomatic Govt. Servant
15. B. R. 22	Left lower lobe	Left lower lobe	24-12-52	Nil	Asymptomatic
16. K. R. 21	Right lung	Right lung	31-12-52	Nil	Died after one year and 7 months
17. A. C. 8	Left lung	Left lung	14-1-53	Nil	Asymptomatic
18. B. S. 32	Middle lobe	Middle lobe	16-1-53	Nil	Asymptomatic

*B. P. F.—Broncho Pleural Fistula.

Case No. Name	Lobes or segments involved	Lobes or segments removed	Date of operation	Complications	Present Clinical Status
19. P. C. 9	Left lung	Left lung	23—1—53	Pulmonary Oedema	Asymptomatic
20. B. K. 17	Left lower lobe and lingula	Left lower lobe and lingula	11—2—53	Nil	Asymptomatic
21. J. K. 26	Left lower lobe and lingula	Left lower lobe and lingula	16—2—53	Pulmonary Oedema	Asymptomatic
22. C. L. 31	Left lung	Left lung	9—3—53	Nil	Asymptomatic
23. S. S. 35	Middle lobe Right upper lobe	Middle lobe Right upper lobe	25—3—53 18—2—55	Consolidation Right upper lobe spread to right upper lobe	Symptoms pre-existed re-operated
24. S. 23	Left lower lobe	Left lower lobe	24—4—53	Hyperpyrexia	Asymptomatic
25. S. S. 21	Left lower lobe	Left lower lobe	27—11—53	Nil	Asymptomatic
26. B. R. 25	Right lung	Right lung	18—12—53	Nil	Asymptomatic
27. J. K. 23	Right lower lobe	Right lower lobe	11—1—54	B. P. F.*	Asymptomatic
28. J. S. 22	Left lower lobe and lingula	Left lower lobe and lingula	12—2—54	Massive Haemorrhage	Symptoms pre-existing. Disease in left upper lobe
29. H. K. 18	Left lower lobe and lingula	Left lower lobe and lingula	19—2—54	Nil	Asymptomatic
30. C. L. 25	Left lower lobe	Left lower lobe and lingula	8—3—54	Nil	Asymptomatic
31. J. L. 16	Left lower lobe and lingula with right lower lobe	Left lower lobe and lingula	26—3—54	Dyspnoea	Symptoms pre-existing
32. T. R. 40	Left lung	Left lung	26—4—54	Operative shock operated in two stages	Asymptomatic
33. M. S. 25	Left lung	Left lung	7—5—54	Hyperpyrexia	Asymptomatic
34. O. P. 11	Right lung	Right lung	6—9—54	Nil	Asymptomatic
35. D. S. 28	Right lower lobe	Right lower lobe	15—10—54	Nil	Asymptomatic
36. K. P. S. 16	Left lower lobe	Left lower lobe	22—10—54	Nil	Died suddenly After 6 months. Was Asymptomatic upto that date
37. I. S. 26	Left lower lobe	Left lower lobe	27—10—54	Oedema lung	Asymptomatic
38. K. 12	Left lung	Left lung	1—11—54	Nil	Asymptomatic

*B. P. F.—Broncho Pleural Fistula.

Case No. Name	Lobes or segments involved	Lobes or segments removed	Date of operation	Complications	Present Clinical Status
39. P. D. 28	Left lower lobe	Left lower lobe	17—11—54	Nil	Asymptomatic
40. K. L. 14	Left lung	Left lung	19—11—54	Nil	Asymptomatic
41. S. C. 17	Lingula	Lingula	1—12—54	Nil	Asymptomatic
42. J. S. 32	Left lower lobe and lingula	Left lower lobe and lingula	8—12—54	Nil	Asymptomatic
43. T. D. 49	Left lower lobe and lingula	Left lower lobe and lingula	15—12—54	Nil	Asymptomatic
44. P. S. 49	Left upper lobe	Left upper lobe	14—1—55	Nil	Asymptomatic
45. R. R. 25	Lingula	Lingula	2—2—55	Nil	Asymptomatic
46. J. 16	Left lower lobe and lingula	Left lower lobe and lingula	16—2—55	Nil	Asymptomatic
47. I. W. 28	Right lower lobe	Right lower lobe	25—3—55	Nil	Asymptomatic
48. K. R. 16	Left lower lobe (Basal segments) and lingula	Left lower lobe (Basal segments) and lingula	1—4—55	Empyema	Asymptomatic
49. K. S. 11	Left lung	Left lung	2—11—55		Asymptomatic
50. S. K. 5	Left lung	Left lung	5—12—55		Asymptomatic

BIBLIOGRAPHY

1. Betts, R. H.: Some aspects of Pulmonary resection. *Indian Jour. Surg.* 12: 1, 1950.
2. Bradshaw, H. H., Pulney, P. J. and Clerf, L. H.: The fate of patients with untreated bronchiectasis. *J.A.M.A.* 116: 2561, 1941.
3. Chestermann, J. T.: Results of Surgery for Bronchiectasis. *Brit. Jour. Surg.* 39: 263, 1951.
4. Haight, C.: Intratracheal suction in the management of Post Operative Pulmonary Complications. *Ann. Surg.* 107: 218, 1938.
5. Lindskog, G. E. and Hubbel, D. S.: An analysis of 215 cases of bronchiectasis. *Surg., Gynec. & Obstet.* 100: 643-651, 1955.
6. Overholt, H. R. and Langer, S.: A new technique for Pulmonary segmental resection: Its application in the treatment of Bronchiectasis. *Surg., Gynec. & Obstet.* 84: 257, 1947.
7. Perry, K. M. A. and King, D. S.: Bronchiectasis. *Am. Rev. Tuberc.* 41: 531, 1940.
8. Pilcher, R.: Segmental resection of lung for bronchiectasis. *Lancet.* 1: 843-846, 1946.
9. Roles, F. C. and Todd, G. S.: Bronchiectasis: Diagnosis and Prognosis in relation to treatment. *Brit. Med. Jour.* 2: 639-643, 1943.
10. Rosemond, P. et al.: Prognosis of residual bronchiectasis after incomplete resection. *J. Thorac. Surg.* 22: 439, 1951.

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LUNG ABSCESS

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Lung abscesses and their treatment have undergone a marked change in recent years. Firstly, reports of the last ten years have shown a real and continued decline in their incidence. Secondly, the trend towards good results with conservative treatment continues, and three factors appear dominant in producing this change: the employment of effective doses of chemotherapy and antibiotics, the intensive use of correct postural drainage, and backing it all, a better understanding of the pathogenesis and selective anatomical localization of the disease process with reference to the surgical approach.

The impetus given by Neuhof and his associates in publications between 1936-1940 urging lung abscess as a surgical problem and employing early surgical drainage considerably lowered the mortality of this disease. When later, antibiotics came into more general use, with the suppression of many of the etiological factors giving rise to these abscesses, their actual incidence declined and their potentially lethal course was dampened down sufficiently to permit effective localization by natural defences, and where indicated, timed intervention by the surgeon.

The factor of early diagnosis in the conservative treatment of these lesions seems to have been taken for granted, perhaps because in countries more advanced than ours, there is a general awareness of recognising the disease process and submitting it to fairly intensive antibiotic and postural drainage therapy from the very start. With the same factors operating in our country but in a rather indifferent manner, it is surprising there are not many more cases of lung abscess to treat, when we are, in a sense, facing to-day the surgical problems of lung abscesses that the other countries have tackled 10-15 years ago.

It is against this background that we have aimed to review fourteen (14) cases of lung abscess treated at the Thoracic

Surgical Unit, Calcutta, during a period of two years.

In them, there is not reflected the advantages of early diagnosis, nor of adequate chemotherapy or the effect of postural drainage; in fact, at the time of admission, these cases have all been "chronic lung abscesses" to start with, and with the exception of two cases cured on conservative lines, had to have surgical measures instituted for treatment.

SELECTION OF CASES

"What constitutes a lung abscess" is notorious in its confusion. For the purposes of this brief paper, the argument has been circumvented by selecting all those cases where clinical and radiological features have pointed to a suppurative process in the lung. Cough with expectoration, pain in the chest, pyrexia, dyspnoea on exertion, previous history of a respiratory illness or haemoptysis have all been considered along with the radiological presentations of an abscess as a localized spherical opacity, segmental consolidation or central cavitation with or without a fluid level. There are ten cases of non-tubercular suppuration in the series. The findings of two tuberculous abscesses, and the inclusion of one infected cyst and one case of abscess following carcinoma, stresses better the fact that "Lung Abscess" is a general descriptive term more clinical than pathological. There is only one female in the series.

TABLE 1

Non-tubercular Pyogenic Abscesses	Tubercular Abscesses	Infected Cyst	Carcinomatous Abscess
10 Cases	2 Cases	1 Case	1 Case
7 Cured	1 Cured	Died	Died
1 Died	1 Died		(out of Hospital)
2 Relief			

* From the Cardiac & Thoracic Surgery Unit, S.S.K.M. Hospital, Calcutta.

and the cases are fairly evenly distributed in every age-decade from 10 to 60.

ETIOLOGY

To try and establish a more specific etiology, the following short and practical classification was employed.

- (1) Abscesses due to *Specific Pneumonias*.
- (2) Those due to *Bronchial Occlusion*.
- (3) Those following *Vascular Embolism*.
- (4) Arising after *Trauma*.
- (5) Abscesses due to *Non-Specific (aspiration) Pneumonia*.

Patients' histories after a month or two of irregular pyrexia become remarkably indefinite, and few could give a connected account of the onset and duration of symptoms, but though all in this group had pyrexia, pain in the chest and purulent sputum, as often, it was usually a haemoptysis that brought them or the medical practitioner to ask for a hospital opinion. As such it was difficult to pin the probable cause to the case, yet it would seem that at least six of the ten were post-pneumonic, etiologically, one was post-exanthema, and one (the only female in the series) was previously hospitalized with pleural effusion and pericarditis for which a full course of antitubercular treatment had been given. Later an acute pyogenic abscess flared up in the right middle lobe and she was readmitted, critically ill, but was saved by external drainage performed as a desperate measure. Inhalational pneumonia cannot entirely be ruled out in these cases, for upper respiratory infection and dental and gingival sepsis are commonly noted in the ages above 30 years. Their selective localization in this group was as follows: six in the upper lobe, postero-lat. segment, two in the apical segment of the lower lobes, and one in the middle lobe. This distribution is equally favourable for both post-abscess. One case presented initially with

pneumonic and bronchial embolic forms of dyspnoea as the main symptom for 2 months, and fever with cough for two days. He was found to have a high eosinophil count besides the abscess and this may have some connection with dyspnoea being the presenting feature in his case.

Many of these cases, on admission, had an irregular, smouldering pyrexia, and sometimes were markedly toxic; loss of weight and malnutrition were noted. The penicillin dosage given outside was invariably inadequate and irregular. Some had also been given the broad spectrum antibiotics, and often streptomycin without any sputum examination or control. As a result, on admission, they were re-instated on a proper regimen with Penicillin G crystalline in high doses up to 8 mega units per day if required, and gradually reduced, with clinical improvement, to a continued period of 2 mega units per day. Postural drainage was insisted upon, and the usual X-ray check on the localization and progress maintained.

The majority had a blood sedimentation above 60 mm. per hour, with a low haemoglobin microcytic anaemia and a white cell count between 10 and 11,000. No A.F.B. were found in any of the 10 cases in this group by direct concentration methods. Clubbing was a feature in most of them, usually associated with abscesses of over 3 months' standing. It may be noted that one of the tubercle cases did not develop clubbing until he developed the chronic abscess.

A typical case in this group presented with high temperature, profuse foul sputum and pain in the right chest. His history dated back to four months when the acute onset lasted about a week and then subsided. Intermittent pyrexia with worsening cough and sputum and deterioration in health occurred. X-rays showed multiple spherical abscesses that were not very thick walled, and located in the lateral subsegments of both anterior and posterior divisions of the right upper lobe bronchus. The fissure was characteristically bulged out. Two days of intensive therapy showed

remarkable improvement, and as this continued, we were enabled, in having a co-operative patient, to treat him entirely conservatively. A bronchogram at 8 weeks showed so little bronchial abnormality that we decided to observe him. Over the last eleven months he has been fit and well.

Not always do we get such a happy result. In case 12 a persistent productive right upper lobe abscess with recurrent flares necessitated a lobectomy. Post-operatively a small bronchial leak was tackled by a rib resection with drainage and it closed rapidly enough. He has had no further trouble since discharge.

Carcinomatous obstruction can closely imitate the slow growing pyogenic abscess. The one case in our series had both clinical and radiological features supporting the latter diagnosis, except, that a year ago he had been treated and cured by radiation therapy for a proven squamous cell carcinoma of the left cheek. No lymphatic metastases existed in the neck, but at bronchoscopy the right main bronchus was choked with growth and was obviously inoperable. Biopsy reported a squamous cell carcinoma — which prompts the interesting question whether the two were independent or metastatically connected (Fig. 1).

Strictly speaking, an infected cyst is not a lung abscess (Fig. 2), but their clinical features and treatment are much the same. Case 10 showed pneumonitic changes early



Fig. 1.

in 1947 following a haemoptysis, and subsequently recurrent bleeding occurred but with no temperature. Diagnosed initially as a lung abscess, bronchograms showed an irregular area of broken down parenchyma near the costophrenic angle posteriorly, fed apparently by two bronchi from the posterior basal group. During operation for lobectomy, considerable difficulty was encountered with tough adhesions and unfortunately owing to a vascular accident a pneumonectomy had to be done. The specimen showed a cyst lined with shining epithelium and communicating with the bronchus.

Passing now to a review of the operative treatment and the results, it is opportune to state with them the principles guiding the surgical approach.

Conservative treatment will cure a certain percentage of cases, and now-a-days the figure is likely to be higher. Two of our cases were cured on conservative lines only, but in all cases it must be carried out with the object of timed surgical intervention being employed if necessary. Surgery may also be required for secondary pathological changes that can ensue and are revealed in follow up bronchograms.

In dealing, next, with the question of open drainage versus resection, there is no doubt that excision represents the surgical ideal. It must be the central pivot, with drainage indicated at both ends of the scale. Resection is not always possible, and



Fig. 2.

though drainage can be a life saving measure, it must not be used as a last ditch stand; it will establish a cure if selectively used in the early case before chronicity is an established fact, and fibrotic surrounding changes are not advanced. During the early phase of our work we treated 3 cases with open drainage. The first was a right upper lobe abscess, and was cured. The second was a young man of 25, but in poor shape, emaciated, anaemic and slightly cyanotic. He died suddenly of heart failure during operation. Autopsy revealed a chronic tubercular abscess in the right upper lobe. The third case, too, was treated by open drainage as a life saving measure. She was in a critical state, with an abscess in the right middle lobe, and it was to her extreme bad luck that a transfusion accident had to occur and cause anuria for 48 hours. She also had repeated attacks of paroxysmal tachycardia, perhaps connected with a previous history of pericarditis, but she survived all these assaults, and was ultimately cured.

There remains now to consider the role of excision, which was carried out in a total of 7 cases. Our reasons for considering resection as the more satisfactory though bigger and more radical procedure are, that not all abscesses are accessible to drainage, there is the risk of a persistent bronchial fistula, or of secondary haemorrhage and even if cure is the immediate achievement, the likelihood of secondary fibrotic and bronchiectatic changes are not annulled. Abscesses may conceal a malignant focus or embedded foreign body inaccessible to bronchoscopy, or they may be multiple and multilocular. — all cogent arguments in favour of excision.

Lobectomy is a satisfactory procedure, and on occasion a bilobectomy may be required. With a lung abscess that requires a pneumonectomy, the problem is more difficult, but with judgment it ought to be employed early before prolonged debility and toxicity and loss of function in the lung prejudice the success of the operation (Table 2).

TABLE 2

Resections	Complications	Result
4 Lobectomies	1 Bronchial Leak	All
	1 Bronchial Fistula with Empyema & Haemorrhage	Cured
2 Pneumonectomies	1 Post Operative Shock	Died
	2 B. P. Fistula with Empyema Haemorrhage following Thoracoplasty	Died
1 Abandoned Resection (Thoracoplasty)	Persistent Cavity	Relief

7 cases were operated on for pulmonary resection. One died from post-operative shock after pneumonectomy for big abscess cavities in the right upper and lower lobes. The second pneumonectomy, already referred to as the infected cyst, developed a large bronchial fistula and an empyema that was drained. Six weeks later following thoracoplasty he had a sharp haemorrhage and died. These are the only two deaths from resection.

A third case, was a chronic left upper lobe abscess of six years' duration following chickenpox and pneumonia (Fig. 3). At operation such dense adhesions were encountered that resection was abandoned and a thoracoplasty carried out. He still



Fig. 3.

has a persistent cavity under the plasty that flares up occasionally. His sputum has never been positive.

The remaining four resections are all lobectomies, and all are cured. Three were in the non-tubercular pyogenic group, and one belonged to the tubercular group. One of these cases was carried out in a man of 58 years for a post-abscess bronchiectasis where a residual parenchymal cavity still persisted. Complications in this group were two instances of small bronchopleural leaks, both of which soon closed down, one conservatively, the other after a rib resection and drainage. The tubercular abscess case after resection also developed a fistula with an empyema; treated with drainage the condition was cured in two months. He is now in the police force driving trucks, nine months after resection (Fig. 4).



Fig. 4.

COMMENT

To comment briefly upon this review of lung abscess treated in our unit over the past two years (Tab. 3) of our 14 cases, 2 were relieved and no definite treatment was done, 1 had an abandoned resection followed by thoracoplasty. 3 cases died, and

TABLE 3

14 CASES		
8 Cases Cured	3 Cases Died	3 Cases
2 Conservative	1 Accidental	No definite Treatment
2 Open Drainage	1 Post Operative Shock	
4 Lobectomies	1 Post-Plasty Haemorrhage for Bronchopleural fistula after Pneumonectomy	

of these one was for post-operative shock after pneumonectomy, one died following thoracoplasty for bronchial fistula and empyema, and one died of sudden heart failure during drainage. Of the 8 that were cured, 2 were cured conservatively, 2 by drainage, and all 4 lobectomies were cured.

CONCLUSION

It would seem that with proper initial management with antibiotics and postural drainage, fewer cases will come to surgery. When they do, their potentially lethal course will be in check, and either a drainage procedure or excisional lobectomy will be decided upon according to the individual cases.

Excision answers up as the most satisfactory course; its mortality and morbidity both are low in the lobectomy group. Far different is the case with pneumonectomy, where the case is often not a good risk, and more extensive surgical manipulation contributes to a higher mortality. Drainage still stands on the other end of the scale to act as a life saving measure.

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CLEFT PALATE *

by R. N. SINHA, Patna.

The present paper is based on the limited experience of the operative treatment of 35 cleft palate patients of different age groups.

My purpose in reading this paper is to focus attention on some of the difficult problems which are inherent in the proper treatment of this notoriously difficult congenital deformity. Even in this introductory phase of my observations, it will not be out of place to confess that "speech results" in my operated series excepting in babies on whom I have operated before the age of 2, have not been ideal, and have left much to be desired, much to my disappointment, especially in the cases where anatomical closure has been fairly satisfactory. In those cases, where due to my own inadequacy, or due to the clefts being very wide, anatomical closure has not been perfect or where due to break down of tissues following operation, small perforations remained inadequate speech results were understandable; but it was difficult to reconcile the "poor speech results" in some of the anatomically adequately treated cases of adult cleft palates. It was one of the reasons, which prompted me to bring up this subject for discussion before this august body.

For a long time the efforts in the field of management of cleft palate cases were largely aimed at the improvement in the technique of the operative procedures in an endeavour to produce better anatomical results, and thus indirectly to improve speech. The ultimate aim of surgery in cleft palate is not only adequate anatomical closure, but also the establishment of normal speech. It is in the latter aim that sometimes disappointments occur.

* Paper read at the 16th meeting of the Association of Surgeons of India, held at Hyderabad on 31st December 1954.

Incidence :

1. Sex

Table I (Sex)

Total no. of cases.....	35
Males.....	24
Females.....	11

This 2.2 : 1 ratio of males preponderating over females is in conformity with other workers (Oldfield; Fogh-Anderson).

2. Age

Table II (Age)

The present series fell under the following age groups when they presented for treatment :—

Age	No. of cases
Between 1 — 2 Yrs.	7 cases
" 2 — 4 Yrs.	6 cases
" 4 — 6 Yrs.	2 cases
" 6 — 10 Yrs.	3 cases
" 10 — 20 Yrs.	9 cases
" 20 — 30 Yrs.	6 cases
" 30 — 40 Yrs.	1 case
" 40 — 50 Yrs.	1 case

35 cases.

It would be observed that before the age of 2 only 7 cases out of 35, offered themselves for treatment; which indicates the lack of consciousness in our people, about the importance of getting operated on at the optimum age.

It would also be observed that between the age groups of 10—30, 15 cases, about 43%, offered themselves for treatment, most probably, to qualify themselves for the matrimonial market, as the age group would have us believe. This then, appears

to be the main incentive for seeking treatment at an age which is well-past the optimum age of 1—2 years. I have dwelt on this at some length to highlight the difficulties I have encountered in getting patients at the right age, and this may probably account partly for the unsatisfactory speech results in my adult series.

3. Types

Table III (Types)

Cleft palate alone with cleft lip....	24 cases
Cleft palate alone.....	11 cases, of which the submucous variety accounted for one.

It was seen, that in the isolated cleft palate cases, the females accounted for 8, and the males for 3. This preponderance of females in isolated cleft palate cases have been observed by other workers as well.

4. Frequency

In our country in the absence of reliable birth registers, which record every birth, it is not possible to give an accurate estimate the numbers of the cleft palates born in relation to the total number of births.

From the figures available from a neighbouring maternity hospital, however, it would appear that the incidence of cleft lip and palate comes to about 1 to 1.5 in every 1000 births, which is in general accord with the observations of other workers.

Embryology & Etiology :

While great advances have been made in the treatment of these conditions in post-operative speech therapy and in orthodontic care the embryology and etiology of cleft lip and palate are still clouded by too many theories, dogmatism and confusion of thought.

Though it is frankly not within the scope of this paper to review the normal anatomy and embryology of the palate, certain relevant features would be recapitulated to facilitate our clear understanding of the

objectives of treatment and the care of these patients. Two views hold the field in embryology. According to the classical view, these anomalies are the result of failure of fusion, or incomplete fusion of the palatine processes. The defective processes would then have to be complete by the time of the 8—10 mm. embryo stage (about the 9th week of foetal life) for that is the time when normal fusion is complete. This view is plausible to a degree, especially in explaining total clefts, but leaves unexplained the simple or partial clefts, and the clefts where epithelial bridges have persisted after birth. One, then, has to postulate that fusion occurred selectively (say in the middle, but not anteriorly or posteriorly). Another drawback is, that should the defective process be completed at so early a stage, it would be difficult to explain why much greater defects of nearby organs did not occur, and why the defect remained so localised.

The modern hypothesis advocated largely by the late Victor Veau, states that the defect is due to failure of mesodermal tissue invasion into the epithelial wall, either by the preventive action of the epithelium, or the poor quality of the mesodermal tissue as it invaded — with subsequent atrophy and separation. In cleft palate, there may be an occasional persistence of the epithelial wall and disintegration of it may cause secondary extension of the malformation.

The clinical entity of submucous cleft palates, by no means rare, lends support to the modern hypothesis.

Pathological Anatomy and Physiology :

The cause of defective speech in cleft palates is mainly nasal escape of air. To prevent nasal escape it becomes obligatory that

- (a) the anatomical integrity of the cleft in the palate is restored
- (b) the reconstituted soft palate is long, mobile, and supple enough to hitch against the posterior pharyngeal wall.

- (c) The palatopharyngeal sphincter consisting mainly of the Superior constrictor muscle of the pharynx and the Levator Palati, act synchronously to bring the posterior pharyngeal wall forwards to make with the elevated soft palate moving backwards, an air-tight diaphragm to close effectively the nasal from the oral cavity, and thus prevent any air escape.

To make matters difficult, the pharynx of a cleft palate patient is frequently enlarged. A marked increase in the bony diameters of the nasopharynx in the cleft palate cases is noticed by comparing measurements taken from a series of roentgenograms of normal and cleft palate skulls of the same age group. Recent observations on cephalometric roentgenograms, and laminagrams by Waldron, Pruzansky, Stark and others, have more or less established this fact. These observations serve to emphasise the fact, that we are dealing not only with a static cleft, but with displaced and distorted structures as well, where normal anatomy and hence function of sphincters, suffer corresponding aberration.

Another important muscle to be considered is the tongue, which is intimately and actively related to the cleft in the palate, since early intrauterine life. The muscular imbalance created by the cleft is further compounded by the tongue's free range into the nasal cavity and the nasopharynx, most marked during suckling and deglutition.

Etiology :

Any factor, to be etiologically effective, has got to operate in the sensitive stage of facial development, which is fairly early.

Several factors are thought to be operative, but how they do operate is not exactly known. The more important factors, suggested by experimental workers, are, maternal nutritional deficiencies, maternal impressions, wide difference in parental age, infection such as Rubella and toxoplasmosis, deficiencies in copper, iodine,

vitamins A & D, riboflavin, biotin, folic acid, pantothenic acid, excessive-androgens, estrogen, insulin, cortisone, ACTH, radiation, administration of chemicals, such as sulfa group of drugs, antifolic acid, thallium, arsenic, antimony. In my present series of 35, after careful questioning, I have been able to find poor maternal health especially in the first trimester of pregnancy only in 2 cases; one of the mothers was suffering from Kala-azar and was getting antimony injections in her early pregnancy.

The effect of maternal impressions, during early pregnancy, though disproven generally, have still a few proponents who believe that a mother suddenly losing her husband soon after conception, or being unwed might just possibly have biochemical changes produced in her, which might cause congenital abnormalities in her offspring.

I can recall only one instance, in which the mother, a school teacher, had conceived prior to marriage, and given birth to a female child with bilateral cleft lip and complete cleft palate. She, of course, married the father of the child, before the child was born, and there was complete absence of hereditary history of clefts on either side. To complicate the picture, the marriage was interprovincial and they belonged to separate religions. Whether maternal impressions, in the way of psychological trauma, have had anything to do in precipitating a congenital anomaly in the off-spring, it is very difficult to say. When this couple consulted me with their first child (about 1½ years old), the mother was again pregnant. She was understandingly very apprehensive, and enquired, if the second child is going to be deformed, and if anything could be done to prevent it. With their assuringly negative family history, the chances appeared to be very small indeed, and I told them so; but on the basis of experimental work, suggested her taking high doses of Riboflavin daily (about 20 mgms. daily-optimum therapeutic dose is about 1.5—2 mgm). I gather that her second child, a son, born a few months

back, is normal. I cannot say whether it was the daily dose of Riboflavin or the absence of a psychological factor that prevented any congenital deformity in the second child, chances of which were very small in any case, considering their family history.

Maternal age :

Hagover, reporting on 140,000 births, observed that women who gave birth between the ages of 36 and 40, had twice as many, and those over 40 had 3 times as many deformed children, as did younger mothers. In my present series of 35, one mother was above 40, and 3 were between 35 and 40.

Tiedeman and Makowsky, have found that the incidence of clefts was singularly high in first-born children, 38% occurring in the first born; 26% in the second, and 12% in the third. Due to inadequacy of data, I have not been able to confirm this.

Association with other non-facial congenital deformities :

Associated deformities like hydrocephalus, microphthalmia; Treacher-Collin-Syndrome, Spina bi-fida, Klippel-Fiel Syndrome, Syndactyly, Congenital Valvular diseases of the heart, exomphalos talepes, etc. have been observed. In my series, two cases, one with a Klippel-fiel Syndrome, and the other with congenital talipes equino-varus, have been observed. The interesting feature is, both were female children and both had isolated cleft palates.

Another case, which I have not included in my series, was of a new born baby brought with a severe exomphalos; and a complete cleft palate; the baby died the same day.

Hereditary factor :

Most workers now agree that an essential element in the etiology is a hereditary pre-disposition but, whether only a few, or most cases are hereditary is still an unsolved question. As to the manner of inheritance, many theories are advanced

which include simple necessity to sex linked recessivity.

Fogh-Anderson of Denmark, after a careful study of 730 families in Denmark during the last World war, found that 30-40% of his patients, had relations with similar or associated deformities, and concluded that inheritance was the most important aetiological factor. It appears that a recessive gene, is operative in most of these cases; but not all who inherit the requisite gene, suffer from the deformities, and the classical Mendelian laws fail to hold good. It is quite possible that additional factors operate before the deformity becomes manifest. The exact nature of those factors is yet to be worked out. It is possible, that the sex-chromosome plays an indirect but important role. We have to deal here with two different hereditary genes—one for cleft lip with or without associated cleft palate, occurring more often in men, in the proportion of 2:1, with a manner of inheritance of recessive character, or more correctly "Conditioned dominance," and the other, for isolated cleft palate, seen most often in women, and presenting a dominant inheritance.

In my series I have been able to find a hereditary factor only in 7 cases out of 35.

TABLE

Case I. Case of cleft lip & palate (Male child) — Post alveolar cleft in Grandfather's sister.

Case II. Case of cleft lip & palate (Male child) — Cleft lip & palate in maternal grandfather.

Case III. Case of cleft lip & palate (Male adult) — Cleft palate in father's sister.

Case IV. Case of isolated cleft palate (adult female) — Mother's sister had cleft palate.

Case V. Adult Female patient with cleft lip and palate — (a) Patient's grandfather's sister had similar cleft lip & palate. (b) Patient's second male child born with extensive cleft lip and palate died at the age of 3 months.

Case VI. Female child with isolated cleft palate (submucous variety) — Maternal grandmother had nasal voice (probably isolated submucous palate).

Case VII. Male child with cleft lip & palate — (a) All the other three brothers have similar cleft lip & palate. (b) Patient's father's brother had similar lesion.

In my series the hereditary influence is manifest in 20% of my cases, in comparison to 30% of Fogh-Anderson's much larger and more systematically studied series. 25-30% with definite hereditary influence has been accepted by most of the workers.

It would be a great deal easier if only there existed reliable empirical figures for genetic prognosis. Firstly, data available in our country, so far, are very meagre or in other ways are not of much statistical significance, and secondly the normal basis for comparison is wanting, there being only a few uncertain statements of the frequency of the malformation in the average population. It seems, therefore, highly necessary that an attempt should be made at elucidating these questions from the wealth of clinical material available in our country. It may be worth considering, whether a 'cleft lip and palate' Registry can be formed on the lines of the American Bone Tumour Registry for statistical purposes.

The main object of such work will be —

- To make an investigation into the average frequency of these congenital malformations in our country.
- To investigate, on the basis of sufficiently large material, fit for the purpose, the occurrence of the malformation among the relations of a number of patients, and to demonstrate from these facts what exact part heredity plays as an etiological factor, for all forms of facial clefts in particular, and all congenital malformations in general.
- And to set up some applicable empirical figures of genetic prog-

nosis, and if possible to advance a theory as to the manner of inheritance.

Diagnosis is usually obvious at birth, especially when associated with cleft lip, but becomes apparent, when milk escapes through child's nose after the child is put to the breast or is given a drink of water or milk. In some cases, a minor cleft may get unnoticed till the child gets to the speaking age, when it speaks unintelligently or with a pronounced nasal twang. In some of these cases of faulty speech, an examination sometimes does not reveal any obvious cleft but a careful examination, reveals the "not-too-rare" submucous variety of cleft. One female child who had been previously examined by several E.N.T. specialists and advised tonsillectomy, adenoidectomy and submucous resection of septum, was successfully diagnosed, and operated on for her submucous cleft palate.

Complications :

Besides speech defects, these patients suffer from otitis media, mastoiditis, and infection of the upper respiratory passages. In my series 31 gave definite histories of chronic otitis media, and 17 reported that they were very prone to respiratory infections.

Best time to operate :

The palate should be repaired before the child learns to speak, i.e. between the ages of 1 and 1½ years. Operations for cleft palate in infants less than a year old, are not followed by any better speech results, but are associated with mortalities of over 10%, compared with the mortality of under 2% for operations during the second year. The post-operative speech results are a great deal poorer, if they are operated on after 2 years.

There are many, however, especially in the States, who believe that there is a retardation of the growth of the maxillae, following early operation on the palate, resulting in flattening of the maxillae and relative prognathism of the mandible. They

advocate a later operation, though in some cases, following early operations, maxillary flattening is observed, all the same, a successful closure of the palate before the child has learnt speaking gives the best speech results, which is our main objective. It is however desirable, that any case, after operation who shows a tendency towards maxillary flattening should have orthodontic care; in our country, however, good speech therapy and orthodontic treatment are still not well developed; and for the present, we have to be satisfied with early closure of the palate assuring good speech results, and speech therapy under personal and parental guidance.

In this connection, it is pertinent to mention that the operative technique should be the least traumatising, as severance of the delicate blood supply or damage to the growth centres of the maxilla, which form the pivot of the growth of the upper face, may lead to retarded growth.

Contraindications to operation:

Operation for the repair of the palate is advisable in all child patients, unless there is evidence of gross mental deficiency or an uncompensated cardiac lesion or other severe congenital lesions, where life expectancy is low. Patients with compensated congenital cardiac lesion may be operated upon, if the case has been previously prepared by an experienced cardiologist.

No adult patient should also be refused operation on account of age. Even if some of them have lost most of the soft tissues of their palates by previous unsuccessful operations, they should be treated by bringing tissues from outside the oral cavity, by using tubed pedicles. This procedure has been successfully tried by Sir Harold Gillies, Prof. Burian of Prague, and others, but I have no personal experience of the same. All the same, the method appears feasible, and should be preferred to the use of inert obturators.

Operation:

There are so many operative procedures available that I would not insist on any

specific method of repair except to use a technique which retroposes the palate as well as joins it together. We use the Wardill Kilner modification of the Veau technique, which seems to us, as good as any.

After the edges of the cleft have been pared, mucoperiosteal incisions are made. At the posterior end of each lateral incision, the pterygoid hamular process is broken or still better, the tendons of the tensor palati are cut to eliminate the tensor action on the repaired palate. After the mucoperiosteal flaps have been elevated, and the two posterior flaps turned backwards, the palatine aponeurosis is completely detached from the posterior border of the hard palate on each side; the nasal mucosa is then separated from the upper surface of the hard palate from behind forwards. The dissection is continued at the posterior end of each lateral incision, external to and behind the hamular process; here the lateral pharyngeal wall is mobilised inwards by blind dissection upwards along the inner surface and posterior border of the internal pterygoid plate to relieve tension on the repaired soft palate. Suture of the halves of the palate is carried out in two layers one on the nasal surface, which is supplemented by mucosal flap or flaps from vomer, when available; the other is on the oral aspect, where the mucoperiosteal flaps are approximated in V-Y fashion to produce elongation, as well as closure. In this operation, anaesthesia is induced by ether and continued by ether, gas and oxygen, on open circuit, given through a plastic intra-tracheal tube, inserted over the tongue, without a pharyngeal pack. A Kilners "shadwell gag" with wire spring ligature carrier is inserted to keep the mouth open.

After completing the operation, the pharynx is cleaned by using the electric suction apparatus, and at this stage, the success in restoring the integrity of the soft palate muscles is tested by lightly stroking the repaired soft palate with the suction end, and the muscular integrity is indicated by "gagging" of the soft palate. We make it a rule at the conclusion of the

operation to bring out the tongue, and keep it anchored to the cheek, by a strong suture, and keeping it there till oedema subsides, and there is no danger of the tongue falling back and causing respiratory obstruction.

Complications usually seen after operations, — besides anaesthetic ones are:—

- (1) Respiratory obstruction.
- (2) Hyperthermia—Luckily we have not encountered any mortality from hyperthermia in our series but we believe it has been reported from several centres in our country. This, we can only attribute to luck and perhaps to the fact that we do not operate on clefts palates in the summer season. In any case which shows a tendency towards rise of temperature, we check it by frequent cold sponging, ice water enema and by giving aspirin in small doses.
- (3) Infection, sloughing of the palate and perforations are in many cases avoidable, if antibiotics are exhibited, dissection is clean and

suturing is not done under any tension:

Mortality: In my present series of 35 I had two mortalities (5.7%) one during the operation, in a child of 14 months and was attributed to anaesthesia. In the other after a successful operation an overzealous nurse removed the tongue stitch, while giving a drink of water in the evening of the operation and the child choked to death before any help could reach him.

Speech results:

We try to assess speech according to the following standards:—

- (1) Group I—Palate complete, function also satisfactory (Good).
- (2) Group II—Palate complete, function not fully developed (Fair).
- (3) Group III—Palate incomplete, function impossible (Poor).

Speech results, in our series according to this standard, as follows:—

SPEECH RESULTS

Age Group	Total operated	Group 1 (Good)	Group 2 (Fair)	Group 3 (Poor)	Total	Remarks
Between 1—2 Yrs.	7	4	2		6	One died during operation
Between 2—4 Yrs.	6	2	2	1	5	1 died soon after operation
Between 4—6 Yrs.	2	1	1		2	—
Between 6—10 Yrs.	3	1	1	1	3	Poor result in one, due to persistence of small perforation.
Between 10—20 Yrs.	9	2	4	3	9	One poor result due to a perforation in the hard palate persisting but in other two anatomical repair adequate.
Between 20—30 Yrs.	6	1	4	1	6	—
Between 30—40 Yrs.	1			1	1	Anatomical repair satisfactory.
Between 40—50 Yrs.	1			1	1	Very wide cleft repair unsatisfactory.
Total	35	11	14	8	33	

It is apparent that speech results have been better, when repair has been early and adequate. It is also observed, that in the later age groups, inspite of adequate anatomical repair, good speech has not been possible in many cases. I venture to advance the following factors as being responsible for them:—

- (a) already developed faulty speech habits—can improve to a considerable extent, with efficient speech therapy depending upon patient's intelligence and co-operation.
- (b) Acuity of hearing.
- (c) The "speech sense".
- (d) Age at which treatment begins.
- (e) Environment and personality of the patient:—

It has been observed, that children of intellectual families, do better than coming from backward groups.

Conclusion:

A series of 35 cases of cleft palate, operated on by me, has been presented. Though the series is very small, and not of much statistical significance, it has indicated:—

- (1) The need for closer study of the problem; the genetic lessons to be learnt from the same may be of some use in our general study of other associated congenital deformities.
- (2) Cases of cleft palate should be operated on early, before the child has learnt faulty speech especially in our Country, where organised speech therapy is not yet possible.
- (3) The final word about the nature of the operation has not been spoken. The classical V-Y operation of Wardill and Kilner and other similar operations designed to produce a longer and more mobile velum

practised by a majority of surgeons and which gives as good result as any have their drawbacks in as much as they do not do anything to reduce the diameters of the pharynx at the palato-pharyngeal level. This may account for some of the indifferent speech results following adequate repair. Our future quest should be to evolve a procedure which will effectually reduce the diameters of the pharynx at the palate level and at the same time produce a long and mobile velum. The efforts of Wilfred Hynes of Sheffield in this direction is worth-taking note of, as he reduces the diameters of the palatopharynx by a muscle pharyngeoplasty and at a second stage repairs the cleft palate and advances the velum. The V-Y operation inflicts a certain amount of damage on the palate and subjacent structures which involves the palatine aponeurosis, the levatores and tensors of the palate and the upper part of the superior constrictor; this also should be avoided.

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BIBLIOGRAPHY

1. Arey, L. B.: Developmental anatomy. Saunders, Philadelphia, 1942.
2. Barsky, A. J.: Principles and Practice of Plastic Surgery. William & Wilkins, Baltimore, 1950.
3. Brophy, T. W.: Oral Surgery, 1938.
4. Bentley, F. H.: Lancet. 2: 862, 1947.
5. Canick, M. Leon.: (Cleft Lip and Cleft Palate, a review of embryology, pathologic anatomy and etiology); Plastic Reconstructive Surgery. Vol. 14: No. 1, 30; Williams & Wilkins, Baltimore.

6. Calnan, J.: Brit. Jour. Plastic Surgery. 6: 264, 1954.
7. Dorrance, G. M. and Bransfield, J. W.: Ann. Surgery. 117: 1, 1943.
8. Fogh-Anderson.: Inheritance of Harelip and Cleft Palate. Nyt Nordisk Forlag- Arnold Busch, Copenhagen, 1942.
9. Hynes, W.: Brit. J. Plast. Surg. 3: 128, 1950.
10. Hynes, W.: Ann. R. Coll. Surg. Engl. 13: 17, 1953.
11. Hynes, W.: Brit. J. Plast. Surg. 7: 242, 1954.
12. Kalter, H. and Fraser, F. C.: Nature. 169: 665, 1952.
13. Kieth, A.: Brit. J. Surg. 28: 173, 1940.
14. Morley.: Cleft Palate & Speech. (Livingstone), 1950.
15. Oldfield, M. C.: Brit. J. Surg. 37: 146, 1949.
16. Politzer, G.: Ind. J. Surg. 9: 184, 1947.
17. Pruzansky, S.: Role of the Orthodontist in Cleft Palate. Plastic and Reconstructive Surgery. 14: 10-29, 1954.
18. Ricketts, Robert, M.: The Cranial Base and Soft structure in Cleft palate speech and breathing. Plastic and Reconstructive Surgery. 14: 47-61, 1954.
19. Stark, B. Richard.: Pathogenesis of Harelip and Cleft Palate. Plastic and Reconstructive Surgery. 13: 20-39, 1954.
20. Tribedi, B. P. and Roy, A. R.: Indian Med. Gaz. 85: 144, 1950.
21. Veau Victor.: Division Palatine. Masson et Cie. Paris, 1931.
22. Veau Victor.: Ann. Surg. 76: 143, 1922.
23. Veau Victor.: Proc. R.S.M. 21: 1868, 1917.
24. Veau Victor.: J. Chir. 40: 321, 1932.
25. Wardill, W. E. M.: Brit. J. Surg. 16: 127, 1928.

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TUBERCULOUS GASTROJEJUNAL ULCER

by H. S. BHAT and JACOB ABRAHAM, Vellore.

The extreme rarity of tuberculous lesions of the stomach and the duodenum is an established fact. Clagett and Walters¹ quote Good² who collected a total of 71,871 cases in which the incidence of gastric tuberculosis was .34 per cent. In 15,165 of the series there was tuberculosis in other parts of the body; the incidence for the latter group, hence was 1.4 per cent. The observation probably indicates that gastric involvement may be found incidental to massive tuberculous involvement of the body especially during the late stages. Reports on tuberculous lesions of the duodenum are also infrequent. The duodenum seems to be spared even when extensive lesions are present in the intestinal tract. This is a common experience of many. Together with 18 personal cases, Matthews et al³ were able to list a total of 123 cases in the literature. Gossman quoted by Matthews found only 5 cases of duodenal lesions in a series of 2,360 autopsies performed on patients who died of tuberculosis.

While the extreme infrequency of tuberculosis of the stomach and duodenum is borne out in records, we have not been able to recognise in literature, a proven case of tuberculous gastrojejunal ulcer. The following two cases warrant reporting, in view of this deficiency.

CASE REPORTS

CASE 1 — No. 21949.

C.C.J., aged 27 years, male, was admitted on July 4, 1955 with the following symptoms:

- (1) Hematemesis, twice, within a period of six months.
- (2) Constant pain in the epigastrium with exacerbations related to food; and (3) loss of weight.

He was operated upon for the epigastric pain in the Army Hospital at Poona in 1952, and the pain reappeared after about 12 months of relief. He was discharged from the Army on being suspected of having tuberculosis of the lung, in 1953. Conservative medical treatment over a period of 12 months had not given the patient any relief.

Clinical findings:— Moderately nourished man with no evidence of any lymphatic glandular enlargement. Chest showed no abnormal signs. Abdomen was soft to feel, with marked tenderness in the midline about 2" above the umbilicus. The right paramedian scar was healthy and no tenderness was elicited over it. Except for the tender area, no other abnormal findings were detected. A clinical diagnosis of gastrojejunal ulcer was made on the assumption that the previous abdominal operation was a gastro-enterostomy or gastrectomy done for a duodenal ulcer.

Investigations:— Blood: Haemoglobin 11.5 gms%. W.B.C.: Total 8,700/cu.mm. Blood urea: 30mgm%. Blood Kahn: Negative. Urine: Normal findings. Stool: Hookworm ova present. Occult blood not detected. Sputum: 3 specimens—no acid fast bacilli. Fractional Test Meal: Both free and total acidity levels were low. No blood was detected. No marked stasis was noted. Barium Meal: Gastrojejunostomy with evidence of partial obstruction. No definite gastrojejunal ulcer was revealed. There was marked tenderness over the anastomosis. Stomach showed some stasis at the end of 6 hours.

Chest X-ray:— Fine striations extending to the right apex from hilus were seen. No definite evidence of any active lesion was detected. **Treatment:** With a diagnosis of gastrojejunal ulcer, an exploration and probable gastrectomy was considered. On July 11, 1955, the abdomen was opened through the old right paramedian scar under epidural anaesthesia. Findings: The stomach was dilated with a thin healed scar in the anterior wall of the first part of the duodenum. The old anastomosis was narrow though still patent. At the efferent loop end of the anastomosis, there was a dense mass adherent to the transverse colon. There were a few lymph glands palpable in the omentum. The small intestines, the mesenteric glands and other viscera, were normal to feel.

A wide gastrectomy was done including the whole of the anastomosis. The line of section of the stomach extended from about 2" of the lesser curvature to the region of the short gastric vessels on the greater curvature. The old duodenal ulcer scar was not excised. The continuity of the jejunum was established by an end to end anastomosis. A retrocolic gastrojejunostomy was done with the institution of a Hoffmeister valve.

Streptomycin 1 gm. twice daily and Penicillin 3 lakhs twice daily, were given parenterally for 3 days. Continuous suction and intravenous fluids were instituted for 48 hours. The post-operative period was uncomplicated.

The patient was discharged on the 14th post-operative day.

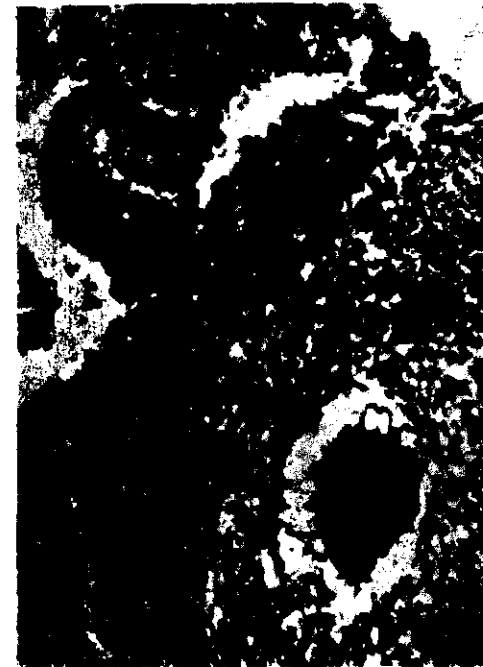


Fig. 1.

Microphotograph showing the typical tuberculous tissue reaction. (Case No. 1.) (x 248)

Pathology Dept. — 2625/55:

The specimen removed at operation consisted of a large section of the stomach, with a loop of jejunum 7" long, anastomosed to the greater curvature. On section, the stoma was 2 cms. wide. At one end there was a thick hard area with an ulcer on the mucosal surface with sharp edges and floor covered by necrotic material.

Microscopic section at the ulcer site, showed jejunal mucosa with large areas of epithelioid cells and Langhan's giant cells in the deeper parts of the mucosa and submucosa. Another bit showed stomach with extensive fibrosis and collections of tubercles in the fibrous tissue.

Impression by Dr. Gordon Hadley: Tuberculous Gastrojejunal Ulcer (anastomotic ulcer) (Fig. 1).

CASE 2 — No. 25856.

R.K., aged 35 years, female, was admitted on August 27, 1955 with the following symptoms:

- (1) Pain in the epigastrium radiating to the spine.
- (2) Vomiting, both spontaneous and induced, relieving pain temporarily.

(3) Loss of weight and emaciation.

(4) Frequent attacks of diarrhoea.

She was operated upon in this Institution, for epigastric pain related to food in 1945, and she had relief from symptoms only for a few months. Previous records showed that she had a gastrojejunostomy done. The symptoms were getting progressively worse from 1950. No chest X-rays were done during the first admission.

Clinical findings:— She was emaciated and anaemic. Posterior cervical group of neck glands were palpable bilaterally. Chest showed no abnormal findings. Abdomen was distended in the epigastric region and visible peristalsis of stomach was seen. There was tenderness in the region of the old scar. Rest of the abdomen showed no abnormal findings.

Investigations:— Blood: Haemoglobin 8 gms%. W.B.C.: Total 8,000/cu.mm. Urea: 21 mgm%. Kahn: Negative. Sedimentation Rate: 1st hour 40 mm.; 2nd hour 76 mm. Urine showed normal findings. Stools: No ova or cysts. Sputum showed no tubercle bacilli in three specimens. Gastric contents showed no tubercle bacilli. Fractional Test Meal: High levels for free and total acidity were recorded.

Chest X-ray:— ? Thickened pleura at the right base and slight suggestion of ? healed tuberculosis in the right upper zone (Fig. 2).

Barium Meal: Pyloric obstruction with stenosis of the gastrojejunostomy stoma was reported. Two large ulcers were visualised with tenderness over the anastomosis (Fig. 3).

Clinical diagnosis of gastro-jejunal ulcer was made.

Treatment: On September 9, 1955, the abdomen was explored through a right paramedian incision. The stomach was dilated and the pylorus was stenosed by a dense adherent ulcer with no evidence of active inflammation around. The stoma of the gastrojejunostomy along the greater curvature was markedly contracted and the anastomosis itself was adherent to pancreas, greater omentum and a loop of jejunum. The adherent jejunum was separated and the anastomosis isolated. The small intestine, the transverse colon, mesenteric glands, and other viscera were normal to feel. The gall bladder was normal except for a few adhesions between it and the first part of the duodenum. A gastrectomy including the dense anastomosis, the stomach between the old ulcer and a line, one inch proximal to the old anastomosis, was done. The jejunal continuity was established by end to end anastomosis. A retrocolic gastrojejunostomy with a Hoffmeister valve was done.

Streptomycin 1 gm. twice daily, and Penicillin 4 lakhs twice a day were given for four days. Continuous gastric suction and intravenous fluids



Fig. 2.
Chest X-ray of case No. 2.



Fig. 3.
Picture showing the two large anastomotic ulcers. (Case No. 2.)

were maintained for 48 hours. She was discharged from hospital on the 18th post-operative day.

Pathology Dept. — No. 3512/55:

Macroscopic: Two segments — one piece of bowel 6 x 3 cm. across, connected by firm white tissue to a segment of stomach 4 x 3 x 1.5 cm. The bowel mucosa was normal. Two ulcers about .5 cm. in diameter seen on the stomach side of the anastomosis.

Microscopic: The floor and edges of the ulcers of the stomach show numerous giant cell system with Langhan's giant cell, epithelioid cells and lymphocytes and fibrosis. A few giant cells contain inclusion of foreign material.

Impression: — Tuberculous anastomotic ulcer (Fig. 4).

COMMENTS

In the case notes presented, there are outstanding facts which have not been reported so far. Out of a record of 30 gastrojejunal ulcers treated during the last five years — from September 1950 to Sep-

tember 1955 — Tuberculous lesions were recognised only in these two cases. All gastrojejunal ulcers developed after a gastrojejunostomy. Except for evidence of healed ? tuberculous lesions, as reported by the Radiologist, no evidence of definite tuberculosis was present in the other parts of the body. Very few reports in literature, mention the presence of tubercle bacilli in the tissue section. Sections of both specimens showed the presence of tubercle bacilli in the giant cells (Figs. 5 and 6). The sections were stained by the periodic acid technique described by Jeyaraj⁴. Efforts at staining bacilli in tissue sections by the Ziehl-Neelson technique were not successful. No biopsies were done on the original duodenal ulcer and hence there is no evidence to confirm that the old healed ulcers were not tuberculous even though clinically at the operation, the scars did look and feel like the scars of

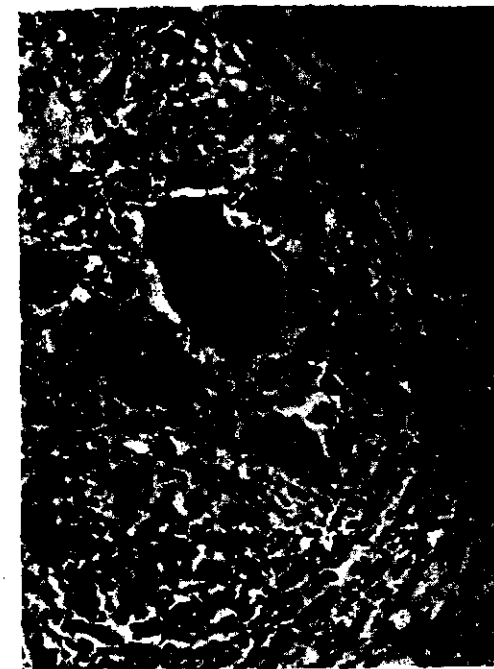


Fig. 4.
Microphotograph showing tissue reaction. (Case No. 2.) (x 248)



Fig. 5.
Microphotograph showing the single tubercle bacillus in the giant cell stained by the special method. (Case No. 1.) (x 500)

peptic ulcers that had healed after surgical intervention. The symptoms also were like those of patients with peptic ulcers of the stomach and duodenum.

In view of the extreme rarity of tuberculous ulcers of the stomach and duodenum, no possibilities of the ulcers being tuberculous were considered preoperatively. Broders⁵ recommended the following criteria after a study of 305 cases, for a diagnosis of tuberculosis of the stomach, and these can be applied briefly to the findings in the cases reported in this paper.

- (1) The tubercle bacillus must be demonstrable in the depths of the ulcer for a positive diagnosis of tuberculosis of the stomach.
- (2) For a probable diagnosis there should be a histological picture of tuberculosis in the stomach.

These two criteria were satisfied to a large extent in these cases namely the microscopic sections show the typical tuberculous tissue reaction and the bacilli were demonstrable by the special method of staining. While this is true, there is no positive evidence to acknowledge that the tuberculous nature of the ulcers was not due to ingestion of bacilli in the sputum, in the face of the radiological findings in the lungs, though the lesions seemed healed and the sputum showed no bacilli on three consecutive occasions. Spread by continuity or contiguity, from adjacent tuberculous organs, cannot be accepted in both cases as the neighbouring viscera were normal and the old ulcers in the duodenum and stomach felt inactive. Since both the clinical examinations and the pathological material leave the question of the mode of infection indefinite, among several possibilities, the haematogenous route is more

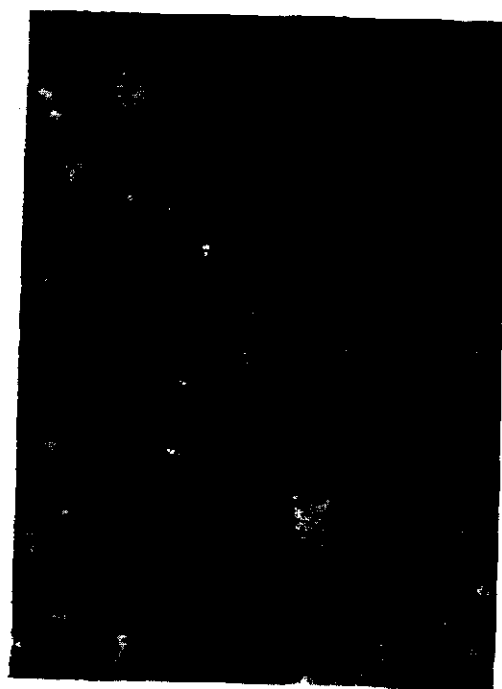


Fig. 6.

Microphotograph showing the single tubercle bacillus in the giant cell stained by the special method. (Case No. 2.) (x 500)

probably the favourable one. From an academic viewpoint, tuberculosis of stomach and duodenum is secondary to tuberculosis elsewhere in the body as a rule.

The nature of the lesions in both cases was established only by microscopic study. In practice, because of the extreme lack of familiarity of such lesions, there is little to confirm by macroscopic examination at operation, unless, the neighbouring viscera like the intestines show gross manifestations of Tubercle on the surface, or strictures.

Surgical procedures either palliative like gastroenterostomy, and radical such as gastrectomy, are described in literature for tuberculous lesions of the stomach and duodenum, if tuberculous lesions elsewhere in the body are healed, controlled, or not manifest. With the advent of

chemotherapy, a minor procedure such as gastrojejunostomy is probably all that is needed for tuberculous duodenal ulcers. Gastrectomy was indicated in our patients as the diagnosis was believed to be non-specific gastro-jejunal ulcers till the microscope proved the specific nature of the ulcers.

The patients after discharge were recommended a complete course of anti-tuberculous therapy and periodic observation.

No attempt is made to discuss why any segment of the gastro-intestinal tract should be particularly resistant to tuberculous infection. In this connection it may be mentioned that stomach and duodenum, like the gall-bladder, liver, pancreas, skeletal muscle and oesophagus, seem to exhibit a high degree of protection towards tubercle bacilli. The status in the stomach in both cases is probably of significance in that a prolonged contact with the bacilli laden sputum and the already existing peptic anastomotic ulcers, was encouraged. The easy access to the jejunum with its lymph follicles at the anastomosis may also be of some importance. Thus in both cases, the tuberculous nature of the ulcers, was probably only secondary, though sputum and gastric contents proved negative after readmission.

The purpose of presenting our cases is manifold :

(1) These cases are probably the first reported.

(2) Tuberculous nature of the lesions need to be suspected, at least, before performing any of the common gastric surgical procedures on patients who have peptic ulcers and tuberculosis elsewhere in the body, since symptomatology of tuberculous ulcers of the stomach and duodenum is like that of the more common peptic ulcers in the system.

(3) One has to bear in mind the possibilities of recurrence of ulceration due to tuberculosis in the anastomotic region in all gastric operations done on patients who

have active tuberculosis mainly in the lung.

SUMMARY

The rarity of tuberculous lesions of the stomach and duodenum is emphasised. The diagnosis is usually based on histological findings.

Case notes of two patients who had histologically proved tuberculous gastro-jejunal ulcers are presented.

It is suggested that in patients who have gastric symptoms and tuberculosis manifest elsewhere in the body, gastric or duodenal tuberculosis needs to be considered especially in our country where the incidence of peptic ulcer of gastro-duodenal tract, and pulmonary tuberculosis is high. While the surgical treatment of gastric tuberculosis and other gastric organic lesions may be identical, with the advent of chemotherapy, less extensive surgical procedures may be justifiable.

ACKNOWLEDGEMENT

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REFERENCES

1. Clagett Oscar, T. and Walters Waltman.: Tuberculosis of the Stomach. Arch. Surg. 37: 505-520, 1938.
2. Good Ralph, W.: Tuberculosis of the Stomach; An analysis of cases recently reviewed. Arch. Surg. 22: 415-425, 1931.
3. Matthews Warren, B., Delaney, P. A. and Dragstedt, L. R.: Duodenal Tuberculosis. Arch. Surg. 25: 1054-1066, 1932.
4. Jayaraj, P.: Periodic Acid in the Stains of Acid Fast Bacilli in the Tissue Section. J. Anat. Soc. of India. 4: 41-42, 1955.
5. Broders, A. C.: Tuberculosis of the Stomach; with report of a case of Multiple Tuberculous Ulcers. Surg., Gynec. & Obst. 25: 490-504, 1917.

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FIBRO-SARCOMA OF THE LUNG

by D. J. REDDY, T. SURYAPRAKASA RAO, K. GOPALAKRISHNIAH GUPTA,
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Almost every week we read in one or the other medical journal reviews, case reports, experimental, or statistical work relating to Bronchogenic carcinoma, Alveolar-cell carcinoma or Bronchial adenoma. These reports stress the alarmingly increasing incidence of bronchogenic carcinoma in Europe, America and also in Bombay. Statisticians, Chemists, Bio-chemists, Surgeons and Pathologists are directing their energies to elucidate the causal factors for the same. Contrary to the frequent reports of epithelial tumours of the lung, stray case reports of neoplasms of mesenchymal origin of the lung are met with. These may arise from the bronchial wall or interstitial tissue of the lung and the more commonly encountered ones in this group are, Fibro-sarcoma, Neuro-fibrosarcoma, Angio-endothelio-sarcoma, Lymphoma and Lympho-sarcoma. These have since been recognised as definite entities and have been separated on authentic histological evidence from the undifferentiated round-celled or spindle-celled sarcoma.

Kahler is quoted by Pollak⁹ and his associates as having made the earliest reference to sarcoma of the bronchus. Adler¹ in his book in 1912 listed 90 cases of pulmonary sarcoma. Ball³ from a review covering the period 1900-1931 observed 14 cases of lung sarcoma, and added one of his own. In this case the lung was so extensively involved that the exact site of genesis of the neoplasm could not be located. Oschner⁸, Debekay, and others noted in 412 patients of primary carcinoma of the lung covering a 22 year period only two fibro-sarcomata of the lung treated by resection. Mallory⁷ reported two pulmonary fibrosarcomas in which pneumonectomy was done and in any case the primary or secondary nature of the neoplasms could not be pronounced with certainty. He further reported the first case of pulmonary

sarcoma met with in 8,000 necropsies in Massachusetts General Hospital. Ellis⁶ quoted by Carswell et al reported a case of spindle-cell sarcoma of the lung in a series of 7,292 autopsies. In all these published reports of pulmonary sarcoma, the primary nature of the tumour cannot be accepted as conclusive, barring those verified at autopsy.

Detailed clinical findings and careful autopsy study of a case of sarcoma of the lung encountered by us, owing to its rarity are felt worthy of being recorded.

Clinical history:

P. K., male, aged 50, sought medical aid for dyspnoea of 15 days duration under Dr. P. Narayana Rao, Govt. General Hospital on 7-2-1956. The patient was an agricultural labourer, addicted to alcohol and enjoyed smoking cigars.

Physical examination revealed massive pleural effusion on the left side with marked deviation of the trachea and the mediastinum to the right. No malignant cells were observed in the blood stained fluid aspirated on three occasions to relieve dyspnoea.

Roentgenogram taken on 15-2-1956 showed diffuse opacity on the left side and a well defined circular shadow (Fig. 1) in close proximity to the diaphragm on the right side suggestive of a metastatic nodule. The patient expired on 12-3-1956.

Provisional clinical diagnosis of "Bronchogenic carcinoma with Metastases" was made.

Chief necropsy and histological findings:

Pitting type of oedema of both legs was observed. The tracheal and mediastinal shift to the right was confirmed. The left lung was adherent to the parietes by dense adhesions. The left pleural cavity contained 3 pints of blood stained fluid.

The left lung was greatly increased in size and weighed 1800 grammes. Major portion of it was fleshy and haemorrhagic. Sectioned surface presented homogeneous appearance (Fig. 2). In continuity with this and just over it was a portion of the normal lung. Projecting between the middle and upper lobes of the right lung was seen a well outlined circulo-ovoid pale white nodule of the

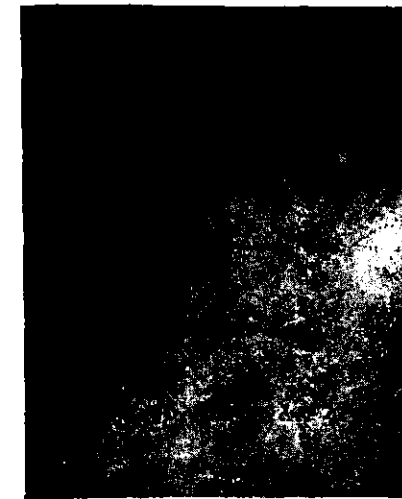


Fig. 1.

Reduction photograph of X-ray chest, showing diffuse opacity on the left side signifying pleural effusion and a circumscribed rounded shadow right base depicting lymph nodal metastases.



Fig. 2.

Photograph illustrates the massive homogenous neoplasm forming the major portion of the left lung. Circumscribed nodule in the contra-lateral lung just above the liver and a circular lesion in the liver, indicating the cyst.

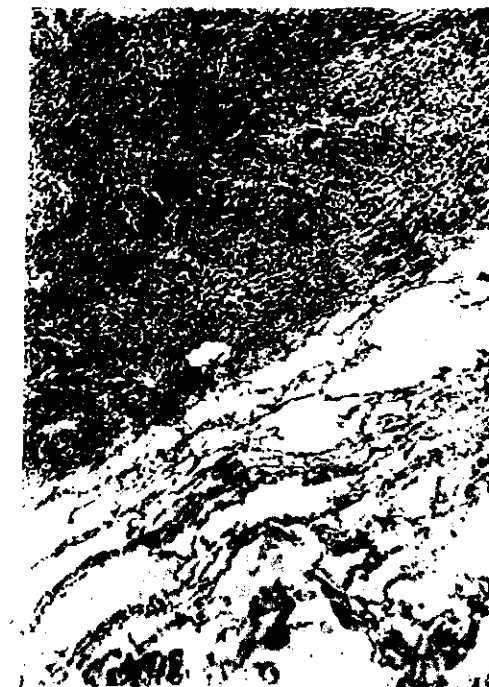


Fig. 3.

Photomicrograph shows collapse of the lung bordering the neoplastic tissue. (H & E x 72)



Fig. 4.

Photomicrograph illustrates rows of spindle cells with hyperchromatic nuclei. (H & E x 324)



Fig. 5.

Photomicrograph illustrates the pleomorphic nature of the cells. They are round, ovoid and spindle cells with hyperchromatic nuclei some of them showing mitotic figures. (H & E x 324)



Fig. 6.

Photomicrograph illustrates tumour giant cells. (H & E x 324)



Fig. 7.

Photomicrograph illustrates necrosis and haemorrhage in the tumour tissue. (H & E x 72)



Fig. 8.

Photomicrograph illustrates commencing myxomatous change and the typical astral shape of the myxomatous cells. (H & E x 324)



Fig. 9.

Photomicrograph illustrates islands of myxomatous change in the tumour mass. (H & E x 72)



Fig. 10.

Photomicrograph illustrates multiple foci of calcification. (H & E x 72)

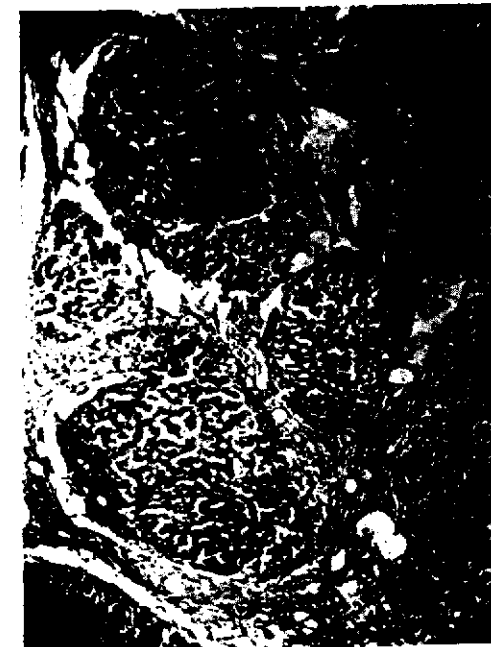


Fig. 11.

Photomicrograph illustrates biliary cirrhosis of the liver. (H & E x 48)



Fig. 12.

Photomicrograph illustrates the fibrous wall of the hepatic cyst and fatty change of the liver cells in the remnants of the enclosed liver tissue. (H & E x 72)

size of a small orange, not attached to either lobes of the lung (Fig. 2). The liver showed diffuse uniform granularity and cut surface disclosed in its upper part a circular cystic space of the size of half-a-rupee coin and of greenish hue. It was filled with brownish viscid material (Fig. 2). All other organs including bones were not affected.

Sections from multiple blocks of the neoplasm and secondary deposit stained with Haematoxylin and Eosin, Van-Gieson and Foot's stain were studied. Frozen sections of the same were also studied. The lung adjoining the tumour was collapsed (Fig. 3). The tumour was composed chiefly of spindle cells, arranged in fasciculi or ill defined whorls (Fig. 4). Some of them were ovoid while a few were round and all showed marked atypicity confirming malignancy (Fig. 5). Large tumour giant cells formed a feature of the neoplasm (Fig. 6). Extensive necrosis and haemorrhage was observed in all the sections (Fig. 7). Myxomatous change was noticed in some of the sections (Fig. 8). Some of these cells assumed a typical astral shape with radially arranged fibrillary processes (Fig. 9). Multiple foci of calcification were also a feature of the growth (Fig. 10). The secondary deposit noticed in the right lung showed similar appearances as the primary neoplasm and no remnants of lymphoid tissue were found. But for an isolated plaque of squamous metaplasia of the bronchus, no focus of neoplastic change was seen in any one of the bronchioles. Sections of the liver showed typical biliary cirrhosis (Fig. 11) and fatty change of the tissue enclosed in the cystic space (Fig. 12).

Morbid histological diagnosis:

"Primary Fibro-sarcoma of the Lung with Lymph nodal Metastases".

COMMENT

The gross and histological appearances of the tumour bear indisputable evidence of primary fibro-sarcoma of the lung. The absence of neoplastic change in the bronchial tree, the massiveness of the growth, excessive cellularity of the neoplasm and the neoplastic mass merging into the healthy portion of the lung point to the genesis of the tumour from the interstitial tissue of the lung. Willis¹² has made reference to such a histogenesis of pulmonary fibro-sarcoma. Interlobar lymph nodal metastases is a significant finding, although a deviation from the usual blood metastasis of these tumours. But for terminal dyspnoea, the patient was asymptomatic and this feature of the tumour needs to be

emphasised. The absence of bronchial involvement points to the futility of endoscopic examination in such cases. Absence of expectoration in this case till the last was a noteworthy feature and this denied the clinician and pathologist yet another source of diagnosis of the new growth. The non-finding of malignant cells in the pleural effusion only stress the fact that negative findings do not exclude the presence of a malignant tumour.

Black⁵ in a review of sarcoma of the lung rightly opined that only five of the reported cases in the literature could be considered as primary pulmonary fibro-sarcoma and our case answers the criteria of such a tumour. The prognosis of these neoplasms as assessed from the published reports is not very encouraging. However early recognition of the tumour before tumour dissemination has occurred, resection of the growth should promise longer period of survival.

We are constrained to suggest any explanation for the biliary cirrhosis noticed in the absence of extra biliary obstruction. Explanation for the solitary cyst in the liver is wanting.

SUMMARY

1. Literature regarding mesenchymal tumours of the lung with special reference to fibro-sarcomata of the lung is briefly reviewed.

2. Clinico-pathological findings in a case of fibro-sarcoma of the lung with lymph nodal metastases are recorded.

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REFERENCES

1. Adler, I.: Primary growths of lung and bronchi. Longman Green & Co., New York, 1912.

2. Averil, A., Leibow, M. D. and David S. Hubbell.: Sclerosing haemangioma of the lung. *Cancer*. 9: 53-75, 1956.
3. Ball, H. A.: Primary pulmonary sarcoma — Review with a report of additional case. *Amer. Jour. Cancer*. 15: 2319, 1931.
4. Banker, D. D.: Primary carcinoma of the lung, a clinico-pathologic analysis of 43 necropsies with a critical review of literature. *Jour. of Post Graduate Medicine*. 108-140, 1-2-55.
5. Black, H.: Fibro-sarcoma of the bronchus. *Jour. Thor. Surg.* 19: 123, 1950.
6. Cartswell James Jr. and Kraeft Nelson, H.: Fibro-sarcoma of the bronchus. Report of a case diagnosed by bronchoscopy and treated by pneumonectomy. *Jour. Thor. Surg.* 19: 117, 1950.
7. Mallory, T. B.: Cabot's case 22441. A malignant haemangioma of the lung with multiple metastases. *New England Jour. of Medicine*. 215: 837, 1936.
8. Oschner, A., Debekay, M. E., Dunlop, C. E. and Richman, I. M.: Primary lung malignancy factors influencing survival. *Jour. Thor. Surg.* 17: 573, 1948.
9. Pollack, B. S., Cohen, S., Borrone, M. G. and Ghassi, A. M.: Primary sarcoma of the lung — case report. *Amer. Jour. Roentgenology*. 41: 909, 1939.
10. Stout, A. P.: Fibrosarcoma, the malignant tumour of the fibroblasts. *Cancer*. 1: 30, 1948.
11. Willard Van Hazel and Robert J. J. Jensilk.: Lymphoma of the lung and pleura. *Jour. Thor. Surg.* 31: 19-44, 1956.
12. Willis, R. A.: Pathology of Tumours. 2nd Edn., 1953. Butterworth Medical Publications. Toronto, Canada.

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SITUS INVERSUS TOTALIS WITH ASSOCIATED ABNORMALITIES

by * D. J. REDDY, T. SURYAPRAKASA RAO, K. GOPALAKRISHNIAH GUPTA,
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and ** V. RAMACHANDRA RAO, Guntur.

Transposition of viscera is known since ancient times. Aristotle, cited by Wood and Blalock¹¹, is credited to have spotted two cases of transposed viscera in animals. Lineback² reports that Fabricius in 1600 A.D. described a case of transposed liver and spleen in the human. In 1824 A.D., Kuchenmeister, according to Wood and Blalock¹¹, first recognised the condition in the living and 75 years later Vehsemeyer¹⁰ demonstrated the condition by X-rays. This condition is more common than recorded, and up-to-date, about thousand cases have been reported. The incidence of this condition from various authors varies from 1 in 1400 to 35,000. The variation in the incidence is attributed to the frequency of recognition either in the wards or in the necropsy rooms. Roesler⁸ observed 1 in 7467 from 22,402 necropsies and this naturally relates to the selective population in the hospitals excluding incidence in the general population. Torgersen⁹ in 1949 from an extensive study of Situs inversus in the general population found 195 cases of Situs inversus in 1.5 million people screened by mass X-ray in Norway and its incidence according to him is about 0.01%. Mayo and Rice⁶ recognised 76 cases of situs inversus of both thoracic and abdominal viscera on physical and Roentgenological examination in 1,551,047 patients registered at the Mayo-clinic during 1910 to 1947, forming an incidence of one in 20,408 among the hospital admissions. During the same period 3 were encountered in 19,287 autopsies. The youngest recorded was 6 months and the oldest 76 years. Many of the new born with transposition of organs are short lived and hence less incidence has been recorded on the

clinical side. P. K. Rao and D. S. Mudaliar⁷ reviewing cases of transposition of viscera reported in the Indian literature, made mention of its clinical recognition in a medical student with complete transposition of viscera who sought aid for appendicitis pointing towards the left iliac fossa. They reviewed another case in a new born child of 24 hours wherein, the caecum and appendix were found on the left side while operating for imperforate anus. In 1915 the late Dr. Santanakrishna Pillai roentgenologically demonstrated situs inversus totalis in one of his cases.

The aetiology of congenital anomalies forms still the subject of inquiry. Adams and Churchill¹ are of opinion that situs inversus may be inherited and a few cases have been observed in more than one member of the family. Situs inversus was first found as a genetic variation in experimental animals in 1948 and reported to have been caused by recessive gene in mice. Mattison quoted by Torgersen⁹ observed the anomaly in mother and daughter while Pernkoff quoted by Torgersen found complete situs inversus in father and partial situs inversus in his child. Cockayne² further gave evidence in support of its incidence in twinning. They are more frequently met with in monozygotic twins than in dizygotic and Torgersen goes to the extent to indicate geographical variation in its incidence which is said to parallel with the incidence of twinning. The most reasonable assumption is that inversion is partly due to some environmental factors possibly causing a division of the dizygotic pair of twins. Experimental evidence and observations in man suggest that variations in the development of the dorsal metamereres play a fundamental role in the asymmetry of viscera.

Johnson³ in reviewing 632 cases of Situs inversus for the period 1925-46 observed

550 Dextro-cardias and 379 instances of situs inversus totalis. In 128 of them Dextro-cardia was the only transposition found. The tabular form records the incidence of situs inversus partial or total, recorded by Johnson.

TABLE I

Author	Partial situs inversus	Colon alone	Liver	Heart and vessels	Stomach
Johnson	41	46	2	20	6

This condition is associated with other abnormalities like multiple splenules, absence of spleen, deformities of nose and frontal sinuses, imperforate anus, atresia of the duodenum; Meckel's diverticulum, anomalies of the spine, defective development of the jaw, hydrocephalus, etc.

Bronchiectasis is reported in 25% of the cases of situs inversus recorded by Torgersen. Kartegener's⁴ triad of bronchiectasis, nasal sinus disease, and transposition of viscera has been recognised by Adams and Churchill in 23% of situs inversus while its incidence in general population is 0.5% as recorded in Mayo-clinic for the period 1922-41.

The recognition of situs inversus in the living is all important, when patients seek surgical aid for vague and unaccountable abdominal or thoracic symptoms. Mayo and Rice rightly laid emphasis on the need to recognise this condition prior to operation to avoid a repetition of incision to the inconvenience of the patient because of the recognised situs inversus. They had also cautioned the need to bear in mind that congenital anomalies are often multiple and that one should be on the look out for a second anomaly in case one was spotted so that the same could be rectified at one operation. The clinical recognition of this condition is made easy when one keeps in mind the existence of this anomaly and by feeling for the lower border of the liver below the left costal margin; or the finding

of the right testis at a lower level than the left, spotting the shift of the cardiac apex to the right by physical and X-ray examination, barium meal visualisation of the stomach, duodenum and appendix, Cholecystography and changes in the electrocardiogram.

The findings of situs inversus totalis with associated nasal proboscis, moderate degree of hydrocephalus and certain rare malformations of the heart not usually recorded with this condition, are sufficient reasons to record this case report.

CASE REPORT

A still born male foetus of 16" length weighing 38 ozs. was handed over to the Pathology Department of Guntur Medical College without any obstetric history 6 months ago. Chief autopsy findings of the case are given below.

The proboscis in the form of a tubular nose, drew our attention and a probe passed through it confirmed our suspicion that it had a blind end (Fig. 1). Sagittal section of the skull disclosed absence of any cartilaginous or bony frame work supporting this structure and totally devoid of any relationship with the oropharynx (Fig. 2). Structures resembling nose were wanting. Brain occupied small portion of the cranial cavity and showed signs of decomposition. Appearances of the cranial cavity were suggestive of hydrocephalus. The oesophagus and trachea were normal. The organs of the thoracic and abdominal cavities showed complete transposition of the viscera (Fig. 3). Each lung consisted of 2 lobes; the left being slightly bulkier than the right. The entire heart appeared to have been made up of the ventricle, the auricle having assumed a posterior position to the left of the mid line. The cardiac apex was seen to the right of the median line. Dissection of the heart revealed one ventricle from which arose the aorta and the pulmonary artery (Fig. 5). On opening the atrium, it was found that there was failure in the development of the inter-atrial septum, this being deficient in the antero-inferior aspect. What might be the left auricle was represented as a small auricular diverticulum which was present in the posterior aspect and to the right, appearing as diverticulum of the terminal part of right superior venacava (Fig. 4). The superior venacavae were two in number. The left was seen opening into the cephalic part of the atrium, while the right one inclined obliquely downwards and to the left and opened into the atrium. The inferior venacava was seen to ascend to the left of the mid line and open into the caudal portion of the atrium. Two pulmonary veins were seen opening into the posterior part of the single atrial cavity near the

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Fig. 1.

Photograph illustrates median projection from the forehead 'proboscis nose' the arrow pointing the proboscis.



Fig. 2.

Photograph shows sagittal section of cranium and oropharynx, illustrating the blind end of nasal proboscis and in no way related to oropharynx.



Fig. 3.

Photograph shows complete transposition of viscera, apex of the heart to the right, right lobe of the liver to left and sigmoid to the right.

rudimentary second atrium described. Aorta descended to the right of the vertebral column (Fig. 4).

Stomach: Stomach was placed to the right of the mid line and the pylorus to the left of the mid line in the transpyloric plane. The mesenteric attachment was directed from right to left.

Caecum and appendix were to the left of the median line, the sigmoid colon and rectum were seen descending to the right of the median line (Fig. 6).

Liver: The right lobe of the liver was seen filling the space underneath the left costal margin with the gall bladder occupying a normal position to the liver but towards the left of the mid line (Fig. 3).

Spleen: Eleven splenicules of different sizes and shapes varying from 3 m.m. to 15 m.m. were seen in relation to the stomach at the fundus in the right hypochondrium.

Kidneys: The right kidney was found at a higher level than the left one.

COMMENTS

The necropsy findings illustrate situs inversus complete. The anomalies of the heart pertaining to the chambers and also the persistence of second superior venacava have rarely been recorded in situs inversus complete. The complete transposition of the viscera and associated cardiac anomalies indicate incompatibility with life. However the necropsy findings remind the surgeon of obscure clinical signs and symptoms in cases of left sided cholecystitis or appendicitis or of right sided diverticulosis

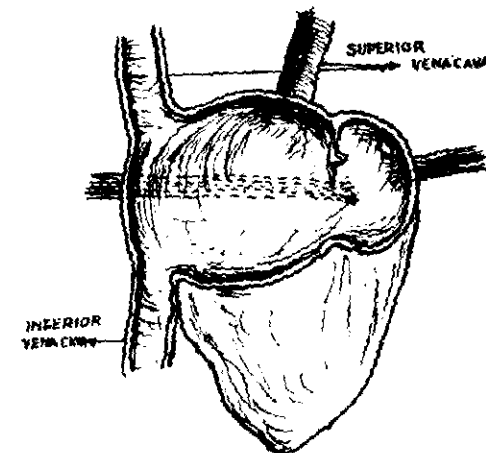


Fig. 4.

Line drawing illustrates single ventricle, rudimentary left atrium and disproportionately large right auricle with a remnant of the septum between the two. The pulmonary veins shown in dotted lines are opening into the rudimentary left atrium. Two superior venacavae and one inferior venacava are seen opening into the right atrium.

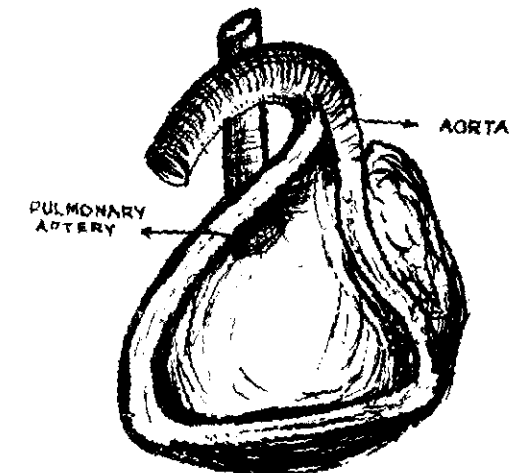


Fig. 5.

Line drawing illustrates the openings of the pulmonary artery and aorta into the single ventricular cavity.



Fig. 6.

Photograph illustrates appendix and caecum in the iliac fossa and sigmoid colon in the right iliac fossa.



Fig. 7.

Photograph shows the sigmoid colon to the right of median line, and the arrow mark points in proximity to the right kidney, cluster of splenicules in the rino-lienl and lienogastic ligaments stomach is to the right of median line with the vertical descent of duodenum.

with or without diverticulitis of the sigmoid colon.

Transposition of viscera according to the available reports are not incompatible with normal health. Johnson recorded personally studied cases given in the Tabular column below, of recognition during life.

TABLE II

(indicating clinical recognition of situs inversus in the living as recorded by Johnson)

S. No.	Sex	Age	Data & aids employed in diagnosis.
1.	F	15	X-ray shows — dextrocardia; caecum left side.
2.	F	27	X-ray and laparotomy.
3.	F	38	X-ray stomach on the right side ECG dextrocardia.

These are sufficient to emphasize the need to keep in mind the existence of partial or complete situs inversus. Our findings are also in agreement with the published reports of others in that situs inversus is associated with other anomalies.

SUMMARY

1. Pertinent literature regarding situs inversus is briefly reviewed.
2. Autopsy findings in a case of situs inversus totalis associated with cardiac and nasal proboscis anomalies are recorded.
3. Emphasis is laid on the need to bear in mind the existence of this condition in thoracic and abdominal surgical conditions manifesting obscure signs and symptoms.

ACKNOWLEDGEMENT

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REFERENCES

1. Adams, R. and Churchill, E. O.: Situs inversus, Sinusitis, Bronchiectasis. Jour. Thor. Surg. 7: 206, 1937.
2. Cockayne, E. A.: Genetics of transposition of viscera. Quart. Jour. Med. 7: 479, 1938.
3. Johnson Robert, J.: Situs inversus with associated abnormalities. Arch. of Surg. 58: 149, 1949.
4. Kartegener, M.: Zur Pathogenese der Bronchiectasien: Bronchiectasien bei situs viscerum inversus. Beitr. Z. Klin. d. Tuberk. LXXXIII: 489, 1933.
5. Lineback, P. E.: An extraordinary case of situs inversus totalis. Jour. Amer. Med. Assn. 75: 25, 1775—December 1920.
6. Mayo Charles, W. and Rice Robertag.: Situs inversus totalis — A statistical review of data on 76 cases with special reference to disease of the biliary tract. Arch. of Surg. 58: 724, 1949.
7. Rau, P. K. and Mudaliar, D. S.: Transposition of organs. Antiseptic. Feb. 1933.
8. Roesler, H.: Beitrage Zur Lehre Von den auge borne Igolierte Rechts lager der Herzens Wien Arch. F. Inn. Med. 19: 505, 1930.
9. Torgersen Johan.: Genetic factors in visceral asymmetry and in the development and pathogenetic changes of lungs, heart and abdominal organs. Arch. of Path. 47: 566, 1949.
10. Vehsemeyer.: Ein Fall von congenitaler Detio kardiac Zugleich ein Beitrag Zur Ver Werthung. der inner Medizin. Deutsche med. Wehnscher. 23: 180, 1897.
11. Wood, G. W. and Blalock, A.: Situs inversus totalis diseases of biliary tract, survey of literature and report of a case. Arch Surg. 40: 885, May 1940.

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COMPLETE RECOVERY FOLLOWING TEN MINUTES OF CARDIAC ARREST UNDER LOCAL ANAESTHESIA

by K. K. SINHA, Kasauli.

Cardiac arrest under general anaesthesia not related to any disease of the heart used to be a major hazard of Chloroform anaesthesia. The first fatality due to cardiac arrest under anaesthesia was reported in 1948, according to Dale².

Attempt at resuscitation by massage was made for the first time by Nichaus in 1889 but unsuccessfully. Successful massage was reported by Inesland in 1889. Successful massage was a great impetus towards a new method of treatment.

With the increased adoption of surgery under varied conditions in various age groups even in states of poor physical health, primary cardiac arrest is by no means infrequent, even though this group does not include cases of direct intervention on the heart. Today, Chloroform anaesthesia has been abandoned and safe anaesthetic agents are used but still primary cardiac arrest occurs. Even local anaesthesia is not exempt. Extensive studies on this problem have been carried out by workers at Boston, and their statistics show that the incidence of the condition is very low in age groups below 40 and progressively increases after this age. Therefore the surgeon and the anaesthetist should be prepared to encounter and deal with this condition in patients of the older age groups and success depends on prompt recognition and immediate coordinated treatment. The factor of Electrocardiographic assessment of elderly subjects for surgery need hardly be stressed as unsuspected cardiac lesions may be masked, and precautions can be taken after their recognition.

Problem of Arrest:

For proper orientation of the problem of arrest, it is essential to realise the changes

which follow in the body after cessation of the heart beat. Circulation ceases and respiration stops after a few breaths. The various organs start suffering from lack of oxygen and essential metabolic substances. This results in their death after some time.

The vulnerability of various tissues differs but the Central Nervous System, suffers most and irreversible damage first takes place in the Cortex. The exact period is not known and the limit of 10 minutes as suggested by Hawkins, McLaughlin and Daniel⁴ may be nearer the critical period than 5 minutes as mentioned by Greenfield³, in the light of present day therapy for the condition. Again there must be a great individual variation.

Likely Biochemical Changes:

Not only does the brain suffer but other organs also start suffering. The studies in connection with Shock have shown that Anoxia of various organs leads to liberation of Vasodilator metabolites. In the absence of adequate Adrenal function during Anoxia, serum K, has been shown to be raised. With the arrest of circulation and non-mobilisation of Adrenal Steroids from the Adrenal Cortex it is not difficult to presume that serum K might be raised following arrest too. When circulation establishes again the accumulation of K would naturally impair cardiac contraction.

Blood glucose is also known to fall when there is Anoxia and absence of Adrenal induced glucogenesis. It is likely that this hypoglycaemic state may be duplicated in arrest too and might be a factor hampering the recovery of the cerebral cortex. It is difficult to predict the behaviour of Adrenal Cortex subjected to complete circula-

tory arrest in reversing the above mentioned possible changes. So it appears that it would be worth while to study blood glucose, Electrolytes, Adrenocortical potency and pharmacological activity on blood vessels of blood taken from a subject having Cardiac arrest immediately after restarting of the circulation.

Unfortunately it was not possible to study these in the case under question, but therapy was planned to counteract these effects and the result was something unexpected.

There are many records of cases surviving for days after cardiac arrest for 5 to 10 minutes in a state of Decerebrate Rigidity; but in many of these cases no method to raise the B.P. immediately to an adequate level was employed and therefore a full blood flow to the brain which is of the order of 1400 c.c. per minute was not obtained till quite some time later when the relatively resistant vital Medullary centres have recovered. In many cases the heart continued to beat for hours although the blood pressure remained at a very low level and never rose. This fact has also been stressed by Rao who used arterial transfusion to get adequate B.P. in two successful cases of massage and this has also been mentioned by others. Little stress seems to have been laid on blood glucose so far, and this is surprising in view of the fact that this is such an important metabolic for the cerebral cortex that slight fall leads to hypoglycaemic coma.

It is being increasingly realised that adequate oxygenation must be started at once and the only way to do it is to start artificial respiration with an endotracheal tube thereby insuring adequate expansion with positive pressure given either manually or with a machine using a Carbon dioxide absorber. This effort must be continued not only till return of spontaneous breathing, but till adequate deep breathing is established. Shallow breathing is of little value and its danger must always be realised.

Cortisone Acetate given parenterally to antagonise the possible rise of serum K,

and to protect the tissues against the stress of circulatory arrest, and to be a substitute for a probable hypofunction of the Adrenal Cortex resulting from the effect of circulatory absence, may be of value.

CASE REPORT

Mr. P., male, aged 45 suffering from Pulmonary Tuberculosis with a cavity in the right upper lobe, was being given local anaesthesia after premedication with morphine for right upper thoracoplasty. The Anaesthetist noted in the last 3 minutes of infiltration of the anaesthetic agent, that the patient was unusually quiet and deep needle pricks which had caused some discomfort before caused no such response. He removed the towels and found the patient slumped on the table, with widely dilated and fixed pupils. The patient was pulseless and heart sounds were not audible.

The surgeon was called from the neighbouring room who immediately opened the abdomen and started transdiaphragmatic massage of the heart. This he continued for two minutes when the heart started beating and pulsation returned to the Aorta and the wound started bleeding. An assistant noted that it was full five minutes from the time of incision before the beat returned. Nearly five minutes had elapsed before the incision was made and to save time the thoracic route which is recommended by many was not employed. Hundred percent oxygenation was carried out with an endotracheal tube with carbondioxide absorber.

Blood pressure was imperceptible. Calcium gluconate 10% 10 c.c. was given I.V. 100 c.c. of 25% Glucose was also given by the same route. Adrenaline 1 c.c. diluted in 10 c.c. of saline had been given intracardially before starting the massage. A continuous Noradrenalin I.V. drip was started with 2 mgms. in 500 c.c. of 5% Glucose at about 120 drops per minute. The B.P. rose after a few minutes to 120/90 and maintained later at rate of 60 drops per minute. Cortisone acetate 50 mgms. I.M. was given. Spontaneous breathing returned about an hour later but it was inadequate and oxygenation was continued. Two hours later the patient showed wide spread muscular activity manifested by increased extensor tone and clonic movements. This settled on administration of 8 c.c. of Paraldehyde intramuscularly, although the B.P. fell to 80/60 following this activity. The rate of Noradrenalin had to be increased to 80 drops per minute to restore the B.P. to 120/90 again.

Nearly 12 hours later the patient started showing signs of C.N.S. recovery manifested by return of pupillary reflex and eye ball movements. Cortisone (50 mgms.) was given again and B.P. was maintained with Noradrenalin. Nearly 18

hours after the return of the heart beat the patient started showing signs of consciousness, manifested by response to loud calls and at the end of 24 hours he started pointing to the endotracheal tube and complaining of pain. Oxygen was withdrawn and three hours later when the patient remained in good condition without oxygen the endotracheal tube was taken out after Atropine gr. 1/100 had been given. The blood pressure was still maintained on Noradrenalin though at a slow rate. Cortisone (50 mgms.) was given on the 2nd day and small feeds ordered. The kidney was functioning adequately as shown by adequate urinary output. The patient had three litres of 5% glucose containing Noradrenalin to a total of 12 mgms. in the 1st 24 hours. On the third day, i.e. 48 hours after the arrest B.P. was maintained without Noradrenalin and the dose of Parenteral Cortisone was brought down to 25 mgms. The same evening he reported pain in his abdominal wound which had burst and was repaired.

The patient made uneventful progress till 3 weeks later when he developed Jaundice which cleared in a few days. The patient does not remember anything about the first 36 hours and psychologically is quite intact and stable. Heavy doses of anti-biotics, Penicillin and Streptomycin were given all along.

The interesting features of this case are: (1) It is a case of complete recovery after about 10 minutes of Cardiac arrest under local anaesthesia, an unusual event. (2) Therapy was based on antagonising the effect of Anoxia and likely metabolic changes arising as a result of Cardiac arrest, i.e. Hypoglycemia, Hyperkalemia, liberation of Vasodilator metabolites and possible deficiency of Adrenocortical steroids. (3) The successful result puts forward a strong argument in favour of studying these factors and calls for further studies regarding the period of Cortical ir-

reversible damage after Cardiac arrest. (4) It also points to the danger of wounds breaking down which goes with Cortisone therapy. (5) The patient had Jaundice at the end of 3 weeks which was toxic in nature and no cause could be found. (6) Available literature has failed to show an approach exactly along these lines although all the drugs have been employed and stress has been laid on adequate oxygenation and maintenance of B.P. by others.

SUMMARY

A successful case of Cardiac resuscitation about 10 minutes after arrest due to local anaesthesia is recorded and a case is made out for therapy using drugs antagonising the possible metabolic effects of cardiac arrest. A plea is made for a study of these changes.

REFERENCES

1. Briggs.: Studies in Cardiac arrest (Personal communication).
2. Dale.: Cardiac arrest. *Annals of Surgery*. 135: 376, 1952.
3. Greenfield.: *Journal of Neurology and Psychiatry*. 1: 306, 1938.
4. Howkins, MacLaughlin and Daniel.: Neuronal damage from temporary cardiac arrest. *Lancet* I: 488, 1946.
5. Scudder.: *Blood studies as a guide to Therapy*, 1940.
6. Ruzicka and Nicholson.: Cardiac arrest under Anaesthesia. *J.A.M.A.* 135: 622, 1947.

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ORTHOPAEDIC SECTION TUBERCULOSIS OF THE SPINE *

by K. S. GREWAL and MOHINDERPAL SINGH, Amritsar.†

We have analysed 768 patients of tuberculosis of the spine. They formed 3.43% of the total number of patients who attended the Orthopaedic Clinic of the V. J. Hospital, Amritsar from 23rd February 1949 to 30th June 1955 (Table I).

TABLE I
INCIDENCE OF SPINAL TUBERCULOSIS

Total patients	Spinal tuberculosis	
	Patients	Percent
22320	768	3.43

Though tuberculosis in general is supposed to be disease of the children, in our series tuberculosis of the spine was commonest in the third decade, i.e., early adulthood. It was closely followed by second and first decades respectively. A large majority, 77.35 per cent, were affected below the age of 30 years, after which the incidence fell with the advancing age. Only 3 patients, (0.39 per cent) were above 60 years of age (Table II).

There was a slight preponderance of females, 51.04 per cent as compared to 48.96 per cent of males (Table III).

TABLE II
AGE INCIDENCE

	Upto 10 years	11-20 years	21-30 years	31-40 years	41-50 years	51-60 years	Above 60 years	Total
Patients	184	200	210	89	60	22	3	768
Per cent	23.96	26.05	27.34	11.59	7.81	2.86	0.39	100.0
Patients		594			171		3	768
Per cent		77.35			22.28		0.39	100.0

In our previous analysis (Grewal, 1952) urban patients predominated (81.4 per cent). The incidence seems to have since risen in the rural people. In the present series, urban patients make 63.02 per cent and rural 35.02 per cent, the addresses being unrecorded in 1.96 per cent (Table IV).

*Paper read at the XVII Annual Conference of the Association of Surgeons of India on 31st of December, 1955 at Amritsar.

†From the Department of Orthopaedic Surgery, V. J. Hospital, Amritsar.

Spine remains the most frequent site of skeletal tuberculosis. The incidence in our series being 34 per cent out of 2260 patients of skeletal tuberculosis. This is followed by hip, knee and ankle in order of frequency (Table V).

On comparing the incidence of tubercular affection of the weight-bearing bones and joints with the non-weight-bearing bones and joints, the former show a very high incidence of 76.37 per cent (Table VI).

TABLE III
SEX INCIDENCE

Female		Males		Total	
Patients	Per cent	Patients	Per cent	Patients	Per cent
392	51.04	376	48.96	768	100.0

TABLE IV
INCIDENCE IN URBAN AND RURAL
POPULATION

Urban		Rural		Unrecorded		Total	
No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
484	63.02	269	35.02	15	1.96	768	100.0

TABLE V
INCIDENCE OF SKELETAL TUBERCULOSIS

Part affected	Patients	Per cent
Spine	768	34.0
Hip	295	13.0
Knee	270	12.0
Ankle	226	10.0
Elbow	158	7.0
Wrist	135	6.0
Sacroiliac Joint	77	3.0
Foot Bones	63	2.8
Ribs	56	2.4
Ilium	49	2.1
Hand Bones	44	2.0
Shoulder	44	2.0
Sternoclavicular joint	14	
Sternum	14	
Scapula	14	
Femur	12	
Tibia	12	3.3
Acromioclavicular joint	4	
Fibula	3	
Clavicle	1	
Humerus	1	
Total	2260	100.0

TABLE VI
INCIDENCE OF TUBERCULOSIS IN
WEIGHT-BEARING BONES AND JOINTS

Total patients of skeletal tuberculosis	Weight-bearing bones and joints		Non-Weight-bearing bones & joints	
	Patients	Percent	Patients	Percent
2260	1726	76.37	534	23.63

Does mobility or some other factor determine the seedling of the bacilli? To answer this question 530 lesions in 508 patients were analysed (Table VII).

TABLE VII
SITES OF INVOLVEMENT IN THE SPINE

Anatomical situation of vertebrae	Children*		Adults	
	No. of Lesions	Per cent	No. of Lesions	Per cent
Cervical	I 5		2	
	II 7		3	
	III 6		5	
	IV 2	4.13	7	4.41
	V 2		9	
	VI —		8	
	VII —		2	
Thoracic	I 4		1	
	II 8		2	
	III 11		5	
	IV 17		9	
	V 24		13	
	VI 33	62.87	20	40.56
	VII 35		24	
	VIII 36		29	
	IX 36		32	
	X 40		47	
	XI 39		64	
	XII 37		85	
Lumbar	I 43		91	
	II 43		93	
	III 32	31.82	90	53.19
	IV 25		98	
	V 19		64	
Sacral	I 6	1.18	15	1.84
Total vertebrae Involved	509	100.0	816	100.0

* Upto the age of 15 years.

Thoracic spine was the most frequent site of involvement in children upto the age of 15 years, 62.87 per cent of the total morbidity occurring in that region. Thoracic spine is the least mobile portion. Though it is difficult to prove, it is surmised that direct lymphatic spread from the tracheo-bronchial glands in children may be an important factor. Other anatomical factors are unfavourable for the disease to settle in the thoracic spine, as lumbar vertebrae are more cancellous and vascular in a growing child. In adults the lumbar region was more frequently affected, in them 53.18 per cent of the total morbidity occurred in the lumbar area. Probably mobility is a more important factor in adults.

Children seem to have a severer type of disease than the adults. Involvement of more than two vertebrae was frequent in children; 52.98 per cent of the children had an involvement of more than two vertebrae whereas in adults 70.3 per cent had an involvement of two or less vertebrae (Table VIII). It follows that resistance in

TABLE VIII
EXTENT OF INVOLVEMENT IN CHILDREN AND ADULTS

Extent of involvement	Children		Adults	
	No.	Per cent	No.	Per cent
Single vertebral involvement	12	47.02	40	70.30
Two vertebral involvement	67		199	
Three vertebral involvement	39	52.98	59	29.70
Four vertebral involvement	21		27	
Five vertebral involvement	18		9	
Six vertebral involvement	7		1	
Seven vertebral involvement	2	1	3	1
Eight vertebral involvement	2		1	
Nine vertebral involvement	—		1	
Total ...	168	100.00	340	100.00

children is less and the disease spreads quickly to the adjacent vertebrae, or may be that many vertebrae are involved together due to the same reason.

Abscess formation was also more frequent in children; out of 101 lesions 83.17 per cent showed radiological evidence of paravertebral abscess; in adults 75.58 per cent of 213 lesions similarly analysed showed paravertebral abscesses (Table IX).

TABLE IX
INCIDENCE OF ABSCESS FORMATION

Region of the Spine.	Children			Adults		
	Lesions analysed	Lesions showing abscess	Per cent	Lesions analysed	Lesions showing abscess	Per cent
Cervical	5	2	40.00	10	5	50.00
Thoracic	50	48	96.00	68	52	76.46
Thoraco Lumbar	13	10	76.92	23	20	83.00
Lumbar and Lumbosacral	33	24	72.73	112	84	75.00
Total	101	84	83.17	213	161	75.58

The incidence of paraplegia was higher in children; 17.35 per cent of the children had paraplegia as against 11.22 per cent of the adults (Table X).

TABLE X
INCIDENCE OF PARAPLEGIA

	Total No.		With paraplegia	
	No.	Per cent	No.	Per cent
Children	280	17.35	45	17.35
Adults	508	11.22	57	11.22

The complications in the form of associated tubercular lesions were also of a severer nature in children; 80 per cent of the children with associated tubercular lesions had active foci as against 74.23 of the adults; even the multiple active foci

TABLE XI
INCIDENCE OF ACTIVE ASSOCIATED TUBERCULAR LESIONS

	Total patients with associated tubercular lesions	Patients with single active focus		Patients with multiple active foci		Patients with active foci	
		No.	Per cent	No.	Per cent	No.	Per cent
Children ...	35	22	62.86	6	17.14	28	80.00
Adults ...	97	62	63.92	10	10.31	72	74.23

were more frequent in children; 17.14 per cent showing multiple active foci as compared to 10.31 per cent of the adults (Table XI).

All these observations indicate that children have a lower resistance against tuberculous infection than the adults.

There were 165 associated tubercular lesions, pulmonary tuberculosis and cervical lymphadenitis formed the largest group. The distribution of the lesions is shown in Table XII in order of frequency.

The types of healing process were also peculiar. In children the bodies of the vertebrae were destroyed quickly resulting in

a large gibbus (Fig. 1); whereas adults generally showed lesser amount of destruction, vertebral bodies were seldom completely destroyed, the kyphos was less marked (Fig. 2), and the tendency for healing of the contiguous vertebrae was early. Ultimately bony fusion might occur equally well both in children and in adults (Figs. 3 and 4).

TREATMENT

We have classified the results as:—

Excellent: The lesion was well healed. There were no residual symptoms and the patient was comfortable after full day's work.



Fig. 1.

Fig. 1. Shows massive destruction of thoracic vertebrae with marked kyphosis of the thoracic spine in a child.

Fig. 2.

Fig. 2. Shows erosions of the contiguous margins of the vertebrae with diminution of disc space without much deformity in an adult.

Figs. 3 & 4.

Figs. 3 & 4. Show early bony fusion in a child and in an adult respectively.

TABLE XII
ANATOMICAL DISTRIBUTION OF THE ASSOCIATED TUBERCULAR LESIONS

Part affected	Lesions in Children			Lesions in Adults			Lesions in Total Series		
	Active	Quiescent	Total	Active	Quiescent	Total	Active	Quiescent	Total
Pulmonary tuberculosis	6	2	8	20	6	26	26	8	34
Cervical lymphadenitis	11	3	14	8	5	13	19	8	27
Pleurisy	—	2	2	4	11	15	4	13	17
Ribs	1	—	1	14	2	16	15	2	17
Foot bones	6	—	6	4	—	4	9	—	9
Hip	1	—	1	5	2	7	6	2	8
Abdomen	1	—	1	2	4	6	3	4	7
Ankle	2	—	2	3	—	3	5	—	5
Knee	1	—	1	2	—	2	4	—	4
Sternum	1	—	1	3	—	3	4	—	4
Miliary tuberculosis	—	—	—	3	—	3	3	—	3
Elbow	1	—	1	2	—	2	2	—	2
Wrist	—	1	1	2	—	2	3	1	3
Mediastinal glands	—	—	—	3	—	3	3	—	3
Scapula	1	—	1	1	—	1	2	—	2
Sternoclavicular joint	—	—	—	2	—	2	2	—	2
Ilium	—	—	—	2	—	2	2	—	2
Sacroiliac joint	—	—	—	2	—	2	2	—	2
Axillary glands	—	—	—	2	—	2	2	—	2
Breast	1	—	1	—	1	1	1	1	2
Epiphyseal-orchitis	—	—	—	1	—	1	1	—	1
Hand bones	—	—	—	—	—	—	—	—	—
Zygometic bone	1	—	1	—	—	—	—	—	—
Humerus	—	1	1	—	—	—	—	—	—
Acromioclavicular joint	—	—	—	—	—	—	—	—	—
Pericarditis	—	—	—	1	—	1	1	—	1
Renal tuberculosis	—	—	—	1	—	1	1	—	1
Anal fistula	—	—	—	1	—	1	1	—	1
Radius	1	—	1	—	—	—	—	—	—
Tuberculoma of brain	1	—	1	—	—	—	—	—	—
Total	37	9	46	88	31	119	125	40	165

Good: The lesion was well healed. The patient had no residual symptoms, but got pain after a full day's strenuous work.

Improved: The lesion was healed but the patient was leading a restricted life.

Same: The lesion did not respond much to treatment nor did it deteriorate further.

Deteriorated: There was no response to treatment and the condition deteriorated in spite of it.

We have been able to follow a total number of 150 patients, who have had treatment in our department. Most of them had an outdoor treatment and others were treated in the hospital.

We have included patients with a follow-up of below one year also, not to prove that the disease was cured in that much time but to show that under proper conservative treatment the disease started improving satisfactorily. The improvement shown is of great value to assess the ultimate prognosis. Out of 50 patients with a follow-up of below one year 30 showed a definite improvement in their condition, 25 showing improvement in six months to one year's time (Table XIII). One can reasonably say that these cases will go on improving and ultimately result in cure. Though only one out of these 50 patients died yet 7 more showed a further deterioration in their condition which should also be considered as bearing a bad prognosis. The condition of 12 almost remained stationary, about whom the prognosis should remain guarded though chances of improvement are ultimately more (Table XIII).

We have grouped our patients with over one year's follow-up into six-monthly groups upto 4 years, and then into yearly groups. The maximum follow-up in seven patients is between 6 and 6.5 years. Excellent and good results were seen in the longer followed up cases. Almost none showed any deterioration after four years of follow-up. Out of the total number of 100 patients followed up for periods above one year 2 died showing a mortality rate of 2 per cent; 11 showed further deteriora-

tion and that occurred in spite of the treatment; only 4 remained as such; out of the rest, 40 patients showed excellent results, 18 showed good results, (together making 58 per cent), and 25 showed a definite improvement in their condition.

The Value of Anti-biotics in Conservative Treatment: For further valuation of results of conservative treatment we confined our observations to the patients followed up for periods above one year. The conservative treatment consisted of rest in plaster beds in open air, nourishing diet and modern anti-biotics. The combination that we have usually used was 3 to 5 mgm. per kilogram of body weight, of isonicotinic acid hydrazide and 1 gm. of streptomycin intramuscularly twice a week. P.A.S. has only been used when the above combination did not improve the general condition of the patient. If P.A.S. had to be combined, it was done with the use of Isonicotinic Acid Hydrazide rather than with Streptomycin. Last combination is especially useful in the outpatients. In 62 patients who were treated in the outpatients department no definite assessment could be made about the value of antibiotics, though our impression is that the antibiotics did help in stabilising the disease in their spines. This impression has been further strengthened by our observations on eighteen patients who were hospitalized and received the antibiotics regularly. On comparing the results in the two groups out of sixty-two outpatients twentyone had excellent and eleven had good results, together 51.61 per cent; seventeen improved, 27.42 per cent; three remained stationary, 4.84 per cent; ten deteriorated, 16.13 per cent. Of the hospital group of eighteen patients eight had excellent and five good results, together 72.22 per cent; four showed definite improvement, 22.22 per cent; the condition of one deteriorated, 5.56 per cent (Table XIV).

Direct attack on the disease: Though direct attack on the disease has been much advocated by Wilkinson (1952), (1955).



(Case No. 1.)

(Case No. 2.)

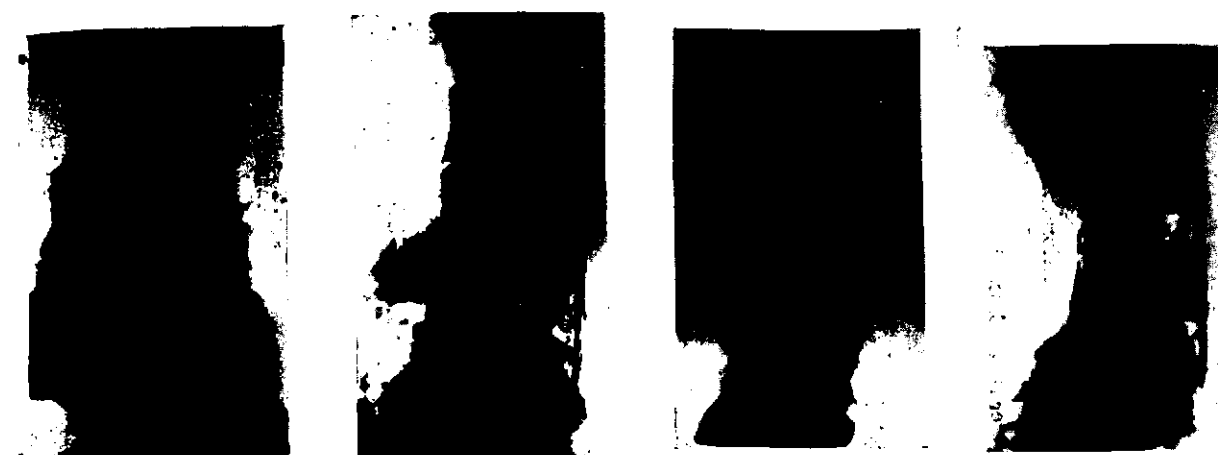
- Fig. 5A. Preoperative X-ray showing tuberculous lesion of lumbar 3 and 4 vertebrae.
 Fig. 5B. Postoperative X-ray showing a soundly consolidated graft.
 Fig. 6A. Preoperative X-ray showing erosions in lumbar 4 and 5 vertebrae.
 Fig. 6B. Postoperative X-ray showing a soundly consolidated graft.



(Case No. 3.)

(Case No. 4.)

- Fig. 7A. Preoperative X-ray showing early disease of lumbar 1 and 2 vertebrae.
 Fig. 7B. Postoperative X-ray showing a soundly consolidated graft.
 Fig. 8A. Preoperative X-ray showing an extensive tubercular lesion of the lumbar area.
 Fig. 8B. Postoperative X-ray showing a soundly consolidated graft extending from lumbar 1 vertebra to middle of the sacrum.



(Case No. 5.)

(Case No. 6.)

- Fig. 9A. Preoperative X-ray showing erosions of lumbar 4 and 5 vertebrae.
 Fig. 9B. Postoperative X-ray showing a soundly consolidated graft.
 Fig. 10A. Preoperative X-ray showing a collapse of lumbar 3 and 4 vertebrae.
 Fig. 10B. Postoperative X-ray showing a well consolidated graft.



(Case No. 7.)

- Fig. 11A. Preoperative X-ray showing erosions of lumbar 1 and 2 vertebrae.
 Fig. 11B. Postoperative X-ray showing a soundly consolidated graft.

TABLE XIII
FOLLOW-UP AND RESULTS

Period of Follow-up	Total cases	Excellent		Good		Improved		Same		Deteriorated		Died	
		Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent
Upto 6 months	17	—	—	—	—	5	29.41	10	58.83	1	5.88	1	5.88
6-12 months	33	—	—	—	—	23	75.76	2	6.06	6	18.18	—	—
Total cases with follow-up upto one year	50	—	—	—	—	30	60.00	12	24.00	7	14.00	1	2.00
13-18 months	26	1	3.85	6	23.07	11	42.31	3	11.54	4	15.38	1	3.85
19-24 "	15	4	26.67	3	20.00	4	26.67	—	—	3	20.00	1	6.66
25-30 "	15	5	33.33	4	29.67	6	40.00	—	—	—	—	—	—
31-36 "	10	6	60.00	1	10.00	2	20.00	1	10.00	—	—	—	—
37-42 "	8	4	50.00	1	12.5	1	12.5	—	—	2	25.00	—	—
43-48 "	7	5	71.42	—	—	—	—	—	—	2	28.58	—	—
49-54 "	7	5	71.42	1	14.29	1	14.29	—	—	—	—	—	—
55-60 "	5	4	80.00	1	20.00	—	—	—	—	—	—	—	—
Above 61 months	7	6	85.71	1	14.29	—	—	—	—	—	—	—	—
Total cases with follow-up above one year	100	40	40.00	18	18.00	25	25.00	4	4.00	11	11.00	2	2.00

TABLE XIV
RESULTS OF CONSERVATIVE TREATMENT IN PATIENTS WITH ABOVE ONE YEAR FOLLOW-UP

Type of Treatment	Total cases	Excellent		Good		Improved		Same		Deteriorated		Died	
		Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent
Outdoor	62	21	33.87	11	17.74	17	27.42	3	4.84	10	—	—	—
Hospital	18	8	44.44	5	27.78	4	22.22	—	—	1	5.56	—	—
Results in Total Series	80	29	36.25	16	20.00	21	26.25	3	3.75	11	13.75	—	—

TABLE XV
COMPARATIVE RESULTS OF SPINAL FUSION AND CONSERVATIVE TREATMENT IN HOSPITAL PATIENTS

Type of Treatment	Total cases	Excellent		Good		Improved		Same		Deteriorated		Died	
		Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent
Spinal Fusion*	16	11	68.75	2	12.50	3	18.75	—	—	—	—	—	—
Conservative** (Hospital Patients)	18	8	44.44	5	27.78	4	22.22	—	—	1	5.56	—	—

*Average Hospital Stay in cases of Spinal Fusion ... 5.2 months.

**Average Hospital Stay in cases Treated Conservatively ... 9.5 months.

we have been rather chary of employing this type of treatment indiscriminately. We have used this method as a matter of necessity in seven patients of paraplegia and one patient of retropharyngeal abscess with respiratory obstruction. We have also used direct attack method in lumbar area in two patients. In patients of paraplegia we have used Alexander's technique (1946) of Costotransversectomy and lateral rhacotomy with curettage of the bodies of the involved vertebrae. Two of these 10 patients have already died, one died two years after the operation and the other one year after the operation, showing a late mortality rate of 22.0 per cent. To provide stability and avoid reflare up of the disease we have done the posterior fusion of the spine in four of the remaining eight patients and contemplate doing the same in rest of the patients in due course of time. In other words unless there is a definite indication for the above procedure we believe that conservative treatment is still superior to the direct attack until further series of results are published to clear this issue.

Posterior Spinal Fusion: Out of the 150 patients who received treatment in our department 16 have been given the posterior spinal fusion, or the 'surgical rest'. The operation aims at giving a massive cortical graft for at least three healthy interspaces, one below and two above the site of the lesion, with rawing of the laminae and destruction of the articular joints at the same level. The area around the cortical graft is further packed with chips removed from the iliac crest and chips made from the corresponding spinous processes. Though this prolongs the period of operation, it gives a sound fusion of the back of the spine (Figs. 5A, 5B; 6A, 6B; 7A, 7B; 8A, 8B; 9A, 9B; 10A, 10B; 11A, 11B).

The operative mortality has been nil and the disability period has been considerably reduced. None of the patients with excellent or good results from the conservatively treated group was in plaster bed for less than a period of 18 months, some remained

even for two years or more; the average hospital stay in the hospitalized patients was 9.5 months. In patients in whom the spinal fusion was done the average period of rest after the operation was 4.4 months and the average hospital stay was 5.2 months. We are now reducing the period of preoperative rest and consider that six months to a year of conservative rest in plaster beds is ample before the patient is operated. Out of these 16 patients given the posterior spinal fusion 11 showed excellent results, 68.75 per cent; 2 showed good results, 12.5 per cent; and 3 improved considerably, 18.75 per cent. Though from radiological point of view 2 of these last three patients should have been classified under excellent or good results, we grouped them with the improved cases because there were minor sequelae of the disease incapacitating them from full day's work; one showed exaggerated reflexes, another a small sinus from the bed of the graft, and the last one has not yet been sufficiently followed up to be correctly assessed (Table XV).

If we compare the results in patients treated with surgical fusion with the results in patients treated conservatively under similar conditions in the hospital, not only the results of surgical fusion are better but also the hospital stay is almost halved (Table XV).

Our conclusion is that results of the conservative treatment are good enough and those with the posterior spinal fusion or the 'Surgical Rest' are still better. If beds and surgical facilities are available early posterior fusion of the spine is the best form of treatment and gives far better results than any other treatment. The direct attack method should be kept reserved only for special type of cases till further details are available about this less explored type of treatment, which seems to carry a much higher mortality.

REFERENCES

1. Alexander, G. L.: Proc. Roy. Soc. Med. 39: 730, 1946.

2. Butler, R. W.: Paraplegia in Pott's disease with special reference to the Pathology and Aetiology. Brit. J. Surg. 22: 738, 1935.
3. Dobson, J.: Tuberculosis of the Spine. An analysis of the results of conservative treatment and of the factors influencing the prognosis. J. Bone & Joint Surg. 33: 517, 1951.
4. Grewal, K. S.: Tuberculosis of the Spine. The Licentiate. 2: 302, 1952.
5. McKee, G. I.: A Comparison of Results of Spinal Fixation Operation and Non-operative Treatment in Pott's Disease in Adults. Brit. J. Surg. 24: 456, 1937.
6. Seddon, H. J.: Pott's Paraplegia. Prognosis and Treatment. Brit. J. Surg. 22: 769, 1935.
7. Seddon, H. J.: Treatment of Tuberculous Disease of the Spine in Adults. Proc. Roy. Soc. Med. 31: 951, 1938.
8. Wilkinson, M. C.: The Treatment of Pott's Disease by Curettage of the Spinal Lesion. J. Bone & Joint Surg. 34-B: 153, 1952.
9. Wilkinson, M. C.: The Treatment of Tuberculosis of the Spine by Evacuation of the Paravertebral Abscess and Curettage of the Vertebral Bodies. J. Bone & Joint Surg. 37-B: 382, 1955.

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FAMILIAL METAPHYSIAL DYSPLASIA

(Report of a Case)

by *PAUL BRAND and **ERNEST BHASKER SUNDARAM, Vellore.

Certain congenital abnormalities of the bones are very rare and their etiology ill-understood. On reviewing the literature extremely few cases of familial metaphysial dysplasia are recorded; hence an elaborate discussion will be omitted and an interesting case will be briefly presented.

CASE REPORT

Mr. G., aged 25, I.P. No. 121447, was seen in the Surgical O.P.D., of Christian Medical College and Hospital on 28-5-1952, with the chief complaint of increasing difficulty in swallowing. Since one and a half years he had severe pain in the left upper abdomen, which used to increase half an hour after meals. The pain was accompanied by a burning sensation which was rather constant.

Now and then he vomited about 8 ozs. of greenish fluid. For the last six months he was not able to swallow solids and was having increasing difficulty in even swallowing liquids. Posture and alkalis did not have a marked effect on his pain.

On examination it was noted, that the patient was quite emaciated and tall, with long, thin extremities. Routine investigations revealed slight anaemia and an F.T.M. showed a moderate hyperchlorhydria. A barium meal showed a smooth narrowing of the oesophagus, one inch above the diaphragm, with minimal dilatation of the oesophagus above the stricture. This was confirmed by oesophagoscopy.

On 2-6-1952, an oesophago-gastrectomy was performed and the histological examination of the specimen proved that it was a peptic stenosis of the oesophagus. Patient made an uneventful



Fig. 1-a.

Fig. 1-b.

Fig. 1 (a & b). Photograph of patient showing the large, medial ends of clavicles, prominent malar eminences and large prominent ends of humeri.



Fig. 2-a.

Fig. 2-b.

Fig. 2 (a & b). Showing enlargement of the tibiae and the knock knee. The enlargement of the digits was mistakenly interpreted as "Clubbing."



Fig. 3.

Lateral skiagram of the skull showing sclerosis of the bones of the base of the skull.

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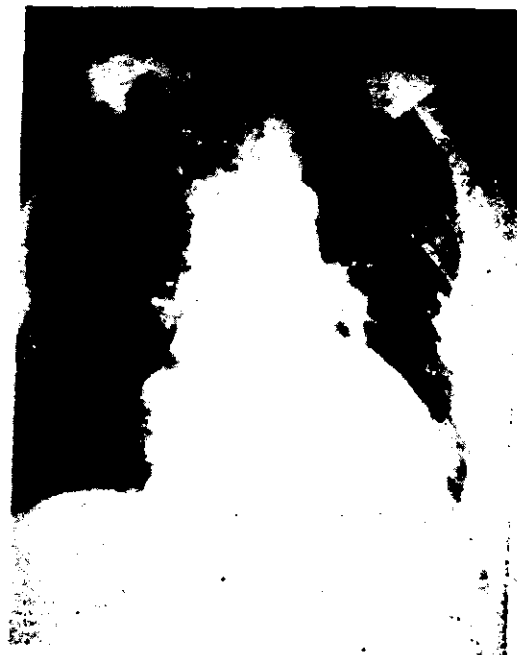


Fig. 4.

P.a. view of chest showing almost normal ribs and scapulae. The medial ends of the clavicles are markedly rarified, with minimal sclerosis. The medullary cavity seems normal in the middle of the clavicles.



Fig. 5-a and b.

Fig. 5 (a). Skiagram of the right humerus showing maximum enlargement of the upper end (b) Skiagram of right ulna showing enlargement with rarefaction of the lower end. The radius is also enlarged but comparatively less. There is enlargement of all the metacarpal bones and phalanges.



Fig. 6-a, b and c.

Fig. 6 (a). Plain skiagram of the femur showing diffuse enlargement starting from the middle one third and maximum at the lower end. The changes are constant in all the bones of the extremities. (b) P.a. and (c) oblique skiagrams of the tibiae and fibulae. The enlargement in the tibiae is more evident in the upper two thirds.



Fig. 7.

Plain skiagram of both feet showing the generalized enlargement of the metatarsal bones, and an old fracture of the proximal end of the left first phalanx of the great toe.

ery, except for a slight infection of the d.

ent was apparently well till 2-6-1955, then turned for a check up. His complaints now

(1) Unable to lie down flat in bed. (2) Pain in the left upper abdomen—2 years. (3) Pain along the thoracotomy scar. On closer questioning it was evident that he was normal only a year after operation, and then started burning pain behind the sternum especially on lying down, he regurgitated sour food. He also complained of vague pain in the tarsal, interphalangeal, metatarsal, ankle and joints. There was no history of injury to bones. On physical examination it was noted the young man was rather tall, with long

The clavicles were thickened and prominent especially at the medial ends. The bones of upper extremities were two to three times the normal size, and especially widened at the metaphyseal ends. The malar eminences were prominent. The scapulae were normal. The bones of lower extremities were also grossly widened at the metaphyseal ends and the patient had a valgum. The left great toe was tender and painful at the meta tarsophalangeal joint, and was grating on movement.

routine investigation were negative, except moderate hyperchlorhydria. Oesophagoscopy showed an adequate lumen at the anastomotic site. Minimal reflux of stomach contents and reddening of the stomach mucosa was noted. This oesophagitis was controlled with anti-acid elevation of the head-end of the bed. Radiological tests were inconclusive.

Skiagrams of the bones revealed a peculiar, constant, enlargement of all the bones of the extremities. The enlargement was maximal at the metaphyseal ends, and the sclerosis in the cortex was minimal. The medullary cavity was slightly enlarged. Lateral view of the skull showed sclerosis at the base. The enlargement of the clavicles was maximal at the medial ends where the cortex was rarefied. Scapulae and ribs seemed normal. In the lower extremities the tibiae were markedly enlarged at the proximal ends and there was an old fracture, with callus formation, at the proximal phalanx of the great toe. The periosteal changes in all the bones were minimal to absent.

COMMENT

Very few cases of this congenital development are reported in the literature. Most of them have knock knee and enlargement of the bones of the extremities. Sclerosis of the bones of the base of the skull, and spontaneous fracture of the phalanges are rare. Even though these bones are soft, healing is rather prompt. There does not seem to be any definite change in the bone marrow. The cause of this developmental error is not understood.

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FRACTURES AT THE NECK OF THE FEMUR

by K. S. GREWAL and V. M. CHARNALIA, Amritsar.

We have been tempted to report a series of cases with fracture at the neck of the femur firstly for the fact that a good proportion of children had this fracture and secondly because good results were obtained from nailing of the adduction fracture of the neck of the femur. We have analysed 112 cases of fracture of the neck of the femur treated in our department. Out of this total, 71 belonged to adduction and 2 abduction and 39 trochanteric type.

Fractures below the age of seventeen: A comprehensive review was given of fractures neck of femur below the age of seventeen by A. J. Ingram and Borden Bachynski in 1953. They reported 24 cases seen during a period of 23 years. We have had eight cases of similar fractures below the age of 17 years in 6½ years (not a very common fracture).

Unlike Ingram et al all our cases belonged to the group of transcervical intrascapular fractures. Four of our cases were treated in abduction P.O.P. hip spica, three by a Smith-Peterson nail and one by primary osteotomy.

Wilson (1940), Carrell & Carrell (1941), and Allende & Lezama (1951) all held the opinion that Whitman's plaster was inefficient and last named authors contended that this treatment resulted in Coxa vara. Collonna (1951) held, however, that Whitman's method of treatment was the best form of treatment in children. Our experience with Whitman hip spica coincides with the first authors. Two of the four cases treated with Whitman's plaster united with Coxa vara (Fig. 1) and one did not unite even after nine months' plaster. One genuine objection to nailing is damage to the epiphyseal cartilage. In one of the cases treated in P.O.P. hip spica early fusion of the epiphysis occurred (Fig. 2). One is inclined to conclude that P.O.P. hip spica also is no guarantee against early

fusion of epiphysis. Moreover though nailing produces early fusion of epiphysis yet it does not produce appreciable shortening of the limb or even the neck (Fig. 3). Both cases of coxa vara that occurred in Ingram et al series were also treated by Whitman's plaster.

Avascular necrosis is reported to be frequent in children. Six out of 24 cases of Ingram et al showed such a complication. In our series two out of 8 (25%) showed this complication and occurred in cases treated in P.O.P. hip spica (Fig. 4). Our observation supports the general statement. Perhaps the injury is much more severe in children which damages the retinacular vessels. Objection has been raised to S.P. nailing firstly for it causes damage to epiphyseal cartilage and secondly it is a difficult operation due to thick cortex. Though the series is too small for any authentic statement yet the advantage gained in having a normal neck shaft angle and almost normal length of the femur and a negligible shortening of the leg far outweigh the disadvantages of Coxa vara in quite a large proportion of cases and also occasional early fusion of epiphysis too. We do not use Knowles pins as we find no extraordinary difficulty in nailing these fractures in children.

Fractures in adults:

In all 104 fractures were seen in adults:—

Adduction in	63 (60.58%)
Trochanteric in	39 (37.50%)
Abduction in	2 (1.92%)

Total 104

Abduction type of fracture: It is impacted, fracture line is generally oblique and fracture shaft angle is above 60° (Fig. 5). This type of fracture requires

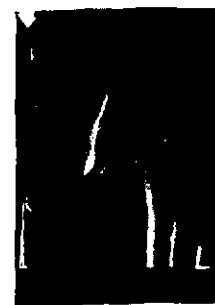


Fig. 1.

Fig. 1. Fracture neck of the femur in a child treated with Whitman hip spica united with coxa vara.



Fig. 2.

Fig. 2. Fracture neck of the femur in a child treated with Whitman hip spica, shows early fusion of epiphysis.



Fig. 3.

Fig. 3. Fracture neck of the femur in a child treated with S.P. nail, shows no appreciable shortening of the neck.



Fig. 4.

Fig. 4. Fracture neck of the femur treated in P.O.P. hip spica, shows avascular necrosis of the head of the femur.



Fig. 5.

Fig. 5. Abduction fracture of the neck of the femur. Fracture-shaft angle is 65°.



Fig. 6.

Fig. 6. A trochanteric fracture treated by skeletal traction in abduction and flexion shows union in a mild coxa vara.

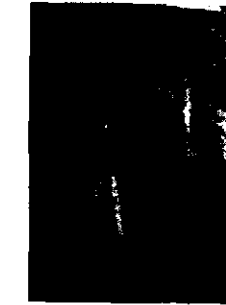


Fig. 7.

Fig. 7. Pre-operative picture of a trochanteric fracture in a young man of 38 years.



Fig. 7A.

Fig. 7A. Post-operative picture. Neufeld Capner nail in position.



Fig. 8.

Fig. 8. Post-reduction picture (A.P. view).



Fig. 9.

Fig. 9. Post-reduction picture (Lat. view).



Fig. 10.

Fig. 10. S.P. nail in position (A.P. view).

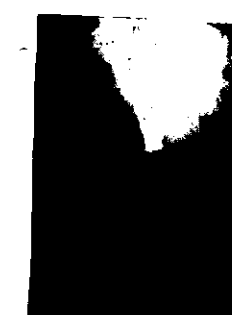


Fig. 11.

Fig. 11. S.P. nail in position (Lat. view).

no immobilisation. Weight bearing may be deferred to 10-12 weeks though the movements of the hip may be allowed early. Prognosis is good as almost all fractures unite in good position.

Trochanteric fracture: Out of the 39, 38 were treated by skeletal traction in abduction and flexion and one by Neufeld Capner nail. Three of them died in the hospital (7.68%), the rest all united in a mild coxa vara (Fig. 6). The ultimate results of successfully treated cases were good in conservatively treated cases. The one case in which nail and plate was applied was a youngman of 38 years (Fig. 7 and 7-a).

The rest of the cases were elderly and as the results of conservative treatment were almost as good as after operation, we have stuck to the former routine and find that the fear of a certain amount of risk which should be avoided as far as possible is present especially in old people who are poor surgical risk. Trochanteric fracture occurred in comparatively older people, age ranging between 22-91 with an average of 64.

Table showing the age of cases of fracture neck of femur.

S. No.	Type of fracture.	Average age.	Max. age.	Mini. age.
1.	Abduction	58	60	56
2.	Adduction	47	80	8
3.	Trochanteric	64	91	22

Adduction fractures: We had 63 such cases out of whom 55 had one or another form of operation for their fractures. Two died before operation (3.17%). Six left against medical advice and could not be traced for follow up.

Type of operation: Nailing was preferred as a first priority operation in fresh fractures. Unluckily all cases did not come in the early stages to the hospital. Only

33 cases came early enough for Smith-Peterson nailing alone. The rest came late and had to be given other operations.

Table showing the type of surgery for adduction fracture of neck of femur in adults.

S. No.	Type of operation.	No. of cases.
1.	Smith Peterson Nailing	33
2.	S.P. Nail and Graft	3
3.	Osteotomy	16
4.	Batchelor's Arthroplasty	1
5.	Excision head and neck	2
Total		55

The maximum period for S.P. nailing which was considered safe was 6 weeks though one would like to nail them as soon as possible after the fracture has occurred. Out of this series of S.P. nailing 31 have united, one case is done only lately whose result is still pending and one case showed non-union. This case of non-union resulted from avascular necrosis. Though our series is not large yet we believe that the success of this operation depends upon the accuracy of reduction and fixation. A high proportion (94%) of bony union encourages us to record this observation. Though we do not agree with the type of reduction advocated by Mc Elvenny (1949) yet we believe that the secret of success lies in seeing the reduction both in A.P. and lateral views and also seeing that the nail is properly placed in the neck and head of the femur. A nail lying parallel to the calcar femorale and as near the centre of the neck as possible is ideal (Figs. 8, 9, 10 and 11).

We have followed almost the method of McElvenny excepting that we do not attach much importance to the type of reduction advocated by him. The patient is put on a Watson Jones table feet securely tied to the foot pieces (Fig. 12). The injured leg is tractioned upon, the amount of traction depending on the amount of displacement. In a fresh fracture very little traction just enough to keep the limb taut is enough.



Fig. 12.

Fig. 12. Patient on Watson Jones table.



Fig. 13.

Fig. 13. Limb externally rotated and traction applied.



Fig. 14.

Fig. 14. Limb abducted till abductors stand out prominently.

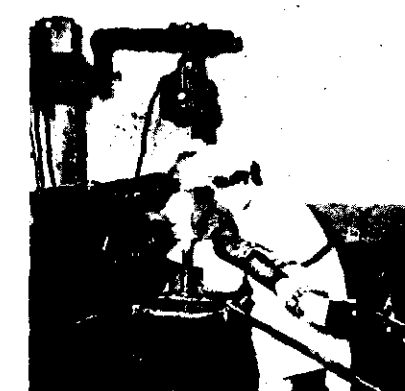


Fig. 15.

Fig. 15. Limb internally rotated with support under the greater trochanter.

The limb is then externally rotated (Fig. 13) and abducted till the adductors stand prominently (Fig. 14). The limb is then internally rotated, both from the foot piece and from the trochanteric region. The trochanteric region is lifted upwards at the same time by the support of the shoulder (Fig. 15).

The limb is then adducted (Fig. 16). A.P. and lateral skiagrams are taken and reduction confirmed both in A.P. and late-

ral views. Guide wires are thrust in blindly from below the base of the greater trochanter aiming at the opposite anterior superior spine. As the limb is internally rotated care should be taken that the direction of the guide wire is 45° downwards towards the floor and that it is inserted in the middle of the lateral surface of subtrochanteric region. The proper guide wire as near the centre as possible is chosen for threading the proper size nail on. (Fig. 17 and 18).



Fig. 16.

Fig. 16. Limb adducted.



Fig. 17.

Fig. 17. Guide wire in position (A.P. view).



Fig. 18.

Fig. 18. Guide wire in position (Lat. view).



Fig. 19.

Fig. 19. Shows non-union at the fracture site. Nail has gone to the upper pole of the head and the graft is seen broken.



Fig. 20.

Fig. 20. Shows McMurray osteotomy in a case of fracture of the neck of the femur. Union is seen both at the fracture and osteotomy site.



Fig. 21.

Fig. 21. Shows Batchelor's arthroplasty in a case of ununited fracture of the neck of the femur. Excision of the head of the femur combined with an osteotomy of Schanz type. Osteotomy fixed in position by an angled plate and screws.



Fig. 22.

Fig. 22. Shows total excision of the head and neck of the femur in a case of ununited fracture of the neck of the femur (Girdlestone pseudoarthrosis).

Non-union: Non-union has been found in various percentages in various series; to mention a few, Neer (1951) 19%, Neer and McLaughlin (1948) 16.1%, Eyre-Brook and Pridie (1941) 13.3%, McElvenny (1949) 3.06%. As our series show a very small percentage of non-union almost the same as described by Mc Elvenny. We feel it is the reduction which is most important. Non-union has occurred only in 3.3% of our cases who received S.P. nail within six weeks of the fracture. A case coming later than 4 weeks has a tendency to non-union in spite of nailing. Three cases of our series who came between two to nine months received nail and graft. This supplementary graft was chosen with a view to encourage union. One case failed resulting in non-union. Incidentally this case was done nine months after the fracture and showed a frank non-union (Fig. 19). The other two united firmly. We are inclined to think that nail and graft is a good operation if the patient comes between 4-12 weeks after which the neck absorption has progressed too much and fibrous union has already set in. After 12 weeks we believe that nailing should not be used and instead primary osteotomy should be the operation of choice. Out of our series osteotomy was done in 16 cases resulting in union in all. None of them complained of any appreciable disability. Movements of the hip remained almost normal. These cases have been followed up between 1-4 years and all of them are happy with the result. We have done McMurray's osteotomy with medial shift of the lower fragment (Fig. 20).

This osteotomy was done in fractures ranging from 12 weeks to six years. Selection was based, however, on the fact that the head had a normal texture and did not show any evidence of avascular necrosis. One case, however, did develop avascular necrosis of the head of the femur even after osteotomy though the fracture healed.

When avascular necrosis was evident and the patient had pain and limitation of movements at the hip joint, osteotomy was

considered inadequate; therefore some type of arthroplasty was contemplated. One case was given Batchelor's type of arthroplasty (Fig. 21). In two others simple excision of head and neck was performed (Fig. 22). These hips remained unstable but were painless and mobile and the patients were quite satisfied with this amount of handicap.

REFERENCES

1. Allende, Guillermo, and Lezama, L. G.: Fractures of neck of the femur in children. A clinical study. *J. Bone & Joint Surg.* 33-A: 387-395, April 1951.
2. Batchelor, J. S.: Excision of head and neck for ankylosis and arthritis of the hip. *Post-grad. Med. J.* 24: 241, 1948.
3. Batchelor, J. S.: Excision of femoral head and neck in cases of osteo-arthritis of hip. *Proc. Roy. Soc. Med.* 38: 689-690, 1945.
4. Carrell, Brandon, and Carrell, W. B.: Fractures in the Neck of the Femur in Children with particular reference to Aseptic Necrosis. *J. Bone & Joint Surg.* 23: 225-239, April 1941.
5. Colonna, P. C.: Fractures of Neck of the Femur in Children. *Am. J. Surg.* 6: 793-797, 1929.
6. Eyre Brooke, A. L. and Pridie, K. H.: Intracapsular fractures of neck of femur. *Brit. Jour. Surg.* 29: 115, 1941.
7. Girdlestone, G. R.: Pseudoarthrosis. *Proc. Roy. Soc. Med.* 38: 363, 1945.
8. Ingram, A. J. and Bachynski, Borden.: Fractures of the hip in children. *J. Bone & Joint Surg.* 35-A: 867-886, October 1953.
9. McElvenny, Robert, T.: Management of intracapsular hip fractures. *S. Clin. North America.* 29: 31-58, February 1949.
10. Neer, C. S. and McLaughlin, H. L.: Follow-up of 130 patients treated by internal fixation with the Smith-Peterson nail. *Am. J. Surg.* 76: 528-536, 1948.
11. Neer, C. S.: The surgical treatment of the fractured hip. *S. Clin. North America.* 499-512, April 1951.
12. McMurray, T. P.: Ununited fractures of Neck femur. *J. Bone & Joint Surg.* 18: 319, 1936.
13. Wilson, J. C.: Fractures of the neck of the femur in childhood. *J. Bone & Jt. Surg.* 22: 531-546, July 1940.

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SPONDYLOLISTHESIS *

(Review of the Literature with Incidence in Indian Cadavers)

by B. D. MISRA, Baroda.

There is no clear definition of this term; in fact it has an entirely different meaning between one author and another.

Kilian was the first to describe in 1854 this condition and gave this term and according to him, it is a condition in which luxation forward of a whole lumbar vertebra occurs. He was of the opinion that this condition was due to caries and inflammation. Neugebauer in 1884, after a study of all the anatomical museum specimens available, described the deformity as an elongation and angulation of the sagittal axis and a dislocation forward of the anterior part of vertebra. He regarded injury as the principal cause of this condition.

Lane, in 1885, discussed spondylolisthesis as one of the numerous changes found in the spine of labourers. Lovett in 1897, reported the first case of traumatic spondylolisthesis. In 1928 Faldini in Italy made an excellent contribution to the study of spondylolisthesis. He applied a different term to each of the two types of lesion; for the rare slip of the entire 5th lumbar vertebra he reserved the name "Spondylolisthesis" and for the commoner lesion he used the title "Spondylolysis".

Meyerding in 1931, reporting 121 cases of great interest from the clinical point of view, reports that trauma is an etiological factor, but obesity, pregnancy and occupational strain may gradually bring on the condition.

Capener (1931-1932) published his paper based on study of 34 cases of spondylolisthesis with special reference to the mechanism of the lesion and its diagnosis. Like Faldini he also classified them into two types. The first, as described by Faldini, he says is rare, the second type being most frequently seen, and this second

type was well recognised by Neugebauer as well as other writers, and consists in the separation of the 5th lumbar vertebra into two portions by a solution of bony continuity in the laminae, posterior to the transverse processes, in such a way that the part bearing the spinous process and inferior articular surfaces moves backwards and the rest of the vertebra slips forward upon the sacrum. This he also calls spondylolysis. Colona in 1954, published observations on the study of 201 cases of spondylolisthesis. He observes the spondylolisthesis as produced by the result of defect between the inferior and superior articular surfaces of the neural arch, is accompanied by a displacement of the vertebral column while usually it is recognised clinically only when it is severe. He further defines the spondylolysis as a separation of the neural arch without slipping. This he points out, is of common occurrence and frequently overlooked even in routine roentgenographic examination. The defect is commonest in the 5th lumbar-vertebra, the next in frequency being the 4th lumbar vertebra.

Newman in 1955 delivering his Hunterian lecture, dealt with this subject in great detail. His observation was based on 204 patients of spondylolisthesis. He has taken this term in a "broad sense" as he says, to mean not only slipping forward of a vertebral body, but the whole mechanism which permits part or part of the vertebra to luxate in such a way. He has divided them into five groups. He is of the opinion that this type of instability could only be caused by deficiency of (1) Lumbo-dorsal fascia & (2) Intervertebral disc. According to him, various authorities including Prof. Wood Jones (in a personal communication) have stated that there is no anatomical or embryological basis to believe that the neural arch is ever developed from two centres. Besides this he has given several

other reasons to prove that the lesion is not congenital.

Majority of text-books in anatomy, Embryology and Surgery, refers to one term only, i.e. Spondylolisthesis (Keith, Grant, Mc Gregor, Mercer). They all define this condition, as described by Colona, while a few text books define this term as merely the slipping forward of the 5th lumbar vertebra—upon the sacrum (Cunningham, Mc Murray). So we get the following definitions in various text-books and by various authors.

(1) *Spondylolisthesis*: The lumbar vertebra (usually the 5th) is in two pieces—the spine, laminae and inferior articular processes being detached (in 5% of individuals) (Grant Keith, Frazer).

(2) A forward displacement of the 5th lumbar vertebra (no separation of the vertebra in two parts) (Cunningham, Mc Murray).

(3) When the body of the vertebra which is in two parts as described in no.1, slips forward then only the condition is known as spondylolisthesis; (when the vertebra is in two pieces but without slipping forward it is spondylolysis (Colona).

(4) *Spondylolisthesis & Spondylolysis* are one and the same condition (Capener).

(5) Slipping forward of a vertebral body and also the mechanism which permit whole or part of the vertebra to luxate in such a way (Newman).

(6) A deformity of the lumbosacral region, produced by the gradual gliding or slipping forward of the lumbar spine on the sacrum (Mercer).

Anatomical Considerations:

I have taken the spondylolisthesis — as defined in majority of text books of Anatomy, i.e. the lumbar vertebra (usually 5th) is in two pieces — the spine, laminae and inferior articular processes being detached. This defect is usually accompanied by a forward displacement of the vertebral column, as the bodies have lost

the restraining influence of the inferior articular processes.

First it attracted the attention of obstetricians and was considered to be chiefly a disorder of women. It has however, been shown since to affect men more often than women. Of the various theories advanced, for this condition, the two most widely accepted were (a) Congenital and (b) Traumatic. The former is undoubtedly most popular. There are so many factors that are brought against this theory by various authors from time to time and now the table seems to be turning. We are still unable to come to a definite conclusion.

The most extensive investigation in this field has been done by Willis (1929) who has reported upon a series of over 700 skeletons and found such defects, in the neural arch of 4.28% of individuals. It must be remembered that X-ray of this area in new born and infants cannot shed much light, because of the dense cartilaginous structure. So is the study of gross anatomical study in a large series of still births and young infants is not great. Only a study of embryology might be expected to give some final verdict on the subject.

In the normal development of a lumbar-vertebra there are 3 primary centres of ossification. One is for the body and one each for the each half of the neural arch. There are also 4 secondary centres. The primary centres appear at about the 15th week and fuse posteriorly during the 1st year. Failure of fusion of these primary centres give rise to a number of congenital anomalies. The neural arch usually fuses with the body at 6th year.

It has been estimated by various observers (Grant, Colona-Willis, etc.) that neural arch defects occur in between 5—6% of the total adult population.

Evidence has also been brought forward to suggest that it is familial; Freiberg (1939) has reported a family of which 61 blood relations were examined and of these no less than 15 had spondylolisthesis. Harris (1951) has also reported the incidence in relation to parent and child.

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Ramand and Renault in 1864, were the first to state definitely that each lateral half of neural arch arises from two centres of ossification and that a congenital lack of fusion of these centres is the primary cause of the neural arch defect. Mall (1906), Chandler (1931), Batts (1939) have failed to find a single instance of double ossification centre for the lateral half to neural arch at either the 4th or 5th lumbar vertebra. Most of the text-books in Anatomy mention about the double centres of ossification (Keith, Grant, Cunningham, Buchanan, Mc Gregor, etc.).

Hitchcock (1940) examined 90 fetuses and found only one centre of ossification. He however, found the original isthmic defect both with and without slipping of the vertebral bodies. He concluded that this isthmic zone is of great potential weakness for it consists largely of cartilage until after birth. He also found that this area is occupied mostly by a large lake of blood vessels, almost, sinusoidal in nature.

These data are based on his study of still born and infant cadavers. He could produce by hyper-flexion of the spine and a moderate degree of force, a fracture of the neural arch at the isthmic area in the lower lumbar region. It can be surmised from this that the fracture can occur at the weakest part of the neural arch during birth. Hyper-extension failed to produce this condition. So it is quite reasonable to think that the position of the infant during delivery is one factor of importance in producing this condition.

Capener (1932) has pointed out the importance of the wedge like influence provided by the upper and posterior border of sacrum, the apex of which is formed by the articular facets of sacrum. This apex is driven upwards and splits the 5th lumbar vertebra into two parts at the site of the congenital non-union.

Willis (1929) points out that as the artery divides at this point either before or after entering the bone, into ascending and descending branches, bone development may progress in a similar way fanning out

in both directions but be defective centrally. In such a case the posterior part of the arch of the vertebra, consisting of spine, laminae and inferior articular processes, is occasionally separated from the rest of the bone, union being effected by hyaline cartilage only. He points out that a similar condition may be seen in the 4th and 3rd lumbar vertebra.

The work of Friberg (1939) and Harris (1951) shows a strong argument in favour of congenital theory.

Harris suggests "If this is not evidence of a congenital origin, it suggests a familial weakness, which permits the defect to occur."

Meyerding (1932) has shown that a congenital defect could exist a life time, without a patient's knowledge; even subluxation to a considerable degree could exist without symptoms. He concluded that underlying in most cases of spondylolisthesis there is a defect in the lumbosacral region.

Turner (1925) has shown that, as many of these patients showing spondylolisthesis are young and give no history of any injury likely to cause fracture of the pedicles, some other factors must be sought in the study of the development of the lower lumbar vertebra. He is of the opinion that the lateral masses are each originally formed from two granules, an anterior forming the lamina and posterior, the articular mass. Failure of the normal fusion of these two primary granules produces a pseudarthrosis; yielding of the fibrous union between these two segments leads to the production of the typical deformity.

Stewart (1953) published his data on the age incidence of the neural arch defects and he has shown that the rise of incidence occurs with age. The Mayo clinic series also shows the above fact. The average age of the patients in the Mayo Clinic series was 40 years. 80% were between the ages of 20 years and 40 years. The rise of incidence with age does not

contra-indicate a congenital defect. As the age advances there are more chances of heavy work and falls. Stewart (1933) has noted the occurrence amongst Eskimo and in them, this condition occurred in over 20%. This I think may be due to injuries arising from frequent falls on the buttocks on ice.

Another important fact to be noticed is that in all the anatomical specimens showing this condition, the separation occurs at exactly the same place. This again is a point in favour of the congenital nature of the defect.

Role of Trauma :

Assuming the presence of a congenital defect, it cannot however be denied that trauma plays an important part in the production of spondylolisthesis. Another important fact to be noted is that so far, a study of the literature on the subject reveals that no one has presented a single instance in which trauma alone has proved to be the cause (of production). So it is highly improbable that trauma alone can produce the condition. Besides this, all the cases or specimens so far reported upon have been of the advanced type and no demonstration has been planned and made of the progress in the particular patient from a preslip stage to the well marked stage. So two factors are essential for the production of this condition a congenital or inherited weakness in the lumbar vertebra and trauma. Such lesions will occur at the same place and the margins will not be smooth.

Data was collected in the Department of Anatomy, Medical College, Baroda. All the bones of a body, when recovered from the maceration tank were scrutinised thoroughly and every vertebra showing such condition was noted and kept since 1949. Till now, in all 57 bodies were macerated and out of these 4 show this clear cut condition. All were above the age of 20 years.

SUMMARY

1. Various definitions given by different workers and text-books, of spondylolisthe-

sis are recorded. Work done by various workers on this condition with special reference to the cause is reviewed.

2. Various factors which favour the theory of congenital origin of the condition is brought forth.

3. Two factors are essential for the production of this condition :—

(a) Congenital or inherited weakness in the lumbar vertebra.

(b) Trauma.

4. The incidence of the condition in adult as noted after the maceration in the Department of Anatomy, Medical College, Baroda, since 1949 has been recorded. 4 out of 57 bodies macerated show the condition in the 5th lumbar vertebra.

I am grateful to Dr. K. K. Bhatt, Professor of Anatomy, for giving me permission to make use of the museum specimen of the Dept. of Anatomy.

REFERENCES

1. Batts, M. (Jr): Etiology of Spondylolisthesis. *J. Bone & Joint Surg.* 21: 879-884, 1939.
2. Buchanan's Manual of Anatomy, 1948. Bailliers Tindal and Co. 7th edition, p. 118.
3. Capener, N.: Spondylolisthesis. *Brit. Jour. Surg.* 19: 374-386, 1932.
4. Chandler, F. A.: Lesion of "Isthmus" of Laminae of lower lumbar vertebra and their relation to spondylolisthesis. *S.G.O.* 53: 273-306, 1931.
5. Colonna, P. C.: Spondylolisthesis. *J.A.M.A.* 154: 398-402, 1954.
6. Cunningham's Text Book of Anatomy. 9th edition. Oxford University Press, London. 1527 & 138.
7. Faldini, G. (1928): *Chir. d. Org. di. Mov.* XII, 545. Quoted by Capener (1932).
8. Freiberg, S. (1930): Studies on Spondylolisthesis. *Acta. chir. Scand.* 82: 1-140. Cited by Colonna, P. C. (1952).
9. Grant, J. C. B. (1948): *A method of Anatomy—Williams and Wilkins—Batimore*, 295-296.
10. Harris, R. I.: Spondylolisthesis. *Hunterian Lecture. Ann. Roy. Coll. Surg. Eng.* 8: 259-297, 1951.

11. Hitchcock, H. H.: Spondylolisthesis; Observation on its development. Progression & Genesis. J. Bone & Joint Surg. 22: 1-16, 1940.
12. Keith Sir, A. (1948): Human Embryology & Morphology. VI edition. Edward Arnold Co., p. 101-104.
13. Kilin, H. F. (1854): De Spondylolisthesis Gravissimae Pelvanguistiae Causa. Nuper Detecta Commentatio Anatomico Obstertrician. Quoted by Willis, T. A. (1931).
14. Lane, W. A. (1885): Trans. Pathol. Soc. London. 36, 364. Quoted by Capener (1932), Lovett (1807), quoted by Meyerding, A. W. (1932).
15. Mall, F. P.: On the ossification centres in the human embryo less than 100 days old. Am. J. Anat. 5: 433-458, 1906.
16. Mc Gregor, A. L. (1941): A synopsis of surgical anatomy, 6th edition. John Wright & Sons, pp. 569-570.
17. Mercer, W. (1950): Orthopaedic Surgery. Arnold, London. 4th edition, pp. 616-618.
18. Mc Murray.: A Practice of Orthopaedic Surgery. Arnold. 2nd edition, pp. 189-191.
19. Neugebauer, F. L. (1888): Contribution of History and Etiology of Spondylolisthesis. London, the new sydenham society. Quoted by Colona, P. C. (1954).
20. Newman, P. H.: Spondylolisthesis — Its cause and effect. Hunterian Lecture Ann. Roy. Coll. Surg. England. 16: 305-323, 1955.
21. Rambaud, A. and Renault, C. (1864): Origine et developement des Os. Paris. Quoted by Willis, T. A. (1931).
22. Roche, M. B.: Pathology of Neural — Arch Defect — Dissection study. J. Bone & Joint Surg. 31-A: 529-537, 1949.
23. Stewart, T. D.: J. Bone & Joint Surgery. 35-A: 937-950, 1953. Quoted by Newman, P. H. (1955).
24. Turner, H. T.: J. Bone & Joint Surg. 7: 763, 1925. Quoted by Capener (1932).
25. Willis, J. A.: Analysis of Vertebral Anomalies. Am. J. Surg. 6: 163-168, 1929.
26. Willis, J. A.: Separate neural arch. J. Bone & Joint Surg. 13: 708-721, 1931.

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THE XVIII ANNUAL CONFERENCE

The XVIII Annual Conference of the Association of Surgeons of India will be held at Indore on the 29th to 31st Dec. 1956 inclusive. Dr. B. B. Ohri, M.S., F.R.C.S., Professor of Surgery, M. G. M. Medical College, Indore, is the Local Secretary, and members will receive individual intimation regarding details and exact dates of the Conference from him in due course.

At the Conference, the following subjects will be discussed:—

1. Cancer of the Lung—
Opener : Dr. A. K. Basu, Calcutta.
(Surgical aspect)
Seconder : Dr. R. Dutt Chowdhuri, Calcutta. (Pathological aspect)
Seconder : Dr. N. B. Roy, Calcutta.
(Radiotherapeutic aspect)
2. Hypospadias—
Opener : Dr. R. N. Sinha, Patna.
Seconder : Dr. R. N. Sharma, Lucknow.
3. Spinal Injuries particularly of the Cervical Spine—
Opener : Dr. H. K. Sarkar, Calcutta.
Seconder : Dr. A. K. Saha, Calcutta.

Besides these, the following Anaesthetic papers will be read at the Conference in conjunction with the above papers:—

1. Anaesthesia in Cancer Lung
by Dr. S. K. Chatterjee.
2. Anaesthesia in Surgery of Spine
by Dr. S. K. Bakshi.

3. Anaesthesia in Pediatrics
by Dr. M. S. Kohli.

In addition to the above a few "Short Papers" will be read at the Conference. Members will get separate notice from the Hony. Secretary about this during the 1st week of September, 1956.

Subjects for discussion at future meetings

- 19th Meeting :
 1. Non-malignant Stricture of Oesophagus
by Dr. Subrata Banerjee, Calcutta.
 2. Surgery of Intracranial Vascular Lesions
by Dr. B. Ramamurthi, Madras.
 3. Tumours of the Testis
by Dr. E. J. Borges, Bombay.
- 20th Meeting :
 1. Acquired Facial Defects
by Dr. M. Mukherji, Calcutta.
 2. Hydronephrosis—Experimental and Clinical Studies
by Dr. B. N. Balakrishna Rao, Gwalior
and Dr. A. E. de Sa', Bombay.
 3. Cysts of the Lung
 - (i) Hydatid Cyst of the Lung—
by Dr. S. K. Sen, New Delhi.
 - (ii) Cystic disease of the Lung—
by Dr. P. K. Sen, Bombay.

NOTICES

RAILWAY CONCESSION TO ATTEND THE 18TH ANNUAL CONFERENCE OF THE ASSOCIATION OF SURGEONS OF INDIA AT INDORE

Concession of Return tickets in 1st, 2nd and 3rd classes on payment of single fare (Mail fares being charged in case of 2nd and 3rd classes) to persons attending the 18th Annual Conference of our Association at Indore during December, 1956, has been granted.

The grant of this concession is subject to the condition that each member produces a certificate from the Hony. Secretary of the Association of Surgeons of India to the effect that he is a bonafide member of the Association travelling to attend the annual meeting of the Association of Surgeons of India and that his travelling expenses will not be borne by Central/State Govt. or Local Body or a Statutory Authority.

Members who are attending our ensuing Conference are, therefore, requested to obtain a Certificate from the Hony. Secretary, on production of a Declaration that his travelling allowances for attending the Indore meeting on the 29th, 30th & 31st Dec. 1956 will not be met by Central/State Government or Local Body or a Statutory Authority.

A. VENUGOPAL,
Hony. Secretary.

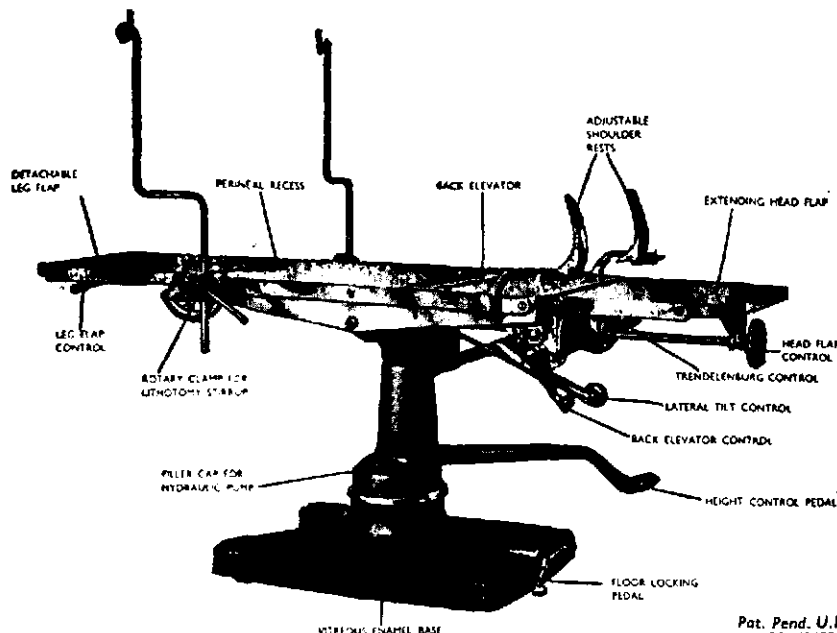
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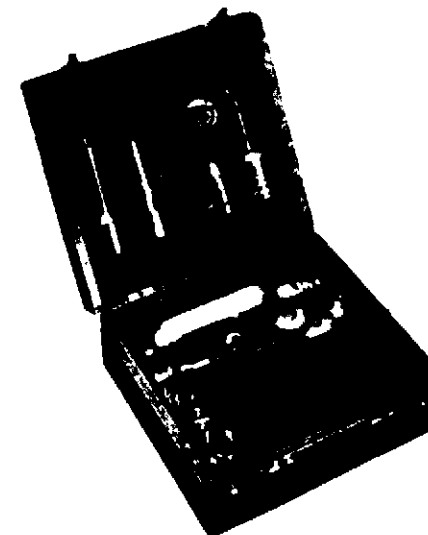
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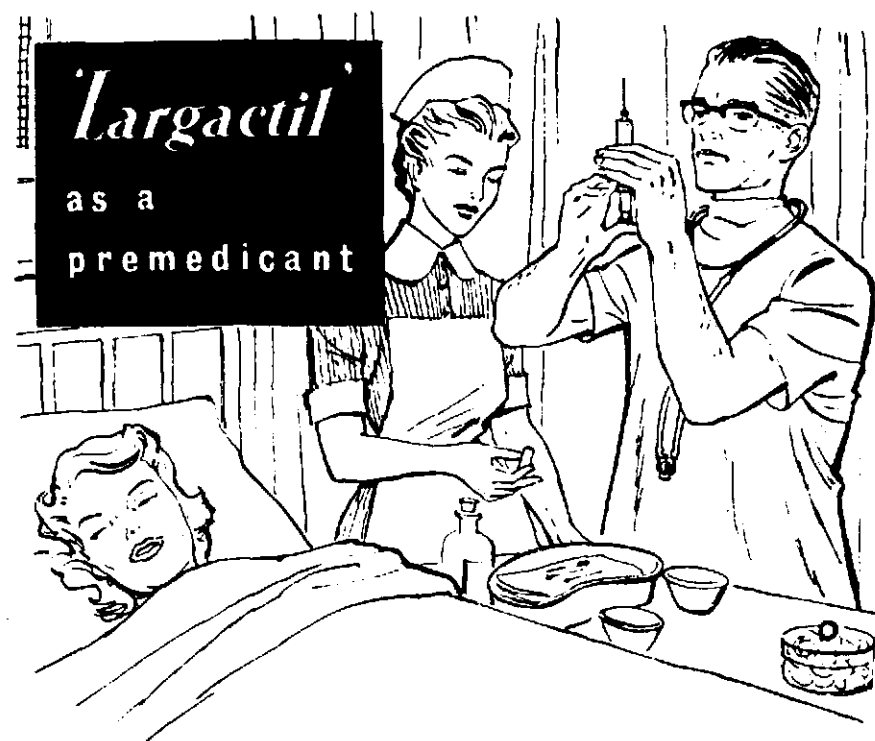
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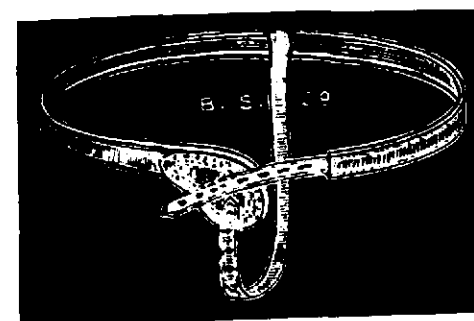
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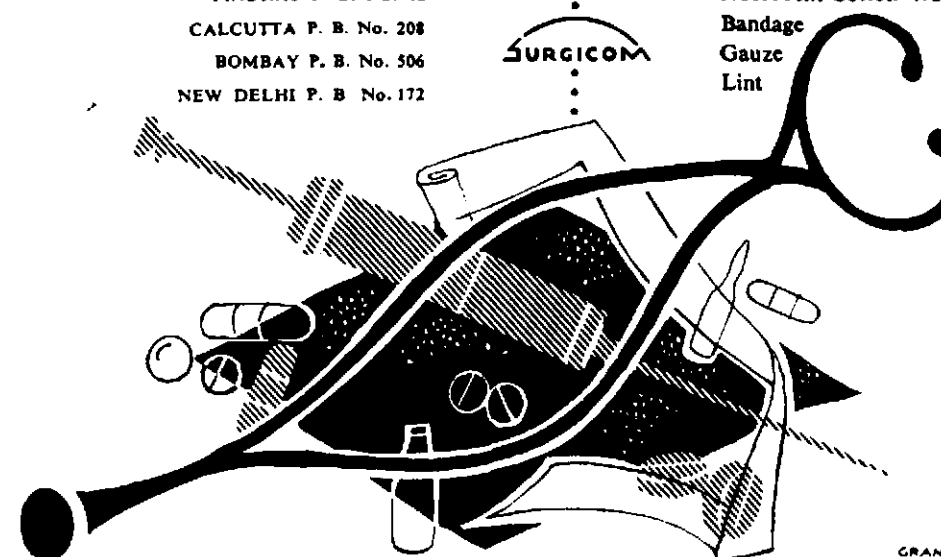
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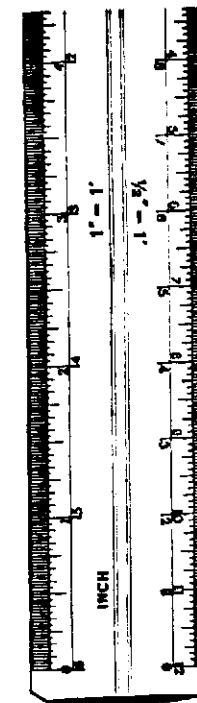
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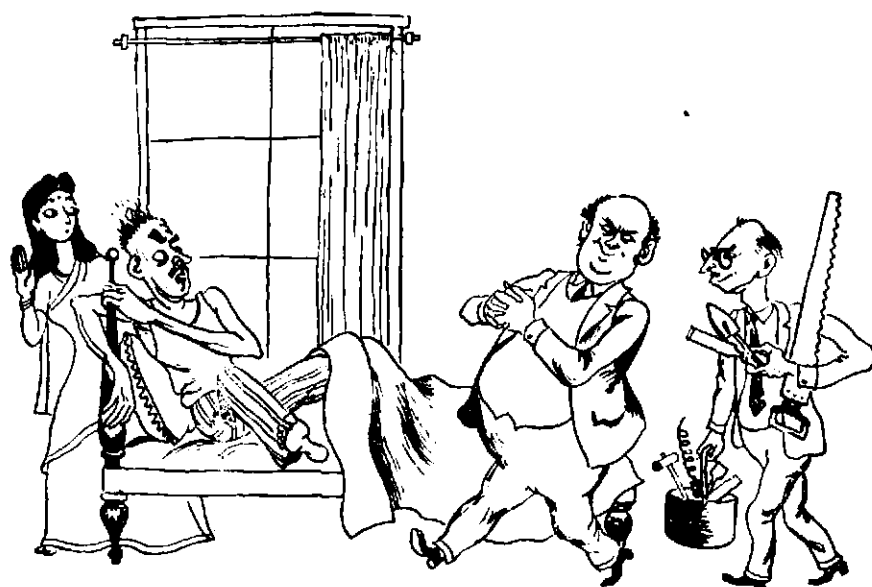
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to battle ...**

To the modern surgeon, (and even more so to his patient) the battery of operating implements used by the surgeon of days gone by would be a horrifying sight. Dirt and uncleanness in both the instruments and their users were more the rule than the exception. Great strides have been made in improving the instruments of operative surgery, but greater still has been the advance made in the science of asepsis with its constant battle against encroaching infection.



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EXPERIENCES WITH THE FIRST HUNDRED CASES OF SURGERY OF THE HEART AND THE GREAT VESSELS — A CLINICAL REPORT *

by P. K. SEN, Bombay.

MITRAL STENOSIS

A short protocol of 103 operations performed upto December 1955 for various disorders of the heart and the great vessels are set out in Table I. As will be seen, correction of mitral stenosis is the commonest procedure (40 cases). This is not at all surprising since rheumatic disease of the heart is probably as common in this country as in the West, despite the impression to the contrary (Vakil²¹). Constrictive pericarditis comes second with 19 cases, which is again understandable since the majority of constrictive pericarditis is tuberculous in origin. Perhaps it is quite possible that many cases of constrictive pericarditis are missed for one would expect a larger incidence of tuberculous pericarditis leading to constriction in our country. Surgical correction of blue babies were third in frequency — 13 cases. Cyanotic heart disease is probably the commonest type of congenital cardiac condition which presents itself to the surgeon. Next in frequency was patent ductus arteriosus — 5 cases and coarctation of the aorta — 3 cases. Various miscellany of congenital cardiac anomalies make up the rest. Two cases were operated for angina pectoris (revascularisation with talc insufflation) and 7 vena caval ligations were done for intractable congestive cardiac failure and/or tricuspid regurgitation. In addition, there were 11 cases of aneurysm of the aorta treated by various methods.

The surgical correction of mitral stenosis is no longer in the realm of dispute as far as practicability and efficacy of the procedure is concerned and the operation has passed into the realm of the common place (Dry⁶, Hanlon⁹, Janton et al¹³). However, many aspects both physio-pathological, clinical and operative have yet to be considerably clarified before standardization of surgical treatment can be obtained at each level.

Selection of Cases :

The equivocal and puzzling results of mitral valvulotomy during the earlier years after its inception were probably due to faulty selection of cases. A clear appreciation of physio-pathological haemodynamics obtained in mitral diseases is necessary before selection of cases can be done with the best and ultimate results. A number of generally accepted factors concerned with selection of cases have evolved, e.g. :—

Mitral Regurgitation :

In the average case of mitral stenosis which presents itself to the surgeon, *all things being equal, the presence or absence of mitral regurgitation to any significant degree probably ultimately dictates the success or failure of surgical correction.*

The diagnosis of mitral regurgitation on clinical grounds is considered an easy task by most cardiologists. But in a given case, it is not *always easy to come to definitive and clear analysis as to the amount of re-*

* A Paper read at the 17th Annual Conference of the Association of Surgeons of India, held at Amritsar, Dec. 1955.

gurgitation present. According to a simple classification suggested by Harken¹¹, cases are divided into four groups:—

- (a) With practically no regurgitation — so-called 'pure' stenosis;
- (b) Where stenosis is predominant but some regurgitation is present;
- (c) Where stenosis and regurgitation are more or less equally marked, and
- (d) Where regurgitation predominates.

By the use of routine diagnostic methods, it may be possible to obtain some general idea as to the presence of marked or clinically significant mitral regurgitation but the ultimate measure of regurgitation depends on the amount of blood which is pushed into the atrial chamber during ventricular systole, and this can only be determined by direct measurements of flow through the left atrio-ventricular valve and the measurement of pressure in the left atrium obtained directly. The measurement of pulmonary 'capillary' pressure gives but small indication of regurgitant flow through the mitral valve. Cardiac catheterization therefore is useful for estimating the benefits of mitral surgery in reducing pulmonary arteriolar and capillary pressure but is of not much value in deciding whether mitral regurgitation is present in significant amount. All the criteria taken singly, which have been generally regarded as indicating the presence of mitral regurgitation, can be produced by other conditions, e.g. left ventricular enlargement can be present with aortic valvular disease, a fairly harsh systolic murmur can be present with minimal regurgitation and direct fluoroscopic evidence of mitral incompetence, i.e. paradoxical pulsation, is considered by many authorities to be ambiguous. Such paradoxical pulsation can be produced by atrial septal defect or by a large flabby myocardium. The existence of definite well-marked mitral regurgitation is a contra-indication for surgical correction (type d). In all other types operation should be advised. Even in cases where mitral regurgitation is present in equal amount as in type c. The operation

of commissurotomy, may, by dilating the valve ring and liberating the subvalvular adhesions and the valve cusps actually reduce the amount of regurgitation as in a 'tear-drop' type of lesion. It has been our practice therefore not to refuse mitral surgery unless the evidence of mitral regurgitation is gross. Of the 40 cases, 29 were of type a, 8 of type b, 2 were of type c and 1 of type d. In the single case of almost pure mitral regurgitation that was operated on, a clinical diagnosis of significant stenosis was made and at operation it was found that there was no stenosis at all — it was purely a regurgitant lesion. This patient died on the seventh postoperative day of uncontrollable auricular fibrillation and congestive failure.

Age:

Age and rheumatic activity are more or less inter-related and we do not operate when clinical evidence of active infection is present, such as joint pains or a recent history of sore throat. However, it seems to us that rheumatic infection burns itself out much earlier in our country than elsewhere because in our series we have had 6 children below the age of 14. The youngest was a boy of 10 years. The spectrum of incidence of rheumatic heart disease in this country seems to fall a full decade earlier than most of the Western countries.

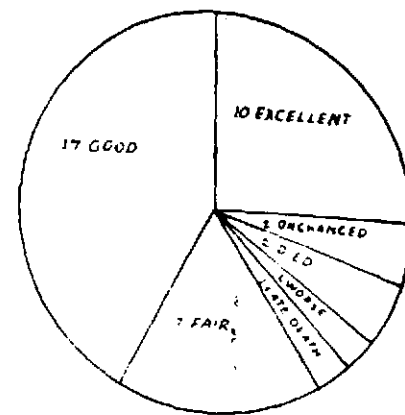


Fig. 1.
Results of operative correction of
Mitral Stenosis.
(40 cases)

Our oldest patient was 50 years of age. We do not consider age to be any specific contra-indication except that we do not generally wish to operate in children below 12 unless the stenosis is very tight, and marked obstruction signs are present with evidence of cardiac failure, a fact of grave prognostic significance in the young. People above 40 generally manage to last out the disease but there are occasions when one may have to operate late. Bailey has operated on 6 patients over the age of 70.

Multivalvular Disease:

The presence of aortic disease is not at all uncommon. About 38% of all cases of mitral stenosis have combined aortic lesions associated with it and about 10% of such cases have associated tricuspid lesions (Clawson et al⁵). The presence of aortic regurgitation is probably a contraindication to the correction of mitral stenosis but not so in aortic stenosis. In aortic stenosis it would be best to correct the aortic valvular lesion before tackling the mitral valve and improving the mitral outflow. Unless the treatment of aortic regurgitation can be placed on a more permanent and accepted footing, the correction of mitral stenosis, unless of a very severe type together with aortic regurgitation should be avoided. Tricuspid stenosis and or regurgitation is no contraindication, and tricuspid stenosis can be corrected at the same sitting or afterwards.

Atrial Fibrillation:

The presence of atrial fibrillation is no contraindication though it definitely increases the operative mortality. We have had 3 cases of atrial fibrillation in our series, 1 died on the seventh day, 1 three months after (delayed death) and the third case behaved well enough on the table but did not improve very much postoperatively, despite a fairly satisfactory commissurotomy. It is our impression that the presence of old standing atrial fibrillation and a large left atrium, the so-called giant left auricle is mostly associated with a regurgitant mitral valve and such cases are best left alone. Comparatively smaller hearts

with atrial fibrillation should certainly be operated on. It is not necessary to correct atrial fibrillation before surgery and it is rarely that it reverts to normal rhythm after. One of our cases changed to normal rhythm for a short period following the operation but reverted to fibrillation and has been fibrillating since.

The Place of Surgery in Mitral Stenosis:

Should all cases of mitral stenosis be operated upon? This is a highly debated issue. As the safety of surgery increases and commissurotomy is performed on a greater number of cases with wider indications, the temptation of the surgeon to advocate surgical correction for all diagnosed cases becomes even greater. There are many proven cases of mitral stenosis which are compatible with a long and useful life. These are so-called asymptomatic group though perhaps in times of severe stress and exercise, e.g. in labour — these may produce symptoms. Such cases are best left alone though there are schools of thought who would advise surgery even in these cases (Brock³, Bailey¹, Julian¹⁴). For those where symptoms are present, the benefits of operation should always be given. However, there is a third type of case where minimal symptoms are present, perhaps only during exercise, in the early teens or twenties; and in such cases it becomes always difficult to predict the course of the disease. If the natural history of mitral stenosis is studied, it will be seen that useful life and fairly tolerable amount of cardiac reserve manages to see the patient through for a certain length of time. Usually, in this country upto the mid-twenties, at the end of which compensation begins to rapidly break down as the patient develops attacks of pulmonary congestion shown by development of paroxysmal dyspnoea, cough and haemoptysis. The work of Brock, and of Gorlin and Gorlin^{7,8}, and others, suggest that this sudden breakdown in the compensation is due to the narrowing of the mitral orifice having reached the so-called critical point. Our experiences have confirmed this finding of Brock and

others by digital palpation of the mitral orifice during surgery.

Some cardiologists have called this type of stenosis a 'malignant' type but in point of fact all stenotic mitral rings which reach such progression are dependent on certain well-known aspects of hydrodynamics. According to the researches of Gorlin and Gorlin, the functional surface area of the mitral valve orifice varies between 4 to 6 sq.c.m. indirectly calculated from cardiac catheterization data. It has been their findings as well as that of Brock who attempted to co-relate the direct palpatory measurements of the mitral ring during surgery with clinical data — that severe symptoms do not occur till the orifice is narrowed to 20% of the original. This is now explained on the basis of a principle of hydrodynamics called the Venturi effect (Rodbard S. et al 17, 18, 19). When a segmental or critical narrowing occurs in the passage of blood flow, the rate of flow increases together with a lessening of (lateral) arterial pressure (conversion of potential into kinetic energy). This leads to approximation of the narrow walls with a simultaneous build-up of pressure behind the temporarily closed or obstructed passage. With the narrowing brought to a critical point, the phenomenon alternates, with the production of a vibratory effect and may lead to marked diminution of flow through the narrow passage much before the actual diminution of the size of the orifice warrants such a fall. Of 40 cases operated on, such a critical state of narrowing which has been described by Brock as being just a little smaller than the tip of the index finger was found in the great majority. 31 cases had narrowing of this order. In fact, one was rather struck by the almost standard diminution of the narrowed mitral valve felt by the exploring finger.

Redondo-Ramirez¹⁶ of the Bailey clinic has simplified the indications of commissurotomy and existing mitral stenosis by the following classification. All cases are divided into asymptomatic and symptomatic. The asymptomatic do not require surgery. The symptomatic cases are further divided into:—

- (a) Those which have never exhibited symptoms of severe pulmonary congestion or heart failure;
- (b) Those which have exhibited such symptoms on more than one occasion;
- (c) Either in actual heart failure or on the brink of it.

Using this classification, only 4 of our cases fall in the first category, the majority of 32, in the second and the remaining 4 in the third category.

It is difficult to predict which case will become symptomatic or will progress rapidly and so was born the idea of the Bailey clinic of 'prophylactic' mitral commissurotomy. It seems to us that the idea of a 'prophylactic' operation could only arise if the risk of mitral commissurotomy at a slightly advanced stage of the disease were appreciably higher than when performed in a symptomatic state. The mortality rates in the asymptomatic cases and those showing early symptoms are materially different and therefore we believe that asymptomatic cases should not be advised surgery, but be watched for development of definitive signs and symptoms of pulmonary vascular congestion or left atrial failure — when operation should be advised.

If mitral stenosis is definitely diagnosed and physio-pathological effects are demonstrable on the pulmonary circulation, the logical solution is surgical relief of the narrowing at an early stage before permanent changes occur in the pulmonary arterioles. In the earlier stages of severe mitral stenosis the left atrium dilates and then hypertrophies in order to pump more blood into the left ventricle. Later this pressure reflects itself in the pulmonary veins, the pulmonary capillaries and lastly the pulmonary arterioles which develop a certain degree of protective spasm. When pressure within the pulmonary capillaries exceeds the pressure of plasma protein, bouts of pulmonary oedema occur. To offset this, a second set of defences are brought about, namely a hypertrophy of

the pulmonary vasculature specially of the pulmonary arterioles, which become thickened. Some changes rapidly progress and become irreversible. The right ventricular output becomes more or less fixed and does not increase on exercise. This leads to the development of dyspnoea on exercise. It is logical therefore to suggest that correction of mitral stenosis be carried out before such permanent changes occur in the small vessels of the lung, and one of the main indications of such change is paroxysmal nocturnal dyspnoea a symptom usually attributed by cardiologists (Lewis et al¹⁵, Gorlin et al⁷) to early or mild stenosis, whereas it usually indicates an advanced state of affairs. The case of a 'prophylactic' commissurotomy is thus strengthened.

Preoperative Preparation :

In preoperative preparation of patients, we have relied on the standard measures to control failure and lessen pulmonary hypertension, e.g. digitalis, salt-poor diet, fluids, diuretics such as mercurials, aminophylline, etc. While it is not necessary to go into details, but our experience has been that a slight over-digitalisation is tolerated very well by these patients and apparently during anaesthesia and surgery they behave better.

Operation :

During operation we always have an E.C.G. hook-up. This is not considered essential by many but we feel that the electro-cardiograms give much earlier indication of cardiac strain and abnormal rhythm such as ventricular tachycardia or ectopic ventricular beats which may herald a catastrophe and such a catastrophe, we feel, is mostly preventable. On 4 occasions, we have through electrocardiographic interpretations been able to stop at a critical time and this, we believe, saved the patients' lives. During manipulations, both intracardiac and extracardiac, the coronary circulation may be interfered with and indications of this can be readily seen in the electrocardiogram.

We have employed the left atrial route in all cases. The appendage was used in all

except in one where the auricular appendage was small and shrunken and the finger was inserted directly through the atrial wall without any difficulty or mishap. In this instance as well as in other instances, we have tried to use the left superior pulmonary vein as advocated by Harken and others but have desisted because we found in both instances the vein to be smaller in size than the index finger. In 7 instances it was not possible to introduce the index finger but we used the little finger which is a fairly satisfactory instrument for breaking the commissure though it becomes a little difficult to carry out a posterior commissurotomy or an instrumental division with the little finger. We have never used a purse-string on the auricular appendageal base or a Rumel-Belmont tourniquet. Mostly we have entirely relied on a snare tourniquet devised by one of us three years ago and have found this an extremely satisfactory, safe and simple instrument (Sen et al²⁰). Mindful of the recent tendency of a swing towards instrumental division of the mitral valve, we are still of the opinion that the index finger or for a matter of fact any finger, is one of the best instruments with which to carry out commissurotomy, as splitting of the valve in the majority of instances occurs immediately, probably at the very first or second attempt. The subsequent manipulations with the finger are merely to improve on the initial effort and carry the divisions up to the valve ring, by which the best results are obtained. It is quite true that instrumental division is necessary in certain cases, specially those with resilient or resistant cartilaginous and calcified valves. We have used a knife (of different designs) division in 7 instances. Our practice is to make a small nick in the commissural margin and then carry on with the finger. The use of the ungloved finger, to our mind, offers no special advantage. In 1 case where subacute bacterial endocarditis followed as a complication, we later felt that the ungloved finger might have been responsible for such a complication. There is no doubt that the ungloved finger gives a greater amount of tactile 'vision' of the valve face and a long nail

may be of some value but having used the gloved and ungloved finger in more or less equal number of cases, I have not been able to convince myself that the ungloved finger confers any special disadvantage. While carrying out commissurotomy, it is our practice to fracture the posterior commissure first, if possible, because we have found that having fractured the anterior commissure, it becomes more difficult to shift the posterior commissure and this, then may require a knife division. While, if the posterior commissure is first fractured the separation of the anterior commissure actually becomes an easier task. The finger must never be kept in the valve orifice for more than two or three consecutive heart beats. Subvalvular exploration must never be carried on at the same time as valvular correction is being carried out. The place of subvalvular exploration is a very definite one and it must be carried out after the commissurotomy has been done. Separation of the chordae tendinae, fused papillary muscles, etc. form a very important part in the digital correction of mitral stenosis and should be attempted whenever possible. We have never used a knife for splitting fused papillary muscle (Bailey) but in a number of instances it has been possible to dissect completely the fused components of subvalvular structures. Much has been written in literature about damaging the main antero-medial cusp ('aortic baffle') during such manipulations, but to us it seems rather a difficult thing to accomplish. Such damage could only be possible if one were using a cutting instrument at right angles to the valve slit. Ordinarily, if pressure is exerted at the right spot, namely a little distance away from the commissure, between the commissure and the valve ring, the valve almost always splits at the commissure.

In this series significant increase of regurgitation did not result from any of the manipulations. However, rupture or tear of the chordae tendinae can produce such increase of regurgitation and this should be carefully guarded against.

It is not our practice routinely to dissect out the great vessels of the head and the neck in the superior mediastinum and compress them during valvular manipulation. We have felt that such a procedure increases the time of the operation without adding materially to the safety. We have employed carotid compression as a routine. In these 40 cases there was 1 definitely proved instance of embolism. This patient developed a mild hemiparesis which cleared up after a week. We believe that dissection of the great vessels to the head and the neck and their compression during finger manipulation should be reserved for only those cases which have had definite embolic episodes before surgery. In cases of atrial fibrillation where loose clots were found within the auricular appendage, we have made a general point to release the snare tourniquet around the auricular appendage for a moment allowing sharp bleeding to occur from within the atrium thus washing out any clots within its cavity. However, the valve face may be a source of embolus (as was the case of temporary hemiparesis reported) and such embolisation cannot be totally avoided.

Postoperative Management :

The postoperative management fluids are of paramount importance. For the first 24 hours in an adult we usually restrict fluids to a maximum of 1500 ml. The replacement of blood loss is carried out as accurately as possible, the loss being estimated by a gravimetric method during operation and we generally replace a little less than the estimated blood loss and not more, the average amount required being about 300 c.c.s. during and after surgery. Subsequently, fluids are given by the vein for a period not exceeding 12 hours and as soon as possible they are given by mouth. The postoperative retention of salt and water which occurs after any major surgery is particularly dangerous in these cases where pre-existing hypervolaemia and salt retention is the rule. Therefore, we do not withhold mercurials even on the day of the operation though we do not give some mercurials the same evening of the operation.

Auricular fibrillation occurred in the postoperative period in 3 of our cases, but the attacks were temporary and cleared up by themselves without requiring the use of any drugs. One case of auricular fibrillation operated upon reverted back to normal rhythm soon after surgery but again developed fibrillation after some days. As a general principle any auricular fibrillation is not corrected before surgery. We routinely employ a drain and believe that is more necessary in mitral surgery than in other types of heart surgery because the congested lungs tend to 'weep' fluid during the first 24 hours.

Lung biopsy was done in about 22 cases and showed arteriolar thickening and some degree of haemosiderosis in the majority.

Auricular biopsy was done in all cases and in these, 7 showed presence of Aschoff bodies but we are not convinced that the presence of Aschoff bodies can be correlated with the actual activity of rheumatic disease and seems to bear no definite relationship with the sedimentation rate.

Results :

There were 2 operative deaths. 1 developed ventricular fibrillation at the end of the operation and though this was corrected by cardiac massage, the patient succumbed few hours after surgery. This was our third case. The second death was the case where auricular fibrillation was present and on digital exploration no stenosis was detected. Following surgery, auricular fibrillation and failure were both progressive and uncontrollable. The patient died on the seventh postoperative day. There was one delayed death — occurring 2½ months after surgery as a result of starvation following development of postoperative psychosis. Of the remaining 37, 22 showed marked improvement, 8 were moderately improved, 3 were only slightly benefitted, 3 remained unchanged and one became worse. This assessment has been made mainly on clinical data based on exercise tolerance, disappearance or amelioration of symptoms and venous pressure studies at rest and

after exercise. Electrocardiographic changes according to our analysis does not have any significant changes concomitant with clinical improvement. Catheterization data, unfortunately, was obtained in but very few.

COMPLICATIONS

Ventricular Fibrillation :

Apart from the routine run of complications one expects in thoracic surgery involving major thoractomy, pointed attention may be drawn to some which seem inherent in the very nature of mitral surgery. Cardiac irregularities invariably occur during digital exploration of the mitral valve and handling of the myocardium specially the atrial ventricular ring from within. We have had an E.C.G. record of nearly all the cases operated on and have noted the development of ventricular ectopic beats and short runs of ventricular tachycardia during such manipulations. While we believe such disturbance of rhythm to be almost unavoidable, specially at the time of digital manipulation of valve and valve ring, any sustained run of ventricular rhythm must be regarded as a danger signal. Of the many predisposing causes of ventricular fibrillation (around which has developed an enormous literature) anoxia is probably the most potent. We have been lucky enough to have only one such complication and we believe that it was probably due to anoxia. During handling of the heart the anaesthetist should be asked to give 100% oxygen and we have always felt happy to be handling a heart which is pink in colour. Treatment of established ventricular fibrillation need not be discussed here. However, we have taken the point of view that immediate and effective cardiac massage is more important than rapid attempts at defibrillation. Defibrillation whether by chemical or electrical means must be attempted but not at the expense of losing time or of keeping up an adequate artificial circulation through cardiac massage. Most hearts would defibrillate by themselves if massage is kept up and anoxia combated.

Subacute Bacterial Endocarditis :

This complication occurred in 2 of our cases and while to some extent is unavoidable, the use of the bare finger is to be criticized in this context.

Psychosis :

Psychosis occurred in 1 of our cases on the fourth day possibly due to multiple embolism as from subacute bacterial endocarditis. This patient also developed certain extra-pyramidal signs such as rigidity, typical speech etc. We have failed to establish whether this psychosis was due to such emboli or was functional in nature. Cardiac psychosis has been described following operations (Bailey having described 24 cases out of 811 cases operated on) but this cardiac psychosis is possibly due to overuse of mercurials and depletion of sodium cation. Exhibition of salt solution usually improves such patients. The case being reported did not show any improvement with sodium therapy.

Of the routine complications, one may draw attention to the development of pericarditis. To us it seemed an almost constant occurrence and I am not sure whether this could rightly be called a complication or a natural corollary of a surgical insult. However, such a pericardial rub may continue for some days and on 3 occasions large effusion formed which took some time to clear up. We have of late followed the practice of making a separate counter opening in the posterior part of the pericardial sac as advocated by Bailey in addition to leaving the anterior incision open for a length of time. This probably allows for better drainage of the pericardial collection into the pleural space and prevents likelihood of postoperative pericardial collection and cardiac tamponad.

CONSTRUCTIVE PERICARDITIS

Nineteen cases of constrictive pericarditis were operated on. Of these, 14 were definitely proven cases of tuberculous pericarditis and 5 were of indefinite origin, possibly tuberculosis. For all practical pur-

poses, in our country at least, one should regard constrictive pericarditis as a tuberculous manifestation. This has been borne out by other workers in the field. (Betts¹, Udupa¹⁰, Sellors⁸, Blalock and Burwell²).

Selection of cases :

While the diagnosis of constrictive pericarditis may be relatively easy, it is likely to be missed if its possibility is not constantly kept in mind. Early diagnosis is important because it is intimately connected with a perennially debated question — when to operate on cases of constrictive pericarditis? The object of surgery in constrictive pericarditis is to release the encased heart from the restrictions of the contracting sheath of thickened pericardium, thus increasing the diastolic expansion of the heart and improving the cardiac output. Essentially, this is a mechanical matter but such decortication of the heart, in order to be fully effective, must be done at a stage when stripping of the constricting sheath can be done both with ease and minimum of risk. At one extreme, is the viewpoint of early operation where people (Holman⁶, Betts¹) advocate excision of the pericardium in all cases of tuberculous pericarditis with effusion presuming that tuberculous pericarditis would invariably be constrictive in its course as

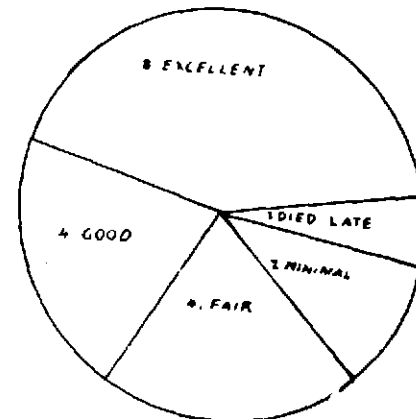


Fig. 2.
Results of operative treatment of
Constrictive Pericarditis.
(19 cases)

healing and fibrosis occurs, and since removal of the pericardium at the stage of effusion is a very simple procedure, technically, the protagonists of this school argue that with modern anti-tuberculosis treatment the right stage to remove the pericardial sheath is at this juncture. On the other hand, there is the conservative school (Sellors⁸ & Harrington³) which believes in tackling cases late, after the tuberculosis process is completely controlled and when surgery merely serves to remove the mechanical impediment binding the heart down. They feel that surgery performed over the site of a burnt-out disease offers the greatest protection. We have taken an intermediate view. We feel that operating during the early stages of tuberculosis activity carries a real risk of replastering as exemplified by one of our cases, whereas operation relegated till such time as fibrosis and contraction becomes marked would entail considerable technical difficulties. Once the epicardium and pericardium become completely glued to each other, it may not be possible to find a workable plane of separation and in such cases it is not possible to decorticate the heart satisfactorily. Calcification, myocardial invasion and fibrosis which are present with advanced cases of constrictive pericarditis would defeat the ends of surgery as would also permanent changes in the liver leading to cardiac sclerosis. We feel that the best time to operate is when a case of tuberculous pericarditis is going on to constrictive changes with increase of venous pressure and enlargement of the liver. The size of the heart is not important. We have often found marked constriction present with a large heart shadow. The activity of tuberculosis disease as gauged by clinical data is valuable but we have learnt not to place undue importance on the erythrocyte sedimentation rate, but adequate and prolonged anti-tuberculosis treatment is, according to us, a sine qua non of good surgery.

Operation :

We have used the Holman sternum splitting approach in the majority. In 2 cases

we have used the left trans-thoracic approach. The bilateral transverse sternum cutting approach as advocated by Johnson and Kirby⁷, is according to us a too traumatic and unnecessary extensive an approach. Most of our patients would tolerate such exposure poorly.

As regards the extent of decortication, we believe that it is not necessary to decorticate beyond the anterior half of the total cardiac circumference. Such release should always be commenced over the arterial ventricle and should at least go up to the atrio-ventricular groove. It is not absolutely necessary to free the atria, though it may confer some advantage. It is very necessary to free the base of the heart to some extent and go laterally as far as the phrenic nerves. Following such release, the intracardiac pressures would adjust themselves as has been admirably shown Holman⁶ in his experiments on dogs. We have been surprised at the operative immunity that the coronary vessels have to the knife while carrying out decortication. Though the decortication is always carried out in such a way so as to avoid injury to the main coronary vessels, one would expect that occasional patterns of superficial myocardial injury would appear on the electrocardiogram which surprisingly never does happen. This discovery made us adopt a much bolder policy in excising the membrane to the epicardial depth. Cardiac arrest had occurred in one case on operation table while chest was just opened. Heart was revived immediately with cardiac massage, but postoperatively this patient showed signs of loss of memory and emotional disturbances suggesting decortication of brain; may be the effect of ischaemia of brain cortex during the revival of the heart.

Results :

These results have been computed on clinical data, venous pressure, electrocardiographic studies and radiological signs of the heart. Accordingly, 8 patients were classified as excellent results, 4 good, 4 fair, minimal improvement occurred in 2 and

one died 2 months after surgery due to replastering and one had been followed up inadequately. We have learnt not to be hasty in the postoperative assessment of these patients as improvement continues to occur for a year or more after surgery.

CONGENITAL CYANOTIC HEART DISEASE

The series treated by us was small — 13 cases. 11 cases were of Tetralogy of Fallot, one of pulmonary stenosis with inter-atrial septal defect and one case of tricuspid atresia. Shunt operations were done in 10 instances (Blalock shunt in 7 and Potts shunt in 3). In 3, a direct pulmonary valvulotomy of the Brock type was carried out. The period of follow-up varied from 3 months to 2½ years. The results and surgical treatment have been set out in the photograph. In assessing the results of the above we have been mainly guided by clinical improvement, lessening of cyanosis, improvement of cardiac reserve, functional activity and the haematocrit.

The subject of congenital hearts specially that of cyanotic cardiac anomalies is an extremely complex one. Today, only a few cases could conceivably not be improved by surgery. But the first problem is one of diagnosis and the exactitude in diagnosis demanded of the cardiologist is of a very high order. In the majority of cases, diagnosis can be arrived at through routine cardiological techniques but cardiac catheterization, angiocardiology and various other studies may have to be done before the diagnosis can be effectively settled. Even so, there remains a small group of cases where the diagnosis remains in doubt. And, even on the operation table the answer to some of these diagnosis cannot be had. Fortunately, these instances can be reduced in number by careful and accurate cardiological assessment before operation.

Tetralogy of Fallot is by far the most commonest of these anomalies to be improved by surgery (about 80% of the cases). Other conditions such as pulmonary stenosis with inter-atrial septal defect (as well as pure pulmonary stenosis which

is not a cyanotic condition but can be considered along with this condition) tricuspid atresia, single ventricle with diminished pulmonary blood flow, truncus arteriosus (with reduced pulmonary blood flow) and transposition of the great vessels are some of the conditions which can be corrected or improved surgically. The detailed consideration of such measures is quite outside the scope of the present paper, however some observations can be made with regard to the general principles underlying surgical relief in such conditions.

Surgical efforts in these conditions are mainly directed towards a twofold purpose:—

- (a) Improving deficient pulmonary blood flow.
- (b) Closure and reduction of any existing intracardiac shunt or communication which is not compensatory in character.

The first can be achieved either by re-routing insufficiently oxygen-saturated blood from the left side of circulation to the right by creation of an artificial ductus such as a Blalock-Taussig or Potts-Smith shunt or any other modification of the principle or by a direct attack on any obstruction existing in the pulmonary blood flow. Such a direct approach can be either through the

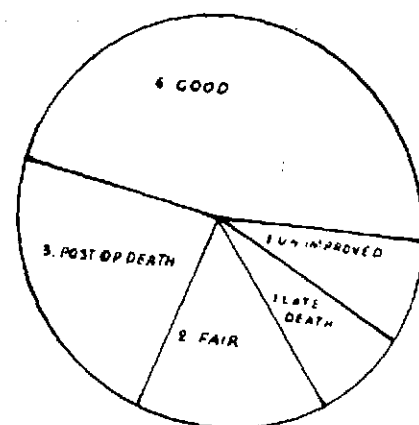


Fig. 3.
Results of surgical treatment of
congenital cyanotic disease.
(13 cases)

right ventricle (Brock³) or through the pulmonary artery (Pott⁹, Sondegaard¹⁰, Dubost¹¹). It is not proposed to go into merits and demerits of the various methods, but we should like to make some remarks with regards to choice between a shunt operation and an operation aiming at direct relief of pulmonary obstruction.

The Blalock-Taussig operation or any other shunt operation seem to have stood the test of time with regard to treatment of Tetralogy of Fallot, specially those with infundibular stenosis. The Brock operation or any other type of direct valvulotomy is best suited to cases of pure pulmonary stenosis with or without inter-atrial septal defect. There seems to be no case for a shunt operation in a pure pulmonary stenosis. However, some have argued that the presence of a right-left shunt as existing in a pulmonary stenosis with inter-atrial septal defect, may need re-routing of unoxygenated blood through a left-right shunt artificially created. However, the light of experience reveals that majority of cases are worsened after performance of such a shunt.

Handicapped as we have been without the aid of accurate and definitive diagnostic equipment, we have usually adopted the following plan of action. If the diagnosis is compatible with that of Tetralogy of Fallot or one of the "Fallot Group" of cases, plans are made for the performance of a shunt. On opening the chest and exploration of the heart and the vessels, obstruction to the pulmonary circulation is sought to be localised by palpation of a thrill and the evidence of a jet and/or marked post-stenotic dilation on the anterior aspect of the pulmonary artery. Such findings almost invariably suggest a valvular type of stenosis — in rare cases, a terminal infundibular one which type is again best corrected by a direct valvulotomy. In such cases, a Brock type of operation is performed. If however, the thrill is localised over the infundibulum or below the origin of the pulmonary artery, a shunt operation is carried out. The performance of a Brock operation for the infundibular

stenosis of Tetralogy of Fallot has not found general acceptance among cardiac surgeons. The mortality of the Brock operation specially that of infundibular resection is definitely higher than a shunt operation and the results of such a direct operation have been found to be not materially superior to those of a shunt. Some have argued that by relieving the obstruction to the pulmonary flow, a right-left shunt is converted into an intra-cardiac left-right shunt. This leads to strain of the left ventricle and possibly some early fatalities due to pulmonary oedema may be explained by such a hypothesis.

Between the shunt operations, we tend to strongly favour the Blalock-Taussig or one of the modifications such as anastomosis of the central end of the left subclavian to the peripheral end of the divided left pulmonary artery. The Potts shunt, we believe, is best reserved for children below the age of 5 or when there are obvious technical difficulties such as a short or very narrow subclavian artery. In cases with right sided aortic arch (25% of cases of Tetralogy of Fallot) a Potts shunt becomes virtually impossible and in these cases again a Blalock shunt is preferred irrespective of age. In children the size of the subclavian artery is very small and therefore a Potts shunt operation is preferred, however the size of the fistula is of great importance. Anything over a stoma of 4 mm. may produce a left-right shunt with great increase of the left ventricular output and may seriously strain the left side of circulation leading to pulmonary oedema. We believe one of our postoperative deaths was due to creation of too large a stoma. The average diameter of the subclavian artery is just about suitable for the required size of a left-right shunt. The utilisation of another artery such as the left carotid should be avoided. It is possible that one of our earlier deaths was due to the utilisation of the left common carotid. Should an artery be too small or too short in length, several procedures can be employed:—

- (a) division of the infundibular pulmonary ligament which allows the

pulmonary hilum to swing to an upper level (Husfeldt⁵),

- (b) a vein graft can be used to bridge the gap, or
- (c) a secondary or tertiary branch of the pulmonary artery can be dissected, divided and an anastomosis done, end to end, between the peripheral end of the branch and the subclavian artery.

We have usually divided the infundibular pulmonary ligament and have attempted one vein graft, however in that case the stenosis was a terminal infundibular one and we proceeded ultimately to do a Brock operation. The patient did well following surgery.

An ideal shunt should be one which exactly balances the amount of blood flowing from the right to the left side of circulation within the heart. In order to have such a balance which brings about the maximum re-routing of unoxygenated blood, the size of the shunt is most important. As has already been mentioned, in the majority, the lumen of the subclavian artery at the thoracic inlet just before the branches are given off is just about right for such a performance. It must be clearly understood however, that unless there is a deficiency in pulmonary circulation, a shunt operation would be of no value. The correction of existing intracardiac septal defects producing intracardiac shunts has been attempted through indirect surgery suggested by Danish, Swedish and some American workers, but a proper approach to such a problem would be that of open intracardiac surgery, through the single or combined use of hypothermia (Swan⁶) artificial pump oxygenators (Newman et al⁸) or cross circulation (Lillhei⁷ & Warden¹¹).

In the preoperative management of such cases, the cardinal points are:—

- (1) Adequate hydration,
- (2) Adequate oxygenation,
- (3) Control of polycythaemia and blood viscosity, and

- (4) Control of infection and congestive failure.

We would like to comment at some length on the third item, namely control of polycythaemia and blood viscosity. While polycythaemia is a compensatory phenomena, in these cases of cyanotic heart disease any such compensation can break down. In cases where a very large intracardiac right-left shunt is present as much as 60 to 70% or even a larger percentage of the output of the right ventricle may be shunted to the left side of circulation and during crying and struggling such infants may have an intracardiac shunt which amounts to 100% of the output of the right ventricle when no blood enters the left side of circulation leading to temporary loss of consciousness. In such patients, the development of polycythaemia may take a very aggressive pattern. In 2 of the cases observed by us such rapid development of polycythaemia led to the development of intra-vascular clotting with the production of oliguria, haemiplegia and gangrene of the leg. In such cases, one may have to bleed these patients and replace the loss with plasma or a plasma expander. It is to be understood that the use of such measures can only be utilised for a temporary purpose and such patients should be operated on as quickly as possible once the blood viscosity is lowered. The haematocrit in some cases rises to the almost unbelievable figure of 70 or over, and unless rapid measures are taken, these patients would die very quickly.

In general we have felt that operation should not be advised in children below the age of 5 but in some instances because of severe cyanosis and marked reduction of cardiac reserve, surgical therapy may have to be undertaken as a comparatively emergency procedure. Hypothermia and temperature control play a very important part in the management of such cases.

Control of infection:

S.B.E. and cerebral abscess of 'quiet' type — 2 cases.

Tracheotomy for postoperative laryngeal oedema — 3 cases.

PATENT DUCTUS ARTERIOSUS

Of the 5 cases of patent ductus arteriosus, only one was an adult, rest were children ranging between the ages of 6 to 15. A ligation technique was employed in all except in one where division and suture were carried out. There was no operative death. But in the one adult case operated on, a secondary false aneurysm developed at the site of ligation which ruptured a month and a half after operation, leading to the death of this patient (a shoe-lace was used instead of silk for this tie). Prior to this, rupture infection had occurred in the false aneurysmal sac leading to development of subacute bacterial endocarditis and at autopsy, multiple pulmonary abscesses were detected.

The subject of patent ductus arteriosus has been very thoroughly dealt with in literature — being the first definitive attempt towards the development of this new speciality. It is nearly 17 years now since Gross first tried the patent ductus arteriosus. The general concepts of surgery in this condition have not changed materially since that date. We believe however, that division of the ductus should only be practised in adults or on broad ductuses. With practice, division and suture of the ductus can be made as safe as ligating, but in the early stages of developing this type of surgery, the surgeon will be well advised to tie instead of dividing. Our usual policy is to place 2 ligatures on either end as close to the great vessels as possible and then place a central transfixion ligature.

The follow-up in these cases operated on by us revealed the disappearance of the characteristic of murmur, marked improvement in cardiac exercise tolerance and some diminution in heart size in all cases. It is our belief that all ductuses should be closed early, before definitive changes occur in the pulmonary arterioles with thickening. Closure of ductuses after pulmonary arterio-

sclerosis sets in would not serve to rid the patient of pulmonary hypertension.

COARCTATION OF THE AORTA

The series of coarctation operated on were too small (3 cases) to make any definite statement based on experience. There was one death on the table of a 9 years old child due to cardiac arrest. Cardiac massage was successful in restoring normal cardiac rhythm after 13 minutes but the patient died subsequently of cerebral damage. No technical difficulties were encountered. Another child of 11 has been operated on successfully and is now healthy. The third, a boy of 18 underwent surgery successfully. However, on the 45th day he developed a leak from the site of anastomosis caused by a staphylococcus aureus (coagulase positive) infection. This organism was recovered in pure culture before death from the blood stream. This case merits special mention because a total resection of the coarctate segment was not carried out but a plastic procedure excising the lateral part of the constriction and approximation of the cut edges was done as suggested by one of Brock's associates (Walker & Haxton). We have always made a point of having an autograft ready before operating on a case of coarctation. How-

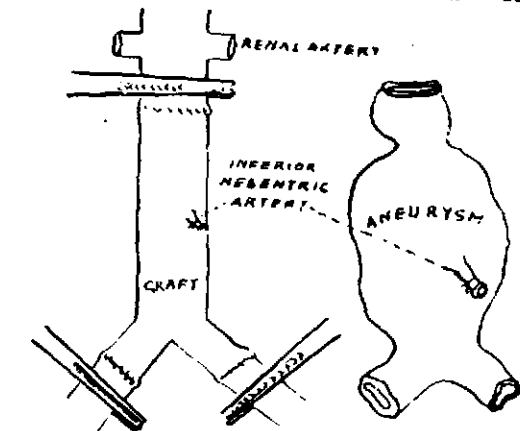


Fig. 4.

Diagrammatic representation of aortic homograft used for replacement of aneurysm of the abdominal aorta and the bifurcation up to the common iliac arteries.

ever, we do not feel that it is justifiable to use a graft except in those cases where approximation of the divided ends is difficult or dangerous. Grafting should never be used as an elective procedure. Recently we have successfully placed a homologous graft to bridge a large defect in one case.

ATRIO SEPTAL DEFECTS

Two cases of suspected atrial septal defect were operated on and an attempt was made to close the defect. In the first, deep hypothermia was employed but the patient developed ventricular fibrillation during cooling and subsequently died (Sen et al). This case will be commented on in detail later on. The other, where an atrio-septopexy was contemplated, turned out to have no defect in the inter-atrial septum on digital palpation through the right atrial appendage. This case was hypothermized for open cardiotomy if required. However, since no septal defect was found, nothing further was done. The next day following surgery, the patient developed severe pulmonary oedema and died. Autopsy revealed it as a case of primary pulmonary hypertension with no intracardiac defect. This case which was studied in detail including angio-cardiography and cardiac catheterization illustrates the diagnostic difficulties which beset the cardiologist when confronted with atypical case such as this.

INCOMPLETE AORTIC VASCULAR ARCH

Aortic vascular arches have attracted the attention of the pediatric surgeon since the writings of Gross in 1945. However, such vascular arches, which are the remnants of the reptilian aortic vascular systems usually produce acute respiratory obstructions in new-born or in young infants. The persistence of such anomalies during adult life and the production of symptoms are comparatively rare. The persistence of an abnormal right subclavian artery arising from the left side and crossing behind the oesophagus has been drawn attention to from time to time in literature (disphagia lusoria) (Bayford¹). The instance of a right sided aortic arch with a left side duc-

tus or ligament of arteriosus producing an incomplete vascular aortic arch has been less often commented on. We have had one such case. This was a man of 28 who came with a short history only of 15 days complaining of dysphagia and 'choking' and hoarseness. Examination revealed a right aortic arch, an aneurysmal dilation of the origin of the innominate artery pressing on the oesophagus producing a pulsatile cut-out on the fluoroscent screen during barium swallow. The right vocal cord was cadaveric in position. Retrograde aortography confirmed the diagnosis and exploration of the left chest revealed the presence of a right aortic arch with a partly patent left ligament arteriosus producing an incomplete vascular arch, enclosing the trachea and the oesophagus within the ring. This ductus was divided leading to complete disappearance of all symptoms. The right vocal cord, following surgery started to function and has regained full mobility. The voice has become normal. The follow-up of the patient for a period of a year and a half has shown no recurrence of symptoms.

ANEURYSM

Eleven cases of aneurysm of the aorta were operated upon. Cellophane wrapping was done in 8, a Babcock type of arterio-venous shunt in 2 and in one, resection of the aneurysm and homo grafting was carried out. The outlook in this field of surgery is generally poor. Our experience with cellophane wrapping has been disappointing except in 2 cases, a saccular anterior aneurysm of the ascending aorta and a large fusiform aneurysm of the thoraco-abdominal aorta. These two have now lived for over a period of one and a half year following surgery and are doing well so far. We attempted resection and grafting of the aneurysm only in one case — suitable cases being difficult to get. This was the case of aneurysm in a man of 71 affecting the abdominal aorta below the renal vessels and involving the aortic bifurcation. Excision of the affected portion of the aorta, ligating the inferior mesenteric artery was

carried out, including the common iliac arteries in the resection. A preserved homograft was used to restore the continuity. Following surgery, pulsations (absent before surgery) returned to both the extremities and the condition of the limbs were excellent. The patient did well until the third day when he developed a large posterior myocardial infarct and succumbed. Autopsy revealed the graft and sites of anastomosis in good condition. The vessels were patent.

The future of blood vessel grafts is by no means a settled problem, but it appears that the use of homografts represents only a passing phase in the development of large vessel surgery. The use of plastics such as Orlon, Vinyon-N cloth etc. has been experimentally shown to have a definite superiority over blood vessel grafts (Hufnagel⁵, D'Angelo²). Their ready availability and lack of antigenic properties make the plastics as close to the ideal as possible for use as blood vessel replacements (Sen & Bhatt⁶).

MYOCARDIAL ISCHAEMIA

The problem of myocardial ischaemia has been one of perennial interest to the cardiac surgeon. The pioneer work of Claude Beck and the development of various techniques of re-vascularisation of myocardium, have, from time to time kindled much enthusiasm in those who are engaged in treating one of the main scourges of modern civilization, coronary atherosclerosis. However, revascularization of the myocardium is not the total answer to this problem, which is the reason why this branch of surgery has not progressed to the extent of other facets of cardiac surgery.

We have treated 2 cases of angina pectoris with coronary insufficiency by a method originally suggested by King⁵ and subsequently improved upon by Thompson and Raisbeck⁸, Beck², Gorelik and Dack⁴. The operation of pericardial poudrage is a simple one. Vascular adhesions are sought to be produced between the coronary and the extra coronary systems by the use of talc dusting. Experimental work done in

this field has shown that the amount of blood flowing through such extra coronary adhesions is large and can very well mimic the intra-coronary anastomosis normally present but obliterated in disease (O'shaughnessy et al^{6,7}). The size of such intra-coronary anastomosis is about 40 μ . The estimated size of extra-coronary anastomosis produced by pericardial poudrage is comparable to such size. One of these was a young woman of 20 with rheumatic heart disease with severe aortic regurgitation. The pulse pressure was recordable and there was enormous left ventricular hypertrophy leading to relative coronary ischaemia. The attacks averaged about 40 to 50 per day and sometimes the patient consumed as many as 100 tablets of Trinitrin in 24 hours. Pericardial poudrage was carried out after resecting the left fifth costal cartilage and 6 gms. of magnesia trisilicate (talc powder) suspended in 5 c.c.s. of normal saline was distributed within the pericardial sac. The approach to the pericardium was through the 'bare' area thus reducing the chances of pleural fibrosis. Following surgery, attacks diminished dramatically in number and intensity and within a fortnight of surgery, her attacks were reduced to one or at the most to 2 a day. The relief of pain persisted till her death which occurred a year later from congestive cardiac failure. The other case, one of coronary insufficiency in a man of 45 who was getting about 8 to 10 attacks of angina was operated on using a similar technique of 4 gms. of talc powder. The attacks have nearly disappeared following surgery. The patient was followed up for 6 months postoperatively, after which he has been lost sight of. In both these cases there were no significant electrocardiographic changes postoperatively but the amount of vascularity in the adhesions produced was obvious because in both cases a bloody effusion developed in the pericardial sac after a week of surgery and multiple aspirations had to be done before the highly vascular soft granulation tissue was converted into firm adhesions. Our experience in this field is very small but in a large series of cases reported by Gorelik and

Dack⁴, Beck², etc., the risks of the procedure is very small and none developed constrictive changes in the pericardium. The simplicity of the procedure and its clinical response seem to commend this procedure strongly.

The Beck II procedure — a revascularization of the coronary sinus by placing a graft between the aorta and the coronary sinus by partial narrowing of the ostium — is a procedure which involves great technical skill and, today, a high mortality rate. Beck's figures show good or excellent clinical improvement in over 80% of his living patients, with an operative mortality of about 20%. We feel the pericardial poudrage should be given a wider trial.

INFERIOR VENA CAVAL LIGATION

The idea of inferior vena caval ligation in severe congestive failure and tricuspid regurgitation was brought to practical application by Perianes of Argentina. The ligation of vena cava below the renal vein would cut down the venous return to the right side of the heart — specially the minute volume, thus lessening the load. It is not the purpose of this paper to discuss the rationale of this procedure which involves many aspects of haemodynamics. However, there are cases of severe congestive failure which are resistant to medical treatment and constitute a real problem. We therefore felt that inferior caval ligation was worth a trial in some of these cases and accordingly, 7 cases were operated on, one case of myocarditis and adhesive pericarditis unknown etiology, and 6 cases of severe rheumatic heart disease. There was 1 death, on the second postoperative day possibly from pulmonary embolism. Of the remaining 6, a definite permanent benefit appeared to result in 3. The other 3 also showed temporary improvement lasting for a few weeks to a few months. The cases became more responsive to medical treatment and in none of these did oedema of the legs occur. We feel that though this approach could never be recommended as a routine, there is a place for inferior vena caval ligation in intractable

congestive failure specially when cardiac insufficiency is brought about by a temporary factor such as some sort of reversible myocarditis or in the preparation of patients for surgery. Two of our cases of mitral stenosis who were an intractable failure were able to undergo mitral commissurotomy after their cardiac failure was improved controllably by inferior caval ligation.

TABLE I
BREAKDOWN OF THE OPERATIONS
CARRIED OUT ON HEART AND
GREAT VESSELS

Constrictive pericarditis	..	19
Mitral	..	40
Blue Babies	..	13
Aneurysm	..	11
A.S.D.	..	1
Coarctation of the aorta	..	3
Patent Ductus	..	5
Primary Pulmonary Hypertension	..	1
Incomplete Aortic Vascular arch	..	1
Poudrage for Angina Pectoris	..	2
I.V.C. Ligation	..	7
Total	..	103

REFERENCES

MITRAL STENOSIS

1. Bailey, C. P.: *Surgery of the Heart*. Philadelphia, Lea & Febiger, 1st ed., 1955, page 482-681.
2. Bailey, C. P., Bolton, H. E. and Redondo-Ramirez, H. P.: *Surgery of Mitral Valve*. Surg. Clin. North America, 32: 1807, Dec. 1952.
3. Brock, R. C.: *Surgery of the Heart and Great Vessels*. Proc. Roy. Soc. Med. 44: 995, 1951.
4. Brock, R. C.: *Surgical & Pathological Anatomy of Mitral Valve*. Brit. Heart J. 14: 489, 1952.
5. Clawson, B. J., Bell, E. T. and Hartzell, T. B.: *Valvular Diseases of the Heart*. Am. J. Path. 2: 193, 1926.
6. Dry, T. J.: *Present Status of Surgical Treatment for Cardiac Disease*. J.A.M.A. 19: 24, 1952.
7. Gorlin, R., Lewis, B. M., Haynes, F. W., Spiegl, R. J. and Dexter, L.: *Factors regulating pulmonary "Capillary" pres-*

- sure in mitral stenosis. IV, Am. Heart J. 41: 834, 1951.
8. Gorlin, R., Gorlin, S. G.: Hydroletic formula for calculation of area of stenotic mitral valve, other cardiac valves and central circulatory shunts. Amer. Heart J. 41: 1, 1951.
9. Hanlon, C., Rollins: Present status of cardiovascular surgery. J.A.M.A. 149: 1-7, 1952.
10. Harken, D. E., Ellis, L. B. and Norman, L. R.: The surgical treatment of mitral stenosis; progress in developing controlled valvuloplastic technique. J. Thoracic Surg. 19: 1-15, 1950.
11. Harken, D. E. and Dexter, L. et al.: Surgery of mitral stenosis. Ann. Surg. 134: 722, 1951.
12. Harken, D. E., Ellis, L. B., Dexter, L., Farland, R. E. and Dickson, J. F., III.: The responsibility of the Physician in the selection of patients for mitral commissurotomy. Circulation. 5: 349, 1952.
13. Janton, Henry O., Glover, Robert P., O'Neill, T. J. E., Gregory John, E. and Frois, Gregory, F.: Results of surgical treatment of mitral stenosis. Analysis of one hundred consecutive cases. Circulation. 6: 321-333, 1952.
14. Julian, O. C., Dye, W. S., Baker, L. A. and Sadove, M. S.: Surgical treatment of mitral stenosis. Arch. Surg. 65: 621, 1952.
15. Lewis, B. M., Gorlin R., Houssay, H. E. J., Haynes, F. W. and Dexter, L.: Clinical and Physiological correlation in patients with mitral stenosis. V. Am. Heart J. 43: 2, 1952.
16. Redondo-Ramirez, H. P.: Personal communication. Quoted from No. 1.
17. Rodbard, S. and Katz, L.: Chicago, I. 11: Personal communication. Quoted from No. 1.
18. Rodbard, S.: Hydrodynamics illustrated in an artificial circulation model. J. Applied Physiol. 5: 191, 1952.
19. Rodbard, S. and Saiki, M.: Flow through collapsible tubes. Am. Heart J. 46: 715, 1953.
20. Sen, P. K.: The use of a snare tourniquet in mitral valvulotomy. A suggested modification of technique. Ind. Jour. Surg. 15: 15, 1953.
21. Vakil: Personal communication.
2. Blalock, A. and Burwell, C. S.: Chronic pericardial disease. S.G.O. 73: 433, 1941.
3. Harrington, S. W.: Chronic constrictive pericarditis: Partial pericardectomy & Epicardiolysis in 24 cases. Ann. Surg. 120: 468, 1944.
4. Holman, Emile.: Surgical treatment of tuberculous pericarditis. Arch. Surg. 61: 266-271, 1950.
5. Holman, E.: Recognition and correction of constrictive pericarditis. Jour. Thoracic Surg. 18: 643, 1951.
6. Holman, E. and Willet, F.: Surgical Correction of Constrictive Pericarditis. Surg., Gynec. & Obst. 89: 129, Aug. 1949.
- 6a. Treatment of active tuberculous pericarditis by Pericardectomy. J.A.M.A. 146: 1, 1951.
7. Johnson, Julian and Kirby, Charles, K.: A new incision of Pericardectomy. Ann. Surg. 133: 540-43, 1951.
8. Sellors, T. H.: Constrictive Pericarditis. Brit. J. Surg. 33: 215, 1946.
9. Sen, P. K., Datey, K. K. and Baliga, A. V.: Chronic constrictive pericarditis. A report of seven cases treated surgically. Ind. Jour. Med. Sc. 3: 343, 1954.
10. Udupa, K. M.: Tuberculous Pericarditis and its surgical management. Ind. Jour. Surg. 14: 315, 1953.

CONGENITAL CYANOTIC HEART DISEASE

1. Blalock, A. and Taussig, H. B.: The surgical treatment of malformations of the heart in which there is pulmonary stenosis or pulmonary atresia. J.A.M.A. 128: 189, 1945.
2. Brock, R. C.: Pulmonary valvulotomy for the relief of congenital pulmonary stenosis. Brit. Med. Jour. 1: 1121, 1948.
3. Brock, R. C.: Direct cardiac surgery in the treatment of congenital pulmonary stenosis. Ann. Surg. 136: 63, 1952.
4. Donzelot, E., D'Allianes, F., Dubost, C., Metianu, C. and Durand, M.: Deductions chirurgicales tirees de l'etude de 54 pieces anatomiques de tetralogie de Fallot. Sem. Hop Paris, 28, 1952.
5. Husfeldt: Personal communication.
6. H. Swan, I. Zeavin.: Cessation of circulation in general hypothermia. Technics of intracardiac surgery under direct vision. Ann. Surg. 139: 385, 1954.
7. Lillehei, C. W., Cohen, M., Warden, H. E. and Vario, R. L.: Intracardiac surgical correc-

tion of the Tetralogy of Fallot defects. *Ann. Surg.* 142: 418, 1955.

8. Newman, M. H. et al: Complete and partial perfusion of animal and human subjects with pump oxygenator. *Surgery.* 38: 30, 1955.
9. Pott, W. J., Smith, S. and Gibson, S.: Anastomosis of aorta to pulmonary artery. *J.A.M.A.* 132: 627, 1946.
10. Sondegaard, T.: Cardiovascular surgery. *Lam. Henry Ford Hospital.* 80, 1955.
11. Warden, H. E., Cohen, M., Read, R. C. and Lillehei, C. W.: Controlled cross circulation for open intracardiac surgery. *Jour. Thoracic Surg.* 28: 331, 1954.

PATENT DRUGS, COARCTATION AND ANEURYSM

1. Bayford, D.: Singular case of deglutition. *Mem. M. Soc. London,* 2, 275, 1794 (Quoted by Bailey, *Surgery of the Heart.* Lea & Febiger).
2. D'Angelo, G. J., Benson, W. R. and Grinson, A.: Nylon (Vinyon-N) Cloth tube graft for arterial defects. To be published. Quoted from Bailey, *Surgery of the Heart.* (Lea & Febiger).
3. Gross, R. E.: Surgical Relief for Tracheal obstruction from a vascular ring. *New England J. Med.* 233: 586, 1945.
4. Gross, R. E.: Surgical management of patent ductus arteriosus. *Ann. Surg.* 110: 321, 1939.
5. Hufnagel, C. A. and Rebil, P. J.: Replacement of arterial segments utilizing flexible orlon prosthesis. To be published. Quoted from Bailey, *Surgery of the Heart.* Lea & Febiger.
6. Sen, P. K. and Bhatt, P. A.: The scope for homologous grafts used for bridging aortic defects. *Ind. Jour. Surg.* 16: 223, 1954.

7. Sen, P. K., Bhatt, P. A. and Shah, C. B.: Intracardiac surgery under direct vision. Closure of Atrio-septal defects in dog; using artificial Hibernation (Hypothermia). *Ind. Jour. Surg.* 16: 251, 1954.
8. Walker, R. N. and Haxton, H.: The Surgical treatment of coarctation of the aorta. *Brit. Jour. Surg.* 42: 26, 1954.

MYOCARDIAL ISCHAEMIA

1. Beck, C. S.: Development of new blood supply to heart by operation. *Ann. Surg.* 102: 801, 1935.
2. Beck, C. S.: Principles underlying the operative approach to the treatment of myocardial ischaemia. *Ann. Surg.* 118: 788, 1943.
3. Beck, C. S., Stanton, E., Batiuchok, W. and Leiter.: Revascularization of the heart by graft of systemic artery and a new branch from the aorta into the coronary sinus. *J.A.M.A.* 137: 436, 1948.
4. Gorelik and Dack.: Myocardial Revascularization by Cardiopericardiopexy. *Jour. Int. Coll. Surg.* 21: 167, 1954.
5. King, E. S. J.: *Surgery of Human Heart.* London. Page 437-438, 1941.
6. O'Shaughnessy, L.: Experimental Method of Providing a Collateral Circulation to the Heart. *Brit. Jour. Surg.* 23: 665, 1936.
7. O'Shaughnessy, L., Slone, D. and Watson, F.: Surgical Revascularization of the Heart. The experimental basis. *Lancet.* 1: 617, 1939.
8. Thompson, S. A. and Raisbeck, C. S.: Cardio-pericardiopexy. *Ann. Int. Med.* 16: 495, 1942.

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USE OF HYPOTHERMIA IN CARDIAC SURGERY

(A report of 8 clinical cases)

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Since the experiments of Bigelow^{2,3,4} first attracted the attention of the surgical world, the field of hypothermia has widened greatly. Many improvements have been achieved in the technique of cooling and much new knowledge has been added to the study of low temperature biology in general and cardio-vascular physiology and metabolism in hypothermia in particular. (Adolph¹, Hook¹³, Dill⁸, Hegnauer¹²). The conversion of the normal response of a warm-blooded animal to a poikilothermal or cold-blooded response was achieved by Bigelow mainly through the use of a general anaesthetic in the form of an intravenous barbiturate. Other means of eliminating or reducing the shivering response have been introduced, specially those of the French school (Laborit et al¹⁴) with the use of various "cocktails", but such anti-histaminics, ganglion blocking agents and nervous depressants have not found general acceptance in clinical application everywhere; however, they represent a very definite advance towards the understanding of the complex processes which maintain the body temperature.

Various cooling methods have been used by different workers; (Churchill⁶, Bigelow^{2,3,4}, Delorme⁹ & Laborit¹⁴) skin or surface cooling using water or alcoholic cooled blankets, direct cooling with melting ice or ice cooled water, extra-corporeal cooling by letting the blood out into an extra-corporeal circuit, cooling it and returning it to the body — the circuit may be veno-venous or veno-arterial or it may be done through cooling body cavities such as the pleural space or the peritoneal cavity. Hypothermia has been used to a moderate degree in order to lessen reactions and metabolism, deeper hypothermia to supplement anaesthesia or to function totally as an anaesthetic agent and

very deep hypothermia for the purpose of caval occlusion and open 'dry' cardiectomy.

An open cardiectomy done under caval occlusion and exclusion of the heart from circulation has been achieved through three separate approaches:—

- (1) an artificial heart-lung machine — pump oxygenator of the Gibbon type;
- (2) cross circulation between a patient and a donor usually a parent, as practised so brilliantly by Lillehei and
- (3) deep hypothermia along the lines originally suggested by Bigelow.

It will be seen therefore that the range of hypothermia and its application in cardiac surgery occupies a somewhat indeterminate position today. Briefly, hypothermia can be used in different ways:—

1. Moderate hypothermia, functioning as temperature control as a metabolic depressant and circulatory stabilizer which makes the performance of certain cardiac operations specially on the cyanotic individual, easier. This idea was first practised by McQuiston¹⁷ (1949) who used very mild grades of hypothermia by operating on highly cyanotic children over ice bags which as they suggested, reduced the tendency to postoperative hyperthermia and also reduced the oxygen demand to some extent. The use of such hypothermia is really one of temperature control for it does not tend to alter the normal homiothermal response of man. The use of this type of hypothermia is directly obsolete today.

2. Deeper hypothermia however, is now being used fairly widely to obtain a better temperature control and functions as an

anaesthetic in many types of cardiac surgery. The degree of temperature reduction need not reach the critical point at which complete change-over to the poikilothermal response occurs, around 30/29°C. At a temperature, a degree or two above this, the conduction of the operation in cyanotic children is carried on with much greater safety as the oxygen demand is greatly reduced and with a lowered heart rate, thus avoiding the dangers of tachycardia and cardiac failure — two of the most dreaded complications during surgery. The main risk of deep hypothermia, namely, an increased susceptibility to ventricular fibrillation is not operative at these temperature ranges. The use of deep hypothermia, 25/26°C. is usually restricted to open, visual cardiomyotomies under caval occlusion for definitive intracardiac surgery such as closure of septal defects.

This paper is based on our experiences in hypothermia, both experimental and clinical. We have since January 1953 carried out over 200 experiments in the dog on various aspects of deep hypothermia and open intracardiac surgery. The study of complications under hypothermia, specially ventricular fibrillation has also been the subject of our researches. Some of this material has already been presented before the Association (Sen et al²²) and will not be considered here in detail. During these 3 years, we have also operated on 8 clinical cases using hypothermia as an adjunct to surgery. A protocol of the cases is given in table . Deep hypothermia was used in 2 cases, both suspected to be auricular septal defects while in the remaining 6, moderate hypothermia was used. The age of these patients varied from 1½ years to 30 and the time period of hypothermia was between 1½ to 3 years. Where deep hypothermia was used in 2 cases, temperatures were reduced to 23 and 29°C. In the others, the temperatures were all above 30 ranging between minimum 32 to 30.5°C. One death was directly attributable to hypothermia — the case of intra-auricular septal defect which developed ventricular fibrillation while being cooled at 29°C.

Technique of Hypothermia and Re-warming:

Premedication, consisting of Pethidine, Atrophine and Nembutal is given an hour before cooling. The patient is lightly anaesthetized preferably in the wards, with a minimal dose of intravenous pentothal and brought to the operating theatre. A small 'booster' dose of pentothal is again delivered and the minimum dose of Scoline necessary for intra-tracheal intubation is injected intravenously. A tube with a cuff is then introduced. The anaesthesia is maintained lightly, with nitrous oxide and oxygen, with small amounts of Pethidine, curara and pentothal being used from time to time to prevent shivering as the body is cooled. A rectal electrode attached to a thermocouple is inserted. An electrocardiographic hook-up is essential. A surgeon is in readiness to do an emergency thoracotomy and cardiac massage before cooling is begun. Positive pressure ventilation is started in the beginning and in the last 4 cases we have used a pump of the type we use for animal experiments capable of ventilation to a maximum of 500 c.c.s. per stroke and up to a maximum of 48 times a minute. The researches of Swan^{25, 26, 27}, Stewart & Virtue²³ and our own work²² in this field have confirmed our belief in the protective role of hyperventilation towards prevention of ventricular fibrillation and we have in the last 4 cases maintained a constant ventilatory rate of 48 times per minute, using a mechanical pneumoflator.

Cooling is obtained by rubbing gently crushed pieces of ice on the torso, arms and legs, allowing the ice to melt with the body heat (thus taking advantage of the latent heat required to melt ice) and taking care not to freeze the skin directly. As soon as the cooled skin becomes firm to the feel, a different area is chosen for rubbing the ice. From time to time, a small amount of alcohol is sprinkled over the area. This reduces the temperature of the skin more rapidly. The rate of cooling generally depends on the size and weight of the patient. However, all things being equal, the variations are not great. If an adequate

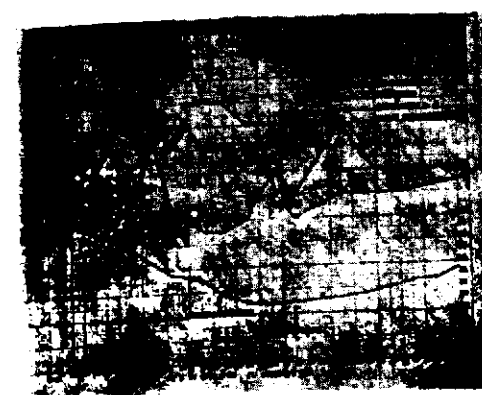


Fig. 1.
Showing a linear relationship in time-temperature fall during cooling.

anaesthesia-curare level is maintained to prevent a shivering response, fall from normal temperature of 37°C. to the critical temperature of 29°C. occurs within half to one hour (Fig. 1). As cooling is carried out, the temperature, time, blood pressure and heart rate are plotted on a graph (Fig. 3). By watching this, one is able to determine the general slope of cooling. We feel that an average safe slope is one where each degree fall in centigrade occurs every 5 minutes. If the slope becomes sharper, cooling is stopped or lessened in area and if the rate of cooling is slow, more pentothal and or curare is injected. Pethidine given intravenously seems to produce a sharp fall in blood pressure in the hypothermic stage and should be avoided as far as possible. Once the temperature reaches about a degree above the intended level of fall, cooling is stopped. The temperature tends to fall by a degree or so after this is done. In one case the temperature fell by 3.5° after stoppage of cooling (Table I) but this was the case where ventricular fibrillation had set in and there was no effective circulation for nearly half an hour, at the end of which cardiac massage was successful in establishing normal rhythm.

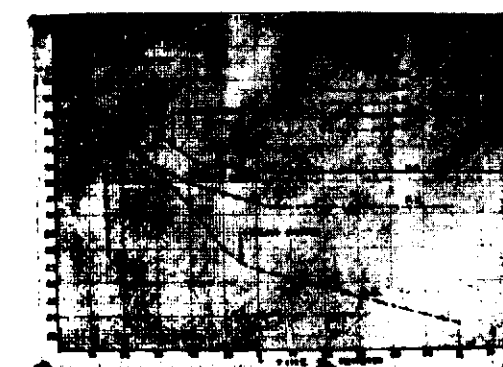


Fig. 2.
Showing variations in cooling curves in different patients.
Note: The further drop in temperature by a degree or two after cooling has been stopped.

During the operative procedure, no further cooling is necessary, the average duration of operation being 1½ to 2 hours during which time the body temperature remains at more or less the desired level and does not tend to rise if a shivering response is prevented. However, after about an hour, the temperature tends to rise again. Frequently, at the end of the operation, the temperature has been a couple of degrees higher than the lowest temperature recorded.

Re-warming is mostly done by the use of hot water bottles covered by blankets. Only in our first patient was re-warming carried out by immersing the patient in a tub containing warm water at 45°C. We have found that re-warming by this method is somewhat cumbersome and the hot water bottle method, though a little slower, achieves the desirable results without complications. Some blisters have resulted from burns through the accidental use of unprotected hot water bottles but with care and using a double layer of blankets between the patient and the bottles, such complications can be avoided easily. Re-warming, generally speaking, has taken about twice the time as cooling.



Fig. 3.

Changes in blood pressure and heart rate during hypothermia. Cardiectomy was done for atrial septal defect.

Behaviour of the circulation during cooling :

The changes produced by hypothermia in circulation are now fairly well-known though all the explanations are not clear. All body processes are slowed and this is manifest in all aspects of circulatory phenomena (Fig. 3). The oxygen demand of the tissues is lowered. There is a continuous and steady depression of the pulse rate (Fig. 3). Such depression is most marked in children with cyanotic hearts. The volume is not altered. The blood pressure falls in parallel with the heart rate (Fig. 3). Cyanosis lessens. One of the most remarkable features of hypothermia in the 'blue babies' is the obvious over-all improvement of the patient's circulation. The T wave becomes progressively flattened and ultimately becomes inverted. The degree of inversion having some relationship with the degree of hypothermia. The ST segment and the J are both depressed along with this inversion (Fig. 4). The significance of the ST segment and the T wave changes will not be discussed here, but it seems to depend on the K/ca balance,

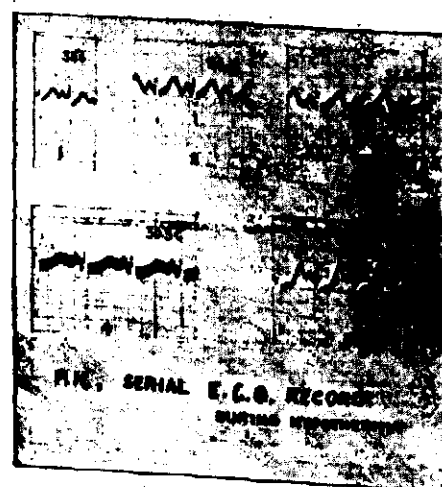


Fig. 4.

Serial E.C.G. changes during a case of hypothermia.

Note: Widening of complexes and 'ST' segment changes.

a factor of great importance in ventricular fibrillation.

Electrocardiographic changes :

These have been reported in detail elsewhere, (Datey⁷, Sen et al⁷) but in the main the changes consist of a drawing out of the complexes, a slowing of the electrical phenomena, more marked in the re-polarization than in the de-polarization. Constant and definite changes are seen in the T wave and the ST segment and the J.

Ventricular irritability begins to be noticed in temperatures below 29°C. Ectopic ventricular beats may occur occasionally and nodal rhythm may replace cyanosis. However, in only one of our cases did such changes develop. No ventricular fibrillation occurred in this case. The incidence of ventricular fibrillation in the hypothermic heart has been the subject of much research. Our experience (Sen et al²²) in this field mostly obtained from animal work has suggested the use of potassium by coronary perfusion in the prevention of

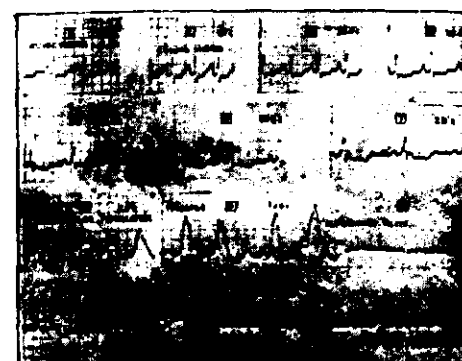


Fig. 5.

E.C.G. record during a case of hypothermia on atrial septal defect. Ventricular fibrillation developed at 28°C.

Note: The reversion to ventricular rhythm with cardiac massage. Later sinus rhythm was established (not shown in the figure).

this complication. In a comparative series done on dogs using a standard method of production of ventricular fibrillation the superiority of potassium over prostigmine (as advocated by Montgomery, Prevedel and Swan¹⁸) has been established. The inversion of the T wave and the depression of the ST segment is generally reduced or neutralised or even abolished by the use of potassium suggesting that these changes occurring in hypothermia are in part at least due to a potassium deficiency in the myocardial cell.

Complications :

It is far easier to trace the causality of complications in an experimental series. But almost all candidates for hypothermia used for clinical purposes are already suffering from serious physiological aberrations, such as cyanosis, polycythaemia, heart failure, hypervolaemia, etc. Which complication is therefore directly due to hypothermia, and in which hypothermia merely played a contributory part or had nothing to do with it whatsoever becomes largely a matter of speculation. Only one

death could be directly attributed to hypothermia where ventricular fibrillation developed under deep hypothermia preparatory to operation for closure of atrial septal defect. There was one death within the first 24 hours following surgery in a child where a Pott's shunt was done for Tetralogy of Fallot. Definite evidence of cerebral involvement were manifest such as dilatatory fixed pupils, loss of deep reflexes and coma. Autopsy revealed no visual cerebral change. Another death, a case of suspected inter-atrial septal defect, on exploration turned out to be a case of primary pulmonary hypertension (confirmed at autopsy) and nothing further was done. Hyperthermia developed in the immediate postoperative period, and the patient died within 48 hours from heart failure. In this case, hyperthermia seemed to play a definite contributory part in precipitating acute heart failure.

In our small series, the major complications directly consequent on hypothermia appeared to be ventricular fibrillation cerebral changes (possibly due to thrombosis and agglutination of the red cells in small vessels) and hyperthermia. Tossat has tried to explain the circulatory collapse of consequent open corporeal cooling by suggesting various hypotheses :—

- (a) Liberation of prostigmine or prostigmine like substances acting as vaso-motor depressants and increasing capillary permeability.
- (b) The closure or occlusion of small vessels in the brain and elsewhere and in the parenchymous organs due to agglutination of red cells forming clots.
- (c) Alterations in the chemical physiological constancy of the blood and metabolic processes with a shifting towards higher values, increase in acids such as lactic and pyruvic acid of the blood and a reduction in the pH of body fluids.

TABLE I
SHOWING TEMPERATURE ANALYSIS IN CASE OF HYPOTHERMIA

Case No.	Patient's initials.	DIAGNOSIS		Age in yrs.	TEMP. IN C.			DEG. IN C.		Time pd. of hypothermia in hours.
		Pre-op.	Post-op.		Before cooling	After cooling	Minimum	Total fall	Fall after stoppage of cooling	
1.	D.B.	Auricular Septal Defect	Auricular Septal Defect	30	38	27	23.5	14.5	3.5	2½ hours.
2.	J.R.	Fallot's Tetralogy	Fallot's Tetralogy with infundibular stenosis	4	37	33.5	32.5	4.5	1.0	3 hours.
3.	P.H.	Fallot's Tetralogy	Fallot's Tetralogy with infundibular stenosis	6	36	32	30.5	5.5	1.5	2½ hours.
4.	R.D.	Fallot's Tetralogy	Fallot's Tetralogy with Pulmonary valvular stenosis	5	38	33	33	6	1.0	2 hours.
5.	H.H.	? A typical Patent Ductus	Int. Vent. Septal Defect	9	37.7	34.2	32.5	5.2	1.7	1½ hours.
6.	A.B.	Auricular Septal Defect	Primary Pulmonary hypertension	18	37	31.2	29.8	7.2	1.4	3½ hours.
7.	B.P.	Fallot's Tetralogy	Fallot's Tetralogy with infundibular stenosis	1½	28	31.5	30.5	6.5	1.0	1½ hours.
8.	R.B.	Fallot's Tetralogy	Fallot's Tetralogy with ? Pulmonary valvular stenosis	7	37.5	33.0	31.5	5.5	1.5	2½ hours.

TABLE II
SHOWING COMPLICATIONS AND RESULTS

Case No.	Patient's initials	Final diagnosis	Total fall in deg.	Time pd. of hypothermia in hours	Complications	Results	Cause of death
1.	D. B.	Auricular Septal Defect	14.5°C	2½ hours	Ventricular fibrillation during cooling and burns	Expired	Ventricular Fibrillation.
2	J. R.	Fallot's Tetralogy with infundibular stenosis	4.5°C	3 hours	Inspiratory dyspnoea requiring tracheostomy and acute gastric dilatation	Living	
3.	P. H.	Fallot's Tetralogy with infundibular stenosis	5.5°C	2½ hours	Nil	Late death (4 months after operation)	Brain abscess
4.	R. D.	Fallot's Tetralogy with Pulmonary valvular stenosis	6° C	2 hours	Nil	Living	
5.	H. H.	Interventricular Septal Defect	5.2°C	1½ hours	Would infection	Living	
6.	A. B.	Primary pulmonary hypertension	7.2°C	3½ hours	Burns and hypertension	Expired	Circulatory failure
7.	B. P.	Fallot's Tetralogy with infundibular stenosis	6.5°C	1½ hours	Inspiratory dyspnoea requiring tracheostomy	Expired	? cerebral oedema ? circulatory failure
8.	R. B.	Fallot's Tetralogy with ? Pulmonary valvular stenosis	5.5°C	2½ hours	Inspiratory dyspnoea requiring tracheostomy	Expired	Brain abscess

While this may have been due to any other cause such as intravenous infusions or blood stream infection — the possibility of reactive hyperthermia following cooling cannot be ruled out. It is therefore very necessary not to start re-warming agents too rapidly and before curarizing and depressant agents have been mostly neutralised. Whatever mechanisms operate in production of these complications will remain a matter of conjecture and debate. Perhaps many mechanisms are involved. The study of low temperature biology is just beginning and a whole new physiology has to be learnt and reviewed as seen and practised in the hypothermic animal.

REFERENCES

1. Adolf, E. F.: Responses to hypothermia in several species of mammals. *Am. J. Physiol.* 166: 75, 1951.
2. Bigelow, W. G., Callaghan, J. C. and Hopps, J. A.: General Hypothermia for Experimental Intracardiac Surgery. *Ann. Surg.* 132: 531-539, 1950.
3. Bigelow, W. G., Lindsay, W. K., Harrison, R. C., Gordon, R. A. and Greenwood, W. F.: Oxygen Transport and Utilization in Dogs at low body temperature. *Am. J. Physiol.* 160: 125, 1950.
4. Bigelow, W. G., Lindsay, W. K. and Greenwood, W. F.: Hypothermia — its possible role in cardiac surgery: An investigation of factors governing survival in Dogs at low body temperature. *Ann. Surg.* 132: 849, 1950.
5. Bobbio, A.: Theoretical Basis and Initial practical results of surgery of the bloodless heart. *Gazzetta Sanitaria.* 3: 20, 1954.
6. Churchill, et al.: Quoted by No. 19.
7. Datey, K. K., Sen, P. K., Shah, C. B. and Lewis, R. A.: Electrocardiographic changes in hypothermia (under publication).
8. Dill, D. W. and Forbes, W. H.: Respiratory and Metabolic effects of hypothermia. *Am. J. Physiol.* 132: 685, 1941.
9. Delorme, E. J. (1952): Quoted by No. 19.
10. Dundee, J. W., Gray, T. C., Mesham, P. R. and Scott, W. E. B.: Hypothermia with Autonomic Block in Man. *B.M.J.* 2: 1237, 1953.
11. Gibbon, J. H.: Application of a Mechanical Heart and Lung Apparatus to Cardiac Surgery. *Minnesota Med.* 37: 171-177, 1954. Quoted by No. 16.
12. Hegnauer, A. H., Shriber, W. J. and Heterious, H. O.: Cardiovascular Responses of the Dog to Immersion Hypothermia. *Am. J. Physiol.* 161: 455, 1950.
13. Hook, W. E. and Storemout, R. T.: Effect of Lowered Body Temperature on heart rate, blood pressure and electrocardiogram. *Am. J. Physiol.* 133: 334, 1941.
14. Laborit, et al. (1952): Quoted by No. 19.
15. Lewis, R. A., Satoskar, R. S., Gaitonde, B. B., Shah, C. B., Datey, K. K. and Sen, P. K.: Biochemical changes in Blood during Hypothermia in Dogs. (Under publication).
16. Lillehei, C. W., Cohen, M., Warden, H. E. and Varco, R. L.: The Direct Vision Intracardiac Correction of Congenital Anomalies by control cross circulation. *Surgery.* 38: 11, 1955.
17. McQuiston, W. O.: Anaesthetic problems in cardiac surgery in children. *Anaesthesiology.* 19: 590, 1949.
18. Montgomery, A. V., Arthur E. Prevdel and Henry Swan.: Prostigmine Inhibition of Ventricular Fibrillation in Hypothermic Dog. *Circulation.* 10: 711, 1954.
19. Scott, W. E. B.: Hypothermia with autonomic block in Man. *B.M.J.* 2: 1237, 1953.
20. Sen, P. K., Bhatt, P. A. and Shah, R. L.: The use of artificial hypothermia in open cardiac surgery. *Ind. J. Med. Sc.* 7: 694, 1953.
21. Sen, P. K., Bhatt, P. A. and Shah, C. B.: Intracardiac surgery under direct vision. Closure of Atrio-Septal Defects in Dogs using artificial hibernation (Hypothermia). *Ind. Jour. Surg.* 16: 2, 1954.
22. Sen, P. K., Datey, K. K., Lewis, A. A., Shah, C. B. and Gaitonde, B. B.: The Prevention of Ventricular Fibrillation in Open Cardiotomy under Artificial Hibernation by Coronary Perfusion of Potassium. *Ind. Jour. Surg.* (under publication).
23. Stewart, B. D., Virtue, R. D. and Swan, H.: An Experimental Study of Cardiac Arrest and Ventricular Fibrillation in Acute Hypoxia and Hypocapnea and in Chronic Hypoxia. *Arch. Surg.* 66: 703, 1953.
24. Stokes, T. L. and Gibbon, J. H.: Experimental Maintenance of Life by a Mechanical Heart and Lung during occlusion of the venae cavae followed by survival. *Surg., Gynaec. & Obst.* 91: 138-156, 1950.
25. Swan, H., Maresh, H. G., Johnson, M. E. and Warner, G. W.: The Experimental Creation and Closure of Auricular Septal Defects. *Jour. Thoracic Surg.* 20: 542, 1950.
26. Swan, H. and Zeavin, I.: Cessation of circulation in General Hypothermia. III Techniques of Intracardiac Surgery under direct vision. *Am. J. Surg.* 139: 385, 1955.
27. Swan, H., Robert Virtue, W., Blount, G. and Kircher, L. T. (Jr.): Hypothermia in Surgery. Analysis of 100 clinical cases. *Ann. of Surg.* 142: 382, 1955.
28. Tossati.: IL Cuore Artificiale, 1951, quoted by No. 4.
29. Warden, H. E., Cohen, M., Read, R. C. and Lillehei, C. W.: Controlled cross circulation for intracardiac surgery. *Jour. Thoracic Surg.* 28: 331-343, 1954.

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EXPERIENCES WITH TUBERCULOMAS OF THE BRAIN

by B. RAMAMURTHI, Madras.

Tuberculomas of the brain are some of the commonest tumours of the brain met with in our country. 19.4% of verified tumours of the brain in our series, have been tuberculomas. Due to various economic, social and environmental factors, tuberculosis is widely prevalent amongst us and tuberculous infection of the nervous system is no exception. The present state is similar to the one that obtained in the Western countries during the beginning of this century. In almost all these countries tuberculomas were very common, though they are now definitely rare. Conditions similar to ours exist even now in the South American countries where also tuberculomas have been found to be fairly common.

INCIDENCE OF TUBERCULOMAS

Author	Year	Tumours	Tuber- culoma	%
STARR	1889	500	51	10.2
BURNS	1908	63	10	15.8
CUSHING	1933	2023	44	2.1
ASENJO (chile)	1951	610	97	15.9
D. J. REDDY (Autopsies)	1950	M.M.C. A.M.C.	10.5 14.5	
CHANDY & ISAIAH	1952	40	8	20.0
AUTHORS (B.R.M.)	1955	180	35	19.4

Starr⁶ in 1889 reported 51 tuberculomas in 500 tumours of the brain whereas Burns² in 1908 reported 10 tuberculomas in 63 autopsies. In the United States in 1933, Cushing⁴ found 44 tuberculomas out of 2,023 cases of brain tumours. As can be seen from the above, the percentage of tuberculomas of the brain fell from about 20% to 3%. But Asenjo et al¹ in 1951 have reported an incidence of 15.9% of

tuberculomas in 610 cases of verified tumours of the brain in Chile over a 15 year period. In India, Reddy, D. J.⁵ has reported an incidence of 10.5% of tuberculomas in all tumours of the brain seen from the records of the Pathology Department of the Madras Medical College and 14.5% from the Andhra Medical College in 1950. In 1952, Chandy and Isaiah³ reported 8 cases of tuberculomas which formed 20% of all the brain tumours seen by them during the previous year. In a series of 180 verified tumours of the brain seen in the Neuro-surgical Department, General Hospital, Madras, tuberculomas have formed 19.4%.

In a series of 476 suspected intracranial tumours, suspected tuberculomas have formed 15.1%. These cases were seen during the five year period from October 1950 to October 1955. It can be seen that the incidence of tuberculomas in our country is quite high and its occurrence has to be borne in mind when examining every case of intracranial tumour.

INCIDENCE OF TUMOURS

Type.	Number.	%
Tuberculoma	72	15
Glioma	38	7.9
Meningioma	25	5.2
Cysticercosis	13	2.7
Gumma	3	0.6
Auditory Neuro-fibroma	34	7.00
Pituitary tumours	58	12.2
Others	233	49.3
Total	476	100.0

Mode of Infection. Infection of the nervous system is secondary to a primary infection elsewhere in the body and probably haematogenous. The focus may be in the lung or in the glands. Tuberculomas have been found usually in patients who are

better nourished than the usual run of tuberculous patients. It is likely that in some cases the tuberculous process becomes more chronic and tuberculomas get evolved by tissue reactions which occur when the resistance of the patient is higher than ordinary.

Most of the tuberculomas in our experience have occurred without any previous history of tubercular meningitis. Because of the frequency of occurrence of tuberculomas it has been our practice to enquire into the family and the personal histories of every patient suspected of intracranial tumour for any evidence of tuberculosis and also to investigate the patient for evidence of tuberculous lesions elsewhere in the body. About half the number of cases of tuberculomas (35 out of 72) presented a contact or personal history of tuberculosis. 25% of the patients showed evidence of concomitant tuberculous lesions elsewhere in the body. The lung was the chief organ affected. Tuberculosis of the kidney, endometritis, tuberculous osteitis, tenosynovitis and arthritis and lymphadenitis have been present as coexisting lesions.

Diagnosis of tuberculomas of the brain is presumptive. Their symptomatology does not vary in any special way from the other intracranial space occupying lesions. If, in a case of intracranial tumour, there is a contact or personal history of tuberculosis, or there is any evidence of concomitant tuberculous lesion elsewhere in the body, the presumption is one of tuberculoma. Other examinations like Erythrocyte Sedimentation Rate, the Mantoux test, a 4th hourly temperature chart, etc. are also done to confirm the diagnosis. In 80% such a presumptive diagnosis has proved correct.

Localisation is by the usual diagnostic method of thorough neurological examination and other ancillary methods like E.E.G., cerebral angiography and ventriculography.

Radiology. Plain X-rays of the skull may occasionally show a calcified area, but this is not common even though such a notion is commonly held. Only 5 out of 72 cases

showed calcified spots in the plain X-rays. But X-rays of the removed specimens show much more obvious calcification. Ventriculograms do not give any indication as to the pathology of the lesion. Cerebral angiography always shows the lesion to be avascular. An avascular intracranial space occupying lesion is more likely to be a tuberculoma or a chronic abscess.

Findings at operation. Tuberculomas of the brain occur either under the meninges or inside the brain substance itself. They are usually adherent to the dura and to the surrounding brain substance. The dura presents a very firm barrier for the spread of tuberculomas. The colour varies from greyish yellow to greyish red. The consistency is hard and the surface is granular. When the tuberculoma is buried inside the brain, the diagnosis may not be obvious. When the brain needle is passed, it encounters resistance not unlike that which is felt when there is a meningioma. But it is usually possible to pass the brain needle through a tuberculoma.

The brain around a tuberculoma shows evidence of oedema and often looks glassy. But this oedema is much less pronounced than in a case of glioblastoma. There is no definite plane of cleavage between the brain and the tuberculoma. Sizes of the tuberculomas removed have varied from one to four inches in diameter. The biggest that we have removed involved the entire frontal lobe of one hemisphere. Occasionally the tuberculomas are multiple. (5 out of 35 cases). Then they present a confusing neurological picture and diagnosis has to be made by ancillary methods of examination.

Histology. On microscopic examination, there is evidence of epitheloid cell reaction with round cell infiltration and giant cell formation. Giant cell systems are not encountered as often as in tuberculous lesions elsewhere in the body. Chandy and Isaiah (1952) have suggested the existence of two types of tuberculomas, one having a better prognosis than the other. We are not able to confirm this in our own experience of 35 cases.

Site. Tuberculomas have been encountered in the cerebral hemisphere, cerebellum, cerebellopontine angle and the pons.

SITE OF TUMOUR

Site.	Number.
Cerebral Hemisphere ..	39
Cerebellum ..	13
Cerebello-Pontine angle ..	11
Pons ..	2

Tuberculomas are commonest in the younger age group, the incidence declining with age.

AGE INCIDENCE

Age group.	Number of cases.
0 — 10	28
11 — 20	17
21 — 30	20
Above 30	7

Occasionally tuberculomas may follow an attack of tuberculous meningitis. A patient who recovers from meningitis may show signs of increasing intracranial pressure. This is most often due to post meningitic adhesions blocking the C.S.F. pathways. But in two instances, ventriculogram have proved the presence of tuberculomas in meningitic cases raising the intracranial tension.

A tuberculoma may occasionally burst into the sub-arachnoid space or the ventricles and set up an attack of acute tuberculous meningitis. This was the commonest complication that faced the surgeons in the prestreptomycin days. 6 out of 35 cases developed this complication. 3 recovered from this, whereas three cases expired in spite of vigorous antibiotic treatment.

Treatment. When a preoperative diagnosis of a tuberculoma has been made the patient is put on antituberculous treatment, with streptomycin, P.A.S. and I.N.A.H. and bed rest. Under this treatment, if the pa-

tient shows improvement in his general and neurological picture then the treatment is persisted in, keeping the patient under observation. But if there is no improvement in the neurological picture and if the intracranial pressure shows signs of increasing, then it is necessary to intervene and remove the tuberculoma like a tumour. The indications for removal of a tuberculoma therefore are :—

- (1) Site,
- (2) Progressive Neurological signs,
- and (3) Non-responsiveness to anti-tuberculous drugs.

In other words, surgery is indicated for the anatomy of a tuberculoma and not for its pathology. If in a case of tuberculoma, the patient is improving with the anti-tuberculous treatment, then, even though the tuberculoma may be well localised, surgery is not immediately indicated.

Before the advent of Streptomycin, surgical treatment of tuberculomas was dreaded. Dandy advocated that these tuberculomas could be removed with a bit of healthy tissue around. Obrader (10) found that only 25% of patients survived surgery alone, whereas 5 out of 6 cases were saved by surgery and streptomycin. In our series, out of 72 diagnosed cases of tuberculomas, in 35, operation became necessary. Of these 35, three cases died in the immediate post operative period. Six cases developed tuberculous meningitis and three of them expired within three months. Four other cases were discharged well from the hospital but expired within six months due to other causes. 25 out of 35 cases of operated tuberculomas have kept well for a period of one to four years.

In operated cases, only intramuscular streptomycin has been given. We do not instil intrathecal streptomycin during or after the operation.

Of the 37 cases that did not need surgery eight expired in six months while the other 29 have done well on antibiotic treatment.

TABLE

Number of cases diagnosed ..	72
Operation became necessary ..	35
Deaths :	
Immediate post operative ..	3
Developed tuberculous meningitis and expired in two months ..	3
Expired within 6 months ..	4
Alive and well ..	25
Not operated ..	37
Expired in 6 months ..	8
Alive after 6 months ..	29

These figures of medical and surgical treatment are not comparable. It should be noted that there are a number of cases which do not need surgery and which do well with expectant treatment with antibiotics. But in cases where the symptoms are progressive, surgery is indicated.

With the advent of antibiotics, it has been possible to remove a large number of tuberculomas which need surgery and thus effect a cure. The risk of post-operative meningitis is much less now, though still cases occur who develop tuberculous meningitis following surgery in spite of antibiotic treatment. Usually the complication of meningitis does not occur and the patient is discharged cured. It is necessary to keep a follow up of the patients and see that they do not get a recurrence.

SUMMARY

1. Tuberculomas of the brain are as common in our country as it was in the West about 40 years ago.
2. In all cases of intracranial tumour, the possibility of a tuberculoma has to be thought of.

3. Diagnosis is presumptive.

4. Indications for surgical intervention are :—

- (a) Progressively increasing intracranial pressure,
- (b) neurological disability, and
- (c) absence of response to antibiotic treatment.

5. Total removal is possible and results of surgery are good under streptomycin cover.

6. With improving general health of the people incidence of tuberculomas is bound to go down.

My thanks are due to the Dean, General Hospital, Madras for permission to publish this article.

REFERENCES

1. Asenjo, A., Valladeras, H. and Fierro, J.: Tuberculomas of the Brain — 159 cases. A.M.A. Arch. Neurol. Psychiat. 65: 146-160, 1951.
2. Burns.: Die Geschurilste des Nervensystem Hirngeschurilste; Ruckenmarks und Wirbelgeschurilste; Geschurilste der Peripheren Nerven, Berlin, S — Karger 1908.
3. Chandy, J. and Isaiah, P.: Tuberculoma of the Brain. J. Ind. M. A. 21: 239-242, 1952.
4. Cushing, H.: Intracranial Tumours: Notes upon a series of Two Thousand verified cases with surgical Mortality percentages Pertaining Thereto, Charles C. Thomas — Springfield Ill. 1932.
5. Reddy, D. J.: Tuberculoma of the Brain. Ind. Jour. Surg. 13: 138-143, 1951.
6. Starr, A.: Tumours of the Brain in Children — Their variety and situation with special reference to their treatment of surgical interference. M. news. Philadelphia. 54: 29-37, 1889.

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PULMONARY FUNCTION STUDIES IN THORACIC SURGERY

(A preliminary report)*

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M. N. RAO, Calcutta.

INTRODUCTION

The study of Pulmonary function is not a recent introduction in the medical world. In fact, as early as 1846, a simple method of measuring pulmonary ventilatory capacity was regularly being used by Hutchinson, who measured the vital capacity with the help of a spirometer. From this time onwards, this subject had been investigated in different countries. Bohr in Copenhagen (1907), and Schuster at Oxford (1911) investigated and tried to establish the physiological standards, and Peabody & Wentworth in America (1917) tried to establish the relationship between pulmonary function and the underlying diseased condition. However, until recently, it was a subject of merely physiological interest and no clinical importance was attached to it. During the years 1914-1918, these function tests were applied for the determination of physical fitness of men applying for jobs in the Airforce. Advances in Thoracic Surgery and Anaesthesia in recent years have brought a new impetus to the study of this subject and careful assessment of various categories of lung function have helped surgeons in determining beforehand the extent or the type of excisional surgery or collapse therapy safely practicable in a given case.

Cournand (1948) first suggested the clinical division of pulmonary function into two categories: (a) Ventilation and (b) Respiratory gas exchange, or the exchange of oxygen and carbon dioxide between the

blood in pulmonary capillaries and the outside air. Ventilation, or mass displacement of air between the outside air and the interior of the lungs is the aspect of pulmonary function which is of immediate concern to the clinician. Defective ventilation may be the only impairment of pulmonary function, while defective diffusion or distribution of gases within the lungs is almost always accompanied by ventilatory defects as well. Furthermore, ventilatory insufficiency frequently the important defect in diseases of immediate concern to the phthisiologist and thoracic surgeon. Only ventilatory functions can be assessed relatively easily and quickly. Finally, the medical and surgical collapse of the lungs and excision of pulmonary tissue are most likely to influence ventilation, and the end result of such therapy are easily followed by repeated ventilatory studies.

This paper presents pulmonary function studies in 33 cases where either some type of thoracoplasty or excisional surgery for a lesion in the lungs have been carried out (Tables I to IV) and (Chart I & II).

MATERIAL AND METHOD

All lung cases admitted for surgery are accepted for pulmonary function investigations except those who are very ill or otherwise having symptoms such as fever, dyspnoea on slight exertion, etc.

Usually cases are referred from other institutions for treatment and as such, all these are failed cases of medical treatment or collapse therapy such as A.P., P.P. or Phrenicolysis. Very rarely a virgin case suitable for surgery is obtained. This is an important consideration to be borne in mind. The already existing poor ventilatory function of such cases (which is due primarily to their diseased parenchymal

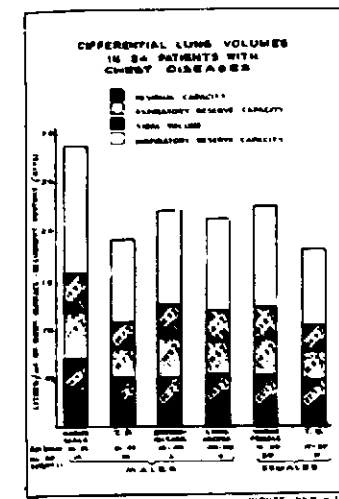


Fig. 1.

Showing differential lung volumes in various pulmonary diseases as compared to normals.

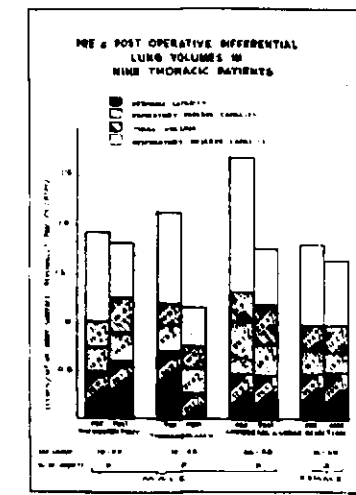


Fig. 2.

Showing various lung volumes before and after operations.

condition) is often complicated by collapse therapy. Post-operative lung function studies are usually made 4 to 6 weeks after operations to eliminate a number of factors which may prevent obtaining of true figures from the patients. Needless to say, accuracy of these studies depends also to a large extent on the co-operation of the patient at the time of the experiment.

In the present paper, an effort has been made to compare pulmonary function of normals with that of the patients suffering from various diseases like tuberculosis, bronchiectasis, lung abscess, etc. where pneumonectomy or resection has subsequently been undertaken. These cases now await postoperative function tests. In this first series, chest diseases are classified under two different headings: Tubercular and non-tubercular conditions. Normal material comprises of 15 men and 35 women in the age group 18 to 45 and 17 to 29 respectively.

In the tuberculosis group (Table I), 12 patients were male and 5 were female. In the male group, findings on 12 tuberculous men were compared to that of 15 normal cases. In the female group of 5 tuberculous

cases, these were compared with 35 normal cases regarding various sub-divisions of the lung volumes. MBC figures of females could not be compared due to lack of adequate data. Amongst these cases, the majority were those who had part or whole of the pulmonary parenchyma destroyed by the disease process including 4 cases with resultant bronchiectatic changes. One case had empyema thoracis resulting from long continued pneumothorax therapy with thickened pleura and shrunken lung.

Non-tubercular diseases like bronchiectasis, lung abscess, etc. which needed surgery, are compared also with the normal material (Table II). In this group there were 7 cases, of which 4 were lung abscess and 3 bronchiectasis. In the female group of non-tuberculous cases, the number was too small for statistical comparison, and the results are presented as such.

For the purpose of ready comparison, all our findings are also presented in Chart form (Chart I). Here we have also included two cases of hydatid cyst of the lung.

In the second series, lung volumes are compared before and after surgical opera-

(From Cardiac and Thoracic Surgery Unit, S. S. Karnani Memorial Hospital, and Industrial Health Research Unit, ICMR, Section of Physiological and Industrial Hygiene, All India Institute of Hygiene and Public Health, Calcutta).

* Industrial Health in India Series (58).

TABLE I Differential lung volumes (IRC, TV, ERC, RC & VC) of Men (18-45 yrs.) and Women (17-29 yrs.) with Tuberculosis of lung compared statistically with normals.

Sex	Lung condition (No. of cases)	Insp. Res. Cap. L/M ³		Total Volume L/M ³		Exp. Res. Cap. L/M ³		Residual Capacity L/M ³		Vital Capacity L/M ³	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Male	Normal (16)	1.24	0.917	0.38	0.170	0.50	0.204	0.70	0.168	9.18	0.366
	T. B. (12)	0.79	0.953	0.28	0.056	0.30	0.144	0.50	0.182	1.41	0.488
Female	Normal (35)	0.98	0.1903	0.31	0.0872	0.39	0.1276	0.52	0.1301	1.74	0.2585
	T. B. (5)	0.74	0.2185	0.27	0.0430	0.28	0.1001	0.49	0.0610	1.32	0.2691

Differential lung volumes (TC, FRC, $\frac{RC}{TC} \times 100$, $\frac{FRC}{TC} \times 100$ and MBC) of Men (18-45 yrs.) and Women (17-29 yrs.) with tuberculosis of lung compared statistically with normals.

Sex	Lung condition (No. of cases)	Total Capacity L/M ³		Func. Res. Cap. L/M ³		$\frac{RC}{TC} \times 100$		$\frac{FRC}{TC} \times 100$		MBC* L/M ³	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Male	Normal (15)	2.89	0.478	1.22	0.346	24.3	2.91	41.9	7.14	61.66	9.926
	T. B. (12)	1.91	0.571	0.80	0.202	26.5	7.045	42.8	4.037	42.13	15.728
Female	Normal (35)	2.25	0.295	0.91	0.1860	22.83	4.651	40.01	5.1243	—	—
	T. B. (15)	1.81	0.293	0.77	0.1234	27.34	4.059	43.00	6.4641	—	—

* MBC figures of normal males are from 37 subjects of age group 18-45 years.

TABLE II Comparative lung volumes (IRC, ERC, TV, RC & VC) of normal males (18-45 yrs.) with males suffering from non-tubercular chest diseases (18-45 yrs.)

Sex	Lung condition (No. of cases)	Insp. Res. Cap. L/M ³		Tidal Volume L/M ³		Exp. Reserve Cap. L/M ³		Residual Capacity L/M ³		Vital Capacity L/M ³	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Males	Normal (15)	1.94	0.917	0.38	0.170	0.50	0.204	0.70	0.168	9.18	0.366
	Non-tubercular, with some other chest pathology (4)	0.92	0.1158	0.30	0.0911	0.41	0.2037	0.53	0.1229	1.76	0.3491

Comparative lung volumes (TC, FRC, $\frac{RC}{TC} \times 100$, $\frac{FRC}{TC} \times 100$, MBC) of normal males (18-45 yrs.) with males suffering from non-tubercular chest diseases (18-45 yrs.)

Sex	Lung condition (No. of cases)	Total Capacity L/M ³		Func. Res. Cap. L/M ³		$\frac{Res. Cap.}{Total Cap.} \times 100$		$\frac{Func. Res. Cap.}{Total Cap.} \times 100$		Max. Breathing Cap.*	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Males	Normal (15)	2.89	0.478	1.22	0.346	24.3	2.91	41.9	7.14	61.66	9.926
	Non-tubercular with some other chest pathology (4)	2.20	0.4363	0.94	0.2502	23.0	3.7532	40.28	5.0757	44.01	9.507

* MBC figures of normal males are from 37 subjects of age group 18-45 years.

TABLE III
Showing differential lung volume and MBC of two female subjects suffering from non-tubercular lung disease.

Name	Clinical Status	Age yrs.	IRC L/m ³	TV L/m ³	ERC L/m ³	VC L/m ³	RC L/m ³	FRC L/m ³	TC L/m ³	RC × 100 TC	FRC × 100 TC	MBC L/m ³
A. S.	Hydatid cyst of left lung	16	0.97	0.24	0.19	1.40	0.28	0.57	1.78	21.1	32.0	29.74
M. S.	Bronchiectasis of left lung	9	0.36	0.27	0.18	0.90	0.87	1.05	1.77	48.6	58.8	40.92
IRC = Inspiratory Reserve Capacity TV = Tidal Volume ERC = Expiratory Reserve Capacity VC = Vital Capacity RC = Residual Capacity FRC = Functional Residual Capacity MBC = Maximum Breathing Capacity												

tions in nine cases. Various types of operations like pneumonectomy, thoracoplasty and lobar and segmental resection were done. As there is paucity of material for comparison in the group, the results are presented casewise before and after the operation (Table IV), and diagrammatically in Chart II.

Experimental procedure followed to determine lung volume of each case was that adopted by Lundgren, Sengupta and Saha (1953). A close type of spirometer was used for determination of the various sub-divisions of the lung. The patients were made to lie down and after sufficient rest, the tests were carried out with continuous spirometer record. As co-operation is essential for the accuracy of such determinations the subjects were taught how to co-operate before the commencement of experiment. In a single recording, which lasted often for 4 minutes ERC, IRC, TV and VC were calculated out of 4 consecutive maximal breathing efforts. Rest for one minute was allowed in between the efforts. In close circuit breathing in the Spirometer, oxygen was used, as it was found that there was no significant change between air breathing and oxygen breathing as far as the volumes of pulmonary function are concerned. The residual capacity was carried out by a modified method of Christies Dilution method. Pulmonary nitrogen of residual air was allowed to be diluted with known volume and composition of oxygen stored in the spirometer. From the extent of this dilution, the residual capacity was figured out. In the actual experiment, after maximal expiration the subject was connected to the closed circuit spirometer, which contained known volume and composition of oxygen in it. The subject was then instructed to hyperventilate for 30 seconds. This ensured good mixing of pulmonary nitrogen of residual air with the gas of the spirometer. After analysing the final gas volume regarding its composition and volume and also analysing the concentration of gases in alveolar air, residual capacity was figured out.

The expiratory minute ventilation tests during rest and standard exercises of one minute were also carried out. But as there

TABLE IV
Preoperative and postoperative differential lung volumes of nine cases of thoracic surgery

St. No.	Subject	Age yrs.	Sex	Preoperative clinical status	Surgery undertaken	IRC L/m ³	TV L/m ³	ERC L/m ³	VC L/m ³	RC L/m ³	FRC L/m ³	TC L/m ³	RC × 100 TC	FRC × 100 TC	MBC L/m ³
1.	ACHUN	17	M	Left lung fibrosis with cavity — Abscess	Thoracoplasty	Pre 0.48 Post 0.46	0.26 0.26	0.34 0.39	1.18 1.13	0.60 0.30	0.94 0.69	1.73 1.43	33.7 20.9	53.0 48.2	60.36 53.17
2.	SNG	43	M	Pulmonary tb. — cavity on rt. chest	Thoracoplasty	Pre 1.20 Post 0.24	0.20 0.20	0.17 0.14	1.63 0.63	0.83 0.27	1.00 0.42	2.46 0.90	33.8 30.4	40.7 46.4	44.79 22.94
3.	SM	18	M	Multiple bronchi- ectatic cavitation — left lung — Dyspnea	Pneumonec- tomy	Pre 0.79 Post 0.55	0.27 0.42	0.22 0.26	1.39 1.31	0.53 0.40	0.75 0.65	1.92 1.71	27.5 23.3	39.3 38.9	32.15 26.50
4.	SC	22	F	Pulmonary tb. rt. lung	Lobectomy	Pre 0.59 Post 0.55	0.23 0.23	0.36 0.34	1.19 1.16	0.58 0.36	0.92 0.70	1.75 1.51	32.0 23.6	52.4 46.2	41.87 28.44
5.	BM	22	F	Tb. left lung	Lobectomy	Pre 0.85 Post 0.61	0.24 0.33	0.25 0.11	1.36 1.07	0.49 0.68	0.71 0.79	1.85 1.75	26.5 38.9	40.2 46.2	45.35 39.94
6.	NC	28	M	Pulmonary tb. rt. side — early lesion	Lobectomy	Pre 1.54 Post 0.50	0.33 0.45	0.65 0.38	2.59 1.36	0.53 0.41	1.18 0.79	3.12 1.77	17.0 53.0	37.9 44.6	72.00 55.15
7.	ASG	25	M	Tb. left lung	Pneumonec- tomy	Pre 0.80 Post 0.45	0.25 0.31	0.31 0.31	1.45 1.08	0.48 0.84	0.79 1.15	1.93 1.92	24.7 43.7	40.8 59.7	23.46 36.23
8.	SCD	52	M	Lung abscess — rt. side	Lobectomy	Pre 1.97 Post 0.59	0.27 0.37	0.43 0.26	1.81 1.24	0.44 0.50	0.87 0.76	2.25 1.74	19.5 23.8	38.5 43.5	54.08 46.44
9.	AS	16	F	Hydatid cyst — left lung	Enucleation of the pul- monary cyst	Pre 0.97 Post 0.69	0.24 0.29	0.19 0.21	1.40 1.23	0.38 0.41	0.57 0.92	1.78 1.64	21.1 25.3	32.0 37.9	29.74 34.56

is paucity of material on normal subjects, comparison is difficult. The standard exercise used in this study was stepping up and down a 14" stool 16 times a minute. Maximal breathing capacity determinations were done with the help of open circuit breathing in spirometer where the subjects hyperventilate maximally for $\frac{1}{2}$ minute with maximal effort. An assembly of mouth-piece was used to guide expiratory air into a big spirometer for recording purposes. Two such determinations were carried out on each subject with rest in between the runs.

All the volume determinations in this have been corrected for body temperature, atmospheric pressure and humidity. To eliminate the effect of the body size on lung volumes, the figures are presented in terms of per square meter of the body surface area.

DATA AND THEIR ANALYSIS

All the data are presented in a tabular form and some diagrammatically. Table I presents the data with differential lung volumes of men and women with tuberculosis of lungs. These data are compared statistically with the normals and the numbers of each group are mentioned in brackets. On statistical comparison, the tubercular cases amongst men showed significantly lower values in inspiratory and expiratory reserve capacities as well as residual and vital capacities. The total capacity, functional residual capacity and the maximum breathing capacity are definitely lower. Amongst the women, the interpretation may have to be reserved due to the very small number of cases. The vital capacity and the total capacity of the lungs in the non-tubercular cases of these 5 women seemed to be significantly lower than the normals.

In Table II are presented the comparative lung volumes of normal males suffering from non-tubercular chest diseases.

It is rather interesting that only maximal breathing capacity amongst the non-tubercular patients is significantly lower than the

normals. The other lung volumes seemed not to be affected at all. The same conclusions are not very obvious as seen from Chart I perhaps because the total number of cases of non-tubercular origin are only four.

In Table III are given differential lung volumes and maximal breathing capacity of the two women subjects, one suffering from hydatid cyst and the other bronchiectasis. There are no norms of the lower age group to which these two patients belong. No conclusions therefore are attempted.

Table IV represents the pre-operative and post-operative differential lung volumes of 9 cases of thoracic surgery. Chart II presents the data diagrammatically operatively.

In the 2 cases of pneumonectomy the total lung volume is lowered after operation, at the expense of inspiratory reserve capacity. The residual capacity, however, after the operation has increased.

In the 2 thoracoplasty cases, the total lung volume is nearly halved. There is proportionate reduction in the inspiratory reserve capacity and the residual capacity, though the expiratory reserve capacity and the tidal volume do not seem to be much affected.

In the lobar resection cases amongst the males the inspiratory reserve capacity is obviously reduced post-operatively. The expiratory reserve capacity and the tidal volume do not seem to have changed much in the males but amongst the females the expiratory reserve capacity seems to be lessened and the tidal volume slightly increased post-operatively.

DISCUSSION

As already mentioned, it will not be correct to draw final conclusions from these data, for the number of cases is too small to be of statistical value.

The first group of cases represent the class of patients where medical treatment for pulmonary tuberculosis had been tried for a fairly long time without gaining the

results aimed at. Most of them had extensive fibro-cavernous type of disease or almost totally destroyed lung on one side. They had spent a long time in Sanatoria. Some of them presented bronchiectasis with resulting atelectasis, segmental or lobar.

All these factors together are responsible for their small volume of ventilatory capacity with proportionate diminution in the other subdivisions of their lung volumes. Of course, most of them present fairly normal RC/TC ratio and FRC/TC ratio, indicating absence of significant emphysema. The very low values in the M.B.C. figures of these patients can be partly explained also by the absence of full co-operation of some of the patients (sometimes due to ignorance).

Considering the second group of cases — i.e. those whose lung functions were also assessed after operations, viz-Plasty, segmental resection, lobectomy and pneumonectomy — the pre-operative conditions of the patients necessitating surgery need some comment. The plasty cases were of long standing fibrocavernous type of disease with poor mobility of the lungs and marked peripheral adhesions. Also they were in poor general condition which prevented more radical surgery.

The lobectomy cases were in fairly good condition with limited disease and with lobar distribution. Often they had had A.P., P.P. or phrenic crush in the past. Naturally they presented initially a small ventilatory capacity but their post-operative figures suggested an early recovery and regaining of some ventilatory capacity, following surgery, when compared with the volume of lung tissue and thereby the volume of the ventilatory surface area removed.

There were two pneumonectomy cases in this series. The first case was a polycystic disease of the left lung and as a congenital condition, it incapacitated the patient, from his very birth causing stunted mental and bodily growth as well. The second case had tuberculosis on the left side which

completely destroyed the parenchyma necessitating pneumonectomy. It would be seen that these (two) cases had completely destroyed lung on one side which possibly served no useful purpose from the functional point of view. Here surgery gave a better scope to the other lung to function by removal of the inactive lung tissue. It will be seen that post-operatively this group suffered less deterioration from their pre-operative functional state, when the volume of lung removed is considered. The total capacity has decreased by 5% only and the vital capacity by 15%. As the residual capacity has increased by 25% the RC/TC ratio has gone up by 7% and FRC/TC by 9%. An interesting thing to note is that inspite of removal of one lung, the MBC has increased by 19%, indicating that there is no obstructing mechanism in the air passage and chances of fuller function of the respiratory system at a later date can logically be expected as a result of surgery.

Next comes the lobectomy cases which occupy the mid-position in this series. Though these cases have suffered a loss of 20% in total capacity and 25% in vital capacity, the beneficial effect of surgery on pulmonary function can be noted by the fall in residual capacity by 1.5%. It means a reduction in dead space or the amount of air which is not moved in or out for gaseous exchange. MBC has suffered a loss of 17% but the apparent disadvantage of this loss can be offset by the fall on the residual capacity. The interesting thing to note is that RC/TC and FRC/TC ratios have increased by 4.7% and 2.6% respectively. This is only apparent and can be explained by the overall loss of total volume. It is noteworthy that the female cases have gained more by lessening of expiratory reserve capacity and slight increase in tidal volume, though the male cases have suffered from loss of inspiratory reserve capacity and no change in tidal volume and expiratory reserve capacity. We can forward an explanation for this. Possibly the volume of lung tissue removed in the male cases was slightly larger than

what was actually scarred and functionless. We must remember that old scarred tuberculous lesions are often associated with residual bronchiectatic areas (which was actually seen in our cases) necessitating removal of the whole lobe.

It will be seen that the thoracoplasty cases suffered most from the loss of total capacity as well as vital capacity by 41% and 32% respectively. However the aim of thoracoplasty on pulmonary function has apparently been successfully achieved. This is denoted by the fact that this loss of total capacity is mainly due to the lessening of the residual capacity which has fallen by 58%. The RC/TC ratio has fallen by 8%. These two findings suggest that the dead space has been considerably reduced. Of course the M.B.C. has fallen by 30% and that is due to the mutilating operative procedure and the splinting effect on the thoracic cage by diminishing the transverse axis of the thorax.

SUMMARY

(1) The importance of lung function studies in respiratory diseases in general and in Thoracic Surgery in particular is stressed.

(2) 33 cases were investigated in this series, 24 only pre-operatively for assessment for the operation and 9 cases both pre-operatively and post-operatively to determine the changes in lung functions brought about by the operation.

(3) The different values and changes in lung function studies obtained after various types of lung operations are analysed.

REFERENCES

1. Birath, G. and Crafoord, C.: Stockholm, Sweden. Function Tests in Pulmonary Surgery. Jour. Thor. Surg. 22: 414, 1951.
2. Comroe, J. H. (Jr.): Maximal Breathing Capacity. Methods in Medical Research. Vol. 2: 209-214, Chicago 1950. The Year Book Publishers.

3. Comroe, J. H.: Interpretation of Commonly used Pulmonary Function tests. Am. Jour. Med. 356-374, 1951.
4. Cournand, A. and Richards, D. W. (Jr.): Pulmonary insufficiency, II the effect of various types of collapse therapy upon Cardiopulmonary function. Am. Rev. Tuberc. 44: 123, 1941.
5. De, P. and De, B. N.: The vital capacity of the Bengalees. Ind. Med. Gaz. 74: 409, 1939.
6. Fowler, W. S.: Lung Volumes. Methods in Medical Research. Vol. 2: 181-206, The Year Book Pub. Chicago, 1950.
7. Gaensler, E. A. and Strieder, J. W.: Progressive changes in Pulmonary functions after Pneumectomy. Jour. Thor. Surg. 22: 1, 1951.
8. Gaensler, E. A.: Analysis and critique of Pulmonary Function studies. Bull. New Eng. Med. Centre. 13: 49-61, April 1951.
9. Gaensler, E. A., Rayl, D. F. and Donnelly, D. M.: The breath-holding test in pulmonary insufficiency: Evaluation of 1000 studies. Surg., Gynec. & Obst. 92: 81, 1951.
10. Krishnan, B. T. and Vareed, C.: The vital capacity of 103 male medical students in South India. Ind. Jour. Med. Rs. 19: 1165, 1931-32.
11. Lundgren, N. P. V., Sengupta, A. and Saha, P. N.: Lung volumes and breathing capacity among Indian men with sedentary occupations. Alumni. Assoc. Bull. Oct. 1953.
12. Matheson, H. W., Spies, S. N., Gray, J. S. and Barham, D. R.: Ventilatory function tests: II Factors affecting the voluntary ventilation capacity. J. Clin. Invest. 29: 682, 1950.
13. Telang, D. M. and Bhagwat, G. A.: Studies in the vital capacity of Bombay Medical Students. Ind. Jour. Med. Res. 29: 723, 1941.
14. Warring, F. C. (Jr.): Ventilatory function: Experience with a simple practical procedure for its evaluation in patients with pulmonary tuberculosis. Am. Rev. Tuberc. 51: 432, 1945.

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HODGKIN'S DISEASE OF THE LUNG

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Primary lymphoma of the lung is not an uncommon neoplasm. This may be lymphosarcoma, Hodgkin's disease or reticulum-cell sarcoma. They have frequently masqueraded as bronchogenic carcinoma, tuberculosis, sarcoid, abscess or lobar pneumonia. Clinical history and physical findings hardly help in the recognition of a pulmonary growth. The presence of a pulmonary neoplasm is first suspected of the finding of opaque shadow in the lung fields on roentgenological examination. Sputum or bronchoscopic examination offer no clue in the recognition of lymphoma of the lung, although Higginson⁴ reported having spotted intrabronchial obstruction by Hodgkin's tissue through bronchoscopic examination. Biopsy report of supraclavicular lymph nodes according to Pool⁷ is said to serve as a clue for spotting Hodgkin's disease of the lung and mediastinum. But experience of others suggests the controversial value of the same. Exploratory thoracotomy is very often indicated, since histological examination of the affected bit alone can declare lymphoma of the lung.

Hodgkin's disease of the lung may be primary or secondary, the latter being due to extension from mediastinal lymph nodes. Primary Hodgkin's disease of the lung is a bonafide lesion. The presence of significant amount of lymphoid tissue around the major bronchioles in the parenchyma of the lung, around small bronchioles and vessels, leave no ground for dispute, that Hodgkin's disease can arise de novo in the lung. Primary nature of pulmonary Hodgkin's disease can only be proved at autopsy but not on clinical or roentgenological findings. Falconer² and Leonard in a review upto 1936, observed 47 cases of pulmonary involvement in 125 of Hodgkin's disease. Moolten⁶ in an extensive review of the subject places primary type as 10 per cent. This is rather high considering that Lumb⁵

in an analysis of 175 cases encountered only one case of primary Hodgkin's disease of the lung. Early recognition of primary pulmonary Hodgkin's disease is important for the mere fact that lobectomy or resection followed by roentgen exposures are known to prolong the survival period considerably.

Hodgkin's lymph-adenopathy finds a place in the daily biopsy reports of the pathologist and very rarely he is fortunate to study the extent of involvement at necropsy. The clinico-pathological findings of a case of Hodgkin's disease of the mediastinum and the lung with involvement of the para-aortic lymph nodes are recorded because the clinical diagnosis was in doubt owing to the misleading changes observed in the axillary lymph node submitted for biopsy report.

CASE REPORT

S., male, aged 50 sought medical aid under Dr. P. Narayana Rao, Govt. General Hospital, Guntur, for cough with expectoration since 6 months on 3-4-1956. One month prior to admission to the hospital, he used to sit up in bed to overcome dyspnoea and fortnight before entering hospital he noticed hoarseness of voice.

Findings of Physical Examination:

Slight puffiness of the face was observed. He was orthopnoeic. Jugular veins were engorged, more so on the left. Trachea was deviated to the right. Entire left half of the chest was stony dull on percussion. Heart sounds were feeble. Liver was palpable one finger below the costal margin. The lymph nodes in the left axilla and left groin were enlarged; but firm and discrete.

Investigations:

Total W.B.C. Count: 20,000 per c.mm.

Diff. W.B.C. Count: P. 80%, L. 13%, E. 5%, and M. 2%.

Urine and Faeces: Nil contributory.

Blood VDRL: Positive in 4 dilutions.



Fig. 1.

Reduction photograph of chest X-ray shows diffuse opacity of the left half of chest and the right border of heart seen more towards the right.



Fig. 2.

Photograph illustrates Hodgkin's sarcoma of the lung, necrosis and cavitation of the neoplastic tissue. Metastatic tumour nodules are seen over the heart and aorta.



Fig. 3.

Photograph illustrates sectioned surface of the neoplasm of the left lung and secondary deposits over the pericardium and aorta.



Fig. 4.

Photomicrograph illustrates total loss of lung structure and interstitial replacement by Hodgkin's tissue. (H & E x 72)



Fig. 5.

Higher magnification of figure 5. This illustrates malignant reticulum cells invaginating into the alveolar lumen and partially occluding it. (H & E x 324)



Fig. 6.

Photomicrograph illustrates Hodgkin's neoplastic cells in perivascular grouping. The monotony of the single type of cell characterising Hodgkin's sarcoma is well seen. (H & E x 324)

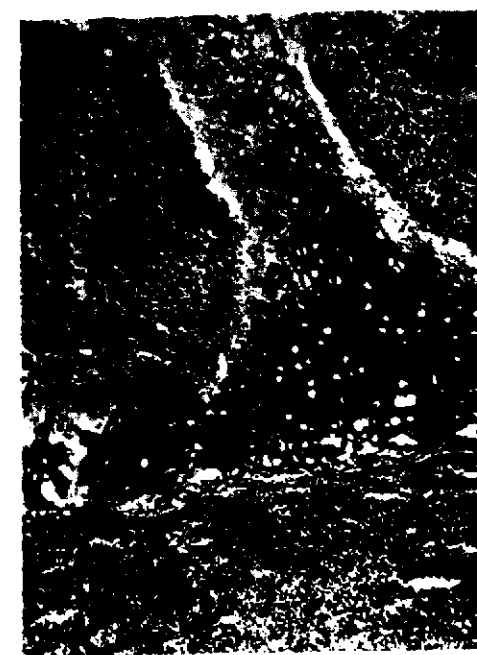


Fig. 7.

Photomicrograph illustrates Hodgkin's cells close to the bronchiolar cartilage—the lining epithelium apparently has been replaced by the tumour cells. (H & E x 72)

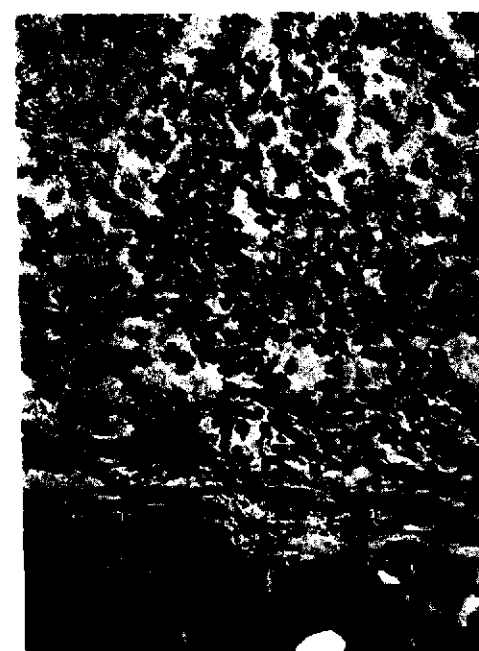


Fig. 8.

Shows higher magnification of figure 8. The sarcomatous nature of the cells is noticeable. (H & E x 324)

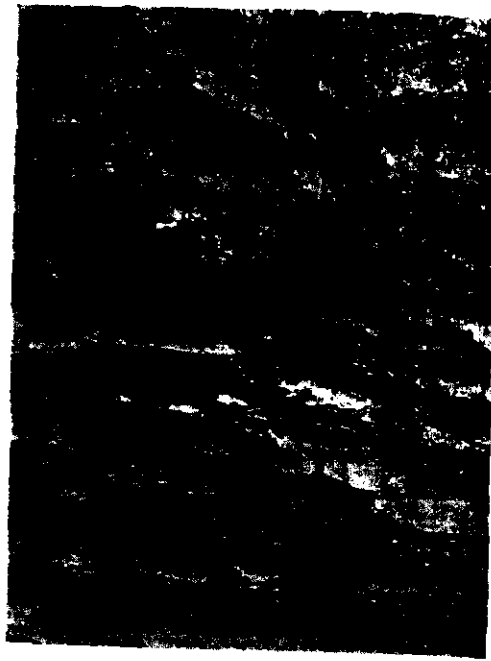


Fig. 9.

Photomicrograph shows Hodgkin's neoplastic cells infiltrating pleura. Some of the cells possess giant size nuclei. (H & E x 324)



Fig. 10.

Photomicrograph illustrates reticulum cells penetrating and destroying oesophageal wall. Bits of oesophageal muscle are seen amidst the neoplastic cell clusters. (H & E x 324)

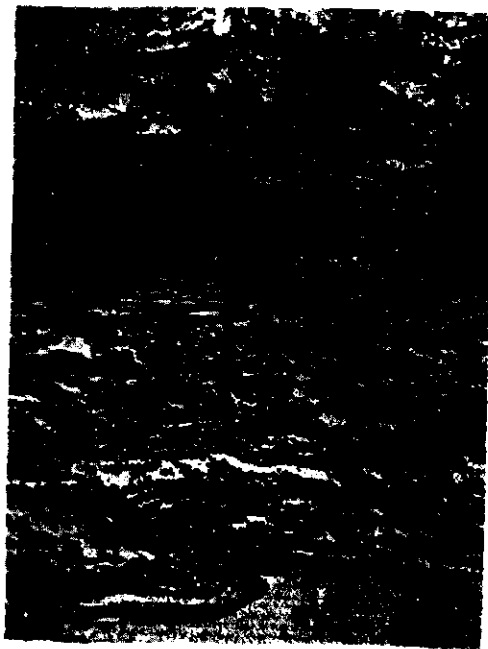


Fig. 11.

Photomicrograph illustrates Hodgkin's neoplastic tissue infiltrating the layers of the aortic wall. (H & E x 72)



Fig. 12.

Photomicrograph illustrates typical "Sternberg-Reed" type of cells, observed in sections of left inguinal lymph nodes. The absence of granulomatous picture and the sole presence of malignant reticulum cells signifying Hodgkin's sarcoma is seen. (H & E x 324. Mag. 2)

X-ray: Uniform opacity occupying the entire half of the left chest was seen (Fig. 1). Rt. border of the heart was shifted to the rt. by half an inch. Dense shadow was seen in the superior mediastinum and trachea was shifted to the right (Fig. 1).

The fluid aspirated from the left pleural cavity was clear and straw coloured. No malignant cells could be spotted.

Biopsy Report of left Axillary Lymph node: (600/56) Massive fibrosis and occasional plasma cell were seen. (? Syphilitic)

Repeated aspirations of the chest were done to relieve dyspnoea and the smears were negative for malignant cells.

Indirect Laryngoscopy: Complete paralysis of the left vocal cord.

The patient in the terminal stages developed pitting oedema of the legs and expired on 31-5-55.

Clinical diagnosis: ? Hodgkin's disease, ? Lymphosarcoma, or ? Broncho-genic carcinoma.

Chief Autopsy Findings:

External appearances observed by the physician were confirmed at autopsy. Spleen was small and weighed 56 grammes. Gastro-intestinal tract nil abnormal. Kidneys and urinary passages were normal. Brain, bones, and prostate showed no lesion.

Cardio-Respiratory Systems:

The rt. lung weighed 1260 grammes. It was congested and oedematous. The anterior mediastinum was filled by whitish homogeneous mass of lymph nodes, and was adherent to the pericardium and left side of the chest wall. The left lung was adherent to the chest wall. It was greatly enlarged. Invading and replacing the upper lobe of the left lung was a dull white tumour mass. Only bits of lung tissue were seen scattered amidst the neoplastic tissue. Pleura was greatly thickened and infiltrated with the tumour tissue. Cavitation was also observed in the left lung typifying necrosis of the tumour (Fig. 2). The heart was displaced to the rt. and the pericardial cavity contained blood stained fluid. Studded all over the visceral pericardium and infiltrating deep into the myocardium and the great vessels of the heart were whitish tumour nodules of varying sizes (Fig. 3). The mass was diffuse and enclosed all the structures in the posterior mediastinum. The aorta, oesophagus, etc. were embedded and enveloped by the neoplasm. The neoplastic mass was firmly adherent to the vertebral column. Sectioned surface of the left lung disclosed ragged and thickened appearance of the mucosa of the larger bronchi.

The left axillary, and inguinal, mesenteric, coeliac and para-aortic lymph nodes were enlarged and some of them were of almond size and firm. Cut surface of them was of dull white colour, and homogenous.

Morbid histology of the neoplastic tissue in lung and lymph nodes:

Sections from multiple blocks stained with haematoxylin and eosin, Vangieson, Foot and frozen sections were studied (456-486/56). The normal parenchyma of the lung in the affected portion was totally wanting. Interstitial infiltration with reticulum cells formed the chief histological feature. These cells were of primitive type and most of them were of variable size and shape. They were hyperchromatic and some of them showed mitotic figures. The subepithelial proliferation of the reticulum cells was so marked as to project into the alveoli and partially occlude their lumina (Figs. 4 & 5). Perivascular proliferation of these cells was a significant feature (Fig. 6). Necrosis and fibrosis were observed. Most of the sections studied from the major bronchi and some showing the minor bronchioles contained no lining epithelium. In close apposition to the bronchial cartilage and appearing as though inseparable from them were seen, clusters of reticulum cells, many of them separated by thin strands of fibrous tissue. Many of them were hyperchromatic and of variable size and shape (Figs. 7 & 8). The sections from pleura showed infiltration with these cells and some of them possessed giant nuclei (Fig. 9). These reticular cells as they penetrated the pleura in places totally disorganised the structure of the pleura. Similar destruction of the wall of the oesophagus was observed by these cells and only bits of oesophageal muscle could be made out amidst considerable collections of reticulum cells (Fig. 10). Sections from the aorta showed not only layers of these underneath the intima but were seen to considerable depth in the rest of the aortic wall (Fig. 11). Section of pericardial nodules showed penetration of the Hodgkin's tissue deep into the myocardium. Sections from the left inguinal lymph nodes showed mostly giant reticulum cells of Sternberg-Reed type (Fig. 12). In none of the sections eosinophils or any significant number of neutrophils or plasma cells were noticed.

COMMENT

The gross and histological findings of the lesions in the left lung, mediastinal and para-aortic lymph nodes, aorta, oesophagus and the inguinal lymph node are pathognomonic of Hodgkin's sarcoma. The significant absence of granulocytic cell series and plasma cells in the case excludes the

common granulomatous variant of Hodgkin's disease. Lymphomas of the lung either primary or secondary to mediastinal lesions, are not infrequently reported and among them Hodgkin's disease forms at least 40% of cases. Cavitation is most encountered in Hodgkin's disease of the lung since the Hodgkin's tissue is prone to necrosis. This often misleads the clinician to recognise them as lung abscess. Leucocytosis noticed in the case is due to secondary infections supervening necrotic tumour tissue. In addition reports are not wanting of the equivocal value of biopsy report of the enlarged cervical or axillary lymph nodes in these cases and the fibrosing lesion observed by us in the initial lymph node biopsy diverted our attention from Hodgkin's disease. It is very often difficult and questionable to establish the primary nature of pulmonary Hodgkin's disease even at necropsy owing to extensive involvement of many organs. We are inclined to suggest that extension from primary mediastinal lesion in our case cannot be ruled out.

That Hodgkin's disease, has a multi-centric origin, is well illustrated by our case report and that the wild proliferation of the reticulum cells in this disease very often blots the normal pulmonary parenchyma is also well depicted by the case report. We feel that in case the condition was recognised at the time of admission into hospital, even pneumonectomy would not have helped the deceased owing to extensive involvement. But an exploratory thoracotomy would have greatly aided in recognising the condition and thus could have given the doubtful benefit of roentgen therapy.

SUMMARY

1. Literature regarding primary lymphoma of the lung with special reference to Hodgkin's disease is briefly reviewed.

2. Clinico-pathological findings of a case of Hodgkin's sarcoma of the mediastinum and lung are recorded and the diagnostic significance of the clinical history, roentgenological appearances of the lungs (chest), cytology of pleural fluid, biopsy findings of the axillary lymph node is discussed.

3. The diagnostic importance of exploratory thoracotomy in lymphoma of the lung is stressed.

ACKNOWLEDGEMENT

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REFERENCES

1. Cooley C. Jack, McDonald John and Claggett Theorn, O.: Primary Lymphoma of the Lung. *Annals of Surgery*. 143: 18-28, 1956.
2. Falconer, E. H. and Leonard, S. E.: Hodgkin's disease of Lung. *Jour. Med. Scien.* 191: 780, 1934.
3. Hazel Van-Willard and Jensik J. Robert.: Lymphoma of the lung and pleura. *Jour. Thoracic Surg.* 31: 19-44, 1956.
4. Higginson F. John.: *Ibid.*
5. Lumb George.: *Tumours of the Lymphoid Tissue*. E. & S. Livingstone Ltd. Edinburgh and London, 1954.
6. Moolten, S. E.: Hodgkin's Disease of the Lungs. *Amer. Jour. Cancer.* 21: 253, 1934.
7. Pool L. John.: *Ibid.*

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SPONTANEOUS RESORPTION OF PANCREATIC CALCIFICATIONS

by U. MOHAN RAU, Madras.

CASE REPORT

Ramiah, male, aged 40 years was admitted on 28-6-1955 complaining of pain in the epigastric region.

This complaint had started two months before, when he used to get severe pain in the entire epigastric region, which was aggravated by ingestion of food. The pain used to last for a few minutes and then subside spontaneously. For the past fifteen days the pain was being referred to the back also. He has had no vomiting. His appetite had been fair and bowels had been regular. There was no history suggestive of any acute attack of epigastric pain suggestive of acute cholecystitis, cholangitis or pancreatitis.

He was not an alcoholic.

General examination:

A fairly nourished individual; thin build, slightly anaemic; not jaundiced.

Local examination of the abdomen:

Apart from moderate tenderness in the epigastric and right hypochondriac regions, there was nothing abnormal. There were no masses felt; the liver and spleen were not palpable.

Investigations:

Urine: Normal.
Hb. %: 80.

Serum Amylase: 160 units/100 c.c.

B.P.: 100/70 mm. of Hg.

Faeces: Macroscopically and microscopically normal.

Estimation of split and unsplit fat revealed normal values.

Random Blood Sugar: 139.4 mgm. %.

Roentgenological investigations:

(A) Plain X-ray of the abdomen (A.P. & Lateral views, Figs. 1 & 2). Multiple opacities in the region of the pancreas, mainly to the right of the midline. A few opacities were seen to the left of the midline also. Appearances were suggestive of pancreatic calculi with pancreatic calcification.

(B) Cholecystography:

(i) Oral route — Gall-bladder not visualised.

(ii) I. V. Cholecystography (Fig. 3).

A normally filling, and a normally functioning gall-bladder was seen. The common bile duct was free from any obstruction. The opacities seen in the plain X-ray were outside the biliary tract.

(C) Barium Meal Series: (Figs. 4 & 5) The opacities appeared to be confined mainly to the head and neck of the pancreas; a few were seen in the position of the body of the pancreas.

During this period when the patient was undergoing the above investigations, the severe attacks

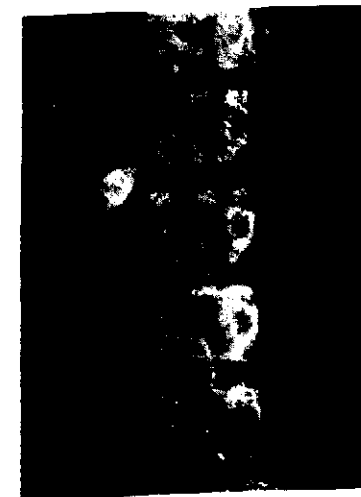


Fig. 1.
Figs. 1 & 2. Plain X-ray of the abdomen (A.P. & lateral views).



Fig. 3.
Cholecystogram showing a normal gall-bladder.
Its function was radiologically normal.

of epigastric pain used to be relieved with oral administration of "Trasentin" tablets or intravenous administration of atropine sulphate (1/100 gr.).

It was decided to explore the region of pancreas, with a view to remove the major calculi which were probably causing obstruction to the main pancreatic duct.



Fig. 4.

Operation Notes:

On 14-7-1955, under spinal anaesthesia (by Dr. Sam Rao) through a right paramedian incision, laparotomy was done. The stomach, duodenum, gall-bladder and bile ducts were normal. The pancreas was palpated through an opening in the gastrocolic omentum. The entire head and neck of the pancreas were studded with diffuse and irregular areas of calcification. The head was bigger than normal. There were smaller areas of calcification in the body of the pancreas. The findings were those of diffuse chronic pancreatitis with calcification; no separate calculus could be made out in the region of the pancreatic ducts even when they were palpated from the posterior aspect of the pancreatic head.

The rest of the abdomen was normal. In view of the local findings and the extensive involvement of the pancreas, it was decided to abandon the idea of further exploration of the pancreatic ducts and to give the patient relief from his pain by a sympathectomy at a later date.

The abdomen was closed in layers.

He had 300 c.c. of "O" group blood during the operation.

He made an uneventful recovery and was completely free from his pre-operative symptoms during the post-operative period. He was able to take his full normal diet and was discharged on



Fig. 5.

Figs. 4 & 5. Barium meal pictures to show the normal duodenal cap and the relation of the opacities to the descending part of the duodenum (which is faintly visualized in Fig. 5).



Fig. 6.

Figs. 6 & 7. Plain X-rays of the abdomen, of the same patient, taken on 23-9-1955; no opacities are seen.

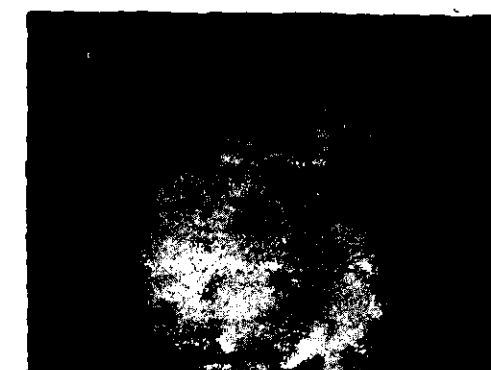


Fig. 7.

27-7-1955, with a request to report again, should there be a recrudescence of his trouble.

On 20-9-1955 the patient reported again with moderate jaundice and loss of appetite, of ten days duration. He had no pain whatever. Clinical examination did not reveal any abnormality apart from the presence of jaundice. His urine showed the presence of bile salts and bile pigments and his faeces was clay-coloured. His icteric index was 64 units. He appeared to be having a mild attack of infective hepatitis (? homologous jaundice as a result of the blood transfusion that he had during the laparotomy).

On 23-9-1955 a plain X-ray of the abdomen was taken to ascertain the position of the pancreatic calcifications and their probable relation to the attack of jaundice. This X-ray did not reveal any opacity (Fig. 6). In order to be absolutely certain, the X-ray was repeated again on 27-9-1955 and this also did not reveal any opacity in the pancreas. Obviously, all the calcified areas had undergone spontaneous and complete resorption.

With the well-recognised dietetic treatment for infective hepatitis, the patient improved very well and he was discharged on 4-10-1955 with advice to continue the treatment under guidance of his doctor. His appetite was fair at the time of discharge; his faeces was almost normal; his jaundice had improved considerably and the icteric index was 32 units.

He made a rapid recovery and when last heard of, on 25-8-1956 was quite well and completely free from pain and all other symptoms.

DISCUSSION

A survey of literature does not reveal any other similar case that has been

reported. Though there are several reports of patients with chronic calcareous pancreatitis who, with no treatment, have had spontaneous subsidence of all their symptoms, there does not appear to be a case where besides complete amelioration of symptoms, there has been roentgenological proof of dissolution of calculi. It has not been possible to procure reports of experiments (if any) where pancreatic calcification had undergone resorption.

Some aspects of calcification:

Though an enormous amount of work has been done on this subject, there are many unanswered problems in this highly complex field of the mechanism of calcification. A brief survey relevant to the case herein reported is attempted.

(A) *Vicarious calcification*, i.e. deposition of calcium salts in areas not normally calcified, has taken place under two groups of conditions:

(i) When the extra-cellular fluid and calcium was normal, e.g. in certain degenerating and necrotic areas as arteriosclerotic plaques, tuberculous calcification and calcified pericarditis. The deposits of calcification in the subcutaneous, fascial and ligamentous tissues in the disease calcinosis belong to this group.

(ii) When the extra-cellular fluid was abnormal, i.e. when hypercalcaemia was present, as in hyperparathyroidism, multiple myeloma, generalised skeletal carcinomatous metastases, vitamin D poisoning, etc. In some of these conditions, calcification has been reported in the skin, conjunctiva and in the tissues around the joints.

Mechanism of this vicarious calcification:
(a) When the extra cellular fluid is normal, there seems to be a local stimulus in the degenerating and necrotic plaques. This local stimulus results in the laying down of a calcifiable matrix in these degenerating tissues. "Likewise, in the disease calcinosis there appears to be some alteration in the fibroblasts of the subcutaneous, fascial and ligamentous tissues, resulting in the elaboration of an abnormal matrix which undergoes calcification, even when the extra-cellular fluid is normal (Howard²)".

(b) The calcification in hypercalcaemic conditions seems to be differently initiated. Here the excessive concentration of calcium appears to play an important role.

(B) Similarity of matrix in all calcifications: The work of Rubin, Howard², etc. has shown that both in bone as well as in areas that undergo vicarious calcification in the human body there is a ground substance or matrix over which the calcium salt is deposited. This matrix is also present in dental tartar and in all types of calcific renal stones (except calcium oxalate calculi).

The matrix is composed of protein and polysaccharide substances, and is microscopically identical with the collagen of other fibroblasts. It is interesting that the matrix in all these calcific areas appears to be similar. It undergoes metachromatic staining with toluidine blue and is strongly positive with periodic acid fuchsin staining.

(C) Brief histopathology of pancreatic calculi and calcification: Microscopically calcified areas are seen (i) around necrotic

debris in the acini, (ii) in the obstructed and dilated ducts, (iii) in the epithelial cells lining the acini and (iv) in the interstitial tissues themselves. The ducts are dilated due to fibrosis produced by chronic pancreatitis.

The calcified material is composed chiefly of calcium carbonate and tribasic calcium phosphate.

(D) Does calcified tissue or calcification undergo spontaneous resorption? Herewith are a few examples of such spontaneous dissolution or resorption:—

(i) The physiological or pathological resorption of bone is a well known entity.

(ii) The vicarious calcification seen in conditions of hypercalcaemia has a particularly remarkable feature, viz. its reversibility. One place where this vicarious calcification is easy to observe is the conjunctival sac of the eye; when the cause of the hypercalcaemia has been removed, the eye lesions have been seen to disappear completely (Howard²).

(iii) Nephrocalcinosis is very often a secondary manifestation of an underlying primary causative disorder, e.g. primary hyperparathyroidism, hyperchloremic acidosis, etc. "Histological characteristics of these nephrocalcinotic kidneys include calcium deposits located chiefly in the walls of collecting tubules and in the medullary interstitial tissue, (besides) areas in which the tubules have been destroyed or are deformed, with cystic dilatation being a common finding." (Mortenson⁵).

Mortenson⁵ et al have collected data on 26 patients with nephrocalcinosis due to hyperparathyroidism, who were followed for one or more years after surgical treatment for hyperparathyroidism. In about 10% of these cases, roentgenological examination revealed a decrease in nephrocalcinosis. A similar study of patients with nephrocalcinosis due to hyperchloremic acidosis, revealed that in practically all the patients, the roentgenological degree of

calcification showed improvement with adequate alkali treatment.

(iv) There are quite a few examples in literature of renal calculi that have undergone spontaneous disintegration or dissolution.

McCrea and Buskirk⁶ have reported the spontaneous disintegration and partial dissolution of a staghorn calculus; this calculus was the result of prolonged recumbency and was made up of calcium phosphate.

Sizeable renal calculi due to hyperparathyroidism have disappeared after the correction of the endocrine abnormality. These calculi were most often composed of calcium phosphate.

(E) What is the mechanism of this resorption?

(a) In bone "during skeletal resorption, the matrix invariably disappears together with lime salts; one never sees bone matrix left behind from which the lime salt has been biologically removed. Perhaps this is done by first disintegrating the ground substance (or matrix) and the mineral constituents can then be readily disposed of. It is believed by many students of bone physiology that the bone cells not only lay down the matrix but also under different stimuli and circumstances, destroy it as well" (Howard²).

(b) The disappearance of vicarious calcification in hypercalcaemia. Whether these deposits are resolved by enzymatic activity of fibroblasts, as is generally conceded to be the case with bone resorption, is not known. The actual nature of the calcium salts laid down in such lesions is unknown.

(c) The disappearance of calcific material of other types and in other regions and diseases, is also not yet explained.

However, in this connection, the recent work of Baker¹ et al is interesting.

Experimental work done by Baker¹ and co-workers has revealed additional factors

involved in calcification. These investigators have shown that in young rats that were given doses of 1600—1800 units of parathormone, calcification was observed within the basement membrane of the renal tubules ("nephrocalcinosis") and in the connective tissue matrix in the arteries, heart, spleen and stomach.

If toluidine blue was administered to rats receiving parathormone, great augmentation of rephrocalcinosis and calcification occurred in the connective tissue.

However, the administration of desoxycorticosterone acetate (DOCA) to animals receiving parathormone, almost completely inhibited nephrocalcinosis. The effects of both toluidine blue & "DOCA" seem to be on the connective tissue ground substance or matrix.

COMMENTS

In the case herein reported, the operation that was performed on the patient, seems to have changed the matrix in such a way, that the calcified areas got absorbed. Whether the spinal anaesthesia or the surgical trauma of partial mobilization of the pancreas brought about this alteration in the matrix, it is impossible to state. Just as in nephrocalcinosis, the calcification in pancreatic calcification appears to be in the interstitial tissues as well as in the lumen of the acini and ducts. In view of the effect of "DOCA" on calcification in Baker's experiments and in view of the now-well-recognized adrenal response to surgical trauma, could there be some relationship between the adrenal hormones and the disappearance of the calculi? Time and further work alone can answer these problems.

SUMMARY

(1) A case of spontaneous dissolution of pancreatic calcification is reported. This appears to be the first case in available literature.

(2) Some aspects of calcification, relevant to the case, are briefly surveyed.

REFERENCES

1. Baker, R., Reaven, G. and Sawyer, J.: "Ground substance and calcification: The influence of dye binding on experimental nephrocalcinosis." *J. Urol.* 71: 511-522, 1954.
2. Howard, J. E.: "Clinical and laboratory research concerning mechanisms of formation and control of calculous disease by the kidney." *J. Urol.* 72: 999-1008, 1954.
3. Howard, J. E.: "Some current concepts on the mechanism of calcification." *J. Bone & Joint Surg.* 33-A: 801-806, 1951.
4. McCrea, L. E. and Van Buskirk, K. E.: "Spontaneous disintegration of staghorn calculus due to recumbency." *J. Urol.* 66: 640-644, 1951.
5. Mortensen, J. D. and Emmett, J. L.: "Nephrocalcinosis: A collective and clinico-pathologic study." *J. Urol.* 71: 398-406, 1954.

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INTUSSUSCEPTION ASSOCIATED WITH TYPHOID PERFORATION OF THE ILEUM

(Case report)

by FORREST C. EGGLESTON and JOHN K. VETTATH, Ludhiana, Punjab.*

While intussusception secondary to typhoid fever has been reported, this in combination with perforation of the small bowel due to typhoid fever is extremely rare. We are therefore reporting one such case which survived.

CASE REPORT

J. S., a 12 year old boy was admitted into the surgical ward of the Christian Medical College Hospital, Ludhiana on the afternoon of Nov. 28, 1955. His chief complaint was pain in the right lower quadrant of 8 days' duration and fever for 10 days. The history began on the evening of Nov. 18, 1955 when the boy came home from school with high fever, headache, and loss of appetite. These symptoms continued without remission and on the 20th he passed about 8 ozs. of dark coloured blood per rectum. Soon after this he vomited twice. The vomitus contained only previously ingested food. After that the patient felt a mild, continuous, aching pain in the right lower quadrant. The high continuous fever and the pain persisted with the boy becoming steadily weaker. On the 27th of Nov. he again passed some dark blood per rectum. He had had no stools since the 20th although he had been passing flatus.

Examination showed a poorly nourished boy, dehydrated, and toxic. Tongue was dry and thickly coated. Heart and lungs were normal. Abdomen was slightly distended and tender in the right lower quadrant. No free fluid was present. Spleen was soft and barely palpable. No spasm or rigidity were noted. Bowel sounds were hyperactive. Rectal examination did not reveal anything abnormal.

On the basis of the clinical findings a diagnosis of typhoid fever was made and the medical service called into consultation for confirmation.

Laboratory investigations revealed urine to be normal; white blood count 6,350; hemoglobin 13.5 gm%. Blood was sent for culture and for Widal.

By the 29th the condition of the patient was very poor. Abdomen was markedly distended and

tender all over, particularly in the right lower quadrant, with slight guarding. Bowel sounds were hyperactive. A plain X-ray of the abdomen showed classical findings of small bowel obstruction without free air. Accordingly, laparotomy was done on the 29th.

At operation the patient was found to have an inflammatory process involving the lower two-thirds of his ileum, with massive enlargement of the regional lymph nodes. Approximately 15 inches proximal to the ileocaecal valve, there was a small (2 inch) intussusception. There were also three areas of intestinal perforation — one 6 inches proximal to the ileocaecal valve, and two above the intussusception. That these were very recent was evident from the lack of peritoneal reaction. The right lower quadrant of the abdomen was filled with small bowel content. The bowel proximal to the area of obstruction was dilated to twice normal size, and had many small areas of haemorrhage in its wall. The caecum was normal.

Decision was made to resect the ileum in the areas of perforation. Accordingly, the bowel was transected at a point about 2½ feet proximal to the ileocaecal valve and removed rapidly by continuing downwards in the tissues adjacent to the bowel to a point about 2 inches proximal to the ileocaecal valve where the bowel was again transected. The two lumens were then anastomosed in an end-to-end fashion using interrupted sutures of fine cotton for the outer layer and continuous catgut for the mucosal layer. The peritoneal cavity was then aspirated dry and the wound closed in layers to the external rectus sheath without drainage. The skin and subcutaneous tissues were left open.

During the operation the patient received 500 c.c. of blood as a slow drip. He had a very stormy post-operative course.

On 1st December the Widal was reported as positive as was the blood culture. Chloramphenicol (Chloromycetin) was started by mouth on Dec. 3rd and from that time the condition of the patient gradually improved. The open wound granulated and healed up.

The pathology report on the specimen also confirmed the diagnosis of typhoid fever. No cause for the intussusception was found. The patient was discharged on Feb. 2, 1956.

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DISCUSSION

This case represents several interesting features :—

- (1) Intussusception in a boy of 12.
- (2) Intussusception along with typhoid fever.
- (3) Multiple perforations of ileum due to typhoid.

It is our belief that the intussusception probably was secondary to an enlarged

Peyer's Patch but it is interesting to note that one of the perforations was distal to the intussusception.

SUMMARY

A case is presented of multiple intestinal perforations secondary to typhoid fever with an associated intussusception in a 12 year old boy with recovery.

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PROSTATIC CALCULI

by M. P. PAI and P. C. NAMBIAR, Dibrugarh.*

Compared to stones at other sites in the urinary tract, prostatic calculi are rare. The case presented here is interesting in that three big stones were tightly packed together around the prostatic urethra completely replacing the prostatic tissue.

Rectal examination revealed a moderately enlarged prostate, hard, smooth, the groove between the two lateral lobes was rather exaggerated, rectal mucous membrane freely movable.

CASE REPORT

D.M., Muslim, male, 60 years, merchant, was admitted on 20-1-1956 in Assam Medical College Hospital for treatment of frequency of micturition and pain in the hypogastrium of seven years' duration.

He complained of increasing difficulty of micturition, associated with frequency which was more during nights, occasional burning sensation, but no haematuria. There was a sense of heaviness and dull aching pain in the perineum.

Clinical Examination :

The patient was a man in his sixties of thin build and fair general health. General examination did not reveal anything abnormal; bladder not distended. There was slight tenderness in the hypogastric region.



Fig. 2.

Three faceted stones removed from prostatic sheath.



Fig. 1.

Plain X-ray showing the stones in situ.



Fig. 3.

Stones held together resemble the prostate.

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Investigations :

1. Blood urea — 44 mg% on 23-1-1956, 20 mg% on 6-2-1956.
2. Kahn & W.R. — Negative.
3. Blood Group — 'B'.
4. Serum acid Phosphatase — 1.2 units per 100 c.c. (Gutman & Gutman).
5. Urine culture — B. Pyocyaneus & Staphylococcus non-pyogenus.
6. X-ray showed a dense shadow in the region of the prostate.

Patient was put on pre-operative chemotherapy to control bladder infection.

Under general anaesthesia retropubic exposure of the prostatic sheath (Millins technique), sheath incised and three stones two big and one small

were delivered out. Sheath closed with continuous catgut. As no Foley catheter was available and there was some oozing in the prostatic fossa — occupied by the stones it was thought advisable to institute a supra pubic drainage of the bladder. Patient made an uneventful recovery, but came back four months later with primary carcinoma of the liver proved by laparotomy.

Weight of the stones was 32.4 Gms. and composition Calcium Phosphate and Carbonate.

ACKNOWLEDGEMENT

We are grateful to Prof. B. N. Banerjee, Principal & Superintendent of the Assam Medical College and Hospital for permitting us to report the case.

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ORTHOPAEDIC SECTION**WHERE DO WE STAND ON HIP PROSTHESIS ?**

by J. E. M. THOMSON, U.S.A.*

Over enthusiasm relative to the potentialities of prosthesis arthroplasty has encouraged many surgeons to use this procedure as a means of treatment for most painful hip problems. There are 53 different types of prostheses to select from; therefore, it is not surprising that recent result studies of patients having replacement arthroplasties recount so many failures. Such reports appear to be discouraging. However, study of these reports discloses that the causes of failures are as follows:—

1. Improper selection of patients, prosthesis arthroplasty not indicated, or not a justifiable surgical procedure, or in some cases another type of reconstruction operation might have been more appropriate.
2. Inadequate pre and post-operative measures.
3. Anesthetic difficulties — because the side position in which the patient is usually placed may embarrass the respiration, or the anaesthetic agent is not chosen to meet the particular needs and risk, or because of mechanical difficulties due to the apparatus used or its use by inexperienced personal.
4. Lack of experience and knowledge in the selection of the type of prosthesis and of the mechanical principles involved in its proper seating or placement.
5. Often not having the proper tools to work with or the "know how" to use them is responsible for failure.
6. Failure in aseptic technique.
7. A great deal has been said of the many complications that occur during and after operation, and one must be alert to their possibilities but the above six reasons for failure often contribute to the occurrence of such disorders.

We must therefore, recognize that when a replacement arthroplasty is successful, it is then because a patient has been and his team of associates have given the proper pre and post-operative care, and that the institution in which the operation is performed, has excellent anaesthesia facilities, and lastly, the surgeon has had sufficient experience and knowledge of the mechanical principles involved and uses meticulous aseptic technique.

The field of usefulness of replacement arthroplasty is very limited. Its appropriateness is primarily within the realm of the painful hip pathology in old people with long standing fixed deformities, contractures and disabilities. It should be considered as an elective "salvage" operation with the same risk of any other major hip operation. Further, it is one in which the head and perhaps the neck of the femur must be sacrificed to seat the prosthesis properly.

Also, it is absolutely necessary during the operation to assure correction of adductor and flexion deformities or other deformities that interfere with the normal hip function. Such a sacrifice of bone and soft tissue should never be considered unless the patient is physically, mentally and economically worth salvaging. If they cannot be materially benefitted, improved and put back into a state of at least limited activity and usefulness, so that they will be of less care to those responsible for them, the procedure is never warranted. Under such circumstances, one cannot expect to have an excellent end result, but the relief of pain, increased activity or mobilization, will often make the last years of life pleasurable.

A prosthesis replacement for acute fractures of the neck of the femur in older people is the one exception to long standing painful deformity of the hip, and here the

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criteria for its appropriateness must be limited by:—

1. The life expectancy of the patient is usually short. (Over 70).
2. The fracture is one that is unlikely to heal or in which there are technical difficulties in reduction and in achieving a stable internal fixation. These include Shearing transverse or oblique fractures of the neck close to the head and the Pauwel fracture type.
3. Pathological fractures due to metastatic malignancy.
4. Conditions that made the patient profoundly handicapped to begin with, such as Parkinsonism, hemiplegia and senility.

When a prosthesis arthroplasty is performed on one of these groups, they can be

mobilized early and are less likely to develop complications; though you cannot in many of these patients expect perfectly satisfactory results; they are more comfortable and to an extent socially independent.

We have used the "Light Bulb" prosthesis more than the medullary (Austin-Moore) type, and our results have been very satisfactory. We have at times with the "Light Bulb" had some resorption and a few wobbles but, in most instances, there is sufficient stability to serve the patient adequately throughout their span of life. We have had our troubles with the medullary type of prosthesis also, but when the neck is osteoporotic, complicated by malignancy or the patient is to be semi-bedfast or a wheelchair invalid the rest of their lives, it is perfectly appropriate to use this type of prosthesis.



Fig. 1.

Three years after a fresh fracture, age 73. This is a standing weight-bearing film in which the prosthesis is ideally placed. To be assured of good stability, X-rays also taken in abduction, adduction and laterally. These follow.



Fig. 2.

X-rays in the position of abduction show no wobble. This is an ideally seated prosthesis. Note the cortical bone developing at the end of the stem and the well settled head in the neck.

In my opinion, the second most useful place for this salvage operation is in non-union of fractures of the neck of the femur. The age group is a little younger, usually in the 60's. In taking this position, however, I am not excluding the appropriateness of osteotomy or fusion, but it is my impression that osteotomy or fusion is economically and functionally more appropriate for patients in the 40's and 50's than in the older groups, as these older groups do not tolerate a long period of cast fixation, nor do they compensate for the limitation of function resulting from fusion. Lastly, these patients over 60 who have a non-union have gone through at least one unsuccessful session of surgery and convalescence and they have had long standing suffering, instability and a deformity. For them, replacement arthroplasty re-establishes a measure of normal hip relationship and function. Again, one cannot expect

after living with a deformity for a long time, that anywhere near normal function can be attained, however, if the deforming contractures are corrected during the arthroplasty and prevented after operation, one can expect comfortable ambulation and satisfactory results in many instances.

Avascular necrosis with the associated changes in the neck of the femur is but one step away from a non-union and probably the contributing etiology is the same. Since many of these occur in the younger middle-aged group, we prefer the cup arthroplasty or hip fusion as a procedure of choice, but in very old people with aseptic necrosis associated with osteoporosis, we have used the replacement prosthesis.

We welcomed the cup arthroplasty for osteo-arthritic or degenerative arthritic hips when it was introduced. In our



Fig. 3.

A good range of adduction with no evidence of wobble or instability.

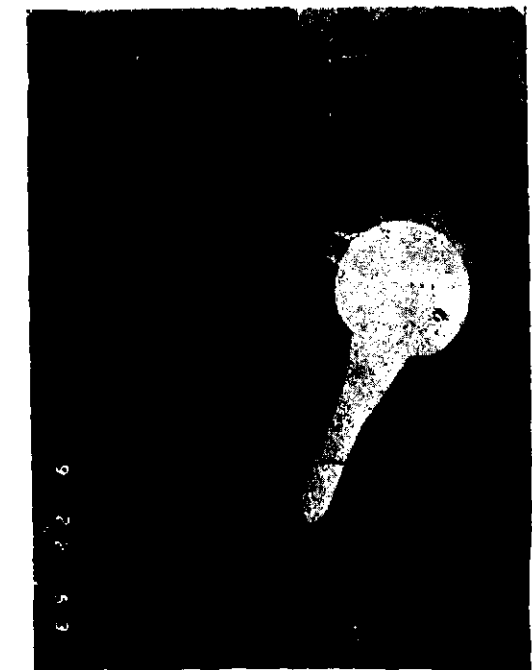


Fig. 4.

A flexed lateral view shows good range of motion and excellent relationship between the prosthesis, shaft and the acetabulum.

experience, we found that the cup was better tolerated in young people. Those patients over 60 when a cup arthroplasty was performed, were often subject to numerous complications and needed revisions. Spurring over-growth so often occurs about the cup which limits function and contributes to pain.

A critical analysis of our cup arthroplasties performed for the relief of arthritic hips was so unsatisfactory that we turned to replacement arthroplasty about six years ago with a measure of success. However, I have never been convinced that it is right to sacrifice the head and so much of the neck which is necessary to apply a metal replacement. We have only a small series of these (42 in number) that we have observed from one to five years with 64% of satisfactory results. The "Light Bulb" prosthesis was used in 36 of these cases. The oldest was 77 years of age. The average for the group was 62. With none of these groups, have we had any major complications due directly to the surgical procedure.



Fig. 5.

Three years after femoral head (Light Bulb) replacement following non-union and painful disability. The tract of the triflanged nail and bone graft used for internal fixation is still evident above the stem of the prosthesis. (The nail had been removed after reduction and apparent healing) and 18 months before arthroplasty.

Restoration of length of the extremity, stability and reasonable function were established to the satisfaction of the patient.

Our study of all these groups leads us to believe that the replacement prosthesis arthroplasty is a more satisfactory operation for older people who do not demand so much of the prosthesis. Younger people with a prosthesis are more active and put their extremity through much more stress and strain, therefore, the prosthesis will not stand up as well as it does for older people who are less ambitious. It is my opinion that no matter what type of prosthesis is used, if the patient lives long enough and uses the prosthesis hard enough, resorption, instability, discomfort and disability will recur, if the patient does not recognize that there is a threshold of fatigue in the neck of the femur and in the prosthesis, that cannot take normal stresses. Continued activity and use beyond that brink or threshold of fatigue, will have an unfavorable effect on the bone and soft tissues about the joint, and cause resorption of the neck. Fortunately, most old people recognize their physical limitations and they are not inclined to use their hip beyond the threshold of fatigue. Therefore,

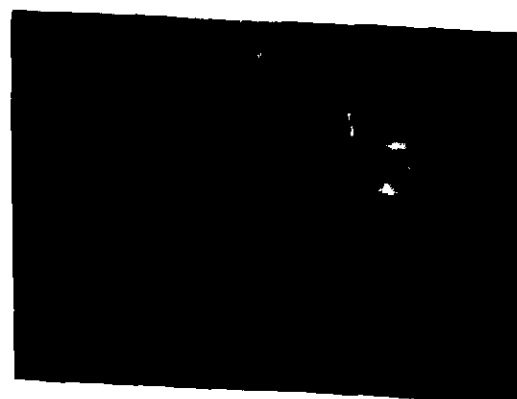


Fig. 6.

Aseptic necrosis following healed fracture of the neck of the femur. The extensive resorption would justify a replacement prosthesis.

with sufficient protection and discretion, they are able to make the prosthesis last them pretty well throughout their life.

It is not my purpose to review the technique of operation in this presentation, nor have I entered the controversies regarding the various types of prosthesis except to mention those of which we are familiar.

When it comes to evaluating results, I feel sure that we will know far more about the subject, if surgeons who are doing this

type of work, would adopt the system of grading developed by Judet, in which the amount of pain, the range of motion and walking ability are graded, according to the statement and action of the patient. At best, the results in all these replacement arthroplasties are mediocre, but the fact that many are improved and about 65% are satisfactory, so far as their ability to meet their individual requirements are concerned makes the procedure worthy of consideration.



Fig. 7.

Non-union, deformity and painful disability persuaded us to perform a replacement of this replacement arthroplasty in 1952. The result after three years shows resorption of the neck, the prosthesis is protruding through the lateral cortex; these findings were evident one year after operation. This X-ray was taken in the position of abduction and we also have X-rays made in adduction.

By limiting her activity and staying within her threshold of fatigue, she now, (three years later) does all her house work, has no pain unless she fatigues, uses a cane only on long walks and conserving her energy, enables her to live comfortably in spite of marked instability of the prosthesis.



Fig. 8.

Adduction increased because of shortening of the neck and wobble.

I wish to emphasize that any metal or acrylic, whether in the form of a vitallium cup or metal prosthesis, can never take the place of a physiological substance as an interposition material over an osteo-arthritic hip.

It is time we completely re-appraise our approach to this particular problem in the light of the fact in the past, soft tissue interposition material has for nearly 57 years given some measure of satisfactory results when used as an interposing membrane between the head of the femur and the acetabulum.

Recently, Professor Kallio of Helsinki, has reported the use of fresh autogenous full thickness skin graft over the head of the femur, the cutex surface against the head and the subcutaneous fat against the acetabulum. His report of some 50 odd cases observed from a period of one to two years appears far more satisfactory than many of our foreign body metal replacements. This leads me to believe that ultimately, the problem of painful osteo-arthritic hip may be solved by the use of our organic resources rather than by mutilation of the hip and metal devices.

CONCLUSIONS

Hip replacement prosthesis has a definite but very limited place in the treatment of painful disabilities of the hip.

The many causes of failure have been enumerated.

Success depends on:

- (1) Erasing the causes of failure.
- (2) Prosthesis replacement should be regarded as a procedure of last resort, a salvage operation on a patient worth salvaging.

Its field of usefulness is limited to:

- (1) Fresh fractures of the neck in people over 70 years of age.
- (2) Non-union fractures of the femur in patients over 60 years of age.
- (3) Aseptic necrosis of the hip in patients over 60 years of age with extensive changes in the head and neck.
- (4) Osteo-arthritis in old people with extensive degenerative changes in the head and neck with intolerable pain and instability.

In considering operative procedures for osteo-arthritis, other measures should be given consideration, as prosthesis replacement is mutilating and requires sacrifice of vital bony structure.

The work of Kallio with a skin cap on the head of the femur is too recent to evaluate. However, if we are to solve this problem, some type of organic substance should be looked for that would allow retention of normal hip architecture, and yet give comfortable function.

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INTRACAPSULAR FRACTURES OF THE NECK OF THE FEMUR

by C. VYAGHRESWARUDU, Visakhapatnam.

Introduction:

The evolution of treatment of fractures of neck of the femur through the last 100 years has progressed considerably though it has not reached final stage. It has earned a name as the "unsolved fracture," and even today it continues to be an unsolved fracture. Usually during world wars science develops in rapid strides and the last world war has given to the Medical Profession effective anti-biotics, improvements in blood transfusion, advances in anaesthesia and better techniques in surgery, which have helped to salvage the mankind, but disappointingly true is the lack of solution for the "unsolved fractures," which still defeat the Surgeon's enthusiasm. Even the unconquerable Mount Everest was ultimately conquered, the Atom has been successfully smashed, why not this "unsolved fracture" be solved?

Historical Background:

It is interesting to note that for a long time the treatment was wilful and judicious neglect. Sir Astley Cooper, asserted that the fractures proximal to the attachment of the capsule would never unite. As such most of the patients were left on bed who used to die of either hypostatic pneumonia, bed sores, or uraemia. Then this masterly inactivity was shaken by the contribution of Gurlt, a German Pathologist, who said that the union of the fracture did not differentiate between the young and the old, and occurs in spite of the old age. Later Senn pointed out that broken bones unite provided that the fractured surfaces are kept in apposition, for sufficiently long time, and he pointed out that in Intracapsular fractures, the fragments were not in apposition.

Royal Whitman gave the Philip to this and he described the method of reduction of the fracture and immobilisation by plaster spica, which was definitely an advance

in the history of this fracture. The procedure represented the first real effort to demonstrate concretely the fundamental truths, so well enunciated by Senn. The successful results advanced in this treatment have been directly proportional to the accuracy of the reduction obtained and the ability to maintain adequate fixation of the fragments. The enthusiasm gradually waned out for this plaster technique, as it required prolonged immobilisation in old people, causing bed sores, plaster sores, and stiff knee joints after removal of the plaster. Even at the end of several months of this plaster misery, the fractures have not united in many cases.

Then Smith Peterson with his epoch making contribution of the three flanged nail for intramedullary fixation, came into the field, which was definitely an advance over the previous methods. This has done away with the plaster spica and the consequent stiff knee joints have been reduced. An advance over this is by Johnson, who introduced the cannulated nail, which can be introduced without Arthrotomy. This method has lessened the operative mortality, and avascular necrosis of the head of the femur, due to the interference of blood supply during operation. As a modification to the three flanged nail pins screws and nails have been introduced by various surgeons and have been extensively used in an attempt to procure better internal fixation. These technical devices have not introduced any new therapeutic principles, but represented the modifications in the method of accomplishing the basic purpose of internal fixation.

The introduction of Arthroplasty by Smith Peterson by vitallium cups and by Judet with acrylic-resin prosthetic heads, have found some enthusiasts to replace the fractured head completely by these artificial heads. The end results of these operations have not been satisfactory to prove

their superiority over the three flanged nail. The introduction of bone grafts, either along with the nail or in place of the nail have been tried in a few cases. The operations have not been in sufficient numbers to prove its worthiness or otherwise.

In the following pages are given end results of sixty unselected cases of intracapsular fractures of neck of femur, which have been treated by Smith Peterson nail operation during 1949—1953, at Government General Hospital Madras, and the end results have been compared with those of others.

Hospital Statistics :

Statistics for the year 1950—1951 have been collected from the available material from the case sheets of fracture neck femur.

Total number of cases admitted in all surgical units six in number. 90 cases

Total number of cases admitted in Orthopaedic unit alone. 100 cases

The present review consists of those 100 cases admitted and treated in the Orthopaedic department alone during one year.

Out of these 100 cases, 34 cases i.e., roughly 1/3 of the total were discharged otherwise, as they were unwilling to stay in the Hospital, and probably have gone to the Bone Setters.

Varieties of fractures are as follows :—

1. Inter-trochanteric fractures	33
2. Transcervical fractures	21
3. Un-united fractures neck femur.	6
4. Abduction fractures	3
5. Discharged otherwise cases	34
6. Deaths	3

Age incidence of the fracture neck femur :—

1. Below 18 years	6
2. Between 18 to 40 years	22
3. Between 40 to 50 years	16
4. Between 50 to 60 years	24
5. Between 60 and above	32

Sex Incidence :—

1. Males	58
2. Females	42



Fig. 1.

Fig. 2.

Fig. 3.

Figs. 1, 2 & 3. Varadarajan. Clinical photo after S.P. Nailing operation.



Fig. 4.

Fig. 5.

Figs. 4 & 5. P. V. Krishnan. P.O. Clinical photo. Three months after operation.

It is difficult to draw conclusions as regards the incidence of each type of fracture. Approximately they are as follows :—

	Bonin's Figs
Abduction fractures	3% 4%
Transcervical fractures—(all un-united fractures of this series & 1/3 of the discharged otherwise cases, included).	40% 33%
Intertrochanteric fractures.	57% 63%

This series carried only 3% mortality and in all the three cases Uraemia was the cause of the death.

Pre-operative preparation of the patient :

In all cases it is better to wait until the patient gets over the shock of the original fracture. Meantime a thorough examination of his respiratory and cardio vascular systems is done. Urine is examined for albumin and sugar and deposits. Blood urea is estimated and blood pressure re-

cordings are maintained. All this data is required, to find out whether the patient is in a fit condition to undergo the operation. The patient's skin is prepared for a period of three days prior to the operation at the site of operation.

Operation :

Position of the patient : The patient is placed in Albee-Compeer's table and anaesthetised. This table is good for easy manipulation and gives room for all later procedures, such as lateral radiography. After anaesthetising the normal leg is fixed to the leg extension.

Anaesthesia : Any anaesthesia such as spinal or general, gas and oxygen, or local or any combination can be used depending upon the patient's condition. In this series all cases have been done under general endotracheal anaesthesia, with gas and oxygen and ether. In a few cases local was supplemented by gas and oxygen anaesthesia. This was very satisfactory and gave the required amount of relaxation without producing undue flaccidity. Spinal anaesthesia was tried in the beginning and was abandoned as it produced too much relaxation of the muscles causing distraction of the fragments.

Manipulative reduction : The fracture is reduced in many cases by Whitman's technique. It was found to be very satisfactory. In a few cases Leadbetter's method also was used. In this technique undue distraction was obtained in some cases. In one case this technique produced a fracture of the shaft of the femur, and as such this was given up later.

Difficulties in correct reduction : Too much distraction of the fragments producing wide gap between the neck and the head of the femur.

2. As there is no control over the upper fragment tilting of the head occurs making accurate reduction impossible in some cases. This can be avoided if the reduction is carried out step by step methodically, i.e., after sufficient traction, and internal



Fig. 6.

X-ray prints of P. V. Krishnan. Shows fracture.

rotation and abduction carried out simultaneously.

Reduction of the fracture is checked by antero-posterior and lateral radiographs.

Position of the Burr-hole : A five to six inches incision on the lateral aspect of the thigh near the greater trochanter is made and the shaft exposed.

The position of the Burr-hole and the subsequent position of the nail is determined in the following way. A straight line is drawn on the reduction X-ray picture, through the head and neck, and shaft of the femur exactly in its centre. The line cuts the surface of the cortex usually below the base of the trochanter, the distance of which is estimated and also the angle at which it cuts the cortex is noted. It gives the rough idea of the angle at which the guide wire should be introduced.

The Burr-hole is accordingly placed exactly at the middle of the transverse diameter of the femur. There is a definite advantage of making a Burr-hole as it will be easier to pass guide wires and manipulate easily. The argument that the nail loses its grip in the cortical bone is too far fetched as this is never too big a hole, and there is always sufficient cortex to keep the nail in position.

Guide Pin : There are many directing apparatus described such as Engle-May guide, Hey-grove's guide, Westcott and Rendu guide. These are more complicated than the easiest method and give more trouble rather than accuracy.

The following method has been worked out and found to be very satisfactory in all cases. An ordinary metal setsquare contained in the schoolboy's mathematical instruments box is sterilised and utilised to serve as a guide to give the correct inclination at which the guide wire is to be passed in relation to the shaft of the femur. Usually the shaft neck angle is between 120 degrees to 130 degrees. The correct angle in the particular case is estimated in the anteroposterior view of the radiograph, after reduction. The setsquare is held by the assistant against the lateral surface of the shaft of the femur at the point of the Burr-hole. The guide wire is introduced into the Burr-hole at the measured angle in the direction of the centre of the hip joint, which is marked by a finger on the femoral artery at the level of the inguinal ligament and in a horizontal level to the ground. An experienced surgeon can feel the resistance of the cortex. Usually the guide wire goes in about $2\frac{1}{2}$ " to 3" in length. Another guide wire is passed in a slight different angle with the above precautions. The guide wire used in the above operation is of Watson-Jones type. The Kirshner's wire is very flexible and so does not enter in the proper direction. The nail which will be threaded on this guide wire may change the direction because of its lack of rigidity. Watson-Jones guide wire in addition to its strength is graduated for helping in calculating length of the S.P.

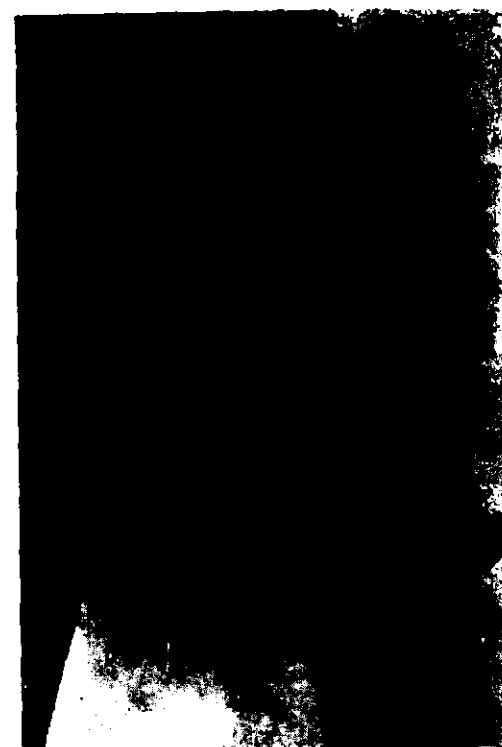


Fig. 7.



Fig. 8.

Figs. 7 & 8. A. P. Lat. after Nailing.

Nail to be used. There is one disadvantage with regard to this procedure. In practice it has been our experience that if the guide wire is not properly centred in the neck but passed nearer the surface it has a tendency to tilt the femoral head and thereby disturb the perfect reduction which was obtained earlier. There is no way to diminish this danger except to strictly adhere to the smallest details such as proper planning of the Burr-hole, and aiming the direction, so as to ensure the proper centering of the guide wire from the very beginning.

The position of the guide wire is checked by both antero-posterior and lateral radiographs. The guide wire which is in the centre of the neck in both views is selected for threading the S.P. Nail.

It is always better to accept a pin which is a little posterior and downwards in the

neck. The danger of the nail which is placed anteriorly and little upwards, is that it ploughs its way out due to the strain caused by the external rotation, and adduction of the limb respectively. In these cases it was possible to accept one of the guide wires which have been introduced in the first instance without being tried for a second time, thereby diminishing the operation time.

Length of the nail : In this series there was no occasion to use more than $3\frac{3}{4}$ " nail in any case. Average nail used is 3" in length, and in small boys it was $2\frac{1}{4}$ " in length to avoid piercing the epiphysis of the head which may result in its early union, thereby resulting in shortening of the limb.



Fig. 9.

Three months after showing the gap filled up. Clinical photo taken at that time. S.P. Nail has not been allowed to pierce the epiphysis.

The final position of the nail was always checked by the two views and the wound is closed.

Post-Operative Care :

In all cases it was uneventful recovery. Convalescence was very much smooth indeed. Penicillin was given for 5 days twice a day intramuscularly, 4 lakhs a day. The limb is supported in natural position avoiding eversion by means of sand bags or the aid of a boot with a splint is utilised. After 24 hours the patient sits up in the bed and after 48 hours gentle passive movements are started twice a day on the operated limb. The knee ankle and the hip are exercised. After the first week the active movements of the hip and the knee are encouraged. On the tenth day sutures are removed, and every freedom of move-

ment is allowed in bed, except weight bearing.

Operation time : The average time taken is 1½ hours in this series, from the time of anaesthesia to the time of closing the wound. The actual operation is about 20 minutes and the rest of the time is wasted in waiting for the radiographs as there were no facilities to obtain rapid development of skiagrams in the theatre itself.

Complications due to nailing : (1) Inaccurate insertion of the guide wire and therefore of the nail result in fracture and extrusion of the nail. The correct position of the guide wire must be ascertained by skiagrams and then only the most centrally placed wire must be selected for nailing to avoid the most above discrepancy.

(2) In-accurate reduction of the fracture results in bad nailing and mal-union.

(3) The shorter nails will break through the head because of the adduction strain, and as such proper length of the nail is essential for good union.

(4) The use of a too long nail will penetrate the joint and the acetabulum into the pelvis thereby causing complete destruction of articular cartilage and limitation of the movements. In one case in this series a 4½" nail has been driven due to the nurse handing over the wrong nail instead of 3½" nail. The check X-ray pointed out the mistake and promptly the nail was removed, and the proper length nail was inserted. Unfortunately this case could not be followed to know the end result, as the patient never turned up to the follow up letters.

(5) Tilting of the femoral head occurs if the guide wire traverses eccentrically. This can be avoided by placing the guide wire exactly in the centre of the head and neck.

(6) Extrusion of the nail : This occurs in many cases when the fracture unites. This is due to slight absorption at the site of the fracture, and permits the fragments to be in apposition till union takes place. The use of Pidecock's pins, to prevent

extrusion is to be avoided as it is likely to keep the fragments separate after the inevitable absorption at fracture site, and it may delay union or may result in non-union.

(7) **Fracture of the nail :** This commonly occurs due to early weight bearing before the fracture has actually united. So far no such case was seen in this series.

(8) **Corrosion of the nail :** This has not been noticed in this series so far. Jacob Keelawaski has reported a series of 426 cases in which 3 nails were corroded. He observed that the corrosion is due to faulty technique in the manufacture of the nail. Chromium coating was not proper. In all these cases corrosion has occurred after the union of fracture. He made a plea for the removal of the nail soon after the fracture has united.

In this series we had one bad nail which while impacting got curled up one of its flanges. This case ended in non-union.

(9) **Removal of the nail :** It is better to remove the nail because of subsequent danger of corrosion or fracture, usually 1 to 2 years after the operation. In this series we have removed four nails in four cases, two of which after the fracture has united, and the other two because of non-union.

DISCUSSION

A tabular statement of the interesting features of all cases is appended.

Age of incidence :

Age	Males	Females	Total
0 to 10 years	nil	nil	nil
10 to 20 "	14	1	15
20 to 30 "	4	2	6
30 to 40 "	2	nil	2
40 to 50 "	10	4	14
50 to 60 "	9	5	14
60 to 70 "	3	2	5
70 to 80 "	2	1	3
80 to 90 "	nil	1	1
	44	16	60

The average age is 41 years, youngest being 11 years and eldest being 85 years. The largest group was between 40 and 50, and there are 19 males and 9 females in that group. The average age is far too low to that of Mason's figures, which is 78 years. In Mason's series there were no younger age group patients.

The interesting features in this series are the incidence of the fractures in age groups between 10 and 20 years, totalling 16 patients of which one is a female patient. Ingram and Bachynaski, (1953) have reported on 24 cases of hip fractures in children between the ages of 2 and 16 years. Out of the 24 cases of this series 11 cases were of transcervical fractures. The present series contains 15 cases but slightly of a higher age group. Ingram and Bachynaski have reviewed the treatment that has been followed by other surgeons such as Wilson, Carrel and Carrel, Colonna, all of them advocated without reservation the treatment by plaster spica method, after manipulative reduction. These authors raising an objection to the above type of treatment and to the introduction of three flanged nail have advocated the use of Knowle's pins 2 or 3 to be introduced in the same way as that of S.P. nails. They also state that the femoral neck in children is denser than in old people and as such when the three flanged nail is driven through the firm cancellous bone of the child, it makes the passage of the nail very difficult and also produces wider gap between the fracture lines, as compared to adults where the bone is soft, and the nail can be introduced with ease without producing distraction of the fragments. We confirm the above findings but we are of the opinion that the gap in children gets filled up without any difficulty. We are in agreement with William T. Green, of children's Hospital Boston who stated that it is much better to use the small size three flanged nail without introducing it into the epiphysal plate lest it produces early union and consequent shortening. He is of the opinion that three or four nails of the type

of Knowle's pins are bound to produce arrest of the epiphysial growth. Ingram and Bachynski also stated that the Knowle's pins have been passed through the epiphysial plate in all their cases and it did not materially affect the prognosis of the cases. In this series we have used three flanged nails of smaller lengths and we have taken care to stop the nail below the epiphysial plate so that it may not pierce.

There is unanimity in reports by all surgeons except by Green that the avascular necrosis of the head of femur is very common in children. But we failed to see this complication in any of our cases, even at least in one, where because of the bad nail the operation was a failure and even though the maximum number of cases were operated during the second month of their injury. Except for the failure of one case due to bad nail, all other cases in this younger age group were successful and the fractures were united without any difficulty and much earlier than in old people.

Sex Incidence :

In this series the sex incidence is as follows :

Males	44	73%
Females	16	27%

The above percentages compare fairly with those of Mason's series.

Nature of Violence :

The nature of injury is trivial in all elderly people. As stated by many this fracture is due to muscular violence and not due to direct injury. Smith of Milwaukee has proved beyond doubt that this fracture is due to muscular violence.

We are in agreement with Ingram and Bachynski that in younger patients the nature of violence is that of direct injury. All our cases gave the history that they fell down either from a tree or from a wall the average height being 15 ft.

Duration of the fracture :

Age	Duration of fracture less than					
	1 week	2 weeks	1 month	2 months	3 months	not known
0 to 20 years	nil	2	2	9	nil	1
21 to 40 "	2	3	nil	nil	1	1
41 to 60 "	26	nil	1	nil	nil	4
61 to 80 "	4	2	1	nil	nil	nil
81 & above	1	nil	nil	nil	nil	nil

Except ten cases which were of duration between 2 and 3 months the rest were all recent fractures. These late comers belong to the younger age group who having tried the various methods of treatment came to the hospital for final trial of treatment. Surprisingly enough the end results, i.e. the union of the fractures were very good. Another interesting feature was that in none of the cases there was absorption of the neck or avascular necrosis of the head which was a common complication in late cases.

Time of operation :

In all cases the operation was performed within ten days of admission into the hospital, by which time the investigations used to be finished.

Traction to the fractured limb :

During the waiting time no case has been put in traction apparatus, or in Thomas's splint. The limb was supported by means of sand bags only. Mason's series contains half the number of cases that were treated either by skeletal traction or by skin traction prior to the operation for an average period of eight days. This was done with the idea of diminishing avascular necrosis due to injury to the blood vessels which might occur due to repeated trauma on movements and to ensure good union. He stated that the end results have not in any

been altered by this method, as the cases without traction also united in about the same time and avascular necrosis was not prevented in those cases in which traction was applied. We agree with the above findings though we have not used traction in any case. It was not found difficult even in old cases to reduce the fracture correctly under anaesthesia, thereby showing that there is no effective contrature of the muscles.

Time of union :

It was not possible to note accurately the time of union in any case in this series. Due to want of beds cases have been discharged with instructions to report every month but patients reported at their convenience sometimes after the fracture has united. Roughly the average period taken in elderly people was found to be 4 to 5 months, and in young people 2 to 3 months.

Avascular necrosis :

This complication was much dreaded and every author in their series has recorded a fairly high percentage of avascular necrosis. Mason has reported 21 cases of avascular necrosis out of 91 cases. This is about 23%. Our figures are 4 cases out of 42, i.e. about 10%. In younger age groups Ingram and Bachynski reported 17 cases of avascular necrosis out of the total 24 cases. Carrel and Carrel reported 33% in their cases. The low incidence of avascular necrosis in our series cannot be explained. Probably this may be due to the incidence of the fracture in younger age groups average being 41 years, and the maximum number of cases being between 40 and 60 years as compared to Mason's series in which the average is 76 years, thereby postulating that the blood supply in younger ages is far better than in older patients. The complete absence of avascular necrosis of the head in younger age groups is still to be explained.

Mortality :

In this series there is no mortality due to operation or in the near post operative

period. Mason's series recorded two immediate deaths and 7 remote deaths.

Results :

The following is the final assessment in 60 patients :—

	No. of cases.	Percentage.
Union	37	62%
Non-union	5	8%
Not known	18	30%

Below is shown the various percentages recorded, of union of the fracture for the purpose of comparison.

Authors		Number of cases reviewed	Percentage of union
1. American Orthopaedic association committee	1939	1488	89.4%
2. do	1941	144	70%
3. Eyer Brook & Priddie	1941	75	70%
4. William & Mclean	1952		75%
5. Mason M.L.	1953	100	58%
6. Present series	1954	60	62%

The figures are self-explanatory. Though we are not able to record high percentage as that of American authors we are in agreement with Mason's figures. We have taken all the not known cases as failures for purposes of calculation. Probably some of the cases in them might have united. It was not possible to assess the actual good results as shown by the return of the patients to their jobs as was estimated by Mason, who has reported that only 41% of the total cases were able to go back to their jobs, even though 58% of the cases of fractures have united. Another interesting finding of Mason was that 13% showed non-union but returned to normal work without any further operative treatment. The rest of the series never recorded the number of actual cases that have gone back to pre-injury employment.

Causes of failure :

Many authors have catalogued various reasons such as inexperienced surgeon, in accurate reduction, improper length of the nail either too long or too short, inaccurate position of the nail in the head, extrusion of the nail earlier than the union of the fracture, avascular necrosis etc., as the causes of failure. Though these are some of the causes they are not solely responsible in every case for non-union. There is still some unknown cause which is responsible for non-union, in an ideally performed operative case. This clearly shows that the answer for the treatment of fracture neck femur is not yet found. No doubt at present it is the best operative procedure available for the surgeon and with confidence he can give a good prognosis, for every other case of intracapsular fracture neck femur.

Problem of un-united fracture of the neck :

It still remains as an "unsolved fracture". Many attempts have been made to solve this problem and each surgeon has described a new operation which in his hands proved good but never stood the test when performed by others. To mention a few of these operations, as reconstructive operation by Whitman, Brackett and Colonna etc., and Osteotomy by McMurray, Shands, Geometrical by Dickson, Bone grafting operations, and Arthroplasty operations by Smith Peterson and Judet have all been described. All the above operations have been tried by many surgeons, but the end results were not very satisfactory. The very fact that there are a number of operations, is an indication of their failures.

Just at the time, when cup Arthroplasty operation of Smith Peterson was showing the signs of dissatisfaction, Judet has described acrylic prosthetic head arthroplasty operation, and even recommended this operation for replacing the fractured head, in recent fractures. Oregan of Manchester, reported a series of 65 cases thus treated, and stated that the results were in no way better than the S.P. nail operation, and

recommended that it should not be done as a routine, in every case of intracapsular fracture.

Dickson of Cleveland made a fervent appeal not to replace the head by artificial prosthetic heads as it will never be a better one than the natural one. We are in agreement with this view, that operations which will replace the normal head, must be abandoned as no artificial one will ever be equal to a natural bone.

Saha of Calcutta has described an Osteosynthesis of femoral neck operation by using tibial bone grafts, in an 'L' fashion introduced in place of the S.P. nail. He has reported only three cases, in which this operation has been done, which is too small a number for any confirmed opinion. Dickson has reported good union after cancellous iliac bone grafts were made in un-united fractures of the femur. He sometimes combined the graft along with Jewett nail in the treatment of these fractures, and has reported good results in all cases.

We have tried in six cases of un-united fractures an osteotomy operation of McMurray. The patients are not satisfied with the result and many of them complained more about the stiffness. Pain in the hip was not relieved, inspite of the good union by the osteotomy as shown by the skiagram. Unlike the western people, our people require more mobile hip joints for their daily activities.

We have seen some cases where they refused operation of S.P. nail and left the hospital some years ago, at the time of examination now they were able to walk fairly long distances, of course with a marked dipping of which they were not worried. All of them had fair movements of all joints. This probably is the answer for all people who can withstand a little pain without much disability. In these patients the trochanter has travelled upto the ilium after the absorption of the neck and was well hitching against the bone which gave support for walking. The same thing must have happened to those patients of Mason's series who had a good functional result even though the fracture was un-united.

Conclusions :

No doubt the S.P. nail operation has stood the test till date, and no other procedure has replaced it so far. The advantages of this operation are :

(1) The fracture is immobilised by internal fixation.

(2) The patient may become mobile and pulmonary complications may be avoided.

(3) The plaster of paris sores are non-existing and bed sores are largely prevented.

(4) Muscle atrophy can be minimised and knee stiffness avoided.

(5) Nursing becomes easier and relatively painless.

(6) The period of hospitalisation is considerably reduced.

Till such time that some better procedure is known, this is the only operation of choice for intracapsular fracture of neck of femur.

ACKNOWLEDGEMENT

My thanks are due to Dr. V. R. T. Swamy, M.S., F.R.C.S. (Eng.), M.Ch. (Ortho.), Professor of Orthopaedics, Govt. General Hospital and Madras Medical College for permitting me to include some cases operated by him and for guiding me in some cases, also for giving permission to publish the material. My thanks are also due to the Dean, Govt. General Hospital, Madras for allowing me to publish this material.

REFERENCES

1. Campere.: Year book of Orthopaedics and Traumatic Surgery, 1950.
2. Watson Jones.: Fractures and Joint Injuries, 1948.
3. Mason, M. L.: Intracapsular fractures of neck of femur. Brit. Jour. Surg. Vol. XL: 163, March 1953.
4. Williams, D. O. and Mclean, E. K.: Fracture neck femur. Brit. Med. Jour. Pp. 580-582, March 15th, 1952.
5. Eyre Brook, A. L. and Priddie, H. K.: Fracture neck femur. Brit. Med. Jour. Surg. 29: 115, 1941.
6. Fractures Committee of American Academy of Orthopaedic Surgeons — statistical report. Bone & Jt. Surg. 21: 43, 1939.
7. Ingram, A. J. and Bachynski, B.: Fractures of hip in children. Bone & Jt. Surg. 35-A: No. 4, Oct. 1953.
8. Dickson, J. A.: The Unsolved Fracture. Bone & Jt. Surg. 35-A: No. 4, Oct. 1953.
9. Truetta, J. and Harrison, M. H.: Normal Vascular Anatomy of femoral head in adult man. Bone & Jt. Surg. 35-B: 1953.
10. Smith, L. D.: Milwaukee—Hip fractures—the role of muscular contraction. Brit. Jour. Surg. 35-A: April, 1953.
11. Gegan, C. F.: Manchester — The use of acrylic head prosthesis in high fractures of femoral neck. Bone & Jt. Surg. 36-B: August 1954.
12. Saha, A. K.: Osteosynthesis for recent and old fractures of femoral neck. Ind. Jour. Surg. 14: No. 2, June 1952.

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OSTEOPETROSIS WITH HYPERTELORISM AND SYNDACTYLISM

by B. RAMAMURTHI and K. M. PILLAI, Madras.*

Osteopetrosis or marble bone disease was first described in 1904 by Albers Schonberg¹ and is also known as Albers Schonberg disease or marble bone disease. It is an anomaly of osteogenesis of unknown origin though there is a definite familial tendency.

The chief features of the disease are the excessive density of most or all the bones of the skeleton with or without excessive fragility. The skull is also affected, chiefly the base. This may lead to a narrowing of the optic canal causing optic atrophy and blindness. The association of orbital and maxillary deformities may lead to a progressive proptosis (Clifton, Frank and Freeman²). Narrowing of the auditory canal may lead to deafness though this is not very common. Other associated deformities like Hydrocephalus, nystagmus, etc., may also be noticed (Fairbank³).

Radiologically almost all the bones of the skeleton show excessive density with thickening of the cortex and narrowing of the medullary canal. All biochemical investigations have proved normal. There is a secondary anaemia.

Hypertelorism was a term introduced by Greig⁴ in 1924 to describe a wide separation of the two eyes with a broadening of the nasal bridge. Greig established that this condition was due to an enlargement of the lesser wing of the sphenoid bone which may be caused by many factors. This abnormality of hypertelorism may rarely occur in osteopetrosis due to the abnormal thickening and enlargement of the lesser wing of the sphenoid bone.

Association of syndactylism with osteopetrosis is very rare. There has been only one report of syndactylism associated with osteopetrosis. Higginbotham, N. L. and

Alexander, S. F.⁵ 1941 reported four cases of osteopetrosis in one family of which three showed syndactylism. There has been no other report of this association in the available literature.

The following case is reported because of the rarity of association of syndactylism and hypertelorism with osteopetrosis because of all the typical features seen in this case of osteopetrosis and because of a new line of treatment tried.

CASE REPORT

Mrs. B., age 29 (NS. No. 5288) was admitted in the Neurosurgical Unit, General Hospital, Madras on 9th September 1955 for a complaint of deafness of 6 months duration with a four months history of headache preceding the deafness. The patient developed buzzing in the ears 9 months ago which was followed by a gradually increasing deafness. Since two months the headache has been severe and the vision was getting dim. The headache was bilateral and also continuous.

On examination the patient was found to have a very broad forehead with a receding hair line. The distance between the inner canthi of the two eyes was much more than normal thus presenting a typical picture of hypertelorism (Fig. 1). The interval between the teeth was considerably increased. She had also syndactylism (Fig. 2), of the middle and ring fingers of both the hands and the third and fourth toes of the left foot.

The optic discs were pale, the right more than the left. The visual fields were constricted. The patient had bilateral deafness for both nerve and bone conduction.

The patient was married and had three children all alive and healthy. No history of a similar complaint was elicited in the family or in the patient's ancestors. The following investigations were done. There was no albumin or sugar in the urine and no cells or casts.

Blood VDRL Negative. W.B.C. 12,400. R.B.C. 3.15 million. Hb. 65%. P.C.V. 30. M.C. Hb. 37. M.C.O. 6.5 C.N. Platelet count 110,000. Blood cholesterol 137 mgms.%.

Serum Calcium 11 mgms%. Serum inorganic phosphate 2.23 mgms%. Alkaline phosphatase 15 units. Acid phosphatase 0.5 units. Urine Calcium 11.6 mgms%. Volume of Urine in 24 hours 1350



Fig. 1.

Note the increased distance between the inner canthi of the eyes and the increased spacing between the teeth.



Fig. 2.

Shows syndactylism.



Fig. 3.

X-rays of the skull showing increased density of bone.



Fig. 4.

X-ray of lumbar spine showing increased density of bone.

c.c. Total calcium elimination per day 15 grms. B.M.R. plus 7%.

X-rays of the skull showed enormous thickening of all the bones of the skull including the bones of the vault (Fig. 3). The other bones were X-rayed and all of them showed an enormous increase in the density with no differentiation between the cortex and the medulla (Fig. 4).

The diagnosis from the X-rays was obviously one of osteopetrosis or Albers Schonberg Disease.

The peculiarity of the case lies in the fact that hypertelorism and syndactylism were associated

with osteopetrosis. Such an association has been reported only once before.

As there has been no known treatment of this condition, the patient was put on a decalcifying treatment in the hope of reducing the pressure on the optic and auditory nerves. She was given 30 grains of Ammonium chloride per day and 500 units of vitamin D. All articles of diet containing calcium were eliminated as far as possible. Though it was a difficult diet to be liked, the patient co-operated and persisted.

At the end of 4 months the patient reports improvement in vision. The radiological and bio-

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chemical features are unchanged. Only the urinary calcium excretion showed an increase (25 grms. per day from 15 grms. per day).

DISCUSSION AND SUMMARY

This patient showed the typical radiological features of osteopetrosis. Her chief complaints were deafness and gradually diminishing vision. There was an associated anaemia. All the biochemical investigations were normal.

The clinical photograph showed the increased spacing of the teeth due to the increasing size of the mandible.

The hypertelorism was explained by the increasing size of the lesser wing of the sphenoid bone.

Because of the excessive calcification, a new line of treatment of decalcification was tried. The patient was given large dose of ammonium chloride and Vitamin D and was put on a diet excluding as far as possible all calcium containing articles of food. In three months time, the patient showed

some improvement in vision and hearing. X-rays of the skull after 3 months showed almost the same density of the skull and the serum calcium and phosphatase level was the same, though there was increase in urinary calcium excretion. It is difficult to predict how long such an effect will last if the dieting and decalcifying treatment are stopped.

REFERENCES

1. Albers Schonberg Munich Med W. V. 365, 1904.
2. Clifton, Frank and Freeman.: Am. J. Dis. Child. 56: 1020, 1938.
3. Fairbank, T.: Atlas of General affections of the skeleton. Edinburgh and London. E. & S. Livingstone. Pp. 31-48, 1951.
4. Greig.: Edinburgh Medical Journal. 31: 560, 1924.
5. Higginbotham, N. L. and Alexander, S. F.: Osteopetrosis—four cases in one family. Amer. Jour. Surg. 53: 444-454, 1941.

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ISOLATED FRACTURE OF THE FIRST RIB

(A Case Report)

by JAMES R. DONALDSON and CYRIL E. MARSHALL, Miraj.

An isolated fracture of the first rib is so infrequently encountered that it is apt to evade one's notice. Lying deep at the base of the neck and protected from direct trauma by the shoulder girdle the first rib enjoys a position of security. Few cases have been reported in the literature.

The importance of the fractures of the first rib lies in the fact that serious complications can occur. Among these may be listed abscess formation, rupture of the apex of the lung, pleurisy with effusion, haemorrhage, nerve pressure, and Horner's syndrome.

Breslin, in 1937,¹ reported on five cases and reviewed twenty seven others recorded in the literature. He reviewed the various aspects of the problem such as the anatomy, mechanism, pathology, symptoms, complications, and treatment of these fractures. He mentions that the commonest complaint was a "sticking pain" in and about the shoulder following severe trauma in a patient in whom, cervical, clavicular, scapular and humeral fractures have been ruled out.

In 1938 Outland² reported a case of bilateral first rib fracture following an automobile accident with uneventful recovery. The treatment given was bed rest for three weeks.

Lane, the English Anatomist, mentioned three ways in which the first rib could be fractured: (1) as a result of indirect violence by a force from behind being transmitted through the clavicle; (2) direct force from behind; (3) indirect force transmitted through the manubrium of the sternum. To these we would like to add a fourth mechanism, namely: muscular violence. We will illustrate this fourth mechanism with a case report.

CASE REPORT

J.R.H.M., a male physician of 54 years, while crossing the Indo-Goan border had to transfer heavy baggage. While lifting a heavy box on to his shoulder he felt a sudden excruciating pain in the left upper chest, followed by breathlessness

and faintness. These symptoms were relieved with coramine and coffee. The pain persisted but the patient preferred to ignore it, and about six weeks later he began to experience pain in the left side of the neck and in the left shoulder and arm. The pain increased in severity and radiated down to the tips of the middle and ring fingers. At this time there was a feeling of "something filling" the left upper chest. This prompted the patient to have an X-ray taken which led to the diagnosis of fracture of the first rib at the costo-chondral junction on the left side (see reproduction). With restricted activity the symptoms have become less, but have not completely disappeared. At the time of writing, six months after the accident, he is still having mild symptoms occasionally, with many pain free days intervening, between the episodes of radiation to the neck, and arm. These have not been severe enough to incapacitate him in any way.

SUMMARY

Isolated fracture of the first rib is an unusual condition. A case has been described which illustrated a new mechanism not previously mentioned in the literature.

BIBLIOGRAPHY

1. Breslin, F. J.: Fractures of the first rib unassociated with fractures of other ribs. Am. Jour. Surg. 38: 394, 1937.
2. Outland, T.: Fractures of the first rib unassociated with fractures of the other ribs. a Case Report. Jour. Bone & Jt. Surg. 20: 492, 1938.



Fig. 1.
Isolated fracture of the first rib.

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THE SURGICAL TREATMENT IN LEPROSY WITH SPECIAL REFERENCE TO TENDON TRANSPLANTATION*

by JAMES R. DONALDSON, CYRIL E. MARSHALL and
W. B. SHIRALKAR, Miraj.*

Although leprosy patients suffer from all the conditions which afflict non-leprosy patients, including trauma, various infections, and intestinal complaints, many of which require surgical treatment, there are a few surgical procedures which are especially useful in case of the patient with leprosy. These procedures are, rhinoplasty, tarsorrhaphy, iridectomy, nerve stripping, metatarsectomy, and tendon transplantation. We intend to limit our discussion to the last operation mentioned, namely tendon transplantation.

The purpose of tendon transplantation is to re-establish a more effective muscle balance and thereby improve the function of that portion of the extremity which is involved. Dr. Paul Brand, of Vellore, pioneered the application of this technique to leprosy. In order that we may approach transplantation procedure intelligently we must have some idea of the pattern of nerve involvement so that we may know what groups of muscles we can depend upon to take the place of those that have become paralysed.

I. UPPER EXTREMITY

In the upper extremity the ulnar nerve is involved at the level of the elbow, and the median nerve is involved at the level of the wrist. The radial nerve is usually involved below the elbow. Therefore the following muscles may be paralysed:

- (a) all the intrinsic muscles of the hand.
- (b) flexor carpi ulnaris.
- (c) flexor profundus to the little finger, uncommonly.
- (d) flexor profundus to the ring finger, very rarely.

- (e) extensors, in less than one percent of the cases.

It should be mentioned that the paralysis frequently seems to start with the ulnar nerve and the intrinsic muscles of the hand supplied by this nerve may be involved while those supplied by the median nerve are still functioning well. When the picture is "full blown" it results in a "clawed" and 2 "flat" hand. By this we mean that it is not possible to actively extend the fingers at the interphalangeal joints, and that it is not possible to actively bring the thumb away from the palmar plane into opposition to the fingers. If the joints remain supple, then both these motions can be done passively. As a result of neglect the "clawing" may become fixed. Along with the loss of muscle power there is a loss of skin sensation. Because these leprosy patients do not feel pain, they neglect their minor injuries, which become infected, and the infection then spreads to the bone and to the tendons so that what should have been a minor incident becomes a catastrophe. The contractures become fixed, the fingers shortened, and in some cases when the tendon has become adherent or destroyed, there is complete loss of function.

The combination of numbness, inability to properly extend the fingers, and the inability to oppose the thumb makes for a very serious disability. We cannot do anything about the numbness except to try to teach the patient to take care of himself. We can, however, ameliorate the mechanical disability by using the sublimus tendons to substitute for the intrinsic muscles of the hand, and thus to relieve the "clawing" of the fingers, and also to restore the opposition of the thumb.

To be acceptable for operation a patient must meet the following criteria: (1) all

wounds must have healed; (2) it must be possible to extend the proximal interphalangeal joint to at least ninety degrees; (3) and the patient must want to have the surgery done.

TECHNIQUE

The hand is prepared for surgery in the following manner. The day before the operation the hand is thoroughly scrubbed and the fingernails trimmed and cleaned. On the day of surgery it is scrubbed in the same manner as the surgeon scrubs his own hands. It is then draped and a tourniquet applied.

The sublimus is released from its insertion on the mid phalanx by an incision along the radial side of the proximal phalanx of the finger, and after the tendon is identified the finger is flexed and the tendon cut. It is then split into its two tails so that when it is pulled into the palm it will not strip the paratenon from the profundus. The sublimus is then dropped into the wound and the same procedure carried out for the next finger. After the four sublimi have been released an incision is made along the distal palmar crease and the tendons pulled into the palm.

The sublimi are then threaded along the lumbrical canals in the following manner. All of the index finger sublimus is threaded along its own lumbrical canal and sutured to the dorsal expansion by three cotton sutures. The long finger sublimus is split back with the back of the knife to increase the length of the two tails. One tail is then used for the long finger itself, and sutured to the dorsal expansion of that finger in the same way as the index finger was. The other tail is used for the ring finger, and it goes through the ring finger lumbrical canal and is attached to the dorsal expansion as was done to the other two fingers. Care is taken to try to get the same amount of tension on the two halves of the long finger sublimus. The little finger sublimus is used for the little finger only.

The ring finger sublimus is then pulled down into the wrist through a small incision just lateral and proximal to the pisi-

form bone. It is one of the superficial tendons just under the carpal ligament. It is wrapped in a moist sponge. Another incision is then made on the ulnar side of the proximal phalanx of the thumb, and the tendon is brought to the extensor mechanism of the thumb through a subcutaneous tunnel that goes under the junction of the palmar and dorsal skin. The sublimus tendon is fixed with three or four cotton sutures.

Care must be taken to be sure that the thumb web space is supple. If it should be contracted, as it often is, a full thickness skin graft may be necessary to increase the web space and allow more effective opposition. The donor site for the skin graft is usually the abdomen.

The wounds are closed with wire. A poly-ethylene tube drain is put in the palmar incision and a pressure dressing is applied with a light gypsona cast applied with the metacarpal-phalangeal joints in 90 degrees of flexion and the interphalangeal joints in extension, and the thumb in opposition. The tourniquet is then released. The tourniquet time is about one to one and a quarter hours. A few minutes before the tourniquet is released it is our custom to give five lacs of penicillin intravenously.

The above description has been given for a "complete" hand operation. In some cases only two or three fingers may need to be done, in other cases only the thumb, and in others a "complete" hand is indicated.

It should be pointed out that for the first few operations it is better not to try to do a "complete" hand as it may take longer than an hour, and the tourniquet will have to be left on too long.

POST OPERATIVE CARE

On the second post operative day we remove the drain through a small window in the cast. The patient receives at least four lacs of procaine penicillin each day for five days. The cast is removed in three to three and a half weeks, and the wire sutures removed at that time. The patient

* Read before the Regional Conference of the Orthopaedic Section of the Association of Surgeons of India held at Patna in Sept. 1956.

is then encouraged to use his hand with special attention being paid to the care of the skin and watching for injuries of all sorts. The patient receives massage and wax baths. In both the pre and post operative care the service of the physiotherapist and the occupational therapist are of great help. Gradually over a period of about four to eight weeks the patients usually considerably better than it was before the operation was done.

II. LOWER EXTREMITY

In the lower extremity the pattern of involvement is different from the hand in that the disability is from the loss of power from certain extrinsic muscles to the foot, rather than from the loss of the intrinsic ones. Just as in the hand the loss of skin sensation allows the patient to neglect his wounds to such a degree that much tissue is destroyed.

The mechanical disability comes from the paralysis of the muscles in the antero-lateral compartment of the leg, that is the dorsiflexors and the peronei. This gives the patient a "drop" foot. Even though he develops a "high-stepping" gait he still tends to abrade his foot against the ground and to produce ulcers by friction. The wounds become infected and the cycle of a chronic foot ulcer is started. The criteria for operation are two: all wounds must be healed, and the patient must want to have the operation.

TECHNIQUE

A bloodless field is no less important in the foot than in the hand, and a tourniquet is used. The tibialis posterior tendon is released from its attachment to the tarsal navicular bone with as much length as possible. Another incision about six inches in length is made above the ankle just lateral to the tibial crest. The muscles are retracted laterally. The interosseous membrane is exposed and slit and the tibialis posterior muscle and tendon are brought into view by pressure from behind. The tendon is caught and is brought into the field. It is passed under the tibialis anterior tendon

and sutured to the bones of the foot, usually one of 'the cuneiforms,' through a third incision. The skin is closed with wire, and the ankle is placed in mid position with slight dorsiflexion and the foot and leg are enclosed in a plaster boot. As the skin is being closed penicillin is given intravenously and the tourniquet is released as the cast is being put on.

POST OPERATIVE CARE

The cast is left on for about four weeks. After about two weeks it can be re-inforced with a walking attachment and the patient allowed to bear weight. The sutures are removed at the time of the cast removal. The patient must practice rocking back and forth on the affected foot to give the posterior tibialis muscle a chance to learn a new function as it has been converted from a posterior muscle to an anterior one, and the timing of contraction is different. Here again the help of the physio-therapist to observe the exercises, and the occupational therapist to help supply repetitive motion is most desirable.

PROGRAM AT THE RICHARDSON LEPROSY HOSPITAL, MIRAJ

At our hospital all new patients are especially examined for hand and foot problems. If it is felt that we can help them, they are admitted, even though they may be bacteriologically negative. Plans are then made for more definitive treatment. If foot wounds are present the patients are put to bed. After the ulcers of the feet have healed, they are scheduled for hand or foot surgery if it is indicated. They are encouraged to protect their hands and to have dressings for even the smallest wounds. Those who want surgical help are then taken in turn. There are very few that do not request help after seeing the improvement that can be obtained. While they are waiting they have massage and wax baths and exercises for their fingers so that the joints remain supple, and the skin becomes soft and pliable. The tendon operations are done at the Wanless Hospital in Miraj and the patients return to the

Leprosy Hospital one mile away three or four days after surgery.

Post operatively the patients receive the same programme of massage and wax baths as they did pre operatively to help them limber up the joints that have become stiff from immobilization and to help them in muscle re-education. This exercise period goes on for as long as is necessary, but usually is not longer than eight weeks.

RESULTS

In the past fifteen months we have done thirty operations on twenty patients. The only serious complication has been one case of wound infection. It is the only case that we operated on in the Leprosy Hospital. Seven have had both hands done, and one has had one hand, one foot, and an arthrodesis of the metacarpophalangeal joint of the thumb of that same hand. There have been two other such operations all for instability of that joint. This instability leads to loss of pinching power, and hence needs to be corrected. In two patients too much tension was placed on the sublimi and neither patient is now able to flex properly the proximal interphalangeal joints. In spite of this both patients feel that they have been greatly helped, and are anxious to have the other hand done. The patients are very grateful for the improvement that they receive so that these

operations are exceedingly satisfying to the surgeon. Men who have been unable to work are again able to earn their own living.

SUMMARY

The techniques of tendon transplantation as they apply to patients with disabled hands and feet due to leprosy have been presented. These are worth while procedures in suitable patients. Since careful pre and post operative care and adequate surgical facilities are needed, tendon transplantations should be done only where such facilities exist.

Grateful acknowledgment is made to Dr. Brand for his help and encouragement in tackling this problem.

BIBLIOGRAPHY

1. Brand, P.: Orthopaedic Care of the Leprosy Patient. Jour. Christian Medical Association of India. Jan. 1950.
2. Brand, P.: Reconstruction of the Hand. Annals of the Royal College of Surgeons of England. 11: 350, 1952.
3. Bunnell, S.: Surgery of the Hand. Lippincott, 1948.
4. Watkins et al.: Transplantation of the posterior tibialis tendon. Jour. Bone & Jt. Surg. 36-A: 1181.

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BILATERAL FEMORAL NECK FRACTURES A COMPLICATION OF ELECTROCONVULSIVE THERAPY*

by CYRIL E. MARSHALL, JAMES R. DONALDSON and
R. V. SHIRVAIKER, Miraj.

Femoral neck fracture is commonly attributed by a patient to a fall. In fact, the older text books mention this as the cause of such fractures. Modern opinion is changing, and an increasing number of cases are being reported of hip fractures unpreceded by a fall, thus supporting the view that these fractures are frequently the result of muscular violence and the fall related by the patient is an event subsequent to the fracture.

In 1953 L. D. Smith reported on a series of experiments carried out at the laboratory of the school of Engineering of Marquette University, Milwaukee, Wisconsin. In these experiments he set out to prove the role of muscular contraction, or the "intrinsic" forces in the causation of femoral neck fractures.

It is not our intention to review his entire paper at this time, but suffice it to say that experimentally he demonstrated that forces acting along the "lines of Stress" rarely caused femoral neck fractures. In other words, forces acting vertically through the pelvis onto the roof of the acetabulum, or forces acting through the greater trochanter did not cause fracture of the femoral neck. The femur might fracture some where else, but not at the neck. However, if such forces acted directly on the neck it did break. Such forces in life can only be caused by the strong lateral rotators of the thigh acting when the limb is fixed. This may occur when a person tries to evert a fall, the limb being fixed on the ground. This is in keeping with the history which many patients with a femoral neck fracture relate.

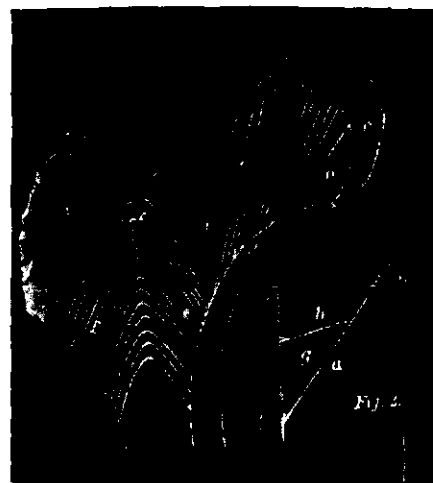


Fig. 1.

This is a diagram showing the lines of stress on the head, neck and greater trochanter of the femur. The area marked "G" shows the area of the middle of the neck devoid of these lines and known as "Ward's" triangle.



Fig. 2.

This is a roentgenogram showing the same lines.



Fig. 3.

This is a horizontal section of the femoral head and neck and greater trochanter showing the resolution of the forces of the external rotators.

- Pull exerted by the external rotators.
- Axis of rotation of the greater trochanter.
- The arc of rotation described by the greater trochanter.
- Is the element of "A" available to rotate the thigh in the acetabulum.
- Is the element useless in rotation, but exerts a compression thrust along the long axis of the neck so that the head is firmly seated in the acetabulum.

In good anterior and posterior roentgenograms of the "hip", the alignment of the bony trabeculae can be traced through the ilium down the neck of the femur to the base of the greater trochanter (Figs. 1, 2 and 3). These are the "lines of stress" mentioned above. Ward, in 1838, described these lines and pointed out the area in the femoral neck relatively devoid of these lines. This area has since been known as "Ward's triangle". It is the weakest point in the femoral neck, and most of the femoral neck fractures occur through this triangle.

In Fig. 3 we can see that when the thigh is fixed and external rotation is prevented the force "D" exerts a shearing torque along the arc "D-E" about the center "E" with a forward bending movement indicated by the arrow at "E-1". It is this element "D" which produces the fractures of the femoral neck seen clinically. There are certain points which we would like to review.

1. In the femoral neck the vertical diameter is 1/3 larger than the horizontal diameter.

2. There is an area of lessened density in the center of the neck or "WARD'S" triangle.

3. In a horizontal section the trabecular system is very rudimentary.

4. The above three factors make the neck vulnerable to the stresses in the horizontal plane.

5. The external rotation of the thigh in transverse and oblique fractures of the femoral neck is determined by the pull of the external rotators.

CASE REPORT

A man aged fifty years was admitted to the psychiatric unit of the Wanless Hospital, Miraj, with vague complaints of generalized body pains, worry, and insomnia. After a thorough physical examination and routine laboratory investigations both of which were normal he was diagnosed as a case of depressive hypochondriasis and a program of treatment with electro-convulsive therapy was planned. During the second treatment a "snap" was heard by some of the attendants, and following the treatment he complained of increased pain in both hips, with painful and limited motion. X-ray studies confirmed the impression that he had bilateral femoral neck fractures.

He was a man, who inspite of his complaints, appeared to be in good health, and had been leading a normal life up until the time of his admission to the hospital. He was started on his treatment within two weeks from his admission so there was no opportunity for him to develop bone atrophy from disuse. On the X-rays the bone texture and density appeared to be normal.

Both the hips were reduced and fixed with Smith-Petersen nails. The patient was then continued at bed rest at home, and reported to us from time to time. At the end of six months he was allowed up and walked with using crutches (Fig. 4 showing nails in place). The following month, both nails were removed and he was allowed to increase his activity (Fig. 5 takes shortly after removal). He had no complaints of pain in either hip joint, although he did feel that the left hip was stiffer than the right one.

DISCUSSION

We feel that this case demonstrates fractures of the femoral neck due to muscular

* Read before the Regional Conference of the Orthopaedic Section of the Association Surgeons of India held at Patna in Sept. 1956.



Fig. 4.

An X-ray taken six months after nailing showing the nails still in place and satisfactory healing.



Fig. 5.

X-ray taken after the nails had been removed.

violence. He had no fall. His electroconvulsive therapy was carried out without any muscular relaxant such as scoline or flaxidil so that the femoral necks were subjected to the full power of the lateral rotators of the thigh. Although there were many references in the literature to fractures and dislocations at their locations such as fractures of the vertebrae, femoral shaft, shaft of the humerus, and dislocations of the shoulder, during electroconvulsive therapy, there were no references to fractures of the femoral neck. This is to the best of our knowledge the first case of bilateral fractures of the femoral neck,

occurring during electroconvulsive therapy, and successfully treated with Smith-Petersen nailing, to be reported.

ACKNOWLEDGEMENTS

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BIBLIOGRAPHY

Smith, L. D.: Journal of Bone and Joint Surgery. 35-A: 1953.

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MONOSTOTIC FIBROUS DYSPLASIA OF BONE*

(Report on four cases)

by A. K. GUPTA, Agra.

Since 1876, when Virchow described a bone cyst and in 1891 when Von Recklinghausen described Osteitis fibrosa cystica, fibrocyst disease of bone has formed a very interesting and controversial subject for discussion amongst clinicians and pathologists and various nomenclatures have been used without any explanation about their nature or aetiology.

Elmslie (1934) classified them into five groups: (1) The bone cyst, (2) Osteoclastomata, (3) Osteoclastomatous cyst, (4) Diffuse fibrosis of bone, (5) Generalised diffuse fibrosis of bone, (6) Hyperparathyroidism and noted that these conditions showed some or all of the following changes in their pathology—(1) Lacunar absorption of bone, (2) Deposition of woven bone, (3) Fibrosis of marrow, (4) The formation of cysts, (5) The formation of Osteoclastomata, (6) Sometimes the development of cartilage. Osteoclastoma though resembling the other conditions of the group in histology, is quite unlike in clinical behaviour and should be excluded. Hyperparathyroidism is characterised by porosis of the entire skeleton, multiple osteoclastomata, cysts of new formation and fibrosis and there are characteristic changes in blood chemistry. Albright, Butler, Hampton and Smith (1937) published 5 cases with multiple cystic areas of bones, patches of pigmentation of skin and sexual precocity. The bone lesion tended to be unilateral and showed Osteitis fibrosa in its histology, and the condition has been called as "Albright's Syndrome" though the condition had been described before by McCune (1936) and Well (1922). Lichtenstein (1938) described 8 cases without extraskelatal changes and suggested the term Polyostotic Fibrous dysplasia. Jaffe and Lichtenstein (1942)

described 15 more cases and they renamed the condition fibrous dysplasia as several (9) monostotic conditions were also found. They reviewed 90 cases in literature of which 15 were monostotic. Schlumberger (1946) reviewed 67 cases of monostotic fibrous dysplasia from the U.S. Army Institute of Pathology and in none of them were any endocrine imbalance or any cutaneous pigmentation and suggested that this may be a reaction to trauma. Strassburger, Garber and Hallock (1951) reported 9 cases of which 3 cases were monostatic in one of which there was cutaneous pigmentation.

The following classification as in Table I seems a reasonable one for the practical point of view.

TABLE I

Classification of Fibrocystic Disease of Bone:

1. Simple Bone Cyst.
2. Monostotic Fibrous Dysplasia.
3. Polystotic Fibrous Dysplasia.
Albright's Syndrome — with Pathological pigmentation and sexual precocity.
4. Osteitis Fibrosis Cystica — Hyperparathyroidism.

During the last 18 months, we have across 4 cases of fibrous dysplasia — all of monostotic variety.

Clinical findings:

Age:— All of them were adolescents and the average age at which they came for treatment was 13. The highest was 16 and the lowest was 10.

Sex:— One male and 3 females. This is the proportion also found in Lichtenstein and Jaffe's series (1942).

* Read before the Regional Conference of the Orthopaedic Section of the Association of Surgeons of India held at Patna in Sept. 1956



Fig. 1.
Radiograph showing lesion in right ilium.
(B.G., aged 10.)



Fig. 3.
Radiograph showing lesion in right femur
comparison with left femur.
(K.K., aged 11.)



Fig. 2.
Radiograph of upper third of right femur
showing cystic area in upper third and
neck of femur. (K.K., aged 11.)



Fig. 4.
Radiograph of upper half of L. humerus showing
cystic area in upper end of humerus
with pathological fracture. (P.V., aged 16.)

Symptoms :

The first case (B.G. — boy aged 10) complained of limping and pain for a fortnight following a vague history of injury when first seen. On examination there was a noticeable limp and there was a shortening of half inch and wasting in right thigh $\frac{1}{2}$ inch. No abnormal findings in the hip. X-ray picture of the right side of the pelvis showed a translucent area in the ilium with delicate

septa, the rest of the pelvis was normal in texture (Fig. 1).

2. Second case (K.K. — girl aged 11) had five fractures, first at the age of seven or eight in the right femur, fractures occurring after trivial injuries. The last fracture occurred about a year before admission. She had a thickening and outward bowing of the right femur with $\frac{1}{2}$ inch of shortening. Movements of the hip were normal. The



Fig. 5.
Radiograph of upper end of left femur showing
lesion with pathological fracture.
(S.D., aged 15.)



Fig. 6.
Photomicrograph of section showing fibrous tissue
arranged in whorls and trabeculae of im-
mature bone.



Fig. 7.
Photomicrograph of section showing occasional
giant cells and high vascularity within the fibrous
tissue.



Fig. 8.
Photomicrograph of section showing loose or
oedematous fibrous tissue.

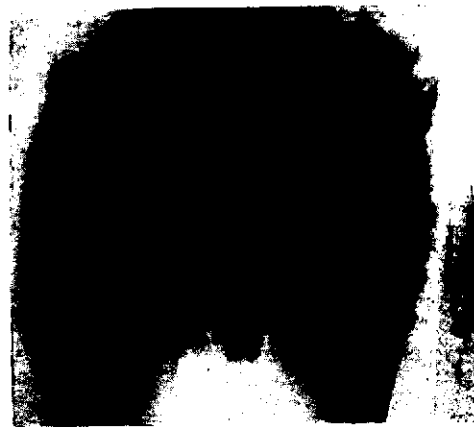


Fig. 9.

B.G., aged 10, case 1. Radiograph of pelvis 4 months after operation — cavity being obliterated.



Fig. 10.

B.G., aged 10, case 1. Radiograph of pelvis 7 months after operation.



Fig. 11.

K.K., aged 11, case 2. Radiograph of upper third of femur right, 7 months after operation (homogenous iliac chip grafts) partial obliteration of cavity.



Fig. 12.

P.V., aged 16, case 3. Four months after operation (autogenous chip grafts) complete obliteration.

skiagram of the hip and upper third of femur showed a cystic area, multilocular, occupying the neck and upper third of right femur (Figs. 2 & 3).

3. Third case (P.V. — girl aged 16) had a fall and injured left arm five weeks before admission, complained of pain: had another fall a week before admission, pain increased and was referred to us. There was swelling and tenderness over the upper

third of the left arm and movements were painful. Skiagram showed cystic area in the upper third of left humerus with pathological fracture (Fig. 4).

4. Fourth case (S.D. — girl aged 15) fell and fractured left femur nine days before admission. History of a previous fall and fracture of same bone seven years before; treatment in a plaster spica



Fig. 13.

S.D., aged 15, case 14. 2½ months after operation (autogenous chip graft) cavity being obliterated.

and union of fracture in three months. X-ray showed cystic area in left femur upper end (Dr. Vyas's case) (Fig. 5).

No extra skeletal lesion was found in any of these cases. In none of these was there any lesion in any other part of skeleton as seen in skiagram.

There was no history of injury previous to these fractures or injuries outlined above.

Radiological findings:

Bones had normal texture elsewhere and also in the affected bone except in the area of the lesion. The lesion appeared as a Radiolucent area ground glass in appearance, sometimes traversed by delicate septa. The cortex was thin and might be expanded. Pathological fractures were seen in two cases. The lesion was in the metaphysis. There was no other defect in any other bone. No soap bubble appearance was seen.

Biochemical findings:

Serum calcium, inorganic phosphates and alkaline phosphatase were normal in all cases. Haematological findings were normal.

Operative findings:

At operation it was found that the cortex was thin and easily broke away. The cavity was occupied by greyish white firm granular somewhat elastic tissue which appeared gritty in character. The texture was that of a firm rubber.

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The grittiness was due to the cancellous bone which was intermixed with it. There were no areas of cartilagenous tissue. There were no cysts, unlike a bone cyst.

Histology:

On histological examination the lesion appeared as a replacement of bone by fibrous tissue, fairly well vascularised and frequently arranged in interlacing bundles and whorls. Within the connective tissues were trabeculae of partly calcified immature bone (woven bone) occasionally there was an osteoclast but they were not so numerous as osteoclastoma (Figs. 6 & 7).

There was no cyst to be found except occasionally degeneration cysts and at places the fibrous tissue appeared loose or oedematous and trabeculae form an arch about the oedematous tissue (Fig. 8).

There was no lipoid containing cells nor any cartilage cells, as reported by Telford (1931). There was no periosteal bone formation. Presence of immature bone and absence of foam cells distinguishes the condition from non-osteogenic fibroma of the bone. There was no area of any haemorrhage found in the slides examined.

Progress with treatment:

In case No. 1 the cavity was evacuated and all fibrous tissue was removed and outer shell broken and apposed to the inner cortex. The cavity in the fourth month after operation show partial obliteration and in the seventh month shows that it is being obliterated in the greater part of its extent. The patient is without symptoms (Figs. 9 and 10).

In all other cases the cavity was in addition to removal of fibrous tissue, filled with cancellous bone grafts (iliac chip grafts). In the third or fourth case it was an autograft and in the second case homogenous graft from another patient. In the latter case the graft has taken but the cavity still persists at the bottom but the greater part of the cavity is being obliterated specially in neck and upper shaft. The progress is rather slow (Fig. 11).

This is not unknown as in Strassburger's and others (1951) series of cases; in their five operated cases bone chips were absorbed on three occasions in two cases. In the third case the cavity has been completely obliterated and condensation can be seen, four months after operation. Patient has full movement of the shoulder (Fig. 12).

In the fourth case, progress is satisfactory and at two and a half months shows that the cavity is gradually being filled up. She is still in plaster (Fig. 13).

DISCUSSION

The aetiology is completely obscure. Schlumberger (1946) stated that it may be due to previous trauma and fibrosis is a normal reaction to trauma. In the present series there was no history of any significant injury prior to the recurrent fractures in two cases and in the other two history was very recent. Chemistry is normal. Sir Henry Platt (1950) is against the use of the term monostotic fibrous dysplasia in single bone lesions as he thinks that the term should be dystrophic bone cyst. He does not think that the histology is helpful and the monostotic variety is totally different from polyostotic types. Be that what it may these cases on gross pathology show similarity with polyostotic fibrous dysplasia rather than with a simple cyst lined by a fibrous wall containing haemorrhagic fluid.

Lichtenstein (1938) suggested that fibrous dysplasia may be the result of perverted activity of specific boneforming mesenchyme and may be developmental in origin. It may be in one bone or in several bones. But the triad of changes seen in Albright's syndrome is difficult to explain except on the theory that changes in base of skull may lead to stimulation of the pituitary. Snapper (1943) on the basis of the finding that the lipid containing foam cells were sometimes found, considered the areas of fibrosis represent the final stages of a lipid granulomatosis. We did not find any lipid containing cells in the four cases mentioned and we tend to agree with Lichtenstein (1938) that it is secondary and hardly a noteworthy feature.

So to sum up, it is probably better at this stage of our knowledge, to put the three varieties of fibrous dysplasia into one group as the bone lesions are similar in pathology, and to regard them as of developmental origin.

SUMMARY

1. Four cases of monostotic fibrous dysplasia have been described.

2. Theories of aetiology of the condition have been discussed.

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REFERENCES

1. Albright, F., Butler, A. M., Hampton, A. O. and Smith, P.: Syndrome characterized by Osteitis Fibrosa Disseminata, Areas of Pigmentation, and Endocrine dysfunction with Precocious Puberty in Females. *New Eng. Jour. Med.* 216: 727, 1937.
2. Emslie, R. C.: Discussion on Fibrocystic Disease of Bone. *Proc. Roy. Soc. Med.* 28: 937, 1934.
3. Jaffe, H. L. and Lichtenstein, L.: Fibrous Dysplasia of Bone. *Arch. Path.* 33: 777, 1942.
4. Lichtenstein, L.: Polyostotic Fibrous Dysplasia of Bone. *Arch. Surg.* 36: 874, 1938.
5. Platt, Sir Harry.: Discussion on the Hip in Fibrous Dysplasia: British Orthopaedic Association Spring Meeting. *Jour. Bone & Jt. Surg.* 32B: 281, 1950.
6. McCune, D. J. (1936): Quoted by Strassburger et al (1951).
7. Schlumberger, H. G.: Fibrous Dysplasia of Single Bones (Monostotic Fibrous Dysplasia), *Military Surgeon.* 99: 504, 1946.
8. Snapper, I.: *Medical Clinics on Bone Diseases.* New York, Interscience Publishers, 1943.
9. Strassburger, P., Garber, C. Z. and Hallock, H.: Fibrous Dysplasia of Bone. *Jour. Bone & Jt. Surg.* 33-A: 407, 1951.
10. Telford, E. D.: A case of Osteitis Fibrosa (with formation of Hyaline Cartilage). *Brit. Jour. Surg.* 18: 409, 1931.
11. Weil (1922): Quoted by Strassburger et al (1951).

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The XVIII Annual Conference of the Association of Surgeons of India will be held at Indore on the 19th to 31st Dec. 1956 inclusive. Dr. B. B. Ouch, M.S., F.R.C.S., Professor of Surgery, M. G. M. Medical College, Indore, is the Local Secretary and members will receive individual intimations regarding details and exact dates of the Conference from him in due course.

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Besides these, the following Anaesthetic papers will be read at the Conference in conjunction with the above papers:—

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2. Anaesthesia in Surgery of Spine
by Dr. S. K. Baskin.
 3. Anaesthesia in Pediatrics
by Dr. M. S. Kohli.
- In addition to the above a few "Short Papers" will be read at the Conference.

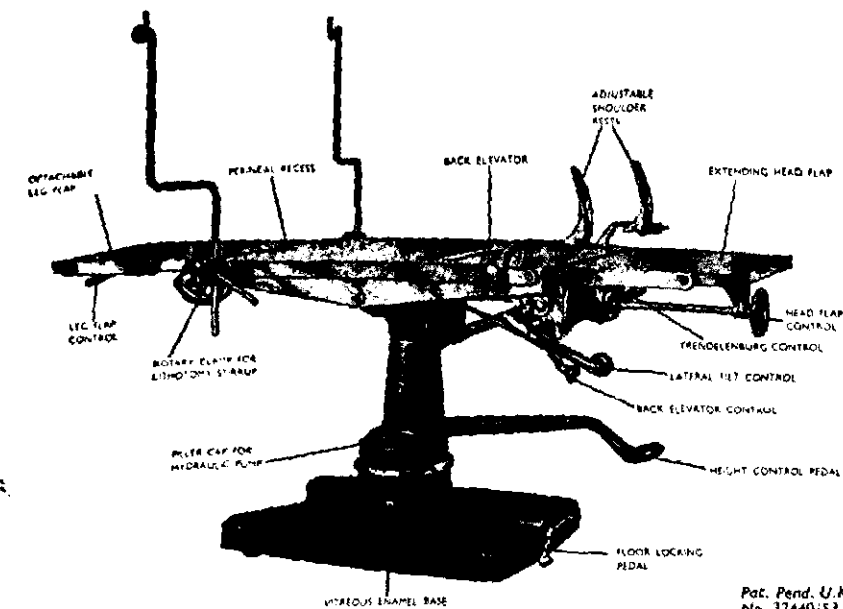
Subjects for discussion at future meetings

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 1. Non-malignant Stricture of Oesophagus
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 3. Tumours of the Testis
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- 20th Meeting:
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 - (i) Hydatid Cyst of the Lung—
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 - (ii) Cystic Disease of the Lung—
by Dr. P. K. Sen, Bombay.

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