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Editor : Dr. A. S. Mannadi Nayar, M.B. & B.S., Ph. D., (Edin.)



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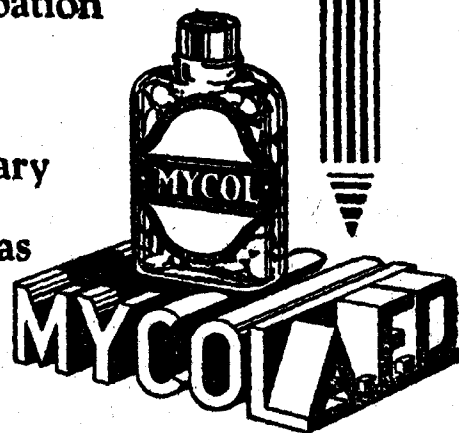


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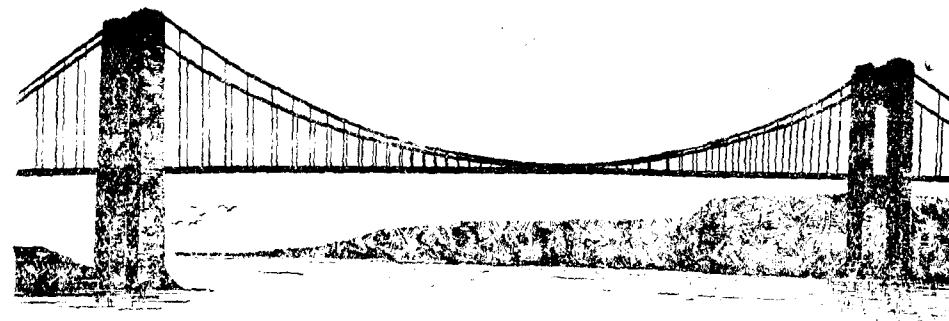
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No. 1.

The role of Blood Transfusion in Modern Medicine.

BY DR. K. RANGANATHAN, M.R.C.S., L.R.C.P.

I am thankful to have this opportunity of giving you an account of one of the most wonderful advances in Surgical practice during the present century—I mean Blood Transfusion—and the part it plays in Modern Medicine. It is a very fascinating study to learn the stages by which the present standard of perfection of the technique has been attained over a period of about 300 years, the value of Blood Transfusion to the Medical Profession, the extent to which the practice has grown and the diseases to the cure or alleviation of which it has been applied. It is essential that I should first review briefly the History of Blood Transfusion in order that the reasons for its extraordinary growth may be understood.

As for the practical side of the operation I am not going to say much, as it can be mastered only by observation and practice. I shall conclude this talk by a demonstration of the technique of Blood Grouping, and if possible, of the apparatus commonly used.

The obvious value of Blood Transfusion from a healthy to an ailing person has been recognised by the Medical Profession in the West from the earliest times. But difficulties of technique have rendered it impracticable until quite recent years. The principal obstacles have been sepsis, occurring to both the donor and the patient, coagulation of blood between the operations of extraction and injection, and incompatibility of patients to receive the blood of donors provided. This last resulted in serious reactions which frequently terminated in the death of the patient. These difficulties have now been overcome. Sepsis by the researches of

Pasteur and Lister, coagulation of blood by defibrination and subsequently by the addition to the blood of citrate of soda. The problem of incompatibility was got over by the discovery of Blood Groups by Jansky and Moss (1907-10).

Attempts to do Blood Transfusion had been made for over 300 years, but they were usually unsuccessful, chiefly because it was so hard to prevent blood from clotting. A definite description of a technique was made by Libavius of Halle in 1615. Translated it was as follows:—
 "Let there be present a robust healthy youth full of lively blood. Let there come one exhausted in strength, weak, enervated, scarcely breathing. Let the master of the art have little tubes that can be adopted one to the other; then let him open an artery of the healthy one, insert the tube and secure it. Next let him incise the artery of the patient and put into it the feminine tube. Next let him adapt the two tubes to each other and the arterial blood of the healthy one, warm and full of spirit, will leap into the sick one, and immediately bring him to the fountain of life, and will drive away all languor."

It is now assumed that the above was only an idea and had not been put to practice because William Harvey's theory of the Circulation of Blood had not been published till 13 years later in 1628. Harvey's discovery is regarded as the first landmark in the History of Blood Transfusion.

In the earliest experiments the blood of animals, e.g., calves, dogs, sheep and horses, was used. These were started in England by Sir Christopher Wren, the scientist and architect. The credit of the first successful transfusion upon a human being is generally given to Jean Baptiste Denys, of Montpellier, Physician to Louis XIV, who in 1667 successfully transfused nine ounces of sheep's blood to a young man, who was suffering from a violent fever which obliged his physicians to bleed him twenty times. Similar experiments were carried out in England and one of these was actually witnessed by Samuel Pepys, the diarist in 1667. The subject of the experiment was a poor Bachelor of Divinity, of whom Pepys remarks 'that he was cracked a little in the head'.

Meanwhile Denys continued the transfusions with varied success until serious controversy arose around the operation. The opponents of transfusion even predicted the growth of horns on a man after transfusion from a sheep. The operation was banned in France by a decree



which provided that 'no transfusion should be made upon any human being, but by the approbation of the Physicians of the Parisian Faculty.'

For more than a hundred years Blood Transfusion was almost entirely neglected. In 1818 James Blundell, Lecturer in Physiology and Midwifery at St. Thomas's and Guys Hospitals, published a paper on Experimental transfusion on dogs with a special syringe invented by himself. He then recorded his results of Blood Transfusion on man. It is reported that in half the number of cases the operation was successful. Fatalities that occurred were attributed to the introduction of air bubbles. Blundell's work in 1818 is considered another landmark in that it marked the real beginning of the clinical application of Blood Transfusion.

Bischoff in 1835 took a great step forward by using defibrinated blood. This was adopted by many surgeons. Mention is made of Sir Thomas Smith, who in 1873 transfused a case of Malæna Neonatorum with defibrinated blood at St. Bartholomew's Hospital.

Blood transfusion has made rapid advances since the beginning of the present century. Crile in 1907 devised an effective method for direct transfusion by which an end to end anastomosis was made between the artery of the donor and the vein of the recipient using a short silver tube. These operations often failed. Even if successful, one was unable to measure the amount of blood that was transfused. The discovery of agglutinins and isoagglutinins in the blood was made by Landsteiner and Shattock in 1901. In 1907 the four blood groups were determined by Jansky and the work was repeated and confirmed by Moss in 1910.

Improvements in technique were rapidly effected, the syringe, anastomosis of blood vessels and the paraffined tube being tried. The year 1913 marks the beginning of indirect Blood Transfusion by means of Kimpton and Brown's method. The last of the discoveries to be made was the use of citrate of soda as an anti-coagulant by Hustin of Belgium. The first transfusion on record with the aid of sodium citrate was performed by Prof. Agote of Buenos Aires on November 14, 1914. This came just in time to save many thousands of lives on the battlefields of Europe, although the possibilities of the operation were not known during the first two years of the Great War. By 1917 the

arrival of the American Army Medical Corps brought the possibilities of transfusion of blood to the notice of the Allied Army Medical Staff and it began to be used with most beneficial results in cases of Haemorrhage and Wound Shock. Donors were obtained by an unofficial reward of a fortnight's leave in England. The supply of donors, it is said, was therefore unlimited.

Knowledge of Blood Transfusion thus gained during the War has been turned to good account in Civil Medical practice. At first the operation was used for cases analagous to those met with in Army practice, *i.e.*, Haemorrhage and Wound Shock, but year by year fresh cases have been found capable of cure or amelioration by Blood Transfusion. In the new kind of warfare that has now arisen in the streets of big towns, the warfare between Traffic and pedestrians, blood transfusion is often the means of saving many lives. The comparative safety of the operation at the present time, has led to a rapid expansion of the clinical conditions for which transfusion has been used. The following is the list of diseases or injuries for which transfusion was given in 1927 in London.

Abortion	...	4	Hæmaturia	...	1
Anæmia	...	25	Hæmophilia	...	4
" Aplastic	...	8	Hæmoptysis	...	1
" Chlorotic	...	1	Hæmorrhage	...	16
" Haemolytic	...	1	Hypernephroma	...	1
" Neonatorum	...	1	Hyperpies	...	1
" Pernicious	...	103	Intestinal Hæmorrhage	...	3
" Secondary	...	23	Laukæmia	...	6
" Splenic	...	13	Lymphadenoma	...	2
" Toxic	...	5	Marasmus	...	2
Antrotomy	...	1	Mastoiditis	...	1
Appendicitis	...	4	Malsena	...	1
Blackwater fever	...	2	Meningitis, strepto	...	1
Burns	...	2	Menorrhagia	...	2
Carcinoma	...	...	Osteomyelitis	...	2
" Bladder	...	4	Perinephric Neoplasm	...	1
" Breast	...	2	Peritoneal Sarcoma	...	1
" Cæcum	...	2	Peritonitis	...	5
" Oesophagus	...	2	Post-operative shock or	...	...
" Stomach	...	36	hæmorrhage	...	30

Carcinoma Uterus	...	2	Post-partum or ante-partum	...	...
Cerebral Glioma	...	1	hæmorrhage	...	10
Colitis, Hæmorrhagic	...	4	Pre-operation	...	33
" Infective	...	2	Prostatectomy	...	4
" Ulcerative	...	5	Puerperal fever	...	4
Crushed or fractured limbs.	10		" Septicæmia	...	12
Infantile diarrhœa	...	1	Purpura	...	10
Duodenal ulcer	...	30	Pyæmia	...	2
Dysentery	...	2	Pyloric stenosis	...	3
Empyema	...	1	Septicæmia	...	23
Ergot poisoning	...	1	Spleen, Banti's Dis.	...	4
Gas	...	1	" ruptured	...	1
Gastric ulcer	...	58	Sprue	...	5
Gastro-enteritis	...	3	Bacteræmia Staphylo	...	1
Hæmatemesis	...	45	Typhoid fever	...	1
			Uterine Hæmorrhage	...	18

In most of the above conditions transfusion is only a palliative measure helping to prolong life. In acute hæmorrhage, on the other hand, it can be considered curative, provided the condition giving rise to the loss of blood can be arrested. There are many types of acute hæmorrhage which have been successfully treated. Perhaps the chief among these are the obstetric ones such as placenta prævia, post partum hæmorrhage, ruptured ectopic pregnancy. I have mentioned street accidents already. One of the most remarkable cases thus treated by blood transfusion is reported by Geoffrey Keynes, Assistant Surgeon at St. Bartholomew's Hospital. The patient before transfusion could only be described as moribund. He was almost unconscious, absolutely blanched, and his radial pulse imperceptible; his jaw was relaxed and his breathing had become a series of fish-like gasps such as are only associated with imminent dissolution. His heart would certainly have ceased beating within a few minutes. Yet his condition improved so rapidly after transfusion that an hour later with the help of a second transfusion, it was possible to amputate his leg above the knee. The patient ultimately recovered having been as near death as it is possible to be and yet remain alive.' In acute hæmorrhage, Geoffrey Keynes considers that "the efficacy of blood transfusion is only limited by the actual cessation of the patient's heart beats."

Ulceration of the stomach and hæmorrhage therefrom is another example. It is quite a common thing in London to transfuse patients before, during or after operation. By this means the patient is fortified against a severe operation, the blood lost is at once replaced, shock is diminished, mortality lowered and the convalescence shortened. I may mention a case of jejunal ulcer which had followed after a Gastro-enterostomy. The operation was performed by Mr. T. P. Dunhill. The patient who was anæmic had received a transfusion before operation. During operation, which consisted in the undoing of the previous anastomosis, excision and making a fresh anastomosis, all of which took about an hour and a half owing to a frightful amount of adhesions, the patient was transfused again. He made a good recovery in spite of the shock and hæmorrhage entailed by such a severe operation.

I have with me here the notes of a transfusion for a case of Empyema and Pyonephrosis which was under the care of Mr. Stanford Howard at the London Hospital. A drainage of Empyema and Nephrectomy had been done. A transfusion of blood was considered essential and was done at 3 a.m. on 19th April 1930. 700 c.c. of blood was transfused. The notes read:—"the patient was moribund and pulseless when the transfusion began. In 20 minutes when half the amount had been transfused, the patient was much better at the end of the transfusion pulse was 110 per minute and strong. The patient had regained consciousness and felt better. He has made an uninterrupted recovery. On June 1st the patient has been home 3 weeks and is now quite fit."

In Pernicious anæmia blood transfusion used to play an important part in the past. In 60 per cent of cases definite improvement followed. It had the effect of initiating or prolonging the remissions so characteristic of the disease. The remarkable effect of transfusion in a case of Pernicious Anæmia has been reported in Norway. "A man aged 33, was dyspnoic, semi-conscious and moribund, when admitted to hospital. His red cells were 850,000 and his Hæmoglobin of percentage 19. Immediate improvement followed the transfusion of 900 c.c. of citrated blood, the red cells rising to 2,000,000 and later to 3,000,000. Twelve days later he was walking about." Blood transfusion now plays a minor role in the treatment of Addison's Anæmia since liver feeding has become the chief therapeutic measure. It is nevertheless an useful stand by and some physicians combine transfusion and liver feeding.

The extent to which blood transfusion is carried out in London can be appreciated from the following list. The full list is a very long one consisting of no less than 190 institutions with a total of 7,696 transfusions during the years 1927-31. I have extracted only those hospitals which have utilised the operation more than the others, fixing 50 transfusions as a minimum.

	1927	1928	1929	1930	1931	Total
Bolingbroke	...	1	3	14	24	62
Cancer	...	33	41	32	48	211
Charing cross	...	29	30	25	34	165
German	...	22	12	6	16	92
Guy's	...	186	159	173	167	872
Hampstead General	...	5	6	7	17	63
King's College	...	23	26	46	61	225
London	...	48	52	48	57	287
London Temperance	...	15	11	17	17	72
Marie Curie	...	9	12	13	18	74
Miller	...	17	49	13	22	136
New Lodge Clinic	...	1	11	14	23	93
Prince of Wales's	...	3	20	13	17	78
Queen Charlotte's	...	4	17	10	15	65
Queen Mary's	...	5	12	18	17	63
Royal Free	...	82	87	51	74	362
Royal Northern	...	35	25	37	45	204
Royal Waterloo	...	12	25	3	8	55
St. Andrew's	...	14	12	14	21	88
St. Bartholomew's	...	192	159	109	97	686
St. George's	...	11	17	17	21	107
St. James's	...	10	12	20	23	75
St. John and St. Elizab	...	2	7	11	18	73
St. Mary's	...	44	54	30	52	238
St. Stephen's	...	15	12	15	10	59
St. Thomas's	...	21	17	12	12	110
South London for Woman	...	6	7	6	19	71
Tropical Diseases	...	17	23	24	11	86
University College	...	37	34	53	36	188
West London	...	40	34	45	60	244

	1927	1928	1929	1930	1931	Total
Westminster	...	34	26	35	60	46 201
Woolwich War Memorial	...	...	7	17	34	25 83
Nursing Homes and private cases	...	111	109	155	154	188 717

The question that next suggests itself is 'how were donors obtained for such a large number of transfusions? The answer to this question is a long story. Donors are generally obtained from among the volunteers maintained by the London Blood Transfusion Service. The growth of blood transfusion in London is closely linked with that of the London Transfusion Service and I have no hesitation in saying that but for the facilities afforded by this organisation, blood transfusion will not be used as a therapeutic measure as extensively in London as it is to-day. I shall therefore attempt to outline at some length the start, development and actual working of this wonderful voluntary organisation, which, thanks to Mr. P. L. Oliver, O.B.E., the Hon. Secretary, I have been enabled to study in detail.

The London Blood Transfusion Service has been in existence for 11 years. It undertakes to supply blood donors at short notice. The volunteers are willing to leave their work or recreation and frequently their beds in the small hours of the morning to go to any hospital where they are required. The story of the inception of this Service is an unique one. One day towards the end of 1921 the Hon. Secretary of the Camberwell Division of the British Red Cross Society was asked if he could provide a volunteer for blood transfusion at the local Hospital. Four members of the Division at once volunteered, and to that request the London Blood Transfusion Service owes its inception.

Mr. P. L. Oliver, seeing that this work was eminently suited for the Red Cross Society, seized this opportunity to prepare a list of members who were willing to volunteer for future cases. As time went on and fresh institutions learned the existence of the Service, the calls grew so fast that the Camberwell Division could not meet all the demands for donors, and recourse was had to the Press. The response was very good. This brought in the London Rover Scouts, the Y. M. C. A., and a large number of unattached volunteers. The London Rovers have since adopted Blood Transfusion as one of their forms of Service.

Table 1. Analysis of volunteers for 1931.

	Members.	Transfusions.
Rovers and Scouts	...	517 664
Toc H members	...	125 209
Ladies	...	228 296
Other organisations and unattached members	...	429 644
Cancelled calls	...	... 265
Total	...	1,299 2,078

It will be seen that roughly one out of every five members is of the gentler sex.

In 1925 the British Red Cross Society took over the organisation at its headquarters. To assist in its work, a Committee was set up consisting of representatives of the Red Cross Society, London Rover Scouts and of the Hospitals Association. The Office is at the private house of the Hon. Secretary and it is open day and night. It is staffed by his wife and himself with two clerks. These latter are the only two who receive any remuneration whatever.

The chief work of the Service consists in maintaining a sufficient body of volunteers spread all over London to cope with the constantly increasing demands for donors, and to fill vacancies caused by resignations. To this end, lectures and demonstrations of Blood transfusion by means of a film are given by the Hon. Secretary two or three times a week to interested organisations such as Y. M. C. A., Rover Scouts, leading Insurance offices, Banks and large Commercial houses. Even if no eligible donors be present at these addresses, the Hon. Secretary is glad to have an opportunity to dispel any fears that may exist as to the dangers of the operation to the donor. He impresses on them how great are the benefits they would confer and how little they would themselves suffer by the operation. Mr. Oliver is now about 60 years of age and has served as a donor nearly ten times. He is none the worse for his generosity. At the end of the talk he leaves a few enrolment forms for the use of intending volunteers

The volunteer has to fill therein particulars of his name, private address, his telephone number or that of his neighbours who would accept a message for him, his business firm and address, hours of duty, times when he would be available and special times when he would not be available and return it to the Hony. Secretary's office. Finally he has to give a statement offering himself as a donor for blood transfusion and undertaking to proceed, on receipt of instructions, to any hospital indicated.

The volunteer has next to get himself grouped. Dr. H. F. Brewer Medical Officer to the Service, is in attendance at St. Bartholomew's Hospital daily except Sundays to group and test the volunteers and also to examine existing donors who may wish to be satisfied as to their suitability at the time for blood transfusion. Besides grouping the blood, Dr. Brewer gives the volunteer a thorough physical examination. After a Wassermann test is done a report of the blood group and the suitability of the volunteer is sent to the Hony. Secretary. The technique of blood grouping is very simple and I shall be demonstrating it in a moment. The cells of the donor are tested against known sera. The serum of the donor is also tested with cells from persons of known group who call at the Hospital once a week for the supply of cells. Donors are classified according to the size and prominence of their veins as +, ++, ++++. Volunteers with poor veins or with a thick layer of subcutaneous fat which will render the introduction of a large bore needle a matter of some difficulty, are not accepted. Dissection of the veins for the purpose of extraction of blood is strictly forbidden, the object being not to cause any pain or injury.

Donors are drawn from all classes of the community—independent and professional men and women, barristers, journalists, shop men and girls, labourers, apprentices, roadmen, maidservants and charwomen. The number of members on the official roll on the 31st April 1932 was 1295, more than a third of whom belong to the London Rover Scouts.

The Secretary maintains a classified list of volunteers according to their blood groups. Distinctive coloured cards are used for each group, green for 1, yellow for 2, red for 3 and blue for 4. Each card shows all the particulars contained in the enrolment form. On the reverse page of the card are noted the dates and hospitals of the donor's previous services.

There are certain conditions under which blood donors are supplied to the hospitals:—

1. No application is to be made unless there are no relatives of the right blood group.
2. The blood group is to be specified, group 4 should be used for a group 4 patient only.
3. Each hospital should undertake a share of the testing and grouping of the volunteers for the general list free of charge.
4. Within 14 days of the transfusion a report for statistical purposes should be forwarded to the Hony. Secretary.
5. The expense will be borne by a Fund raised by the Service.
6. No charge will be made for Voluntary hospitals, but any spontaneous donation made in respect of the Service shall be paid into the above Fund.
7. The needle method of extraction should alone be used. Cutting down on the vein or opening it is forbidden, and donors are instructed to refuse to serve unless this condition is observed. The operation is to be carried out by a skilled surgeon and not by students.

We shall now suppose that a certain patient has been admitted to a Hospital in London in an exsanguinated condition after a street accident or after a smart hæmorrhage from placenta prævia. What happens is this:—The Surgeon at once telephones the Blood Transfusion Service asking for a donor, specifying the blood group of the patient. Such calls come in at the office at all hours of day or night. Occasionally appeals for blood donors are picked up by the British Broadcasting Corporation and transmitted to the Service by telephone. The remarkable increase in the demands upon the Service will be seen from Table II.

Table 11.

1921	...	1	1927	...	1,298
1922	...	13	1928	...	1,333
1923	...	12	1929	...	1,360
1924	...	62	1933	...	1,627
1925	...	428	1931	...	2,078
1926	...	737			

By reference to the Card index and distribution list, it is possible in a minute or two to choose a donor of the right group in the neighbourhood of the hospital calling. Most donors are called up by telephone to their business office by day. After office hours express messages are telephoned to the donor's nearest Post office. After 8 p. m. when Post offices are closed, a number of Y. M. C. A., Toc H hostels and private persons accept and convey messages to donors living near. As a last resort, the Police are asked to call for a donor, but most people have an objection to a Police Constable hammering at their door at dead of night. For donors in the neighbourhood of Dulwich, the Hony. Secretary cycles out to call them. The record number of calls was 14 in twelve hours between 9 a. m. and 9 p. m. on 23rd September, 1929. Five calls were received in the course of an afternoon that I spent in Mr. Oliver's office.

Immediately upon receipt of instructions, the volunteer proceeds by taxi, if required, first telephoning the Hony. Secretary that he is doing so. The Secretary should know within half an hour whether he is going or not, as it will make all the difference between life and death. The Service is so well organised that it rarely takes more than half an hour by day or an hour by night to get a donor of the right group to the institution calling. Donors are instructed to spare no expense to get to their destination in urgent cases. Occasionally they have been sent over 40 miles by taxi.

I have observed volunteers thus supplied acting as donors at St. Bartholomew's Hospital. A direct grouping test of the donor's cells with the recipient's serum is done immediately before the transfusion. If no agglutination be present, the transfusion is proceeded with. Anything from 400 to 700 c. c. of blood is withdrawn from the vein by means of a large bore needle, the site of the puncture having been previously anaesthetised by novocaine. The arm is dressed in the usual way. The donor rests for about an hour, takes a cup of tea or black coffee and the next hour he is at his work as if nothing had happened. The Service guarantees donors against any ill effects from transfusion and the Eagle, Star and British Dominions Insurance Co., have presented a free policy indemnifying donors against any injury from transfusion up to 50 per cent of any claim from £100 to £500. The total amount paid in the past ten years has been £82, in every case due to

secondary causes, such as inflamed arms or iodine burns and 75 per cent of this has been refunded by the Hospitals concerned.

As soon as possible after the operation, the donor is requested to report by letter or telephone all the expenses incurred, including loss of salary or wages, if any, and these are at once refunded. He is also required to report any delay, discourtesy or difficulty that has been met with. The Committee takes prompt action by bringing to the notice of those responsible anything that appears to them to indicate either lack of consideration to the donors, or a failure to make use of the latest and most approved methods. One General Hospital in London has now been made to run its own service because no volunteer could be persuaded to serve at that Hospital.

A Certificate of Honour is issued to each volunteer after undergoing the operation together with a copy of the Surgeon's report on the case. A Badge is awarded to any member who has served 10 times. 161 members or 12½ per cent of the total personnel have qualified for this. A Bar is added to the Badge for every 10 additional services. Seventeen members have the bar for 20 services, 3 for 30 and 1 for 40 services.

Donors of groups 1, 2 and 3 are usually called about once a year but the demand for group 4 is so great that some are serving regularly every three months or less. A limit of 3 months has been fixed as the minimum between two donations by the same individual more to prevent too frequent dislocation of private and business engagements than for health reasons.

After each transfusion a questionnaire is sent to the Hospital asking for the following information. Surgeon, name of the patient, sex and age, blood group, disease or injury, amount of blood taken and the result of the transfusion. This is filed and a copy is sent to the donor. An analysis of the figures for 1928 gives the following figures:—

Excellent (life undoubtedly saved) ...	610 cases or 52%
Satisfactory ...	304 „ 26%
Improvement but followed by death ...	203 „ 17%
No improvement ...	62 „ 5%
Cancelled or no report received ...	154 „ ...
	1,333
	100%

I am sorry I am unable to give figures for more recent years as the report for the quinquennium 1927-31 is under print.

Blood transfusion is now recognised as a life-saving measure, particularly in cases of urgent hæmorrhage, that it should be possible in every hospital to give a blood transfusion to a patient within half an hour of his arrival on the premises. Obstetric emergencies such as, Post-partum hæmorrhage, Ante-partum hæmorrhage ruptured Ectopic pregnancy, being of the gravest urgency, to save time in obtaining blood donors of the right group, Titus in 1920 advocated the grouping of the blood of all pregnant women well before the expected time of confinement and having compatible donors available. Mr. P. L. Oliver, the Hony. Secretary of the Transfusion Service, goes a step further. He wishes that every man, woman or child should have his or her blood group tattooed on the arm. He says "you never know when you will be knocked down by a motor vehicle".

I have outlined the working of the London Blood Transfusion Service in a rather detailed manner. I may now emphasize the most outstanding points in favour of such an organisation for the supply of blood donors.

1. No time is lost in testing prospective donors several of whom in succession may be found unsuitable.
2. In urgent cases there may be no time or facility for blood grouping.
3. Uncertainty as to how or where to obtain a blood donor will result in the postponement of the decision to transfuse until the patient has passed to a more or less hopeless condition.
4. The interests of the donors are safeguarded by a careful preliminary examination and laying down certain stipulation as to the technique to be adopted by the institutions.
5. The volunteer, unlike a relative, usually approaches the operation with the conscious heroism that he is helping to save a life and therefore with equanimity, which is a great help to the surgeon.

May I, before I conclude, plead for an extended use of blood transfusion in our part of the country? Besides the surgical, medical and

obstetrical conditions which are common to both the Temperate and Tropical climates, we here have a large field for the use of blood transfusion, I mean in Tropical diseases. Almost every Tropical disease causes a more or less severe secondary anæmia for which blood transfusion could be advantageously tried. A beginning has already been made. Transfusion has been used for intestinal hæmorrhage in typhoid, chiefly for combating the anæmia. Attention has been called to the Anæmia of pregnancy as an indication for blood transfusion. Low (1928) recommended transfusion during or after an attack of Blackwater fever. Manson-Bahr in 1929 reported excellent results of blood transfusion in cases of Sprue. Further research is need to show the possibilities of blood transfusion in other Tropical diseases.

Notes on Anaemia during Pregnancy.

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In submitting the notes on anæmia of pregnancy which I am about to read to you this evening, I might mention that I was closely associated with Dr. Margaret Balfour in an Enquiry undertaken under the auspices of the Indian Research Fund Association at Bombay between the years 1925—1928, on the cause and incidence of this disease. My part of the work consisted of the collection of material from the various hospitals and its pathological examination at the Haffkine Institute Bombay.

At the conclusion of my lecture I hope that as many as possible will take part in the discussion which will follow. There must be many among you who have experience of this disease which is so prevalent in the tropics and is so frequently met with in the hospitals in our midst, at Cochin, Muttancherry and Ernakulam and which yearly takes a heavy toll of the lives of the women and children in India. For many years past anæmia has been known to occur during pregnancy, sometimes assuming the severe type as is seen so frequently in India. I have heard of cases reported from other tropical countries and in 1927 also saw similar severe cases in the Government Hospital at Seremban, Federated Malay States. It is only in recent years that this disease has received any special attention. In the past it has generally been regarded as being the result of previous or present infection of hookworm or malaria intensified by the occurrence of pregnancy, and even today in many hospitals in India, this is commonly believed.

The low incidence of this disease in the United Kingdom may be gathered from maternity hospital records. In 12,000 cases reported from the Rotunda Hospital, Dublin, 1921-23, only one case was included and in 1,800 cases reported from Queen Charlottes Hospital, London, 1923, one case was recorded and during the three years I was in charge of the Military Families Hospital at the Curragh, Ireland, I did not come across one single case.

In 1925 Balfour sent out a questionnaire to a number of maternity hospitals in India and received from all parts of the country particulars of 426 cases of anæmia occurring during pregnancy. These appeared from the clinical symptoms to be of the same type as the cases seen in Bombay but details of pathological examinations had not usually been available.

This anæmia occurred mostly in women between the ages of 20 and 30 years who were usually in either their first or second pregnancies with a history of illness commencing from about the 5th to the 7th month and progressing rapidly, sometimes with a fairly definite history of sudden onset setting in with fever with or without rigors lasting about a few weeks or perhaps less which then passed off leaving them in a weak state of health unable to perform their household or other work. But more frequently there was an indefinite history of ill health with puffiness of the feet and body and increasing weakness.

The cases seen were in women during pregnancy who were mostly suffering from an acute type of the disease. In these there was marked facial pallor with pearly white sclerotics and blanched finger nails. The skin showed a sort of watery transparency and there was much swelling of the face and often of the whole body with an œdema or puffiness of the feet and angles. There was breathlessness on slight exertion with palpitation and weakness accompanied in some cases by gastro-intestinal symptoms, anorexia, nausea, vomiting, dyspepsia, diarrhoea or constipation and in other cases by a soreness about the mouth and tongue which often presented a glazed appearance; and there was at times a burning sensation in the fauces. There were other cases that seemed to have a craving for food.

Seasonal Incidence.—It was remarkable that the majority of cases seemed to occur or at any rate were seen in hospital between October and April and comparatively few during the remaining months of the year. This could not be accounted for by the seasonal variation of the birth rate.

Course and termination.—The majority of the patients who entered hospital were severely anæmic, and under treatment, *viz.*, rest in bed, good food, iron and arsenic injections, blood transfusions, liver extract or liver broth, they sometimes showed signs of improv-

ment in health but more frequently no improvement took place. They either left hospital or remained on for delivery which was sometimes premature with a majority of the infants still born or dying shortly after birth and the patients themselves who had not died before labour succumbed during parturition or shortly afterwards. The non-fatal cases sometimes got better soon after delivery and were discharged from hospital in an almost normal state of health. Cases have been recorded of complete recovery with subsequent healthy pregnancies and normal deliveries with healthy babies at a later date.

Pyrexia.—The temperature charts showed usually a low irregular type of fever with no marked periodicity.

Pulse.—Always rapid.

Heart.—Invariably dilated.

Blood pressure.—Low.

Lungs.—Sometimes signs of pulmonary oedema.

Spleen and liver.—Not usually enlarged though a few cases showed signs of slight enlargement.

Examination of blood.—The blood changes were very similar to those found in cases of ordinary pernicious anæmia. In a series of 84 consecutive cases examined the findings were as follows:—The blood was not normal in colour and had almost always a muddy tinge. The C. I. was above unity in a large proportion of cases, the average being 1.05. The Erythrocytes varied between 430,000 and 3,570,000 per c.mm, the average being 1,874,133. They showed pronounced variations in size, the macrocytes being more numerous than the microcytes and poikilocytosis was fairly frequently seen. Nucleated red corpuscles occurred with very varying frequency the Megaloblast being the type of nucleated red cell commonly noticed, and it had been observed that when a high percentage of Normoblasts were present the Prognosis was favourable. In severe cases several Karyolytic forms of erythroblasts were noted.

Polychromatiphilia and Achromia were constant features of the blood picture, the former change being very common in Megalocytes and nucleated red cells. Basophilic degeneration was seen only in the very severe cases and blood platelets were practically always absent.

The Hæmoglobin did not diminish in the same proportion as the red blood corpuscles: the percentage varying between 15 and 55, average being 38.08. There was nothing abnormal about the appearance of the Leucocytes except for an occasional Leucolysis. There was observed to be a slight increase in the Polymorphonuclear elements and occasionally Myelocytes were seen. The total Leucocyte count varied between 3,200 and 22,300 per c.mm. the average being 8,553. So far as I observed a Leucopænia was only present in cases suffering from chronic malaria.

The average differential Leucocyte counts of this series of 84 cases was as follows:—

Polymorphonuclears	...	...	...	67.9%
Lymphocytes	...	...	...	23.2%
Mononuclears	...	...	...	7.2%
Eosinophils	...	...	...	0.7%

The blood of 23 normal pregnant patients was examined as controls. Anisocytosis was noted in 2 cases, otherwise nothing abnormal was found. In another series of 25 consecutive cases the findings were as follows:—

Red blood cells	...	1,210,000 per c. mm.
Hæmoglobin	...	33 per cent.
Colour Index	...	1.6 "
Leucocytes	...	8.416 "
Polymorphonuclears	...	57.1 "
Lymphocytes	...	38.6 "
Mononuclears	...	3.5 "
Eosinophils	...	0.8 "

Poikilocytosis was present in 13 cases, Anisocytosis and Polychromatiphilia in 24, Achromia in 23, Malarial parasites in 1, Normoblasts in 16, Megaloblasts in 11. The red cells varied from a maximum of 2,830,000 to a minimum of 500,000 and the Leucocytes from a maximum of 32,000 to a minimum of 3,200. Blood platelets were absent or scanty. The foetal blood was always found to be normal. In 13 cases in which the blood was cultured I found it to be sterile in 11. In 1 case Streptococci (non-hæmolytic) were present and in 1 case gram negative bacilli.

Kahn's test for Syphilis was done in 32 cases of which 15 were positive and 17 were negative.

Blood grouping of mother and child was investigated in 36 cases, in 24 the blood grouping differed between parent and child. Of 17 normal pregnancy controls 5 were found to be in different grouping.

Van denbergh's test.—Out of 32 cases examined 2 were negative. The remaining cases gave an average indirect reaction of 0.69 unit. 9 gave a reaction above unity, the highest being 2.0 units.

Examination of blood calcium contents.

Most cases normal.

Examination of gastric juice.—No Achlorhydria. Only a few cases examined.

Examination of urine.—Catheter specimen collected with Aseptic precautions of 107 cases examined for albumen 52 were positive, 55 negative. Of 150 cases bacteriologically examined I found 37 to be sterile, most of those were examined Ante partum and in the remainder examined mostly post partum the following organisms were isolated on culture.

B. Alkaligenus	... 23 cases.
B. Pyocyaneus	... 18 "
Streptococci	... 7 "
Staphilococci	... 5 "
Coliform organism	... 32 "

Gram negative organisms not identified further 28 cases.

The urine was examined in 41 cases of normal pregnancy Ante partum and of these 32 were found to be sterile on culture of the remainder 6 contained B. Alkaligenus, 2 gram negative organisms and 1 B. Aerogenes.

Examination of Faeces.—From October 1925—April 1927.

Examination for worm ova done only in cases showing Eosinophilia. In 5 of these cases the ova of round worms were present, in 1 case Whipworm and in 1 case Hookworm. (This last disease is rare in Bombay).

In 1928, April to October, I examined the faeces for worm ova in all cases as a routine and found in many of these there were multiple worm infections. Repeated examinations however were done only in a few cases and ova were seen on second or third examination which were absent on first examinations.

Dr. Talpade visited a number of patients in their homes and made observations as regards social position and surroundings. She found that the patients were not chiefly those of the poorest classes. Many were the wives of well-to-do merchants and clerks living in airy and comfortable houses. Others lived in flats of many rooms well ventilated and admitting plenty of air and sunlight, clean and in good repair. Again others were living in dark, overcrowded rooms shared by more than one family.

The Indian women of Bombay generally lead inactive lives and rarely leave their homes. This applies more to Mahomedans than their Hindu sisters owing to purdah conditions. It is not customary for these women to join in outdoor sports or in fact take any exercise in the open air as the women of non-tropical countries do.

Before proceeding further I would like to mention that while in Bombay I saw this disease in one well-to-do English lady during the latter half of her pregnancy. She was about 25-28 years of age, primipara and her only previous illness was an attack of pleurisy with empyæma about two years previously. I noted her gradually increasing pallor and malaise with slight puffiness of the face and feet. There was no Albuminuria. I left Bombay shortly before she was admitted to a Nursing Home for confinement and later heard that she had a normal labour and was delivered of a healthy child about full term and died suddenly on the 8th or 9th day of the puerperium with symptoms of acute Dyspnoea. I was told by the doctor who attended her delivery that she was in a very severe condition of anæmia on admission with the usual appearance of cases of this disease.

The following are details of two typical cases studied :—

12-3-28. Case 1. D. D., Aged 25, Hindu. Caste Marathi.

Previous pregnancies 4 at full term. Two children living.

Diet stated to be 'mixed'

Home surroundings, good. A two roomed airy house occupied by three persons.

History.—Staying in Bombay for the last 3 years. Before that was at Sarantwadi. Had two normal pregnancies. Children living. She had oedema during the last two months of her two previous pregnancies and both children died one when 3 days old and the other when 6 days old. Was well one month after these two deliveries.

Stated to have fever with rigor 1½ years back which lasted about 6 months.

Condition on admission to hospital. Anaemia Severe. Swelling well marked of face and body. Oedema of feet and ankles.

Liver and spleen—Not palpable.

Urine—Albuminuria—Heavy deposit.

Heart. Dilated. Haemic murmur in pulmonary area.

Uterus. Midway between Umbilicus and Ensiform cartilage.

Digestion—Sore mouth for the past 15 days.

Blood pressure. 145. Pulse 102. Temperature 98°F.

15-3-28 Put on liver substance grs. 14 daily.

27-3-28 General condition improved.

28-3-28 Faeces. Ova of Ankylostome, Trichuris Trichuria and one ova unfertilised resembling that of Ascaris Lumbricoides. B. Welchii absent.

Blood Red cells. 1,630,250 per c. mm. Anisocytosis ++ Polychromia + Poikilocytosis ++ Blood platelets nil. Achromia +

Neutrophils 84% Mononuclears 2% Lymphocytes 13% Eosinophils 1%
30-3-28 " 76% " 2% " 21% " 3%

Red cells 1,490,000 per c. mm. C. I. O. 89. Leucocytes 8,100 per c. mm.

Urine. Pure culture of non Haemolytic Streptococci.

Kahn's test for Syphilis negative.

4-4-28 Put on liver soup.

Still anæmic.

Given carbon Tetrachloride m. xv in capsule at 8 a.m. preceded for two days by p doses of glucose in water four times per diem also this morning at 6 a.m. ½ oz. glucose given and a saline at 12 o'clock and enema S.O.S.

12-4-28. Urine. Albumen ++ Oedema unaltered. Liver treatment discontinued. Vegetable soups given.

20-4-28. Oedema less. Feels better.

1-5-28. Natural delivery. Baby 7½ lbs.

Pulse 98. Temperature 99° F.

Anæmia less marked. Oedema less.

8-5-28. Continues to improve. Bowels regular. Pulse 100-120.

Temperature 97-99. Baby well.

10-5-28. Left hospital.

Case 2. A. Hospital Cama Bombay.

A Hindu aged 18 years was admitted into hospital on the 2nd April 1928 with a history of malaria three years ago. During the present pregnancy she had an attack of fever with rigors during the 4th month, lasting for one month. There was an attack of vomiting at the end of the 6th month which continued on and off until the period of her death. The previous pregnancy was normal and child alive. On admission to the hospital she was found to be anæmic, had irregular fever, prostration, oedema of feet and puffiness of face and diarrhoea. She left hospital on the 11th April and returned for readmission on the 20th April in a more advanced state of anæmia. On examination, the liver and spleen were both palpable, she had albuminuria and a pulse of 100-140 per minute with a temperature ranging from 97° to 100° F.

Laboratory findings:—

Examination of blood.—Red cells 864,000 per c. mm. Hb. 28% C.I. 16.

Leucocytes 9,300.

Blood Films showed Poikilocytosis + Anisocytosis + + Polychromia + + Achromia + Basophylic degeneration + Blood plates absent. No signs of malarial parasites. Normoblasts, Megaloblasts + 6 and many Myelocytes present.

Differential Leucocyte count.

Neutrophils 58% Lymphocytes 33% Mononuclears 9% Eosinophils nil.

Urine.—Albumen + Culture yielded a pure growth of Hæmolytic Streptococci.

Fæces.—Semi fluid and of a brilliant green colour.

Ova of Trichuris Trichuria and many crystals of Leucin and Tyrosin present.

Culture.—Abundant growth of Hæmolytic B. Welchii.

Patient rapidly grew weaker and died on the 25th April undelivered.

Post mortem examination.—(Unable to get relatives consent for an examination of Thoracic contents.) Large amount of subcutaneous fat of a deep lemon yellow colour. All the abdominal organs very anæmic looking. Placenta adherent to the anterior wall of uterus. Foetus male 7½ months and well nourished and normal in appearance. Uterus, tubes and ovaries very pale otherwise normal.

Kidneys enlarged and fatty looking.

Stomach and intestines pale and empty, no thinning of walls, no ulceration observed.

Liver slightly enlarged and of a pale yellow boxwood colour. Contents of Gall Bladder a bright green colour.

Spleen slightly enlarged and of a slate grey colour. One small hæmorrhagic patch seen.

Pancreas hard, pale and slightly enlarged.

Tibia marrow red throughout, showing hyperplastic changes.

Ferrocyanide reaction. Spleen + + Liver + Suprarenal + Kidney +

Direct smears made from Placenta and spleen showed absence of malarial parasites.

Smear from mucosa of small intestine. Long chains of Streptococci and on culture these proved to be of a strongly Hæmolytic type.

Bone marrow from Tibia showed well marked Hyperplasia with large numbers of Eosinophilic Myelocytes, Megaloblastic cells, non-granular Mononuclear cells and pigment granules.

Spleen.—No hyper or Hypoplasia of Lymphoid follicles Eosinophilic cells + +

Liver.—Hæmosiderin granules in liver cells. Fatty changes present.

Kidneys.—Showed patches of fatty degeneration with degenerative changes in the epithelium of the tubules and Glomeruli.

Animal experiments.

Some strains of B. Welchii Haemolytic and non-Haemolytic were isolated from fæces of cases of anæmia, normal pregnancy, and non-pregnant cases of anæmia. In view of the presence of B. Welchii and Haemolytic Streptococci in the intestine in the post mortem examination. Dr. Mehta and I continued the animal experiments which had been begun in 1927 by Drs. Mehta and Emanuelov. Whole living cultures of B. Welchii given subcutaneously or intraperitoneally in repeated doses produced slight anaemia and even death. Supernatant liquid obtained by centrifuging B. Welchii broth culture and given either subcutaneously or intraperitoneally did not produce an immediate effect, but in some cases death supervened without anæmia. This anæmia was characterised by remissions when the injections were discontinued.

Toxin, prepared by passing B. Welchii broth culture through Chamberland filters when given subcutaneously or intraperitoneally produced no anæmia.

B. Welchii culture and toxins were pathogenic to the unborn young even when the animal herself remained healthy. The young were invariably still born or died within a fortnight after birth.

Feeding with repeated doses of whole living culture of *B. Welchii* and Streptococci alternately either with or without previous treatment with Sodium Fluoride given orally failed to produce anæmia though death occurred in a few cases. Feeding with repeated doses of whole living culture of *B. Welchii* even when each dose was preceded by Na F. treatment also failed to produce anæmia. If at the same time the animals are kept without greens in diet death without signs of anæmia supervenes. Treatment of pregnant animals with Na F alone or followed by *B. Welchii* culture was Toxic to the unborn young which were nearly always still born or died shortly after birth.

These series of experiments with *B. Welchii* cultures and their toxins offered no evidence that pregnancy anæmia in the Guinea pigs and rabbits due to the Toxins of the *Welchii* Bacillis absorbed from the intestine.

Posterior No-Loop Gastro-enterostomies as performed in the Government Hospital, Madura.*

BY CAPTAIN C. S. S. SARMA, L. M. & S.

The operation of Gastro-Enterostomy for Pyloric Stenosis is of course a palliative operation. But it has none the less a perennial interest to the student and practitioner of abdominal surgery, especially in the south of India. It is an operation that demands the utmost resources of the surgeon, his anæsthetist and his assistants. It is a severe test of his asepsis and that most elusive thing of all, his after interest in the continued health of his patients, with whose entrails he has taken such onerous responsibilities. It is an acid test of individual skill, judgment and technique. It further affords a most elaborate training for the would be aspirant in surgery in that it encompasses all conceivable varieties of incisions, dissections and sutures that he will ever be called upon to make through all varieties of structures. It also furnishes a ready measure of progress. In fact it is the one operation where one should not only work "on time" but should at the same time be vibrant with responsibility, intrepid in judgment, quick in resources, neat in technic, perfect in details, and all with the Damocles' sword of imminent operative mortality! "Frequency of practice" is a trite thing to say, but achieved only by a fortunate few and even amongst the favoured, increasing perfection and unerring precision, fall to the lot of still fewer. The surest test of the master in the art, is the constant supply of cases for his clinic. It is a fact that some surgeons have had the luck to operate thrice a week for years and have had on an average a Gastro-Enterostomy every time. The breadth of mind and generosity to teach, may, again, not be combined in the same surgeon who is sedulous enough to perfect his technic but is incessantly rattling off his assistants, who degenerate soon into unintelligent surgical orderlies. The training of assistants and keeping them up at a high standard is the key-note of modern surgical team-work and in no other operation is the

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beauty of such team work so instructively manifested as in a Gastro-Enterostomy.

A few words on the ætiology of peptic ulcer in the South of India requiring gastro-enterostomy, will be of interest. That it is fairly frequent, common in both sexes, and debilitates and kills appreciably, are all common knowledge. Whether it originates in the bites of the ubiquitous hook-worm, or whether it is a septic embolus lodging in the smaller gastric radicles leading to necrosis of the mucosa at the affected point, or whether it is due to the corrosive action of metallic mercury and vegetable irritants administered therapeutically by indigenous practitioners, cannot be stated for certain. But sepsis in one form or other has been thought to account for a large number of cases. Such sepsis is commonly met with in the gums, teeth, nasal sinuses, throat and the alimentary and urinary tracts. The delay in the healing of acute ulcers may be the result therefore of low-grade bacterial infection of the blood-stream as much as it is thought to be due to the irritation of the acid gastric juice. The rigour of quack-therapeutics in the treatment of gonorrhœal and syphilitic affections is another feature in the ætiology. Often semi-starvation limited to the blandest of diets and simultaneous administration of imperfectly purified mercury, arsenic and sulphur by mouth, in the shape of powders or mixed in oils, should be held responsible for starting the ulcerative processes in the stomach. The crude liquor as well as imitation potable spirits which the natives in India consume in such quantities, have been shown to contain deleterious essences and ethyl alcohol in excessive proportions. It is just possible that this factor also enters into the causation of gastric ulcers.

The use of chillies and highly spiced articles of condiments, the excessive use of cocoanut oil, tapioca, vitamin deficiency, tobacco and chunam, have been advanced as causes by some.

The eating of the fruit of the prickly pear is a common habit with all classes of the agricultural population of southern India. The fruit is always at hand in the fields; it is somewhat sweet, refrigerent but at the same time highly astringent. When taken in excess it causes foecal impaction. In the mofussil the enema nozzle has often to be buried in the inspissated mass to rid the lower bowel of this troublesome repast. What it does down below it might do above just as well and originate coagulation of the gastric mucosa and pave the way for bacterial infection.

Cumbu and Cholan of South India have a glistening epicarp and when freshly eaten from the stalk, raw the mucous membrane of the mouth. They are slightly irritant and start a mild catarrhal enteritis. They have sharp edges and the way they are eaten is, curiously enough, fraught with mishaps. The stalk is held between the palms and with the thumb and forefingers the grains are squeezed in the hollow of the hand, the epicarp is blown off and the grains swallowed; necessarily taking a few of the sharp scales in. Sometimes these scales and grains work their way into the gum margins between the incisors and give rise to an alveolar abscess. It is just possible that some are found accumulated behind in the voluminous folds of the gastric mucous membranes perforating their delicate structure and affording a site for the ulcerative processes.

Taking the statistics of this hospital, one can say that no class, age, or sex is exempt from these peptic ulcers. The highest age met with is sixty; the lowest, twenty. The average works at 32.8 or 33. The longest duration of symptoms is fifteen years, and the shortest three weeks. Almost all have had prolonged medical treatment, both allopathic and indigenous. The patients are at times frankly exasperated at the out-patient department for the suggestion of any further medical treatment. In one case, the out-patient department, decided to try a few days more of medical treatment. But the patient managed to steal into the office room of Col. Harley and laying himself prostrate at his feet, begged "to have his stomach out and his pain cured." He would have no more of the same out-patient mixtures of which he said he has had his fill in half a dozen hospitals. This a young man of twenty and he had all his exquisite gastric suffering due to a very long, much kinked, nasty appendix which was subsequently removed.

Some present numerous branad marks on their belly. Often the whole epigastrium above the navel is marked with confluent dots or linear streaks sometimes numbering between twenty, to thirty, and inflicted by burning with hot seed or small iron rods. Patients have thus stamped on their bellies indubitable evidence as to the genuineness of their pain and earnestness "for a cure surgical" when all else has been tried and abandoned. Some date their troubles to a love philter which was administered to them by their wives.

The patient is generally of typical appearance. He is a thin ill-nourished adult, with the abdominal fat all wasted away, the skin thinned out and transparent, with the veins showing out prominently. The face bears a peculiar pinched look of chronic hopeless suffering. He has a sallow earthy complexion. The appetite is practically lost, either due to dread of the pain or the longdrawn-out and futile experiments in dieting. The attitude of mind is bordering on hypochondria or gastric neurasthenia, often mistaken for malingering.

It appears to me, that the stomach is to be distinguished, from all other hollow muscular organs, by the peculiarly indescribable character of its pain. Some have a sub-conscious feeling of weight in the stomach and protest they have a lump inside and talk of an attack of wind and a point of obstruction against which it is hard to get over. The pain is described sometimes as gnawing or griping or grinding, burning or boring. Some describe it as starting above the umbilicus and passing backwards and upwards. A point of maximum tenderness is found just to the right and sometimes to the left of the middle line and in other cases between the umbilicus and the xiphisternum. The pain in *gastric ulcer* is said to come on dramatically at night and wake the patient up in a seizure of agony. The humbler duodenal ulcer gradually unfolds itself from the foggiess of many dyspepsias wherefrom its peculiar hunger pains gradually emerge as a separate entity amidst the vague abdominal discomforts, acid eructations and flatulence. The patient may exhibit all varieties of subjective sensations from more taciturnity to violent suicidal mania.

The upper portion of the rectus is in a chronically contracted state as though its segments were perpetually on guard over the painful and irritable viscus. Often it is rigid and the skin over it hyperæsthetic. The appearance in thin individuals is characteristic. The upper portion of the epigastrium is peculiarly full in contrast with the markedly scaphoid nature of the lower half of the abdomen. Often small lumps of fat could be felt and the skin freely moved about. There is tenderness of the rectus on deep pressure.

Next to pain, vomiting is a constant symptom. This has a definite relation to food and is either natural or induced by the patient. There is retention of food in the stomach and fermentation of the contents. This goes on for months or years with periods of remission or exacerba-

tion. Vomiting is the culminating act of the painful contractions of the stomach and it ushers in comparative restfulness. It is the painful contractions, more than anything else that drive the patient to seek relief. In women the pain is often of such intensity to make them cry piteously and in the highly strung nervous creatures, it often provokes a hysterical outburst. Often the pain becomes constant and vomiting is induced on the slightest of provocations. Even a draught of water provokes the characteristic pain, which is relieved by vomiting. The soda-water which originally gave relief is now dreaded, the slight hyperæmia induced by the carbonic acid gas apparently aggravating the stomach condition.

The third diagnostic sign of pyloric stenosis next to pain and vomiting is visible peristalsis. This is elicited by making the patient drink water, as much as he can at one draught and then getting him to adopt the recumbent posture. Succussion splash is elicited by gently shaking the body sideways. Often the stomach contour is mapped out and in a few minutes with the patient quietly breathing, the stomach in cases of pyloric stenosis enters into vigorous peristalsis. Often in cases of atony, there is intestinal peristalsis. Melæna is an early symptom and worth investigating. But the history is seldom volunteered and in late cases it is not present.

The more elaborate tests include radiographic examination of the alimentary tract, both on the fluorescent screen and by filming the opaque meal at stated intervals. Major H. Hingston, I.M.S., of Calcutta, attaches more value to the screen than the photo. In Madras doubtful cases are alone subjected to Radiological examination.

The occult blood-test and fractional test meal are two other methods of investigation available. The duodenal ulcers are expected to show high and sustained acidity curves and gastric ones, normal curves.

Major H. Hingston, I.M.S., relies on a sextette of signs and symptoms to clinch his diagnosis of peptic ulcers, they being, pain, rigidity of the rectus, black stools, supplemented by positive occult blood test, radiographic demonstration of delay in the emptying of stomach contents and appropriate acidity curve-readings. Here in Madras Hospital practice, the majority of cases one encounters with are those which have gone on to well-marked pyloric stenosis. In such

cases pain, vomiting and visible peristalsis then form a triad of unmistakable signs and symptoms, which have been found safe enough to form a diagnosis and operate upon.

The Preparation of the Patient.

The preliminary preparation of the patient is in the medical wards. It is neither prolonged nor drastic. And this is as it should be, as the patients are such poor surgical risks and do not stand well elaborate preparatory treatment. On admission, a thorough examination of the patient is made after completely stripping him. His weight is recorded, his urine is examined for sugar and albumen and microscopically for casts. Hookworm treatment is given the day after admission and repeated a week later. A blood film is examined for Malarial parasites and in appropriate cases the Wasserman test is done. The sputum is examined for tubercle bacilli and the motions for amæba and parasites. The patient where he can afford, is advised to undergo dental treatment—all should undergo dental treatment and it is hoped to start a dental clinic soon in this hospital—all cases showing bad pyorrhoea are given gargles and have their gums painted with tincture of iodine. The stomach is washed twice daily for a week with saline solution and a carminative mixture containing 5 to 10 minims of Tr. Belladonna per dose is given to allay the spasms. The patient, if anæmic, is treated with six injections of the cacodylates of iron and sodium with strychnine, or plain sodium cacodylate grs. 3 subcutaneously. Some have gross scabies, pediculi, or eczema. Others have ulcers of the mouth. All these are studiously eradicated before putting them up for operation. One occasionally comes across a history of old gonorrhoea in addition. If found to have a stricture as well, this is attended to.

The patient is throughout fed on plain milk, 3 pints a day with 3 ozs. of sugar. Where inanition is extreme, the patient is started on glucose saline per rectum straightaway. The patient is put up for operation after the eighth day stomach wash and an enema the night before and another three hours before the operation. His weight is taken the day before the operation. A warm bath is given the previous evening.

The operation done in Madura for pyloric stenosis is the "posterior no loop gastro-enterostomy without clamps." There can be no question of doing this operation from mere text-book knowledge alone. One has

to watch it being done several times by a surgeon accustomed to do abdominal operations, assist him first at instruments, then at the operation and finally do the operation many times under his guidance before one can confidently undertake this operation himself. Each surgeon has his own method. It is well to study every one of them and assimilate each under the direct guidance of the master before adventuring on one's own hook.

Some do a partial gastrectomy, others do a preliminary appendisectomy as a routine and to save time entrust this to be done by their competent assistants, what time they are engaged on another table. Some do not remove the appendix as a routine. Some advocate the use of clamps. There are differences in stitching, the material to be used in suturing the mucosa, and whether the anastomosis should be completed in two or three layers, and also as to the number, closeness, and the time of application of the stay sutures to be applied to the slit in the transverse meso-colon.

The following suture materials are required for a Gastro-enterostomy operation.

- (1) Four full length thick silk on half curved needles for stays.
- (2) Two full length thin but strong silk on fully curved intestinal needles, for the serosa, one being both a spare one and for the purse string suture for appendisectomy.
- (3) Twelve medium cat gut strands half length for securing vessels.
- (4) Two full length fine but strong catgut on fully curved intestinal needles for the anastomosis, one being a spare one.
- (5) Two thin catgut half lengths on fully curved intestinal needles for securing the slit in the transverse meso-colon.
- (6) Two full length catgut on two fully curved Hagedorn's needles for closing the abdominal parietes, the thick one for the peritoneum, the thin one for the aponeurosis.
- (7) Twelve silkworm gut sutures half lengths on half curved needles for suturing the skin.

Technique.

The operation can be considered conveniently in five stages :

- (1) Anæsthetising the patient and towelling.
- (2) Incision and muscle displacement.
- (3) Inspection and " packing " off the field of operation
- (4) Gastro-enterostomy with or without appendicectomy.
- (5) Closure of the abdominal parietes.

Chloroform is the anesthetic used and occasionally an injection of morphine and atropine precedes its administration in nervous and hysterical patients. The patient is brought on a stretcher and put on the table. The anaesthetist commences his operation and as the patient is getting under his clothes are removed, the hands kept close to the sides and tied across below the buttocks by a half knot at each wrist with a piece of bandage. The screen is adjusted at the head of the table. The whole of the abdomen and pubis, which have been previously shaved are now painted liberally with Tr. Iodine on a brush, starting between the nipples to down below both Poupart's ligaments, including the pubic regions, penis, and scrotum. Special attention is paid to the umbilicus.

Four towels are arranged as follows.—One across the lower abdomen in a line with the two anterior superior iliac spines, one across the pit of the stomach. The right linea semi-lunaris is then followed and a towel is laid by the first assistant, who stands on the left side, and he lays it vertically and exactly in the middle line. Four towel clips are applied to the four corners, the abdominal sheet is then spread out by the surgeon and his assistant, slipped over the screen, and secured below it by an artery forceps. The first assistant lays on the abdominal sheet two large towels, four small tailed towels, tailed gauze pad, a long gauze wick, sponges and in addition soaks plain sterilised gauze in warm saline. The instrument assistant hands the knife to the surgeon and at the same time, lays on the abdominal sheet two pairs of curved scissors, two pairs of dissecting forceps, one pair of rat-tooth forceps, one finger grip forceps, and a dozen artery forceps. By this time the patient usually comes under the effects of the anaesthetic.

Incision and Muscle Displacement.

The right upper para-median or lateral rectus incision is made vertically down, starting about four inches above the umbilicus and to the right of the lines alba, and ending about two inches below the level of the umbilicus. The length of the incision varies with the individual shape of the abdomen. In narrow cylindrical abdomens the incision is necessarily smaller. The incision should be made boldly down to the anterior rectus sheath, which is at once neatly incised throughout the entire length of the incision in the skin. The muscle displacement is now commenced. The assistant steadies the divided anterior rectus sheath with a pair of artery forceps, on his side after securing any spouting vessels in the skin or muscle. The surgeon with delicate strokes of the knife dissects the anterior rectus sheath from the underlying muscle. At the linea transverse or the tendinous inscription of the rectus muscle, the sheath is intimately incorporated with the muscle. The surgeon makes a neat and careful dissection here, and shaves off a tiny bit of the underlying muscle, both to facilitate dissection and avoid buttonholing the aponeurosis. Two fingers are hooked beneath the loosened anterior rectus sheath and the muscle separated from the posterior layer of the rectus sheath by a sweep of the fingers, until it is held attached by a few tendinous filaments posteriorly, which are carefully divided. The muscle which is now free, is displaced laterally to the right. The two prongs of the dissecting forceps are dipped and a fold of the posterior rectus sheath with the underlying peritoneum is picked up and raised. The assistant immediately steadies this fold by lightly catching it in a pair of artery forceps, and at the same time lifts it up a trifle. The surgeon nicks it carefully with the belly of the scalpel. If the peritoneum is not immediately opened or if it is thickened, what happens is, a raw surface is seen. The surgeon again picks up a fold of this denuded area with his dissecting forceps and the assistant's artery forceps, and cautiously nicks it until the peritoneum is buttonholed and the admission of air makes the intestines and the omentum fall away from the incision. The incision in the peritoneum is now rapidly enlarged upwards with the scissors while the two fingers which are immediately insinuated underneath and held parallel to the incision guard the viscera below and serve as directors. The lower portion of the incision into the peritoneum is similarly enlarged (by reversing the direction of the same two fingers without withdrawing them) either with a pair of curved scissors or the knife. It is a point of

great importance that the peritoneum must be neatly and quickly incised by sight as otherwise the viscera may start protruding and hamper the extension of the original nick. It is advantageous to cultivate the art of ambidexterity, and also to familiarise oneself with the use of the knife and scissors to rapidly incise the peritoneum.

Inspection.

The abdominal contents are now rapidly inspected. The stomach and omentum are exposed to view. The pylorus is sought for and its condition ascertained. The anterior surface of the stomach is rapidly inspected both along its lesser and greater curvatures, for stippling of the peritoneum, indurations, adhesions, etc. With a piece of gauze, the stomach is lifted out of its bed along with the transverse colon, the great omentum and spread out above in a fan like manner exposing the posterior surface of the transverse meso-colon and the stomach. The posterior surface is rapidly inspected. The main indication for the gastro-enterostomy is confirmed and demonstrated to the assistant.

The surgeon selects an avascular spot on the posterior surface of the transverse meso colon, which should also be as near the pylorus and as near the greater curvature as possible. The Assistant picks this up with dissecting forceps and nicks it with curved scissors. The surgeon introduces his thumb and forefinger and tears through the opening sufficiently to permit the introduction of three fingers. He then pulls through the rent a segment of the posterior wall of the stomach. In making the slit through the posterior layer of the transverse meso-colon one should avoid carelessly injuring any of the branches from the arches of the middle colic artery. This accident is said to have happened to Kocher and so might happen to anybody.

The surgeon now applies the four stays. He is still holding the segment of the stomach between his fingers and starts applying the left hand stomach stay as near the pyloric end as possible. The silk is passed through the serous and muscular coats at the extreme limit of the intended anastomosis and is handed over to the assistant. The assistant pulls it double, clips on an artery forceps, cuts the threads short, and returns the needle to the instrument assistant. The surgeon now applies the right hand corner stomach stay as near the greater curvature as possible and hands it on to the assistant. The surgeon thrusts the index finger and the thumb on-wards the vertebral column, feels for the abdominal aorta, and close to the

left of it he feels again for the very first loop of small intestines. He hooks it between his fingers and brings it out of the abdomen and demonstrates it to be the very first loop of the jejunum, its direction being from left to right. He kneads it flat to squeeze out its contents and lays it parallel to the segment of the posterior wall of the stomach already held between the stays. He then secures the left hand corner intestinal stay and then the right hand corner stay and hands them both to the assistant, as before to clip them short on artery forceps, and return the needles.

The two upper stays are held gently lifted up by the assistant and the surgeon lifting up the abdominal parietes, applies the square tailed abdominal towel (handed by the instrument assistant) to the upper corner of the wound, pushing the transverse colon and the omentum gently back into the abdomen above. The two lower stays are similarly lifted up and the surgeon then applies the lower square tailed towel to the lower angle of the wound. Then the right side of the incision and then the left side are both shut off by two towels. A gauze pad is then inserted into the lower angle of the wound over the square towel, in order to shut off a gap between the entering and emerging coil of jejunum where otherwise soiling might take place. A long roller gauze wick three inches in diameter is then insinuated between the stomach segment and the jejunum between the intended line of anastomosis. Two large towels are now spread out on either side fixing the portion of the gauze which now protrudes beyond the gut and clipped by artery forceps to each other above the stomach and below the jejunum, so that now nothing is visible except the portion of stomach and jejunum isolated for anastomosis. This keeps the anastomotic surfaces quite steady and in close approximation as though they had been clamped. No injudicious pressure is made. If the towelling (which is the secret of this achievement) has been good, the rounded convex borders of both viscera are invariably in excellent apposition, ready for stitching, without awkward folds or crypta under which one has to get round to manœuvre his stitches.

The Anastomosis.

The instrument assistant gives a full length fine silk threaded on a fully curved intestinal needle. The surgeon commences stitching the serosa from the left. The suturing includes the serous and muscular coats only and is applied Lembert fashion. The assistant draws the

thread, makes the first knot after the stitch is passed and keeps the end clipped by an artery forceps. The assistant draws the thread in between the stitches, just taut enough to raise the viscera in apposition for the next stitch. The surgeon applies the stitches roughly at one-eighth of an inch interval and this sero-muscular posterior line of stitches extend from two to three inches, according to the condition flabby or otherwise, of the stomach. The instrument assistant is all the while maintaining gentle traction on the two right hand corner strays. When the stitching of the serosa reaches the right hand corner the stitch is locked and the needle is taken below the two stays and kept pinned to the towel above.

Steadying the left hand stays with the left hand, and with a small knife the surgeon incises the stomach $\frac{1}{2}$ of an inch away from the posterior sero-muscular suture line, down to the mucous membrane which he carefully buttonholes. Then with a pair of curved scissors, he neatly and rapidly enlarges the incision right up to the two corners of the ellipse. The redundant gastric mucous membrane pouts into the incision, and oozing and spouting gastric vessels are encountered. The surgeon and his assistant, each on his own side, pick up the vessels, teasing open the cut mucosa with a pair of dissecting forceps and catching the bleeding point. Often from six to eight vessels require thus to be secured.

The instrument assistant hands over thin or medium catgut, after testing them to see they are not friable. He holds each one of them stretched horizontally between the thumb and forefingers of each hand and the surgeon picks them up. The assistant cocks up each artery forceps while the surgeon slips on the knot and ties it and hands over the loose ends to the assistant who cuts off the ligature short. When the hæmostasis is complete, the surgeon incises the jejunum rapidly in a similar manner, but never has to tie any vessels here.

The instrument assistant hands him the thin catgut on a fully curved intestinal needle for the posterior-all-coats-running suture. The surgeon enters the needle from the mucosa of the intestine at the left hand corner, traversing through all coats. The assistant knots after the first stitch has entered the mucosa of the stomach, the knot being on the mucous side. The redundant free end is kept clipped to an artery forceps. The instrument assistant keeps traction on the right hand pair of stays with the left hand and mops the area with strips of warm

moist gauze, in between the stitches. The surgeon himself draws the catgut taut to make sure that he leaves no weak spots. When the stitching has reached the right hand corner, the instrument assistant removes the right hand pair of stays. The stitching has been so far all from within outwards. The surgeon now commences the anterior through and through layer of stitches. At the extreme corner it is entered vertically and then continued parallel to the sides of the incision in Connell fashion alternately unfolding the stomach and the jejunum. When the stitching reaches the left hand corner, it is knotted to the end, kept clipped on an artery forceps and cut short by the assistant. Great care should be bestowed in getting sound apposition and that no loose tags of the gastric mucous membrane protrudes out. The stitching now, will be evident, is all from without inwards.

The silk thread pinned to towel is now taken and the anterior sero-muscular-running suture is now put in. This includes the serous and muscular coats as before. The assistant now helps in the rapid application of this line of stitch by drawing out the needle and handing it back to the surgeon for the next stitch. Thus the surgeon and his assistant do not change hands and the stitching is rapidly concluded. The assistant uses a special forceps to gently draw out the needle and the surgeon takes care to receive the needle in good position to apply his next stitch while at the same time drawing out the thread sufficiently taut to raise the next point to stitch.

When the running sero-muscular-suture has thus been returned to its starting point on the left the assistant removes the left hand corner pair of stays, knots the silk, and cuts the end short.

The square towels, gauze pad together with the two large towels are now removed. The roller gauze is now gently pulled upon at both ends the slit in the transverse meso-colon is sought for and carefully adjusted over the anastomosis. Its two extreme ends are secured to the jejunum by two cat gut sutures, which are knotted and clipped short by the assistant. The roller gauze is cut short and close by the assistant and the surgeon removes it by gently drawing it out, and at the same time he inspects the posterior line of the anastomosis. The viscera are returned into the abdomen, the great omentum and transverse colon are adjusted gently into their natural position. The anastomosis will be found to slip up behind the transverse colon and the omentum.

At this stage the appendix is investigated and removed if desirable.

The abdominal parietes are closed as follows. The posterior layer of the rectus sheath and the peritoneum are closed by a running catgut suture of thick catgut, starting from the lower angle of the wound to the upper. The assistant secures the first knot, cuts the redundant end short, and draws with one hand the thread taut while at the same time keeping the parts well in view by the other hand. As soon as the peritoneum is stitched warm saline is poured into the wound, blood clots and debris are sponged dry. The rectus muscle is adjusted in its bed and the aponeurosis is now stitched with thin catgut from below upwards. At the tendinous inscription of the muscle, the stitch includes a bit of the rectus muscle. The assistant knots the stitch below, cuts off the tag draws the thread through and knots it above and cuts it short as before. Warm saline is again poured into the wound and the skin wound cleared of clot and debris.

The skin is stitched by interrupted silk-worm gut sutures. The first assistant commences stitching from the lower angle of the wound, and the surgeon from the upper angle, the instrument assistant handing them each a half length silk worm gut on a straight half curved Hagdorn's needle as often as they finish stitching. He has to keep four stitches in his hand in advance and thread fresh ones as often as the needle is returned to him. He at the same time sees that all the instruments are cleared off the abdominal sheet and counts the needles. The first assistant then mops the wound dry, by gentle rolling with dry sterilized gauze. A coating of Tr. Iodine is applied on a brush. He applies sterilized dressings to the wound and sees to its bandaging by the nursing orderley. The patient is then carried on a stretcher to his bed and the nurse in charge administers glucose saline per rectum. In an uncomplicated case the operation thus done, should not take more than 25 minutes and if the team is working properly not one word need be spoken throughout the operation.

Delay in Operation.

Where one watches the master doing week after week gastroenterostomies by the dozen, one comes across a number of causes which tend to delay. Some are in the nature of accidents, others are preventable. Although the irreducible minimum of twenty to thirty minutes in the expert and with the permissible margin of up to 45 to 60 minutes

in the novice are rarely exceeded, still minor mishaps not chronicled in any book do happen and the surgeon has got to depend on none but his mother-wit to come to his rescue. It is at such junctures that the surgeon's best traits of head and heart are displayed and they betray a strong family likeness to the indomitability and resourcefulness of the general in the field of battle. It is far easier to scare and rattle off one's assistant, and make him a more nervous automaton for the next gastroenterostomy. But the real master tides over these with the supermost non-chalance and conserving his spleen strikes silent unconscious responsibility all round. I shall enumerate below some of the accidents, all small in themselves, but pilfering to me enormously in the aggregate which I have actually observed.

1. Delay due to anesthesia.
 - (a) The patient stopping breathing.
 - (b) The patient straining.
 - (c) The patient's respiratory passage getting clogged with mucus and the patient retching.
2. (a) The silk getting drawn out of the eye of the needle, due to too short a length of the end beyond the eye.
 - (b) The needle breaking.
 - (c) The thread snapping short.
 - (d) The thread being accidentally cut by the instrument assistant while removing the right hand stays.
 - (e) There being knots or irregularity in the silk, the irregularity catching in the serosa and becoming difficult to pull through.
3. Blunt knives,
4. Bleeding from transverse meso-colon while drawing stomach out.
5. The difficulty in securing haemostasis owing to several causes:
 - (a) A vascular stomach.
 - (b) Friable ligatures.
 - (c) Blunt pressure forceps.
 - (d) Formation of a sub mucus haematoma.

(e) Accidental ragging of the mucosa while incising it with scissors.

(f) Friable gastric mucous membrane.

(g) Pouting and non-apposition of the mucous membrane.

(h) Accidental encountering of an ulcer in the anastomotic line.

6. Patient coming out of anaesthesia while the peritoneum is being stitched.

7. If gastrectomy, appendisectomy are also done and if other abnormalities are met with. To certain extent these could be eliminated only by allotting appropriate parts to each assistant and strictly adhering to it. Each surgeon has his own dispensation of choice, whether to associate his assistants lavishly or parsimoniously in the performance of an operation. I shall at the risk of repetition enumerate categorically the part allotted to each assistant in the Madura Hospital in the performance of a gastroenterostomy.

First Assistant's Duty.

1. To sponge, secure any spouting vessels in the skin, and to steady the anterior rectus sheath while making the dissection.

2. To lift up the peritoneum while incising it.

2-a. To nick with scissors the transverse meso-colon and expose the posterior surface of the stomach.

3. To cut off the loose ends of the stays after fixing each in artery forceps, and lift them up when the surgeon tucks the rest of the viscera inside the abdomen, and 'packs off'.

4. To draw the silk while applying the posterior sero-muscular suture.

5. On his side, to sponge, secure vessels in artery forceps cock them up and cut short the ligatures.

6. To knot and draw catgut while keeping steady traction on it between stitches.

7. To cut off the left hand corner stays at the top and dislodge them carefully without cutting the silk below.

8. To draw the needle for the anterior-sero-muscular silk Lembert's suture and hand it back, knot and cut off the ends.

To knot and cut off the ends of the two stays of catgut introduced into the slit transverse meso-colon and the jejunum.

10. To keep traction on the continuous peritoneal suture of the abdominal parietes, knot and cut the ends off.

11. To keep traction on, knot and cut the ends off the continuous catgut suture of the aponeurosis and keep parts well exposed.

12. To stitch the skin at the lower end without crossing hands.

13. To dress the wound.

The Instruments Assistant's Duty.

1. To hand over the instruments for muscle displacements, towel clips, knife, curved scissors, two pairs dissecting forceps, two pairs rat-tooth forceps, one dozen artery forceps.

2. To hand over the four stays and collect the needles.

3. To hand the small tailed abdominal towels spread out between his hands, the two larger towels, the gauze pad, and the gauze wick to 'pack off' the peritoneal cavity.

4. To hand the serous suture silk and steady the stays on his side.

5. To test every ligature and hand them, holding them between both hands and discard the artery forceps used in securing the vessels.

6. To hand over the catgut to suture the anastomotic hole and to steady the stays, mop in between the stitches with the firm short squeezes and to remove the right hand corner stays when the stitching approaches his corner.

7. To take back the needles used in the anastomosis.

8. To hand over the two catgut half-length sutures for securing the slip in the transverse meso-colon and take back the needles.

9. To get ready for appendisectomy.

10. If necessary to steady the peritoneum and hand over the peritoneal stitch of catgut, and pour saline.

11. To hand over the aponeurotic stitch of catgut and pour saline.

12. To be ready in advance with four stitches of silk-worm gut for the skin-sutures, and remove all instruments.

13. To count the needles.

Even with this scheme of team work, conscientiously followed delays due to the patient are considerable. They are mainly due to the abnormalities met with in the course of the operation.

They are due to difficulties.

1. In opening the peritoneal cavity due to past peritonitis.

2. Adhesions of the stomach and duodenum to the structures in the neighbourhood, *viz.*, liver, gallbladder, and adhesions to structures forming the stomach-bed, the posterior abdominal wall.

3. Difficulty in extricating a suitable segment of the stomach through the transverse meso-colon.

4. Stricture and adhesion of the jejunum at the duodeno-jejunal flexure necessitating an anterior loop operation.

It would be interesting to catalogue here all the various abnormalities that have been from time to time met with in the course of Gastroenterostomies extended over many years.

1. Lumps, hard and soft of various sizes, from a marble to an orange at the pylorus, the first part of the duodenum.

2. Scarring near the pylorus, saddle back ulcers of the lesser curvature.

3. Adhesions of the stomach and duodenum, to the liver, gallbladder, to the transverse meso-colon, the greater omentum.

4. Cancer of the pyloric end, rare.

5. Tubercular nodules on the jejunum.

6. Various conditions of the stomach, low stomach, muscular atonic, fatty, vascular, hour glass, leather-bottle, highly scarred stomach,

stomach struck back against the posterior abdominal wall near the vertebral column.

7. Round worms, food, fresh blood, slots in stomach.

8. Mucous membrane at the site of the anastomosis friable, thickened, gelatinous, or actually ulcerated and otherwise unhealthy.

9. A small piece of detached omentum on the upper surface of the pylorus at the site of an ulcer.

10. Several scars of old ulcers in the intestines.

11. Congested gastric veins.

12. Dilated gall-bladder owing to pressure of pyloric and duodenal adhesion to the posterior stomach wall.

13. Hypertrophied and friable gastric muscle.

14. Where gastric symptoms were indefinite, the following abnormalities were found in the appendix ;

(a) Long appendix with sigmoid, curve, acute kinks, bulbous tips, retro-caecal in position, discovered and dissected up with difficulty.

(b) Foetal type of caecum.

(c) Appendix represented by a button-like stump.

(d) Caecum not descending below the crest of the ilium.

(e) Constrictions, congestion, worms, inspissated faeces, concretions, ulcers, mustard seeds.

(f) Extremex mobility of the caecum.

(g) Appendix curled up in a pocket by itself with remnants of Jackson's membrane.

After-treatment.

After the patient recovers consciousness, he is put in Fowler's position. Vomiting, post anaesthetic, as well as ushering the onset of reaction after the operative shock, is usual at this stage. The usual stale dark blood, sometimes, dark, tarry, clots, are vomited. Sometimes several ounces of dark liquid blood are vomited, but such is unusual.

If the abdomen is distended the bandage is slightly loosened and the flatus-tube is passed.

Nothing is given by the mouth during the first 24 to 36 hours but gargling the mouth and sucking of ice are permitted. Glucose saline per rectum is the mainstay to allay the troublesome thirst and up to 3 to 6 pints are given. Usually the urine is passed naturally. If not a catheter is passed every 4th hour. After this period whey and albumen water are given. Later barley water is given and egg-flip with brandy. On the third day and if the abdomen is obstinately distended, earlier still, Magnesium sulphate in dram doses is given upto 8 doses every hour until the bowels act. Excessive action of the bowels is not aimed at. Black tarry motions are sometimes passed signifying melæna. Patient is next fed on plain milk, then broth then bread. Thus in a week the patient is brought again on milk-diet. On the eighth day the skin-sutures are removed. The dressings are inspected on the third day and the suture line painted with Tr. Iodine. Rice is added at the end of a fortnight and by the third week the patient is brought to ordinary Indian mixed diet. The secret is to stimulate the patient to eat, the test of a return of normal gastric function being the progressively increasing appetite. The trick to achieve this is just to keep the patient desire some food and to yield to it making haste slowly. He is put on an alkaline Carminative mixture if such a thing secures him a relish for his humble dietary.

Post-operative Complications.

The following common post-operative complications of Gastro-enterostomy demand notice and treatment on well recognised lines

1. *Shock*.—Recognised by quick thready pulse, profuse drenching of sweats, cold clammy forehead, a falling temperature, shallow breathing and a distended abdomen.

This treated by glucose saline per rectum up to 6 pints, Adrenalin or Pituitrin 1 c.c. subcutaneously, hot water bottles to the feet, and warm blankets.

2. *Vomiting*.—Post-anaesthetic vomiting is usual, and is limited to four or five hours at the most. Sometimes gastric mucorrhoea is abundant. If at all persistent and abundant and disturbing the patient's rest and obviously exhausting him, the following plan will be found effective.

Posterior No-Loop Gastro-enterostomies

1. Wash the stomach with saline.
2. Morphine and atropine $\frac{1}{4}$ gr. and $\frac{1}{200}$ gr. hypodermically.
3. Bismuth subnitrates and Sodii Bicarbonas grs. 5 as in powder for 6 doses every hour.
4. Cerii Oxalas grs. 2 T. D. S.
5. Iced orange juice and bits of ice to suck.
3. *Haematemesis*.—Morphine Tartrate $\frac{1}{4}$ to $\frac{1}{2}$ grain hypodermically, Calcium Chloride grs. 5 to 10 with potassium bromide grs. 10 in mixture T. B. S.

4. *Retention of urine*.—This is an evidence of shock and if so will pass off with a few catheterizations. If the bladder shows an obstinate tendency to fill in spite of regular catheterization and the patient has a tendency to pass but cannot actually pass urine by himself, an intravenous injection of "Cylotropine" immediately starts the urinary flow. The patient should be put on Urotropine grs. 10 T. D. S.

5. *Pain*.—This is complained of but by few. Where at all severe and disturbing sleep, sleeping draught for the night or Aspirin grs. 7 Potassium Bromide grs. 10 for the first day will suffice. The Doctor's persuasion that all is well and assurance of uneventful recovery will go a long way to secure adequate rest.

6. *Distension* is sometimes very troublesome. If loosening the bandage passage of the flatus tube, turpentine enema, an injection of Pituitrin 1 c.c. or Eserine Sulphate grs. $\frac{1}{80}$ and Mistura Carminativa with Tr. Belladonna minimums 5 to 10 per dose on the first 24 to 36 hours do not appreciably reduce the distension, it will be much better to start the bowels moving with dram doses of Magnesium Sulphatis every hour for eight doses and give at the same time fractional doses of Calomel (sixth of a grain every hour) by mouth for a few doses. Some authorities recommend the routine use of a turpentine enema every day for the first five days.

7. *Hiccup*.—In very badly distended cases as well as in toxæmic ones, hiccup is an occasional complication. Vigorous measures should be immediately instituted to rid this most ugly complication. A morphine injection of $\frac{1}{4}$ grain should be given at once and may be

repeated. Adrenalin m. 10 by mouth may be tried and the bowels made to act early.

8. *Constipation*.—Where at all severe requires the daily use of glycerin and soapwater enemata, and Mistura Cascara Sagrada by mouth.

9. *Pneumonia* directly attributable to the irritation by the anaesthetic as well as the hypostatic variety in debilitated individuals is occasionally met with. Wherever possible, it is best treated by fourth hourly hot turpentine stupes to the chest, garlic juice by the mouth, potassium permanganate enemata once daily, a mild Diaphoretic mixture containing Potas. Citras, Potas. Bicarb, Viu. Ipecac, Tr. Belladonna, and Liquor Ammon-Acetatis. The heart is supported by brandy, two to four ounces daily, tepid sponging, the ice-bag, or the evaporating lotion to the fore-head, where the pulse shows signs of failing injections of strychnine and digitalin (as well as Tr. digitalis in 15 m. doses in the mixture) or Camphor in oil grs. 3 intra-muscularly may be used. Adrenaline is best avoided. However treated, pneumonia occasionally proves a fatal complication. It is sometimes influenza and the signs are chiefly bronchitis or bronchopneumonia. Curiously enough, the thin and wizened individuals appear to be better surgical risks so far as this complication is concerned than the apparently more robust-looking.

10. *Parotitis* is an occasional complication. This is a tell-tale phenomenon pointing to the fact that attention to the mouth has been defective. Pot. Chloras or Pot. permanganate gargling and painting the swollen gland with Tr. Iodine or external application of glycerinum Ichthyol cum belladonnae will give relief.

The patient is usually discharged at the end of three or four weeks, and the criterion is the freedom from the pain of his characteristic contractions, improvement in appetite, and steady gain in weight. The immediate results as enumerated above are most gratifying, in the cases of well marked pyloric stenosis.

But in small proportion of cases vomiting recurs, and the patient goes steadily down-hill and rapidly wastes. This may be due to stagnation of bile and pancreatic juice in the afferent loop as well as numerous mechanical causes affecting the drainage of the afferent loop.

Continental surgeons have tried and abandoned a number of ingenious devices to circumvent this stagnation in the afferent loop. Moynihan observes:

"The whole question as to regurgitant vomiting has, however, receded into the background in my experience. I never see it in any case of mine now, nor have I seen it in the last few hundred cases. I believe regurgitant vomiting to be due chiefly to a mechanical defect in the operation, a defect which consists mainly, if not solely, in the leaving of a loop of jejunum, between the flexure and the anastomosis. This loop becomes "water-logged", bile and pancreatic juice distend it, being unable to escape from it easily into the distal limb. Regurgitation through the pylorus then occurs, or the weight of the heavy loop causes a kink at the anastomosis which closes the entrance to the distal limb. In some cases post operative adhesions distal to the opening may be the cause of that obstruction, which is invariably present in cases of "regurgitation."

The above cause and the over looking of an intestinal stricture as well as at the time of operation are the common causes of regurgitant vomiting, where one encounters it. In one case it was found that the anastomosis was done half way down the jejunum. It may be due to faulty technique, to a too narrow anastomosis, the anterior loop operation, etc. The treatment of regurgitant vomiting, as Moynihan says, must be by operation, in serious cases. An enter-oenterostomy must be performed. In the slighter cases relief is often afforded in a remarkable manner by lavage of the stomach every 24 hours for a few days."

12. *Diminished appetite and return of symptoms*.—These are almost always attributable to irregular and injudicious dieting. Some advocate a routine use of alkalis and belladonna extended over six months, even after a gastro-entrostomy, to get the full benefits of this drainage operation. Magnesia Carbonas as antacid, and Tr. Belladonna as an anti-spasmodic, together with the stomach wash, must be the main line of treatment in the milder forms of apparent failure. Omission to do an appendisectomy is often responsible for a return of the painful Dyspepsia where that organ was not inspected at the time of the original operation or the patient's general condition precluded it.

13. *Gastro-jejunal ulcer*.—In a country where desperate and urgent surgery is the order of the day and where people wander far and

wide in search of a cure, the "follow-up" system of cases in place of accurate statistics to show that from the very few cases on record of secondary operations mostly done on middleaged men and women. complications under this head must be very rare indeed. And there is a strong reason for this. Moynihan says :

" My own experience shows that the unsatisfactory results which follow upon gastro-enterostomy are due (apart from technical errors) almost exclusively to the performance of the operation in improper cases. If the operation is restricted to those cases in which definite organic disease is discovered in the stomach, distal to the suggested anastomosis, or in the duodenum, the results are uniformly satisfactory. Bad results are due to the adoption of the operation in cases where no lesion is present to justify it."

Anomalies in Intestinal Rotation and Fixation and their Surgical Complications.

DR. N. MANGESH RAO, M. B. & C.M., F.R.C.S.E.

Development of gastro-intestinal canal in the embryo.—About the fifth week the gastro-intestinal canal is attached to the aorta in the mid-line by a mesentery. This canal is supplied by three arteries from the aorta which delimit the three parts of the canal.

1. The foregut supplied by the coeliac axis gives rise to the stomach and duodenum as far as the bile papilla. There are practically no anomalies in rotation or fixation of the part.

2. The midgut supplied by the superior mesenteric artery gives rise to the rest of small intestines, caecum and colon as far as the middle of transverse colon. Anomalies of rotation and fixation chiefly occur in connection with this part.

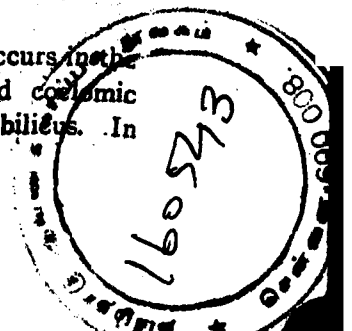
3. Hind-gut supplied by the inferior mesenteric artery gives rise to the rest of the colon and the rectum.

In the fifth week the midgut is in the form of a U-loop lying in the mid vertical plane, the proximal part being in front and distal part behind the superior mesenteric artery, the two limbs of the loop being called prearterial and post-arterial respectively. From the apex of the loop the vitelline duct passes into the umbilical cord.

At this time a band like formation in the upper part of mesentery of hindgut fixes it to the left side of the origin of superior mesenteric artery and as the hindgut develops in length a loop called the colic-angle forms on the left side of root of superior mesenteric artery. The terminal end of foregut also gets fixed to the right side of root of superior mesenteric artery. The midgut thus has a narrow base for its mesentery between the above two fixed points.

During the fifth to tenth week further development occurs in the midgut. But as the liver enlarges rapidly at this time and coeliac cavity is still small the mobile midgut is forced into the umbilicus. In

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this process and the further development of the midgut the loop undergoes a 90° counter-clockwise rotation, the prearterial segment lying to the right of the artery. The root of midgut mesentery is narrow and bounded by the fixed points of foregut and hindgut mentioned above called the duodeno-colic angle. The mesentery of midgut is divided into a right and a left leaf by the superior mesenteric artery. The prearterial segment (right leaf) now grows rapidly in length and the postarterial segment in thickness. The caecal bud appears in the postarterial segment and develops in size with the ascending colon distal to it. The left umbilical vein lying in front of the prearterial segment forces it further to the right and the growing liver pushes the postarterial segment upwards and to the left. The increase in length of midgut and change in its position causes an S curve to appear in it. This concludes the first stage in rotation. Anomalies in this stage of rotation are only possible in the presence of complete extroversion of cloaca (Dott.)

The second stage of rotation begins from the tenth week. Owing to increase in size of coelomic cavity and a decreased rate in the growth of liver the resulting negative pressure induces the midgut to return to the coelomic cavity aided by the rapid growth in length of the prearterial segment. As the postarterial segment with the thick colon and large caecum finds the umbilical opening too small, it remains behind and the prearterial segment returns inside the coelom, the most proximal loops returning first. As further loops pass in, the primary ones are forced upwards and to the left behind the superior mesenteric artery. These in their turn force the developing hindgut upwards and to the left and downwards to occupy its future normal position. The caecum with the rest of postarterial segment now returns into the coelom, but the caecum now lies anterior to the mesenteric artery and at the level of umbilicus. Further development in the colonic part of this segment pushes the caecum upwards to the right towards the under surface of right lobe of liver. In the second stage therefor the prearterial segment rotates counter clockwise through 180°. The forcing of caecum upwards assists in the rotation. Further development in the prearterial segment brings parts of it again in front of the artery. Hence some portions of it complete 360° rotation in the two stages. But the postarterial segment only completes 270° in its rotation.

Anomalies in this stage may be (1) Non-rotation, (2) Malrotation, (3) Reversed rotation.

According to Norman Dott the non-rotation is due to sudden return of both segments together owing to large size of umbilicus at this time. The condition in such cases would be that the caecum would be on the left side level with umbilicus or just below it, the small intestines occupying the right half of coelomic cavity with the terminal part of ileum crossing from right to left. The ascending colon and transverse colon which are usually small in such cases and descending colon, will all occupy the left half of coelom cavity. In these cases the mesentery of caecum and ascending colon persist. The case reported in this article belongs to this group. In 'Malrotation' the caecum may pass across in front of the superior mesenteric artery and be fixed near the pylorus or sub-hepatic region and the prearterial segment invaginate into the left leaf or postarterial mesentery but in front of the mesenteric artery. The postarterial mesentery in such cases forms a sac in which the prearterial segment, i.e., most of the small intestines, are found. A second type is one in which the postarterial segment remains in the left side, but the prearterial segment is pushed in front of the artery into the mesentery of postarterial segment which stretches out a sac and the caecum etc., come to lie in front in the middle line. A third type may occur in which the caecum occupies the pyloric region and the prearterial segment shows no signs of rotation. In these cases a long narrow mesentery fixed at the duodeno-colic angle results and most of the small intestines occupy the right and aspect of abdominal cavity. Such cases are very liable to volvulus.

Reverse Rotation.—The prearterial segment passes in front to the left and postarterial segment behind the artery to the right. Hence the duodenum is in front of superior mesenteric artery and transverse colon behind the artery. But this condition is very rare.

Third Stage.—The caecum and ascending colon increase in size and caecum travels down to occupy the right iliac fossa. Next fixation of different parts of intestines occurs. The postarterial mesentery fuses completely with parietal peritoneum except the portion belonging to part of transverse colon. The prearterial mesentery fuses with parietal peritoneum to form its normal attachment. The mesenteries of caecum ascending and descending colons fuse with parietal peritoneum and are obliterated.

Anomalies in the third stage may be.—(1) Non-descent of caecum, (2) Mobile caecum and terminal ileum from non-fixation of post-arterial mesenteric segment, (3) Mobile caecum and ascending colon from non-obliteration of their mesentery, (4) Excessive fusion or abnormal fusion may produce a variety of conditions.

Surgical complications of the above conditions may occur or the condition may be noticed while a laparotomy for other purposes is done.

Either volvulus or obstruction may occur in non-rotation, mal-rotation or in reversed rotation and where the postarterial mesentery is not fixed. This may occur in infants. Volvulus of this type does not cause immediate obstruction to circulation but only to lumen of the gut. Later however obstruction to circulation also occurs. Clinically the condition is difficult to diagnose. It resembles pyloric stenosis of infants, but bile is present in the vomit. In older children and adults it is still more difficult to diagnose except with the help of barium meal roentgenograms. In older patients the obstruction is of the high type and pain is unconnected with taking of food and bowel movement. Emptiness of right side of abdomen is suggestive (Waugh). In adults there may be only vague abdominal symptoms or none at all, the condition being discovered in an exploratory laparotomy.

Case Report.—Mrs. S. I., aged 29, was admitted into General Hospital for symptoms of chronic intestinal obstruction of about 9 years' duration.

History.—About nine years previously patient had pain in the left side of abdomen and felt something "rolling" inside. There was vomiting and she was unable to retain food. This lasted about three days. Similar attacks occurred now and then lasting for couple of days. During this period she gave birth to two children. During the last three to four months the attacks have become worse and more frequent.

Examination revealed couple of tender lumps on the left side of umbilicus. The abdomen was distended especially when pain was severe. Roentgenograms after barium meal showed a non-rotation of intestines with caecum and colon lying in the left of abdomen. In addition delay of barium in the terminal part of ileum was also noted. A clinical diagnosis of tubercular entero-peritonitis was also made.



Picture II. One hour and a half. Small intestines are all seen to the right side as before. Barium is beginning to pass to the left in the last part of ileum.



Picture I. Half after barium meal. Duodenum and upper part of small intestines are seen all on the right of vertebral column.



Picture III. Two hours. Barium is passing across through terminal part of ileum.



Picture IV. Three hours and a half. Barium is passing up the ascending colon.



Picture V. Five hours. Shows delay in the ileum. The terminal part of ileum is visualised and shows a narrowing in one part and also shows the distended ileum proximal to it. Barium is just passing through transverse colon into descending colon.

These rentgenograms were done by the X-ray Institute, Madras, and the writer of the article is obliged to Capt. T. W. Barnard and his Assistants for their great help.

Laparotomy on 4th October 1932. A left para-umbilical incision was made and peritoneal cavity opened into. The duodenum passed straight down on the right side and jejunum, ileum occupied the right half of coelom. The last portion of ileum crossed from right to left to end in the caecum. The caecum, ascending, transverse and descending colon were all occupying the left half of abdominal cavity. The caecum and ascending colon, had a mesentery of about five inches width. In the terminal 14 inches of ileum, hypertrophic tubercular areas about one to two inches in size and three inches apart were found. The ileum proximal to them was hypertrophied and distended. The ileo-caecal group of glands were enlarged. Tubercles of the size of pinhead were present on the peritoneum over the lesions. An iso-peristaltic lateral anastomosis between the ileum proximal to the hyperplastic areas and proximal end of transverse colon was done. Wound healed by first intention with relief of pain for sometime. The pain again appeared but there were no signs of obstruction and bowels were regular.

I am greatly obliged to Dr. M. R. Gurusawamy, Second Physician, for assistance in the clinical diagnosis of this case. I am also obliged to the Staff of X-ray Institute, Madras, for the barium-meal roentgenograms and assistance in their interpretation.

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Editorial.

We offer our hearty congratulations to Dr. T. S. Thirumurthi, Professor of Pathology, Medical College, Vizagapatam, on the well merited honour of "Rao Bahadur" conferred on him by the Government.

We understand that the proposals of the Retrenchment Committee, regarding the revised scales of pay for the Madras Government Servants, as approved by the Government of Madras, are circulated to the heads of departments. As we are not in possession of a copy of the same we are not in a position to consider it in detail. But what we wish to press on the notice of the Government is this: It has been conceded that the Madras Medical Service is a homogeneous one. The Assistant Surgeons, Civil Surgeons and Selection Grade Civil Surgeons all belong to the same Service just like the Captains, Majors and Colonels belong to the same Indian Medical Service.

All the permanent Assistant Surgeons entered Service with the full hope of becoming Civil Surgeons and Selection Grade Civil Surgeons under the existing scales of pay. This is only a legitimate aspiration of the Service men. The new scales of pay and prospects of Service should not affect the existing men. They should apply only to the future entrants who come with open eyes regarding their prospects. But to disappoint the existing Service men by artificially dividing them into separate groups, by interposing new scales of pay and by dulling their prospects is, to say the least, bound to create discontent and strain their loyalty to the service. This, in our opinion, is an unhealthy precedent which, if allowed to occur, is likely to mar the attraction and integrity of Government Service.

We trust that the Government in their anxiety to effect retrenchment will not fail to consider this aspect of the question which, in our opinion, is a serious one. We are not sure that the retrenchment cannot be effected

without resorting to the application of the new scales of pay and prospects to the existing men in Service. We shall consider the new scales of pay to the Madras Medical Service when we get further information.

We are happy to learn that the Madras Government is going to restore the 10 per cent cut by the 1st April 1933, in due fulfilment of the promise of the Finance Member to the Legislative Council. We offer our grateful thanks and congratulations to the Madras Government as this wise step will enhance the confidence of their servants in the Government.

Association Notes

The Annual General meeting was held on Saturday the 17th December 1932. The Annual report and the auditor's statement of accounts were adopted. The following office-bearers were elected:—

President.

Dr. A. Lakshmanasami Mudaliar.

Vice-President.

Dr. M. R. Gurusami Madaliar.

„ T. Madhava Rao.

Executive Committee.

Dr. P. V. Cherian (*Treasurer*).

„ G. R. Dinker Rao.

„ N. Mangesh Rao.

„ N. S. Narasimhan.

„ P. Venkatagiri.

„ Miss E. Maduram.

„ C. Abbu.

„ S. Ramakrishnan

„ A. S. Mannadi Nair } *Secretaries.*

Mr. Y. Ramaswamayya was appointed as auditor for the next year.

Dr. P. Kutumbayya moved a resolution that the Executive Committee be requested to represent to Government through the Surgeon-General regarding the posting of certain members of the service to the Teaching appointments in the Civil Surgeon grades but drawing a pay of an assistant surgeon.

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level of its predecessors, several prominent Radiologists having promised articles of much
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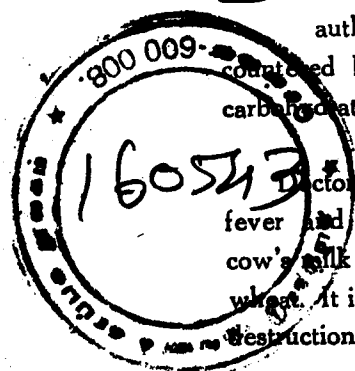
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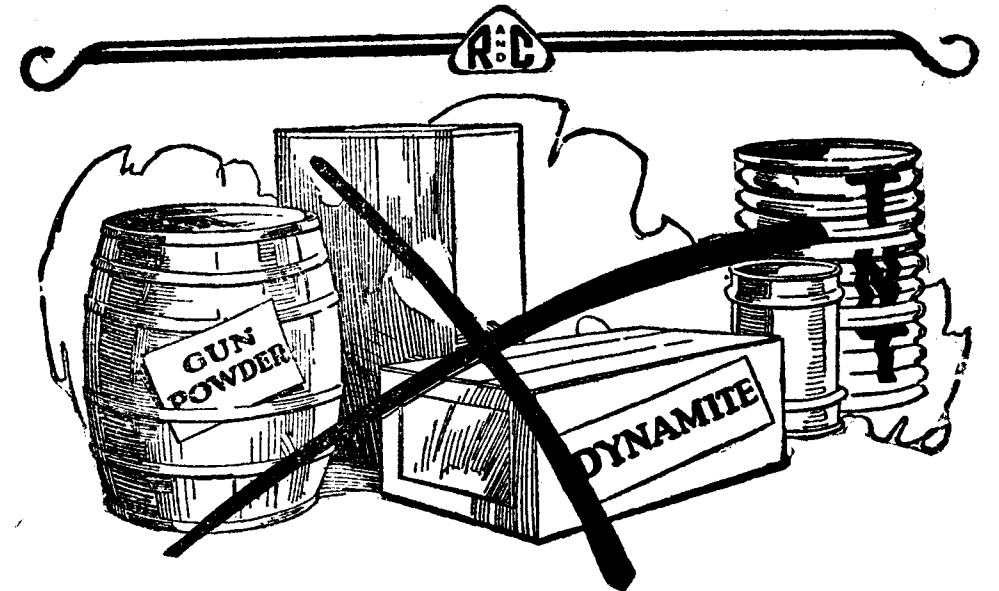
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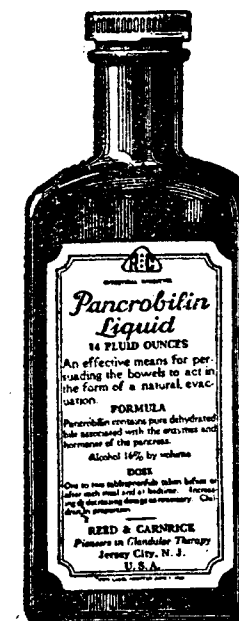
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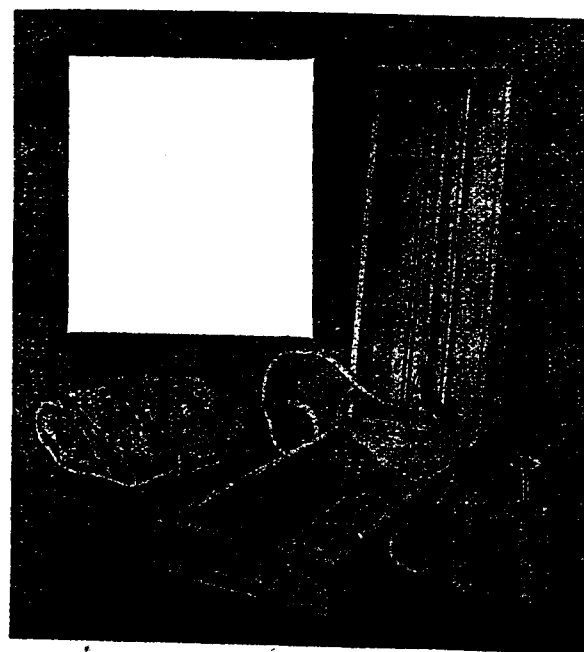
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