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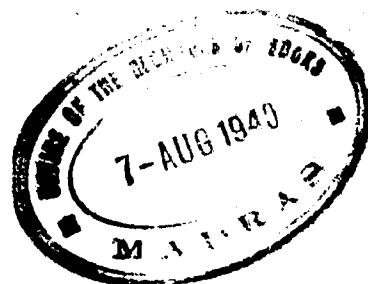
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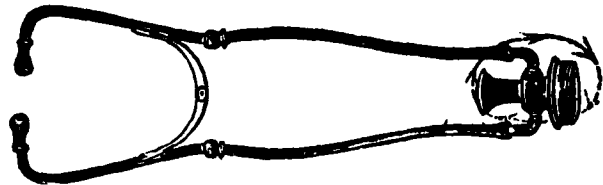
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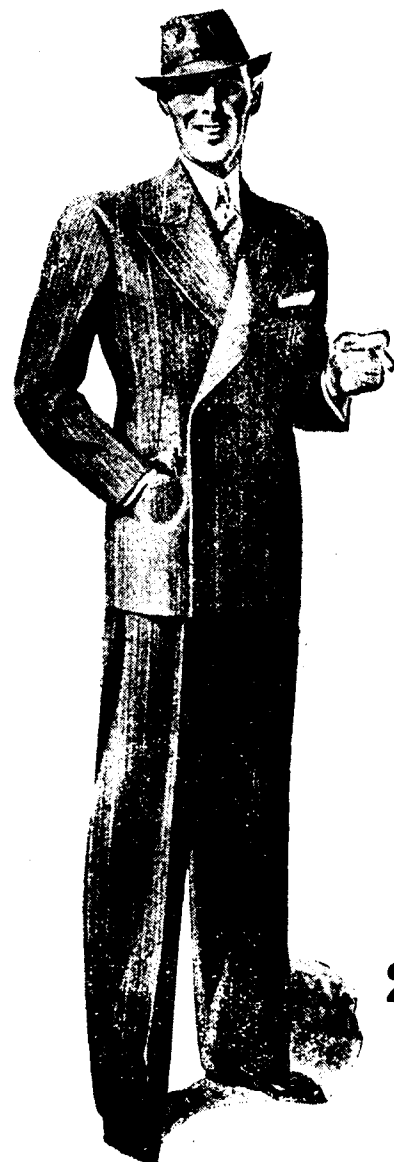
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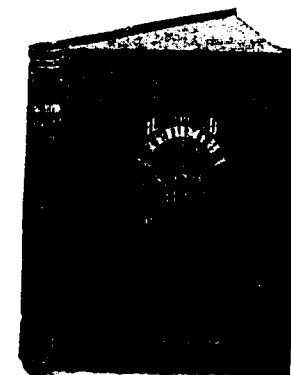
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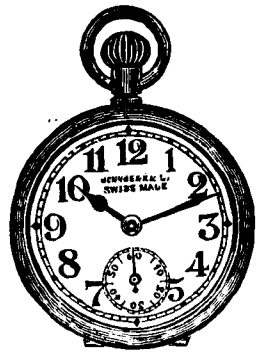
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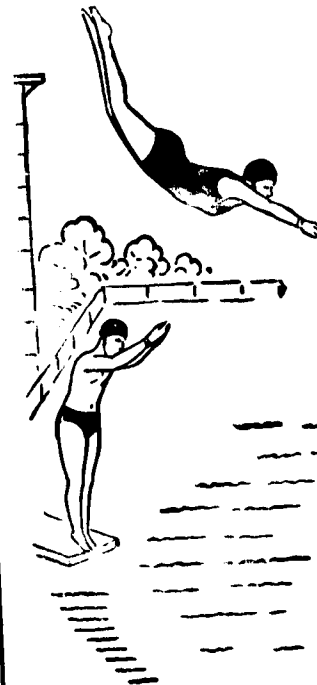
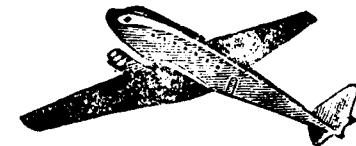
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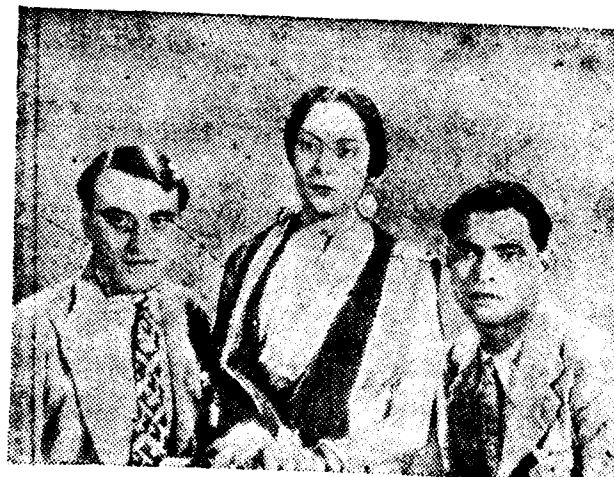
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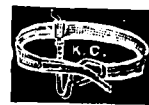


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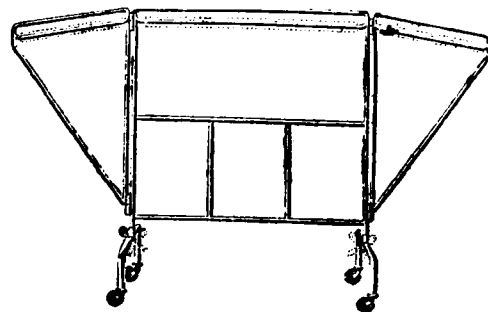
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—British Journal of Surgery, April 1940.

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Vol. XIX.

JULY 1940.

No. 4.

Some Anatomical Considerations of the Liver Bearing on its Pathology

BY Dr. P. RAMACHANDRA RAO, M.B., B.S., Ph.D. (Lond.),

(From the Department of Pathology, Medical College, Vizagapatam).

Much water has flown since Malpighi (1687) corrected the errors of Fallopius (1523-1562) and established the direction of the flow of bile from the liver to the duodenum independent of the gall bladder and cystic ducts and since Wepfer (1664) discovered the lobular structure in the liver of pigs; yet, our knowledge of this important organ today has been truly described as inversely proportional to its size. In this paper, my object is to present chiefly those obscure points in the anatomy of this organ, the elucidation of which appears to be intimately linked up with the correct appreciation of the mechanism of the various morbid changes appearing in disease, and offer a few criticisms on the validity or otherwise of the different current views on these points.

1. Developmental Anatomy

The Parenchyma and the biliary apparatus.—The human liver develops as a single diverticulum from the ventral wall of the future duodenum (Thompson 1908). In the early part

of the development (4.9 mm. embryo) however, a solid mass of cells from the anterior and ventral wall of this diverticulum alone, is observed to proliferate in the form of irregular masses and anastomosing cords of cells, in which the peripheral arrangement of the nuclei suggests a solid tubular structure (Bremer). An axial capillary lumen bounded by 5 or 6 cells is distinguishable in the hepatic trabeculae of the 10 mm. embryo (Toldt and Zuckerkandl) and becomes more marked in the 37 and 44 mm. embryos. The thickness of the trabeculae and the number of cells bounding the axial capillary become progressively less on account of the stretching of the cords (Toldt and Zuckerkandl). This tubular structure however persists only in the livers of some of the lower vertebrates, e.g., myxinoids, reptilia, etc., after birth. These compound branching anastomosing tubules or hepatic trabeculae grow out into the ventral mesenteric portion of the septum transversum and insinuate themselves there into the meshes of the pre-existing vascular

network formed by the paired system of vitelline veins. (Bremer). The ground plan of this vascular network, is said to be remarkably constant (McIndoe) and its growth rapidly progressive with the growth of the hepatic trabeculae. In the 10 mm. embryo, in which the hepatic ducts have not yet extended to any noticeable distance, up the portal ramifications, detached ducts lined by cuboidal or columnar epithelium and connected by one or both ends to the hepatic trabeculae, representing the unvalled junctional tubules of the portal periphery, (canals of Hering) have been observed. Thus these structures are genetically related to the hepatic trabeculae and are different from the later developing (walled) bile ducts.

The rest of the hepatic diverticulum consisting of deeply staining cells, abruptly marked off from the anterior and ventral parenchymal bud, gives rise to the gall bladder, cystic, common bile and hepatic ducts. The last mentioned structure appears along side the main branches of the portal vein and establishes free communications with the hepatic trabeculae, in the 22.8 mm. embryo. Thus, in the human embryonic liver unlike that of chick (2 diverticulæ) only one diverticulum is present, yet this consists of two separate parts—Pars Hepatica and Pars Cystica (Hertweg) from which the hepatic parenchyma and the "canals of Hering" on the one hand and the biliary ducts and gall bladder on the other arise respectively (Geraudel 1907, Hertweg, Felix and others).

The portal vein.—The extra-hepatic portal vein is formed from the paired vitelline veins by a process of anastomosis ventral and dorsal to the duodenum and atrophy of the right part of the caudal and the left part of

the cranial loops. In the 7 mm. embryo, the left umbilical vein joins the cranial part of the loop, and the umbilical blood overshadows the vitelline circulation, and drains out through the ductus venosus into the inferior vena cava. At birth the vitelline route is restored again and the umbilical route is obliterated.

The hepatic artery.—The hepatic artery develops primarily as the artery of the gall bladder and is first seen following the hepatic ducts in the 10 mm. embryo. It forms capillary plexuses especially around the hepatic ducts from which the blood is drained by venous radicles into the portal branches.

2. Gross Anatomy

The size and weight.—The size (average 2.6 x 1.5 x 8 cm.) and weight (1500 g. or 2.5 to 2.7 per cent of body weight in adults and 3.6 to 4.4 per cent in the new born child (Sternberg)) of the organ can vary within very wide limits without being abnormal, on account of:—

(1) The unique sponge like distensibility of its vascular and lymphatic apparatus (Sir Lauder Branton, Azoulay and Jacquelin) and its important function as a protective reservoir of blood in the circulatory circuit close to the right heart (Werner Gerlach).

(2) The variations in the size of the hepatic cells corresponding to the different metabolic phases of the organ. Simonds and Calaway noted 25 per cent increase in the ratio between the hepatic weight and the body weight in dogs after temporary constriction of the hepatic vein, due to oedema of the organ and swelling of the hepatic cells.

The lobes.—The customary division of the organ into four lobes refers only

to a superficial lobation and is of little significance to the morbid anatomists, as these lobes never betray an individuality in any morbid process of the liver. On the other hand a line running from the fossa for the gall bladder, to the entrance of the hepatic veins into the inferior vena cava, has been shown to divide the organ to very nearly equal and separate halves, supplied by the right and left branches of the portal vein, hepatic artery and hepatic duct respectively [Wertheimer and Lapage (1896); Cantile (1898); Serege (1901); Silvestri (1905); Looten (1908); and Bartlet Corper and Long (1909)]. McIndoe and Counseller have more recently demonstrated in celloidin corrosion preparations an absolute independence between the two halves of the biliary system and only a capillary and arteriolar anastomosis in the case of portal venous and hepatic arterial trees respectively.

The parenchymal foliæ.—The fine uniform foliations of the liver seen both on the surface under the capsule and also on the cut surface erro-

neously hitherto called lobules, are due to a remarkably regular and exact dovetailing of the terminals, of the hepatic and portal venous trees so that each portal terminal has two hepatic terminals, one on each side at a maximum possible but constant distance and connected only by a capillary sinusoidal network (Kretz, Kelly, Epplen, Mall and others). Direct anastomoses have been denied by McIndoe and Kolliker. The terminals of either of the venous trees are reached by a system of 5 or 6 divisions at nearly right angles, from their main trunks. The absence of valves in the branches or trunks of these veins requires particularly mention. The hepatic parenchyma forms a continuous mantle between the branches and terminals of the two venous trees (Löffler, Von Theile). According to this conception of a unity of the hepatic parenchyma, the following change in the nomenclature of the divisions of the hepatic vein were suggested by Fick and accepted by Brans Pfhul and others.

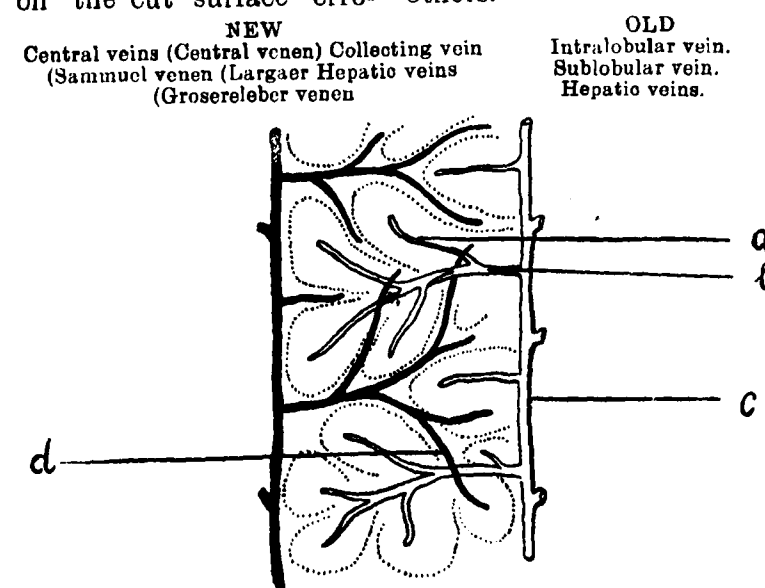


Fig. 1 — Diagram representing the plan of the vascular dovetailing and the consequent formation of foliations. a—central vein; b—collecting vein; c—larger hepatic vein; d—portal terminal (Reproduced from 'Human Embryology' Vol. II. Kibel and Mall.)

The last, does not receive smaller capillaries. The others receive capillaries throughout their length, unlike the portal radicles in which the capillaries are terminal. (Fig. 1.)

The hepatic artery.—The course and distribution of the hepatic artery in the liver closely follow those of the

portal vein, round whose branches the arterial branches have been observed to wind round (Fig. 2.). But the method of the final distribution of the hepatic arterial terminals has been subjected to some dispute. Conheim and Litten believed that no arterial blood directly flowed into the sinusoids.

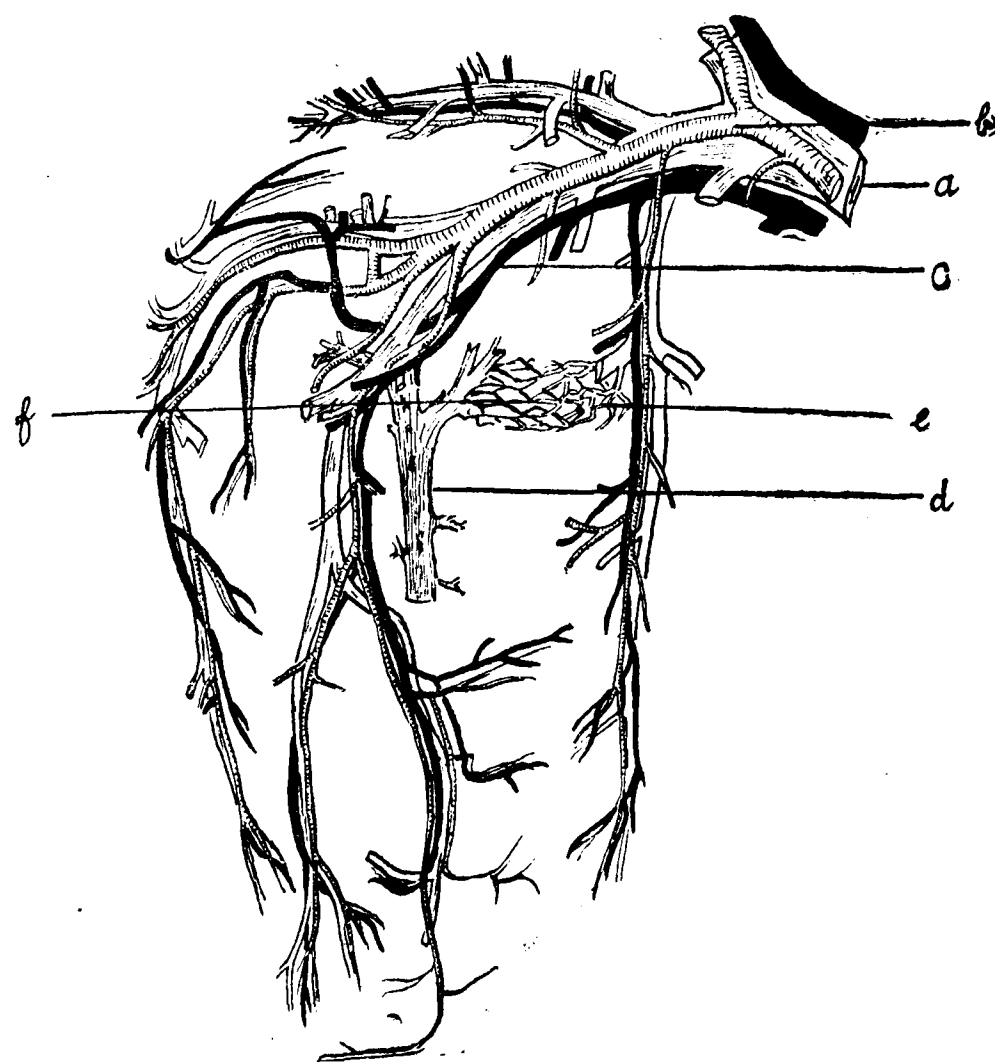


Fig. 2.—Diagram representing the distribution of the blood vessels, ducts and the capillary extensions of the former in and about the foliæ, a—portal vein, b—hepatic artery; c—bile duct, d—hepatic vein, e—portal sinusoidal territory, f—hepatic sinusoidal zone. (Drawn from the picture of a lobule of the liver of the pig; in F. Henke and O. Lubarsch's Handbook of Special Pathological Anatomy and Histology p. 79).

Rindfliesch concluded from certain morbid anatomical evidence (amyloid change) that the arterial blood reached the midzone of the parenchymal mantle. The conclusions arrived at by Cameron and Mayes after a carefully carried out investigation with milk injections followed by specific staining and with lipoidal injections followed by X-ray photography of the vessels of organ confirms to a large extent the older views of Kiernan (1833), Theile (1844), Beale and Weber (1851), Kolliker and Oppel, Pfuhl (1922) and Loeffler (1927), and may be accepted at present as sufficiently authoritative.

According to their conclusions, the hepatic artery is essentially a nutrient vessel of the Glisson's sheath and its structures and very little of its blood flows directly into the sinusoids.

The following are its modes of final terminations:—

(1) A rich capillary plexus on the wall of the branches of the bile ducts; this is the most important part of its destination.

(2) A capillary plexus on the wall of the branches of the portal vein.

(3) A capillary plexus in the Glisson's sheath.

The blood from these capillary plexuses is collected by venous rootlets which drain into the branches of the portal vein. These constitute intra-hepatic rootlets of the portal system.

(4) An occasional arterial capillary has been observed to drain directly into the sinusoids.

(5) An arteriolar plexus under the capsule which anastomoses with the branches of the phrenic, internal

mammary and suprarenal arteries, and establishes communications with the vessels of the right kidney and epigastric region. The arterio-venous anastomoses presumed by Gad (1873), to be present in the ramifications of Glisson's sheath, outside the lobules have found no support by later observers.

The bile ducts.—The ramifications of the right and left branches of the biliary tree in the right and left lobes followed again the divisions of the portal vein in the Glisson's sheath and terminate at the periphery of the parenchymal foliæ in the canals of Hering or junctional tubules.

The lymphatics.—The drainage of the large amount of lymph ($\frac{1}{3}$ — $\frac{1}{2}$ of the entire lymph of the body) filtered out in the liver, is subserved by three sets of lymphatic efferent plexuses viz.—

(1) The Portal.

(2) The Hepatic.

(3) The Subcapsular and Diaphragmatic.

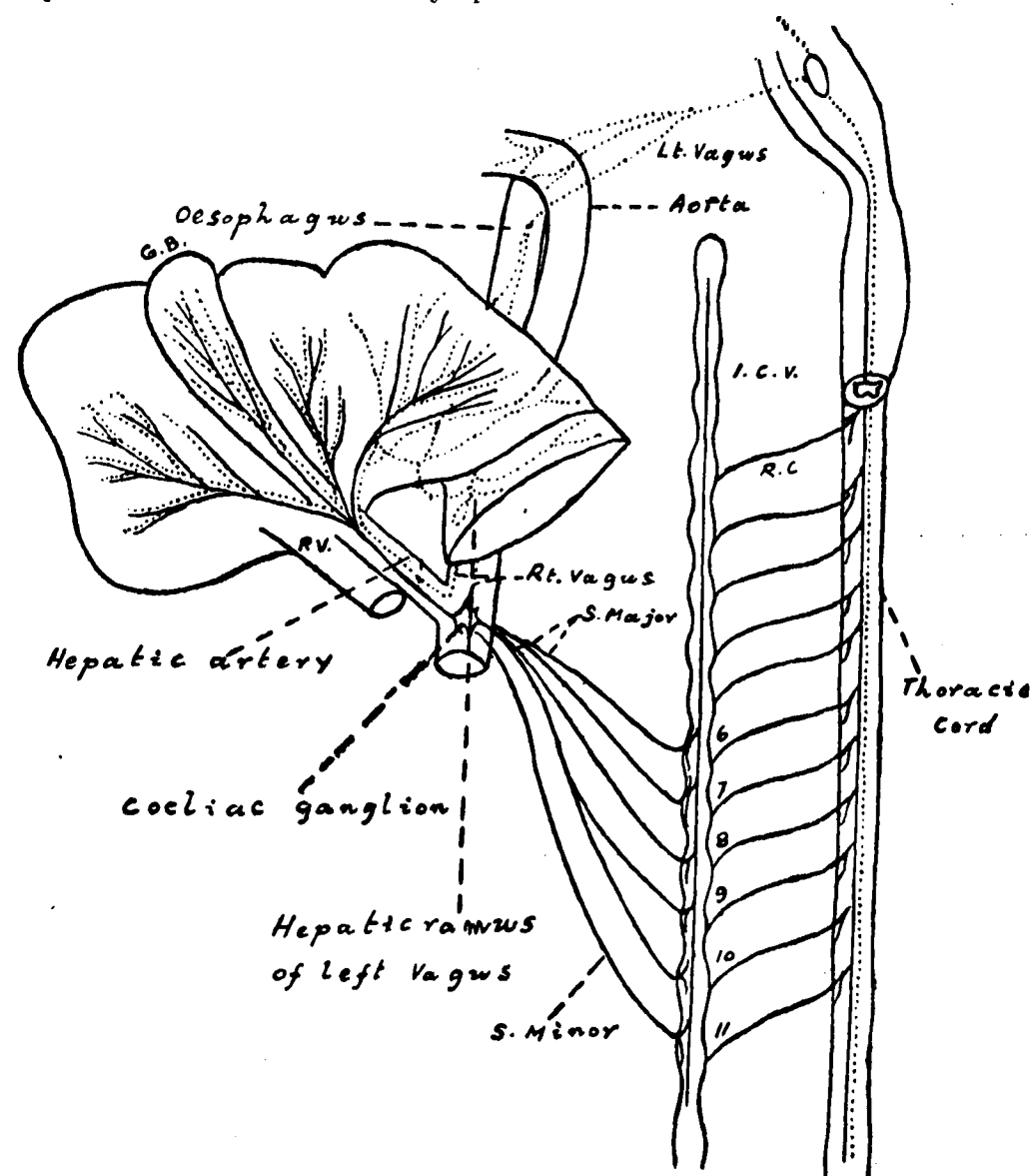
The portal plexus of lymphatics, lodged in the loose connective tissue of the Glisson's sheath, is the most important afferent group which after passing out of the liver through the Porta Hepatis, traverses the portal and pancreatic group of glands, to drain finally into the receptaculum Chyli. The lymphatic plexus accompanying the hepatic veins, pierces the diaphragm along the inferior vena cava and anastomoses with the third set in the posterior mediastinum. The third set of lymphatics from the convex surface of the liver pass along coronary and falciform ligaments to glands behind the lower end of sternum above the diaphragm and thence pass upwards with the internal

mammary vessels. These communicate freely with sub-peritoneal and subpleural lymphatics of the diaphragm and some of them also open directly into the thoracic duct. (Teichmann).

The perisinusoidal lymph spaces lying between the hepatic cords and the reticular walls of the sinusoids, described by Disse as lymph vessels, have been successfully injected by MacGillavry, Maresch and others. They have been described as lymph

sheaths by Fleischl, Budge, V. Wittisch, MacGillavry and Schmidt. These can be shown to open into the portal hepatic lymphatic plexus. (Mall, 1906) and may be viewed as the roots of the latter (Werner Gerlach).

The nerves of the liver.—The liver is richly supplied with nerve fibres of both sympathetic and parasympathetic origin. The accompanying diagram of Kuntz (Fig. 3) is self explanatory.



Some Anatomical Considerations of the Liver

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Both the right and left vagi send branches to the liver. The former pass behind the oesophagus and stomach to join the coeliac ganglion, from which post ganglionic fibres enter the liver and are distributed along with the portal vessels. The latter pass in front of the oesophagus and enter the left lobe of the liver in the gastrohepatic ligament, and are more or less exclusively distributed to that lobe. Among the thoracic segments that send out sympathetic fibres to the liver by way of the splanchnic nerves, the coeliac ganglion, and the anterior and posterior hepatic plexuses, the ninth is probably the most important (Arthur Keith). Besides the above mentioned, fibres from the phrenic nerve supply sensory branches to the mesohepar and other attachments of the liver (Arthur Keith); extrinsic fibres also ascend into the liver on the walls of the vessels. Inside the liver, though Korolkow is said to have observed the distribution of medullated fibres to the coats of blood vessels and of non-medullated fibres to the lobules, I was not able to demonstrate more than a stray medullated fibre or two in numerous bundles of non-medullated fibres found in the periportal connective tissue of the first three orders of portal divisions. (Fig. 4). The ultimate distribution of the non-medullated fibres in delicate plexuses around hepatic vessels, bile ducts, and hepatic cells described by previous writers [Berkeley (1893); Greving (1924); and Dogiel (1895)] has to be accepted with caution, as the perisinusoidal and pericapillary reticular fibres are also argentophilic and have been frequently mistaken for nerve fibres in preparations stained by silver impregnation. In my frozen preparation of P. M. livers stained by the silver impregnation technique of Bielchowsky modified by Gross Schutz,

the non-medullated nerve fibre bundles stain in the larger divisions of the Glisson's sheath, but the ultimate terminals failed to take the stain, probably due to the loss of the neurilemmal sheaths and early post mortem destruction of the naked axis cylinders. The other silver impregnation techniques like Hoff's modification of Cajal's method of staining for nerve endings (suggested by Dr. Carmichael) and the different modifications of Foot's technique invariably stained only the reticulum. The intravital staining with methylene blue, by which Wolf (1902) had found the fibres to penetrate the liver lobules and terminate in a network about the liver cells, may be accepted as a more reliable method but not applicable to post mortem material.

The connective tissue.—The Glisson's connective tissue sheath of the afferent vessels and excretory ducts is so scanty in the liver of the new born, that its presence normally, was denied by Beal. Even in the adult livers it is scanty and represents the adventitial connective tissue of the vessels and lymphatics contained in it. It contains besides collagen fibrils, numerous reticular and elastic fibres and histiocytes. The reticulum of the sinusoidal network of the parenchyma is continuous with collagen and reticular strands of this tissue.

3. Microscopic Anatomy

The Parenchyma.—In this, the mesenchymal elements constituted by the sinusoidal network with its reticulum, endothelium and Kupffer cells are as worthy of consideration as the anastomosing hepatic cords of entodermal origin. Much of the misconception that even now exists in many quarters regarding the minute anatomy of this part of the organ, is

principally due to the absence of a well defined cell wall or limiting membrane in the hepatic cells and the resistance of the reticulum to the ordinary methods of staining. McNee's schematic representation of the parenchymal structure is very lucid, but needs modification, in that it conveys the impression of the presence of a lobular configuration in the parenchyma. In (Fig. 5). I have endeavoured to combine the continuous mantle

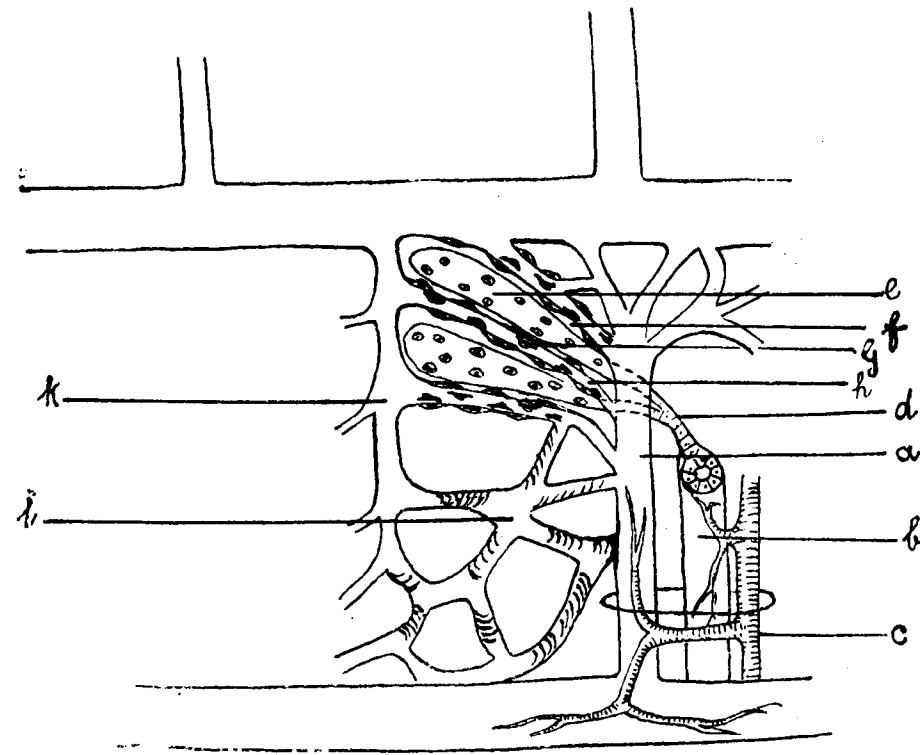


Fig. 5—Schematic representation of a hepatic folium; a—portal terminal; b—bile duct; c—hepatic artery; d—canal of Hering; e—hepatic cord; f—the lymphspace of Disse; g—Kupfer cell; h & i—sinusoids; k—central vein.

conception of the parenchyma, with McNee's scheme of the relation of the hepatic cords to the bile capillaries and the sinusoids. The cross anastomoses between the hepatic cords and the sinusoids have been omitted for the sake of simplicity. In frozen sections of the liver stained by the Foot and Menard technique especially when counterstained by passage through oxalic acid (5 per cent) sol. after toning, the majority of the segments of the convoluted anastomoses

ing hepatic cords, occupying the meshes of the capillaries clearly show a solid tubular structure and arrangement of nuclei. (Fig. 6). The hepatic cords have a potential axial lumen which is again not easily definable unless when outlined by the accumulation of metabolic products as hæmosiderin in early cases of Hæmochromatosis or by bile thrombi in biliary stasis, bounded usually in adult human livers, by two hepatic cells. In the stretched



Fig. 4-b—One of the larger nerve bundles in the third order of the Portal space—*a*—non-medullated nerve fibre bundle. (Gross-Schultz' modification of Bielschowsky's stain: Apochrom, obj. 4. m.m. periplanat eye piece—4 mm Leitz.)

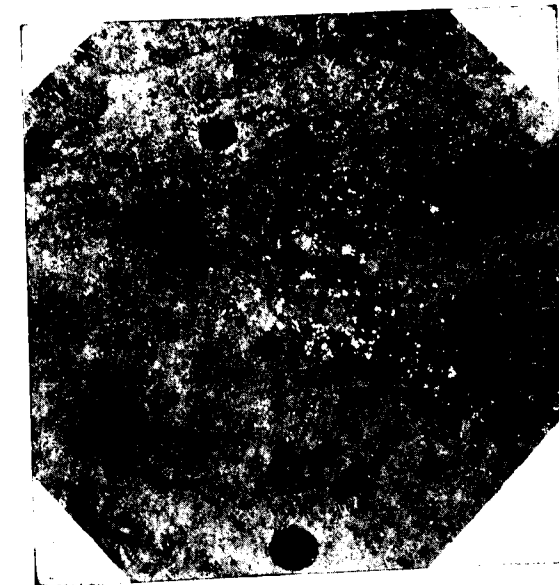


Fig. 4-a—Photomicrograph showing the bundles of non-medullated nerve fibres in a part of the Portal space of the 2nd order. The nerve bundles are stained dark. (Gross-Schultz' modification of Bielschowsky's method. obj. 0. m.m. Periplanat eye piece.—4 m.m.)

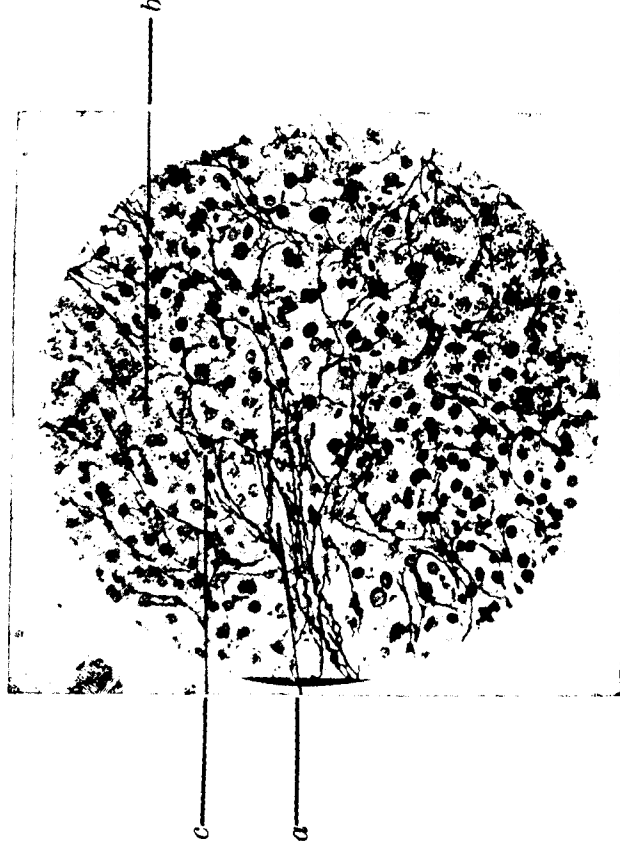


Fig. 6—Photomicrograph showing the segments of the hepatic cords lodged in the meshes of the sinusoidal network; most of the segments show a double peripheral row of nuclei; *a*—portal terminal; *b*—hepatic cord; *c*—sinusoids. (Foot and Menard's silver carbonate impregnation technique Apochrom obj. 4 m.m. Periplan eye piece, 4. m. m. Leitz.)

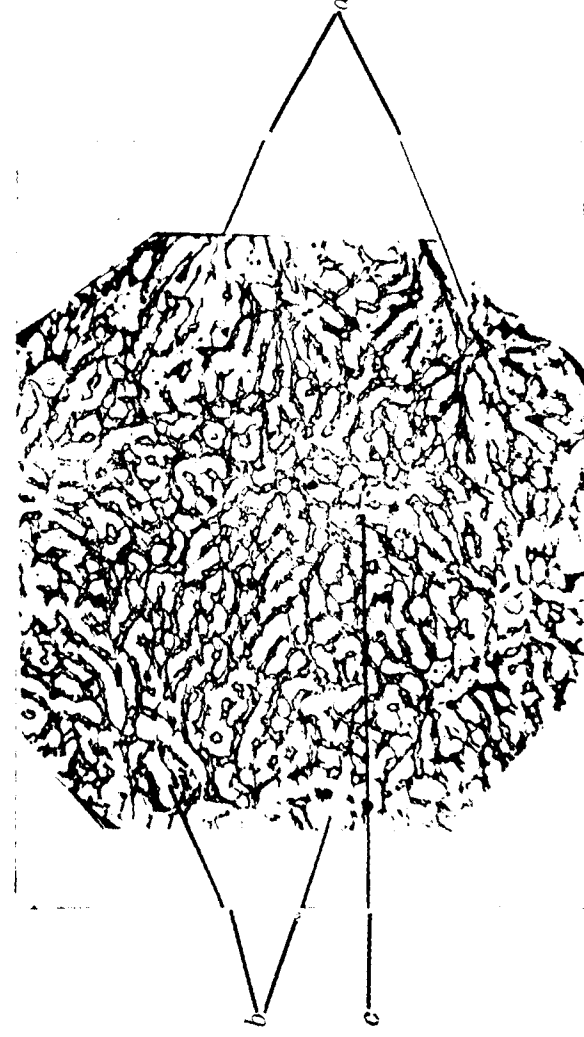


Fig. 7—The sinusoidal capillary network between the Portal and hepatic venous terminals; *a*—Portal terminal; *b*—hepatic terminal; *c*—portal territory; *d*—central territory; *e*—intermediate zone. (Foot and Menard's silver impregnation method Apochrom. obj. 8 m.m. Periplanat eye piece 4 m. m. Leitz.)

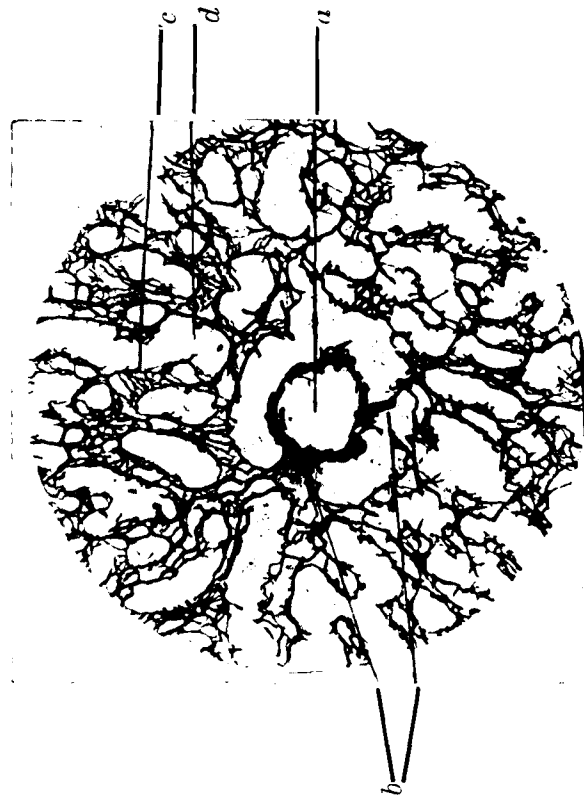


Fig. 8—The central vein with the capillary bed around :
a—the central vein ; *b*—the capillaries draining
 into the central vein ; *c*—the sinusoidal network.
d—the meshes in which the hepatic cords are
 lodged—unstained. (Foot and Menard's silver
 Carbonato impregnation method. Apochrom
 obj.—4 m. m. ; Periplanat eye piece—1 m. m.
 Leitz.)

condition (Toldt and Tuckerand) of the cords in the normal adult liver, the bounding cells often appear to have glided over each other in many places, showing only the nucleus of one cell in the cross sections and an eccentric axial lumen. These cords open only towards the periphery of the portal spaces into the junctional tubules (canals of Hering). On account of the free anastomosis between the convoluted cords, the entire parenchyma of each lobe exhibits a continuity and it would be incorrect to talk of a hepton in the manner of a nephron. The discussion as to whether the central hepatic vein (Kiernan) or the bile duct terminal (Sabourine and Brissaud) or the portal terminal (Mall) is the centre of the hepatic unit, is fruitless.

The appearance of the hepatic cells in stained preparations may be very variable, and undue importance should not be attached to this, for such changes may be brought about by specific alterations in the diet. Maximow and Bloom have pointed out that in animals fed :—

(1) with excess of fat, there is fatty infiltration, of the cells with decrease of mitochondria,

(2) with excess of carbohydrate, pallor of the cells and accumulation of small iron containing particles, between the glycogen granules

(3) and, with excess of proteins, swelling of the cells with numerous protein inclusions. The intracellular plasmatic channels [(Asp., 1873); Fraser, (1895); Nanwerck; Herring and Simpson;] and R. B. C. inclusions (Browicz) in hepatic cells, described by older writers, were evidently the anastomotic capillary sinusoids which cross the hepatic cords and their contents, their walls not being demon-

strable by the older methods of staining.

The sinusoidal capillary bed.—The remarkable constant depth of this network of capillaries (named by Minot as sinusoids) connecting the terminals of the portal vein has already been referred to. A complete wall is provided to the sinusoids by—

(1) an abundance of branching argentophilic reticular fibres proceeding both from the portal terminals and the walls of the hepatic veins and running parallel to the length of the capillaries.

(2) A feltwork of finer hairy transverse processes from the above with a fine ground substance,

(3) the lining endothelial cells

(4) and adventitial Kupffer cells.

The disposition of the reticular fibres streaming both from the hepatic vein and the portal vein on the walls of the capillaries into the parenchyma, suggests a division of this capillary bed into a hepatic venous and portal venous capillary territory, corresponding to the central and peripheral zones usually referred to in the so-called lobules. A physiological individuality of these territories can be inferred from the nature of their response to substances like Adrenaline, Histamine, etc.

The vessels.—In the minute anatomy of the portal vein, the author has been frequently impressed with the variations in degree of dilatation or constriction of the same level of the venous tree in different preparations, both from experimental and autopsy material. The thickness of the media of the vessels accordingly varies with the state of dilatation or constriction. In guinea pigs, in which the portal

venous musculature is particularly strong, I have noticed evidences of constriction in one part of the vessel (thick media and crowded endothelium disposed almost at right angles to the wall) and relaxation (thin media and spread out endothelium) in the adjoining segment.

The relation of this anatomical observation to the still obscure mechanism of the portal circulation and to the vasomotor mechanism presumed by Burton Opitz in the co-ordination of the arterial and venous afferents of the liver deserves further study.

The division of the parenchyma into three zones, *viz.*, of permanent repose in the centre, of permanent function at the periphery, and an intermediate zone of activity during digestion, based on a mitochondrial study without reference to the phase of vascularity of these parts (Noel and others) has less justification, as the morphology of the mitochondria in cells is well known to vary with the variations in the vascularity of the part.

The hepatic veins.—The central veins are normally devoid of connective tissue wall; the lining endothelium and ground substance being supported only by a coat of loosely arranged longitudinal or somewhat spiral branching reticular fibres. The united veins have more connective tissue and elastic fibres but no circular fibres or muscle tissue. The description of smooth muscle fibres in the walls of the large hepatic venous trunks in man by Elias and Feller (1926) and its relation to a sluice mechanism said to be present in Dogs [Bauer, Dale and others (1932)] at the junction of these veins with the inferior vena cava, sensitive to substances like Adrenaline (relaxation)

and Histamine (contraction) deserves mention.

Bile ducts.—The large bile ducts except the common bile duct have no smooth muscle tissue but possess considerable elastic tissue in their walls. They are lined by columnar epithelium having two rows of mitochondria one under the free margin and the other between the nucleus and the base. The junctional tubules are lined by cubical epithelium without connective tissue walls.

Comment

The genetic independence of the biliary ducts from the hepatic cords suggested by the development of the former at a later date from a mass of cells separate from those of the latter, lends support to the belief that in regeneration of the hepatic tissue, probably the ducts play very little part; but the possible differentiation of the hepatic cells from the cells of the junctional tubules and vice versa is favoured by their identity of origin. Besides, the above embryological fact lends weight to the theory of aplasia of ducts in congenital biliary cirrhosis and in the rare congenital cysts of the liver.

That the genesis and maintenance of the foliated structure peculiar to the hepatic parenchyma, is not intrinsically connected with the hepatic tissue but with the ground plan of the vascular network, both in the embryonic and in the adult liver, is often ignored, while looking for the cause of the loss of typical structure in cirrhosis; hence also the significance of the distortion of the hepatic and portal trees and the irregularity in their inter-relation, pointed out by McIndoe, is often missed.

The remarkable distensibility of the vascular and lymphatic apparatus and the physiological variations in the size of the hepatic cells do not warrant the promiscuous use of the term "Hypertrophic" liver to all conditions of hepatomegaly. In fact Hoppe Seyler's analyses of the liver in the so-called cases of hypertrophic cirrhosis show no increase in either hepatic or connective tissues.

The division into the right and left lobes has increased significance when considered in conjunction with the two main stream lines in the portal stream and explains the more frequent localization of the amoebic abscesses to the right lobe of the liver and the more frequent atrophies of the left lobe.

The supply of the major part of the arterial blood to the bile ducts must have a close relationship, hitherto not realised, to the incidence of pericholangitis and cholangitis in blood borne infections and toxæmias, and no doubt is responsible to preservation of these structure in conditions of extensive parenchymal necrosis as in acute yellow atrophy.

The rich sympathetic and parasympathetic innervation of this organ offers an anatomical basis for a presumable delicately poised autonomic balance in the organ, the disturbance of which may form the basis of many of the little understood attacks of hepatitis and necrosis. In the present day our pathological knowledge of this organ is entirely divorced of the changes in this master tissue.

Besides, in the causation of ascites of hepatic origin, the integrity of the important lymph draining apparatus has attracted little study of attention.

A considerable portion of the periportal plexus of lymphatics is occluded and organised in the late stages of decompensated portal cirrhosis, is beyond doubt.

The oedematous distension of the lymph spaces of Disse leading to separation and shrinkage of the convolutions of the hepatic cords, and a parenchymal oedema is often described vaguely as rupture of the hepatic cell columns.

The division of the sinusoidal bed into a hepatic and portal territory would offer an anatomical explanation to the distribution of the degeneration to the centre in back pressure, and in certain types of toxic necrosis and to the periphery in certain cases of fatty infiltration and hæmorrhagic necrosis, (eclampsia) according as the etiological agent affected the Hepatic venous or Portal venous trees respectively.

The unique abundance of the reticular fibrils (invisible in ordinary staining) on the walls of sinusoids of the human liver often continuous with collagen strands in the portal periphery and recognised to be capable of collagenous transformation in disease, is no doubt the source of the fibrous tissue which appears without marked fibroblastic proliferation in cases of cirrhosis following on the wake of the parenchymal atrophy and permanent closing down of some part of the capillary bed for reasons which need not be discussed here.

The free anastomosis between the hepatic cords, is responsible for the absence of biliary obstruction and jaundice in cases of obstruction of the smaller intrahepatic divisions of the bile ducts.

Summary

I. Developmental Anatomy.

The genetic independence of the bile ducts from the liver tissue including the canals of Hering.

The tubular structure of the branching anastomosing hepatic cords.

The genesis of the portal vein from the vitelline venous plexus which pre-exists the growth of hepatic tissue.

II. Gross Anatomy.

Variability of the size and weight on account of the distensibility of the venous and lymphatic apparatus of the organ.

The hepatic parenchyma is foliated and continuous—not lobulated.

The foliated structure, a result of the vascular pattern.

The Hepatic artery—a nutrient artery of the Glisson's capsule, vessels and ducts.

The three afferent lymphatic plexuses—portal, hepatic and diaphragmatic.

The sympathetic and para-sympathetic innervation of the liver.

The Glisson's capsule—an adventitia of the vessels.

III. Microscopic anatomy.

The parenchymal parts—the anastomosing hepatic cords with capillary

lumen of entodermal origin, in a sinusoidal network of mesenchymal source.

The reticular tissue on the sinusoidal walls.

The division of the parenchymal capillary bed into portal and hepatic venous territories.

The anatomical evidence of vasomotor activity of the portal branches.

The structure of the hepatic veins.
Comment.—The relation of the above anatomical facts to some of the hepatic changes in disease.

Acknowledgments.

The histological study of the reticulum and the nerves of the liver, on which the author has chiefly based his conception of the subject, was conducted in Prof. Kettle's laboratory in St. Bartholomew's Hospital, London, during his work in 1931—33, for the thesis on cirrhosis of the liver, accepted for the Ph.D. degree in pathology of the University of London. He has great pleasure in acknowledging the inspiration he has freely drawn from him in formulation of the ideas conveyed in this article.

His grateful thanks are also due to Prof. T. S. Tirumurti, for his encouragement and to Dr. M. V. Radhakrishna Rao for the assistance in the final preparations of the paper.

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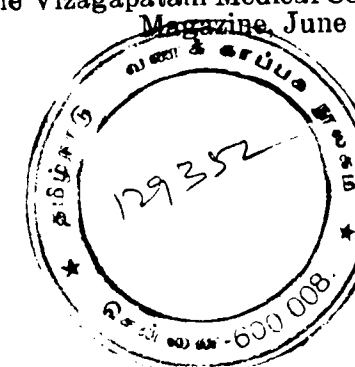
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SOME EXAMINATION HOWLERS.

Prof: What do you feel on putting your hand on the patient's chest?

Pupil: I feel a thrill sir.

Prof: And what is that thrill due to?

Pupil: It is due to a purring cat sir!

The patient had cedema of one of his lower limbs. When asked the cause for it, came the unexpected reply that it was due to an unilateral nephritis.

Why is it an upper motor nemone lesion and what is the test for it?

Because the upper limbs are paralysed. The test applied is the coin test—You drop a coin and ask the patient to pick it up. If he picks it up it is positive.

What is the treatment of Pott's disease. Remove the diseased vertebrae. And what is one to do with the spinal cord. Remove that as well!

"I'm not denying that women are foolish, God Almighty made them to match the men".
—Mrs. Payser.

"To most men, experience is like the stern lights of a ship, which illumine only the track it has passed."
—Coleridge.

The fickleness of the women I love is only equalled by the infernal constancy of the women who love me.
—G. B. S.

A politician is a person with whose politics you don't agree. If you agree with him he is a statesman.
—L. G.

The simplest way of acquiring charm is to acquire a million dollars and let the fact be known.
—Jack Hanley.

A Welshman is a man who prays on his knees on Sundays and on his friends for the rest of the week. A Scotsman is a man who keeps the sabbath and anything else he can get for nothing. An Irishman is one who doesn't know what he wants, and is not happy until he gets it. An English man is a man who says he is self made and never ceases worshipping his maker.

—Sir Howard D'Egulle.

Infantile Cirrhosis OR Inter-Cellular or Peri-Cellular or Mono- Lobular Cirrhosis.

BY DR. K. NARAYANA MURTHI, M.D.,

(Hony. Physician, Govt., General Hospital, Madras.)

Diseases of the liver in adults and children are complicated in tropical countries like ours. There are several pre-disposing and exciting causes to which young children in our country are exposed. Idiopathic enlargement of the liver is commonly known as Infantile-biliary cirrhosis is a very common disease in our Presidency.

Infantile hepatic cirrhosis or to be simpler Infantile-cirrhosis is a disease of childhood which presents considerable difficulty both in diagnosis and treatment. The literature on this subject was meagre and scattered sometime ago, but of late a good volume of it has accumulated, the greatest contribution being made in our presidency by Drs. Tirumurti, Radhakrishnarao, Pandalai, Prabhu, Ramachandrarao, Murthi and others.

It is a disease found exclusively in India occurring among Hindu-Brahmin children between the age periods of 6 months to 3 years, though Muhammadans, Anglo-Indians and other races contributed to a small percentage towards the incidence of the disease.

It is very common in Bengal, Madras and Bombay Presidencies and United Provinces and is unknown in other parts of India. The disease particularly begins with dentition

and almost runs a fatal course within 3 months to an year. The author is inclined to view Infantile enlargement of the liver as a definite clinical entity, characterised by a slow and insidious onset with enlargement of both liver and spleen, with late ascitis occasionally with or without jaundice invariably ending in death.

History.—Castellani and Chalmers in 1919 have suggested that this disease is another form of Kala-Azar, but it is found in India in places where Kala-azar is unknown. The first person that described the clinical signs and symptoms was Sen in the year 1887. In 1891 Gibbons described in detail the morbid anatomy and histopathology of the disease which the present day text-books are still copying. The next contribution was in 1922 by Mukerji. Since then many papers have appeared on the subject dealing with etiology, symptomatology, epidemiology and treatment of the disease.

Geographical Distribution.—From no part of the world the disease has been reported to occur, except a report of a case from Mexico and a few cases from North China. Price in his text-book of "The Practice of Medicine" considers that the disease is unknown in France and England; but cases of cirrhosis in children are

ascribed to ascending cholangitis. Rogers and Megaw in their text-book on Tropical diseases while recognising cases of non-alcoholic cirrhosis among Indians, did not throw any light on Infantile cirrhosis on account of lack of post-mortem material. Manson-Bahr devoted 3 pages in his Manual of Tropical Diseases for the description of the disease. Year after year cases are reported in the Indian Medical Journals and one is certain of the disease existing as a separate entity.

It is very difficult to say why the disease is unknown in other parts of the world or as a matter of that why it is unknown in some parts of India. In India cases have been reported mostly from Calcutta and Madras and a few from Bombay and United Provinces; Travancore and Mysore also reported the occurrence of the disease. In our Presidency, the Southern districts are more affected than the Ceded Districts and the Circars. It is prevalent in both towns and villages. A great part of Bombay Presidency, Punjab, Kashmir, Rajaputana and Assam is entirely free from the disease. It is noteworthy that this disease is unknown in Assam where Kala-azar is rampant. Altitude and height do not seem to have any bearing on the incidence of the disease as cases have been reported from the Deccan Plateau—Mysore and Hyderabad which are about 2,500 ft., above the sea level—while in Bengal in some districts where the disease is prevalent the soil is found to be alluvial and not far above the sea level. Climate does not seem to have any bearing on the incidence of the disease. Humidity, wet and dry seasons of the year do not increase the number of cases, since the disease makes an insidious onset and it is brought to the notice of the practitioner at an advanced stage and so it

is difficult to find out the season when the disease has actually begun.

Etiology.—The disease is very common among the vegetarian and particularly among the Brahmins and to a less extent among non-Brahmins. Its occurrence is decidedly less among Muhammedans and Anglo-Indians. The children of the rich and middle classes are more affected than the poor and labouring classes. This disparity may be explained by over-feeding which is a common thing among the rich. The first male child is said to be more prone to this infection and the disease tends to run in families. Statistics show that more male children have become victims to this disease than female children. It is rare before six months and after three years of age. Frequently it is at this period the mother often conceives; and this short interspacing of child-birth probably serves as one of the etiological factors in the causation of the disease. The mortality rate is very high between 9 months and 2½ years.

Very many theories as regards causation have been advanced from time to time. The restricted nature of the occurrence of the disease and its limited distribution in India do not support all the theories propounded sometime ago.

Syphilis and Alcohol.—Neither syphilis in the parent nor alcohol seems to have anything to do with the etiology. If alcoholism in the parent is the cause of the disease—which we don't believe at present—and if it causes cirrhosis of this type, it should have been prevalent in other countries as well where the people are accustomed to use alcohol freely. The author has seen a number of cases of infantile cirrhosis in children whose parents are unquestionably teetotallers, nor infants noticed with this complaint born to

parents who are accustomed to take alcohol. Besides this there is no pathological evidence in the liver as we find in the liver of addicts to alcohol except the enlargement. The fine mottling of the liver is definitely against the hob-nailed liver in the *alcoholics*. Syphilis in the parent can also be ruled out as the Wassermann reaction of the blood of the infant and the mother was found to be repeatedly negative. It is true that Wassermann reaction is negative in a large number of cases of hereditary syphilis, but it is very difficult to believe that all cases of infantile cirrhosis are cases of congenital syphilis with a negative Wassermann reaction. Besides this repeated examination of many sections of the liver stained by Livaditi method does not reveal any spirochaetes in it. No other evidence of congenital syphilis is present in clinical laboratory or X-ray findings. Nor the features of the two diseases are found identical.

Malaria.—Examination of the blood for malarial parasite to account for the splenomegaly was found to be repeatedly negative. Cuddapah, Kurnool and several other districts where malaria is rampant, this disease is seldom found. The urban distribution and its rarity in rural parts are some of the evidence which are against malarial etiology.

Kala-azar.—In Malabar and in Bombay where Kala-azar is unknown this disease is reported to occur. From the Mediterranean area where infantile Kala-azar is exclusively found to occur, infantile cirrhosis has not been reported. Clinically also these two diseases widely differ.

Infection.—Infection which may be either bacterial or parasitic or ascending cholangitis or amyloid degeneration have all been suggested as

causative factors but the available evidence does not support any of these theories. But the disease attacking successive children of the same mother suggests the possibility of infection. The history of the occurrence of the disease in the family can be commonly elicited. It is also to be noted that in a Joint Hindu family where all children mix up in play, sleep and eat together the same food, the children of a particular mother alone develop the disease while others do not contract it. Nor the occurrence of the disease is observed in a rented house where a number of families reside, when in one family the child is discovered to be suffering from the disease and the other children not contracting the disease. It is not known as yet whether the faeces or urine of a case of infantile liver do carry an infective agent, but however so far experiments carried by the author on animals with gastric and duodenal fistula fed with contaminated food mixed faeces and urine did not develop lesions in the liver.

It is not yet known how the toxins absorbed from the gastro-intestinal tract instead of causing multilobular cirrhosis could cause an intra-lobular cirrhosis. Probably the nature of the toxin and the age factor might modify not only the type but also the tissue reaction, but it is hard to believe how the toxin can not give rise to two different lesions in the same organ, e.g., Liver.

We can with a slight stretch of imagination presume that the toxins can be elaborated in the gastro-intestinal tract of the infant which is not adopted to utilise the adult diet and particularly a faulty diet. The toxins produced thereby cause gross changes in the insufficient liver of a child with an inadequate defence mechanism,

particularly when they act for a long time. Products of the disordered digestion with an abnormal flora and fauna in the intestinal tract, do cause a gastric upset, causing vomiting, diarrhoea and sometimes fever. This is exactly what the child suffers from during the early stages. The liver of the child for sometime meets this abnormality and subsequently it fails. It is this breakdown that we notice with all its complications in the infant in the later stages of the disease. Dr. Pandalai ascribes the failure of the liver to meet the situation partly to hereditary and partly to an inferiority of the paranchyma of the infant's liver and also to that of the reticulo-endothelial system. Even this, is not a complete explanation.

Diet.—Faulty diet in children is supposed to be an etiological factor. Over boiled milk, deficiency of fat and sugar in cow's milk deficiency in vitamins and excess of feeding with carbohydrates have all been mentioned as the possible etiological factors. These views however divergent they are, viz., one upholding—excess of carbohydrates administration as the cause—while another upholding lack of it as the cause of the disease,—but the author is inclined to hold that the administration of carbohydrates should help the liver to recover its function rather than damage it. Excess of fat in the diet to a certain extent is to be blamed (though very few Brahmin children are fed on excessive fat). The author noticed fat globules in the stools of children suffering from the disease. Dr. Lahiri produced fatty degeneration of the liver in his experimental puppies by feeding them on excess of fat. But it is strange that excessive fat is not at all contained in the food given to the children in a Brahmin family. Hindu Brahmin diet is poor both in proteins and fat still more so

in vitamins. When such is the case it is still a problem how the child in that family can suffer from fat indigestion. Can there be any disturbance of metabolism and consequent mal-absorption of fat or can there be any endocrine defect? Why the disease is unknown among the poor class people where the diet is defective cannot be explained.

Dietetic irregularities, such as irregular feeding whenever the child cries, too frequent feeding and feeding with unsuitable articles of diet, such as over boiled cow's milk, undiluted cow's milk, or rich and farinaceous food, early conception of the mother, and consequent early weaning of the child with the above unbalanced diet and defective diet must have a bearing on the causation of the disease. Artificial feeding is resorted too early when the child is too young. The mother on account of too early pregnancies may have deteriorated in health and as a result weaklings are born and they become victims to this dire disease. Personally the writer is inclined to believe, though dietetic irregularities may not be the sole cause of the disease, yet they play some part in the causation of the disease. It is to be remembered that irregular feeding in the case of breast-fed infants does not matter unlike the case of regular feeding of infants by artificial diet.

Mother's Milk.—Another theory is worth mentioning that the mother's milk is in some way responsible for producing the disease in children. This observation was worked out by Col. Forsyth by examining a number of specimens of breast milk—bacteriologically and otherwise with inconclusive results.

Vitamins.—The deficiency of vitamin "C" is adduced as the cause of

the disease and infantile cirrhosis is considered as a variant of Infantile scurvy or Barlow's disease. Since the disease occurs among well-to-do class of children the deficiency of vitamins in general does not seem to hold good—although the part they play cannot be overlooked.

Virus.—The other theory if the disease could be a virus is engaging the writer's attention. The disease occurring in several children in a family and its prevalence in certain endemic areas and the immunity attained by the child after 3 years, all uphold his contention that it may be a virus disease.

Secondly, several children after vaccination have been found by the author to go down-hill and in such of them he noticed enlargement of the liver and spleen. One cannot ignore the mother's history of her child, that since vaccination (in the third or the sixth month) it was not in good health. One has to keep an open mind if a modified vaccina virus of a low grade virulence could give rise to splenomegaly in children.

Vagotonia.—The author has investigated the problem—if the nerve supply to the liver is at fault—by cutting the vagus nerve on the right side at the first instance and later the left side also in his experimental animals. After two months a section of the liver taken from those animals showed a cloudy swelling of the liver parenchyma, without formation of fibrous tissue. Unfortunately or fortunately none of the animals except the dog suffers from cirrhosis of the liver and

hence the difficulty of demonstration of the formation of fibrous tissue in our experimental animals. I presume work in this direction will throw considerable light on the causation of the disease; the reasons for such an assumption are many which needn't be mentioned in this short paper.

Deficiency of Anti-toxic substance of the liver.—It is also conceivable that there may be some deficiency of anti-toxic secretion, hitherto undiscoverable anti-toxic secretion of the liver, the deficiency of which makes the child vulnerable to the disease.

Endocrines.—The author noticed gynæcomastia in a child of infantile cirrhosis aged two years. What bearing this endocrine factor has in this disease cannot be explained? Thymus, thyroid, anterior pituitary and gonadotropic hormones all are thought of as one of the causative factors; but all are disappointing.

Castor Oil.—Lately Dr. Tirumurti and the author in their "Preliminary report of the possible etiological factor in the causation of infantile Biliary Cirrhosis" are able to adduce evidence that castor oil may be a possible etiological factor in the causation of the disease, basing their findings on the experimental animals and on the epidemiological studies.

However all the theories above mentioned, though partly explain some factors in the causation of the disease, but yet one must admit that the etiology is still obscure.

(To be continued).

"Tuberculosis of the Spine"

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Summary

1. **Incidence.** Site, age, sex, complications, types of lesions study of museum specimens in Madras.

2. Etiology—

Mode of Infection $\left\{ \begin{array}{l} \text{Hæmatogenic.} \\ \text{Lymphatic.} \end{array} \right.$

3 Pathology:

(a) Sites.

(b) Varieties.

1. Central.

2. Metaphyseal.

3. Periosteal.

4. Appendiceal and Arthritic.
Spinous process—Pedicles
Transvers process.

(c) Sequence of events—Morbidity
Anatomy and Pathology.

(d) Associated changes.

(1) Mechanical deformity of the spinal column.

(2) Abscess formation and tracking in various regions.

(a) Cervical.

(b) Dorsal.

(c) Lumbar.

3. Involvement of the spinal cord.

4. Symptoms.

1. Pain.

2. Rigidity.

3. Deformity.

4. Abscess formation.

5. Nervous Symptoms.

5. Ritual Examination of a spine.

1. General appearance—attitude—gait.

2. Spine—Irregularities—movements.

3. Cold abscess: Situation and course.

4. Paraplegia.

5. Changes in Thorax and pelvis.

6. Changes in Heart and blood vessels.

7. Radiographic changes.

6. **Diagnosis.** Importance of early diagnosis.

7. Differential Diagnosis.

(a) *Cervical*—Torticollis—Brevicollis—Arthritis Deformans—Syphilis—Primary and secondary neoplasm.

(b) *Dorsal*—Rickets—Simple Kyphosis and Scoliosis—Spinal

Neuralgia—Kummel's—Scheurmann's—Calve's—Compression Fracture, etc.

(c) *Lumbar*—Hip joint diseases—Sacro Iliac—other causes of low backache—as Lumbago, Spondylitis deformans, Fibrositis, Sciatic pain.

8. **Prognosis.**—Mortality Rate.

9. **Treatment.**—1. *General.*

2. *Local—Conservative.*

(a) *Complete recumbency.*—Methods of fixing—

1. Whitman or Bradford Frame.
2. Plaster bed or boat.
3. Double Thomas' Splint.
4. Firm mattress bed.
5. *Anterior Shell.*
6. Phelps' box.
7. Pugh's frame.
8. Gawin's wheel-barrow splint, etc.

Duration—18 months to 24 months.

Indications for the removal of the patient from recumbency.

(b) *Ambulatory*—No movement—Celluloid spinal jacket or Taylor's brace.

(c) *Convalescent stage*—Regulated movement—

Duration 3 to 4 years.

10. **Treatment of complications.**

(a) Abscess—Aspiration; of—Cervical and Thoracic:—Costs—transversectomy.

(b) *Paraplegia.* Laminectomy—Laminectomy with bone-grafting.

(c) *Deformity.* (Gibbus)—

1. Whitman Hyperextension frame.
2. Calot plaster jacket.
3. Wedge block method.

11. **Operative treatment.** Osteo-Synthesis (a) Albee's method—

Indication and contraindication for Albee's.

1. Pain—
2. Muscle spasm.
3. Increasing deformity—
4. Abscess formation—
5. Paraplegia.

(b) Hibb's method—

Post-operative treatment.

12. **Continued after.** Care.

Tuberculosis Disease of the Spine.

Incidence.—Tuberculosis of the spine is not only the commonest but the most serious of tuberculous infections of bones and joints carrying with it as it does a high mortality rate varying from 40 to 50 per cent. To show that the vertebræ is the commonest bone to be affected, it is enough if we quote Whitman's figures which speak for themselves. Whitman cites 4299 cases of Spinal caries as against 3329 of Tuberculous Hip and 3222 of all the other joints put together. **Our figures in this department are 188 cases of Spinal caries as against 195 cases of tuberculosis of all other joints in the past three years.**

Age.—It is commonly seen in children under ten with a maximum incidence between 2 to 5 years. It is rare over the age of 35 and before the age of 1 but no age is exempt. In children both sexes are equally affected while in adults, males predominate.

"Tuberculosis of the Spine"

Site, Age and Sex Incidence in Madras General Hospital Orthopaedic Department.

Cervical 30 MC—8
FC—0
M—18

Of which 11 were over 35 years and amongst these 11 there were 3 over 50 years.

F—4

Number of Vertebra:—
1 2 & 3. 3 & 4. 3 to 5. 3 4 5 3 to 6. 4 & 5. 2 4 5 5 5 & 6. 4, 5, 6. 4 to 6. 6 and 7

Dislocation of Atlas from Axis 20 M
12 M 38 M 35 M 7 MC 60 M 9 MC 16 F M 23 M age not noted M F 2½ MC 50 M
38 M 25 M 60 M adult F 10 MC 4 MC
35 M 37 M 55 M 16 F 40 M 60 M
5 MC
25 M

M.C. 8
F.C. 0
M. 18
F. 4

Dislocation of atlas from Axis—1
Vertebra affected—

No. 1—1 (M)
No. 2 and 3. 3 (M)

3 and 4—4 M and 2 children.
2, 4, 5—1 male.
3, 4, 5—3 M and 1 child.
3, 4, 5, 6—1 child.
4 and 5—1 male and 3 females.
5 —1 male and 1 child.
5 and 6—1 m.
4, 5, 6—1 F and 2 children.
6 and 7 2 M and 1 child.

MC—20
FC—11
M—48
F—12
Of the males there were 3 over 50 years of age and of the females one over 50.

Dorsal. 91

Number of Vertebrae affected
4 & 5 5 & 6 4 to 6 4 to 7 4 to 8 4 to 9 5 to 7 7 to 10 1 5 to 9
5 M 2 F 2½ M 15 M 8 M 39 F 60 M 40 M 12 M 38 M
6 M
5 M

6 and 7. 6. 7. 8 to 10. 9 and 10. 9 to 11 7 to 9. 7 to 10 8.
5 M 3 M 13 F 4 M 4 M 25 M 6 M 40 M 22 F
24 M 20 F 3 F 5 M 21 M
3 F. M 27 F
5 M
13 F

10.	9 to 12.	10 and 11	10 to 12.	11 and 12.	11.	12.
7 F.		3 M	9 F	13 M	22 M	3 M
30 F.		30 M	40 F	1½ M	11 M	28 M
		4 M	3 M	3 M		32 M
		— M	24 F	4½ M		30 M
		11 M	22 F	15 M		— M
				55 M		32 M
				7 M		9 M
				25 M		3 M
						28 M
						4 F
						20 M

MC— 9
Lumbar 71 FC —10
M —32
F —20

Number of Vertebrae affected.	1.	1 and 2.	2.	2 and 3.	3 and 4.	1 to 3.	1 to 4.	2 to 4.	2 to 5.
32 M	4 F	11/12	30 M	42 F	13 M	31 M	18 F	10 F	
30 M	14 F	F	28 F	37 M	6 F		10 F	16 M	
— M	5 M	20 F.	30 F	30 F	F		17 M		
1½ MC	6 F		40 M	30 F	30 M		F		
4 F	40 F		14 M	2 F					
20 F	4 F		21 M	55 M					
7 M	4 M		40 M						
3 M	55 M		30 F						
25 M	Adu- lt M								
45 M	5 M								
15 M									

3 and 4.	3 to 5.	4.	4 and 5.	5.	1 to 5.
28 F.	25 F.	19	20 F	(Adult) M	M
			25 M	27 F	Lumbodorsal—25 F
			19 M	15 M	Lumbar —30 F
			30 M	25 F	
			18 F	13 M	
			M	50 F	
			6 M	5 F	
			2½ M	15 M	
			15 M		

Lumbodorsal.

11th and 12th—IL	12th and IL.	12th DV and 2LV	10th and 12—D24— LV	11 and 12 DV. 2,3,5 LV.
9—M	9 M	30 M	14 M	5 M
1½ M	30 M	40 M		
	60 M	F		
	20 M			
	30 M			
	A M			
	25 F			

12th DV. 5 M	10,11,12 and IL. A M	2L 14 M	6,7 D. V. and 3 and 4 LV. F with Spondylitis.
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Lumbar Vertebrae.

Total Number of cases ...	88
Number of cases in females ...	34
Number of cases in males ...	54
Number of cases above 35 years ...	11
Number of cases above 50 years ...	4
Number of cases below 10 years ...	21

Lumbar 67

Lumbodorsal 19

Vertebrae	Total	Males	Females	Vertebrae	Total	Males	Females
L 1	11	9	2	10 DV to 1 LV	1	1	—
L 2	2	—	2	10 DV to 2 LV	1	1	—
L 1 & 2	10	5	5	11 & 12 DV to 1 LV	2	2	—

Vertebrae	Total	Males	Females	Vertebrae	Total	Males	Females
L 3	1	1	—	12th & 1 LV	7	6	1
L 2 & 3	8	5	3	12th & 2 LV	3	2	1
L 1 to 3	4	2	2	9th DV to 2 LV	1	1	—
L 4	1	1	—	12th to 4 LV	1	1	—
L 3 & 4	6	2	4	10th DV 1 & 2	1	1	—
L 1 to 4	1	1	—	12th DV LV	1	1	—
L 5	7	3	4	11th—12 DV 2, 3, 5, LV	1	1	—
L 4 & 5	9	7	2	6 & 7 DV 3 & 4 LV	1	1	—
L 1 to 5	1	1	—		1	—	1
L 2 to 4	4	1	3				
L 2 to 5	2	1	1				

"Incidence of disease in this series (191) according to age in Madras"

1. Below 1 age 11 months	...	1	5. Between 11 & 20	...	...	43
2. Between 1 & 2	...	...	6. " 21 & 50	...	...	63
3. " 3 & 5	...	...	7. " 31 & 50	...	...	20
4. " 6 & 10	...	...	8. Over 50	...	...	8

Sex:—MC 37 FC 21; M 98; F 36;

Incidence of complications and new bone formation

Number of cases		CERVICAL		Upper Dorsal		Lower Dorsal		Lumbar	
		M	F	M	F	M	F	M	F
44	Abscess Plus	...	...	1	—	2	12	19	4
8	Paraplegia	...	...	—	—	2	3	1	2
20	Scoliosis	...	...	—	—	3	—	10	3
22	New bone formation noted in radiograms	...	...	—	1	1	—	3	3
—	Lumbar 14	...	...	—	—	—	—	—	—
—	Dorsal 6	...	...	—	—	—	—	—	—
—	Cervical 2	...	...	—	—	—	—	—	—
22	Kyphosis	1	1	1	—	6	3	6	4
6	Kyphoscoliosis	—	—	1	—	1	3	—	1
122	Cases								

"Tuberculosis of the Spine"

The following cases had lesions in other parts of the body in addition to tuberculosis of spine.

25 M	12 DV and Shoulder L.
6 MC	9, 10, 11 DV and Hip L.
6 FC	4 to 10 DV with lungs.
8 FC	LV and Focus in Rt. Acetabulum.
8 FC	Cervical and Dorsal.
12 M	C 1 & 2 Lymph glands.
5 MC	CV Lymph glands.
25 M	L 4 and 5 and Hip disease.
4 MC	2, 3, 4 DV. Hip and ankle pain.
30 M	Dorsal Vertebrae with multiple lesions in other bones.
30 M	Dorsal Vertebrae with Lungs, Epididimis, Kidney.
30 M	Dorsal Vertebrae with Epididymis.
12	of which 6 children all below 30.

(b) Central and Periosteal.

Cervical	...	...
Dorsal	2	2
Lumbar	4	...

(c) Periosteal

Cervical	1	...
Dorsal	3	1
Lumbar	3	0
	93	31

(d) Appendiceal.

Ribs.	9
Ala of sacrum	1
Transverse process	3 (dorsal 1 and lumbar 2)
Spinous process	2 (Cervical)
Spondylolisthesis	2
	17

The following specimens are available in the Madras Medical College Museum and are noted here with the kind permission of the Professor of Pathology.

New bone formation around the sides of the Vertebrae.

30 F	L 3 and 4.
56 M	L 3, 4, 5 (No spondylitic change in other bones.)
17 M	L I and II.
	No new bone in lumbar region after 4 years.
	2 and 3 CV child 4 FC after 1 year.
	C and upper dorsal—F was seen after 2 years—complete recovery of bones was noticed.

Types of Lesions in 141 cases of the present series.

	Male.	Female.
(a) Central		
Cervical	15	2
Dorsal	39	20
Lumbar	26	6

1. P. 4349—Child.—There is affection of the vertebrae from the 12th D.V. to the 1st Sacral V (both inclusive). There is collapse of the 1st, 2nd and 3rd L. V. with kyphosis. Posterior longitudinal ligament is stripped up to the 10th D. V. There is pressure over the cord. The dura is thickened.

2. J. 237—Adult—Lumbar caries. —Wedging of the 1st and Lumbar Vertebrae. Dense bridges of bone on the sides and anterior aspect of the 2nd and 3rd, 3rd and 4th and 4th and 5th lumbar vertebrae, and also between 11th and 12th D. V. Intervertebral spaces diminished. Albee Graft is in position but looks fractured in its upper part. It has consolidated. This specimen was re-examined by the Professor of Pathology and the

bodies of the vertebræ were histologically tuberculous.

3. J. 163.—Bodies of 8th to 12th D. V. affected. Marked Kyphosis with apex at 10th D. V. Abscess seen.

4. J. 34.—7, 8, 9 and 10 D. V. affected. There is collapse and wedging of the 8th D. V. Extreme angular curvature; sequestrum inside the spinal canal. Pressure on cord; Heads of the 7 to 10th Ribs affected. Calcification on the lateral aspects of 8th to 10th D. V. Calcification anteriorly on the bodies of 8th and 9th D. V. dislocation of the 8th D. V. 11th and 12th D. V. show subperiosteal foci.

5. J. 150.—Tubercular caries with angular curvature. Erosion and nearly complete destruction of the 4th Dorsal V. Heads of ribs also eroded. Inter-vertebral spaces encroached.

6. J. 8.—7th to 10th D. V. (both inclusive) affected. Periosteal in type. Shows subperiosteal multiple foci in the anterior and lateral aspect of the body.

Etiology.—The disease is a tuberculous infection of the vertebræ. Hitherto it has been believed that the infection is invariably blood-borne, but recently the view has gained considerable support, that it is some times due to a lymph borne infection which passing through the para-vertebral lymphatics and perhaps the Thoracic duct, penetrates the periosteum and enters the interior of the bone through the perivascular spaces. This mode of infection explains the condition wherein many vertebræ are affected.

It is believed that the latter possibility, *viz.*, lymph borne infection occurs in association with tuberculosis of the abdominal or medi-

astinal glands and there is clinical evidence to show that vertebral tuberculosis is some times the result of a direct spread from overlying glandular disease. One of the patients who had tuberculous ascitis 4 years ago developed multiple foci in the vertebral bodies. The disease is probably disseminated by both means but the *Hæmatogenic* mode is the commoner.

(Regarding the type of bacillus, the infection is bovine in type in about 20 per cent of cases of all ages in other countries). By blood borne infection is meant an organismal embolus which gets implanted within the cancellous tissue of the vertebra from (a) distant foci like the lungs, lymph nodes, etc., which *site* may be silent or active.

Bovine tuberculosis is not said to be common in India; but "A study on the incidence of Tuberculosis revealed the fact that the disease was not so uncommon in animals in Madras as it was supposed to be prior to 1919. A fairly large number of cases of tuberculosis has been detected so far in the working bullocks belonging to the Madras Corporation and it appears strange that the incidence in cows in Madras is practically nil".

Pathology.—Though any part of the spinal column may be affected, the vertebræ of the lower thoracic and upper lumbar regions, especially the last three thoracic and the first and second lumbar, are the most liable to the disease. This incidence is generally attributed to the fact that in the lower thoracic and upper lumbar regions there is a great range of mobility as well as a considerable amount of weight-bearing. This location is influenced by trauma as well as by strain. Further, this region with a large cancellous area not only provides an ideal nidus for the disease

but also the great bulk of thoracolumbar lymphatic channels converge, through which infection occurs.

Exciting cause.—The exciting cause which induces the bacilli to settle down is probably trauma. But the trauma must be mild. A severe injury as a fracture calls forth such a rapid reparative action that the bacilli have no chance to establish themselves. Thus a mild trauma like sudden contraction of the Psoas may result in a periosteal tear with effusion, in which the bacilli may settle down. Many patients give history of prolonged fever like that of typhoid in the early stages. This probably means general infection with tubercle.

Varieties.—There are four varieties of tuberculous infection of the vertebra, depending on the site. They are

1. *The central.*—Where the body or centrum is affected and seen in children;

2. *The Periosteal.*—Where the anterior part of the body just below the anterior longitudinal ligament is affected and seen in adults: the vertebræ may be attacked either on the anterior or posterior surface; the X-ray signs may be late in appearing; posterior lesions produce tumour syndrome.

3. *The metaphyseal*—at the lower and upper surfaces of the vertebræ; the epiphyses themselves are immune to origination of the disease: two neighbouring metaphyses may be attacked; and

4. *The appendiceal*—where the spinous process, the pedicles or the transverse process are affected.

Affection of the spinous process is commonly met with in the cervical

region: a true tuberculous arthritis of the occipito-atlantoid and atlanto-axial group of joints also occurs.

Morbid Anatomy and Pathology.—As pointed out earlier, the infection starts in a small focus due to the implantation of an organismal embolus within the spongy cancellous tissue of the vertebræ. The sequence of events in the vertebræ is the same as those of Tuberculous infection of other spongy bone with at first rarefaction and later leading on to destruction of the bony lamellæ. Caseation follows in its wake with the characteristic tuberculous pus and a cold abscess may form. But tuberculous infection of the vertebræ differs from that of the other bones in one important, respect *viz.*, the absence of new sub-periosteal bone formation. The periosteal osteogenic activity seen in Tubercular Osteomyelitis which is generally due to a superadded secondary infection is never seen in the vertebræ. For some obscure reason the subperiosteal new bone formation on the anterior surface of the vertebral body is rare and the beneficial buttressing effect is not forthcoming, thus increasing the potential gravity of spinal caries. The buttressing effect is occasionally seen in Madras in X-rays and in two of the 6 museum specimens; 10 per cent of our cases show new bone formation radiologically. Two other factors which also assist in undermining the bone strength are the fibrous or myxomatous degeneration of bone marrow and endarteritis obliterans of the nutrient vessels both of which are due to the toxins in the blood. Since osteoporosis is the hallmark of Tuberculosis and the cortical bone is very thin, collapse of the vertebræ is imminent.

The Histology.—The tuberculous granulation tissue is the same except

that a few osteoclasts may be seen which assist in the work of bone destruction.

Central Type.—This type occurs in children and the lesion starts generally from the cancellous bone of the body of the vertebra near the disc-like epiphysis usually towards the anterior surface. The localization of the disease to the centre of the vertebral body depends upon the anatomical fact, that greater blood reaches the body through the posterior spinal artery whereas the upper, lower and anterior surfaces have a different blood supply. Discrete lesions may be found in several adjoining vertebrae and according to Boyd it is the rule and not the exception in the vertebral column. (Boyd's pictures illustrate this fact). This is also constantly borne out in our experience. Several of the cases in this series had multiple lesions separated by healthy vertebrae both in adults and children. The essential pathology of this type can be summed up in one word—osteomyelites. The centre of the body becomes caseous and the disease spreads to and destroys the intervertebral discs but spares the transverse processes, spines and articular processes. It is worth while remembering the fact that the discs are destroyed in Tuberculosis, for in secondary carcinoma of the vertebrae which radiologically simulates Tuberculosis, the discs are hardly ever involved. The bodies collapse in front while the spines remain intact behind preventing dislocation so that an acute curvature develops with its convexity pointing backward (Kyphosis). Though angular deformity is common, pressure on the cord is rare.

Causes of collapse of the bodies anteriorly—

1. Respiratory motion.
2. Superincumbent body weight.

3. Contraction of abdominal muscles.
4. Other normal movements.

Periosteal type.—This type is seen in adults where the disease is limited to the anterior aspect of the vertebrae—due to the fact that the greater portion of the blood reaches the surface of the body, by branches from the cervical, intercostal or lumbar arteries. The infection spreads round the bones, up and down to the contiguous vertebrae and the intervening discs. This form does not lead to deep destruction of the bodies, and there is, therefore, no marked angular deformity. But several vertebrae are affected. Boyd gives a picture where all the dorsal vertebrae have been affected. Pus collects under the anterior common ligament, ultimately resulting in large cold abscesses.

Tuberculous periostitis is the form usually found in the adult. Our own figures show they are mostly central lesions. It differs from the central variety in three particulars—(1) It is naturally a more diffuse process, so that half a dozen vertebrae may be involved (2) Owing to the absence of extensive destruction in the vertebral bodies there is much less deformity, the deformity being a gentle curve (3). The process being a superficial one, abscess formation is commoner and occurs at an earlier date. (Boyd).

The other two types, viz., epiphyseal and appendiceal are rare and not commonly met with. The structure of the bodies of the vertebrae is almost entirely made up of spongy bone; tuberculous disease in bone is almost entirely confined to this cancellous bone structure to the exclusion of the denser or vertical portion, i.e., the lateral masses and spinous processes. It is to be remembered that the

articulations of the heads of ribs are commonly affected both clinically and in museum specimens.

Associated Changes.

Mechanical deformity of the Spinal column.—The deformity is usually a simple kyphosis but sometimes a certain degree of scoliosis is added. In 10 per cent of cases in this series Scoliosis was met with. The deformity varies in different parts of the column and depends upon the anatomy of the vertebrae.

In the Cervical spine the roots of the transverse processes lie almost directly lateral to the vertebral bodies and tend to prevent deformity. The collapse is incomplete because the pedicles and the transverse processes remain unaffected and acting as wedges prevent full inflexion of the upper segment upon the lower. If two or more bodies are destroyed the inflexion angle is greater and approximation of the opposing surfaces is incomplete.

In the dorsal spine, the column is weak and the pedicles lie well behind the vertebral bodies and offer no obstruction to inflexion and consequently the deformity is often great. The deformity may be a gradual bend but often there is an acute angulation or gibbus. In the dorsal spine, the collapse is eventually complete and whatever the extent of the disease the inflexion continues until the approximation of the opposing surfaces is accomplished. The progress of inflexion is in proportion to the amount of destruction.

In the lower dorsal region, a variation occurs. When one or more bodies are destroyed, the inflexing surfaces are brought into opposition in such a way that the anterior surface of the vertebrae immediately

above the lesion comes to lie in contact with the upper articular surface of the vertebrae immediately below. This peculiarity results from the natural resistance to inflexion of the ribs and the laminae which in this situation are large and are without appreciable inter-laminar spaces.

In the lumbar region the mechanism of collapse resembles that in the cervical region; inflexion is incomplete owing to the natural lordosis and a sinking of the neural arch inducing a certain amount of extension. Wherever lordosis is the natural curve of the vertebral column, the inflexion is incomplete and as healing depends on complete inflexion, the prognosis is affected by this.

The effects of kyphosis may be severe. The vertebral column above and below a marked kyphosis endeavours to produce compensation and maintain the body erect by undergoing a considerable degree of lordosis. Thus in the cervical and lumbar regions, the deformity is one of loss of the normal lordosis on straightening or flattening out of normal curve.

Deformity in the thorax.—This is secondary to kyphosis and may be very severe. When the gibbus is in the upper dorsal region, the sternum is depressed; when in the lower dorsal, the sternum is pushed forwards and compressed from above downwards. Thus there is great interference with the expansion of the chest and there is considerable displacement of the Heart and the great vessels.

In affections of cervico-dorsal junction, the neck is short, there is a uniform high kyphotic curve with pigeon chest and lumbar lordosis; the sternum is pushed forward and the child has dyspnoea on slightest exertion.

Formation of cold abscess and tracking in various regions.—The formation of cold abscess has been mentioned earlier. It consists of the characteristic tuberculous pus, granular debris and granulation tissue. Abscess formation is a serious result of spinal caries, and is commoner and occurs at an earlier date in adults, since the process is more superficial. At first the abscess lies close to the diseased bone limited anteriorly by the pre-vertebral fascia but its ultimate course in various directions depends upon the arrangement of the anatomical planes. Since an abscess of this kind starts deeply, it is often not recognised for some time. But if the abscess gets secondarily infected by septic organisms either by bursting or by other modes, a grave element with risk to life is introduced. Secondary infection without sinus need not be despaired of. *B. coli* infection cases get well. These abscesses give rise to few symptoms other than a soft swelling and sometimes those due to pressure. They cause no leucocytosis and no constitutional disturbance apart from the small rise of temperature due to spinal caries itself, unless they are secondarily infected when the swelling itself is warm and there may be leucocytosis. They do not cause pain except that due to the bone disease until they approach the surface. The appearance of a cold abscess in some situation not far from the spine is not unusual to be the first thing noticed; in every cold abscess reasonably near the spine or in the characteristic spots to be mentioned below, the spine should be examined.

Cervical caries.—In the neck, an abscess may pass

(1) into the pharynx anteriorly and form a chronic retro-pharyngeal abscess.

(2) laterally to the skin of the posterior triangle at the posterior border of the sternomastoid.

These two are the commonest sites seen in Madras.

(3) downwards into the posterior mediastinum.

(4) into the back of the neck, tracking along the posterior divisions of the spinal nerves and appearing just lateral to the midline or spine.

(5) into the Axilla, tracking along the deep layer of pre-vertebral fascia which forms the sheath for the axillary vessels.

Dorsal caries.—In the dorsal region an abscess may pass

(1) into the posterior mediastinum. Such an abscess is silent unless it presses upon the trachea. Posterior mediastinal abscess is very commonly met with in Madras; the abscess may open in the root of the neck and was seen in one case.

(2) into the psoas sheath (under the medial lumbo costal arch, forming a *psoas abscess*).

(3) into the sheath of the Iliacus, if the primary focus in the bone is anterior to the attachment of the Psoas fascia and form an *iliac abscess*.

(4) into the sheath of the quadratus Lumborum under cover of the lateral lumbo-costal arch.

(5) into the abdomen in front of the aorta, an abscess-like this may simulate an aneurysm which is usually very painful; but I have met with a case verified by autopsy where the course of an aneurysm was painless.

(6) along the thoracic spinal nerves and may come to the surface along the

branches. Thus it may appear in the back near the midline. Most commonly it occurs anteriorly at the middle of the rib appearing along the lateral cutaneous branches. Such an abscess may be mistaken for primary tuberculous abscess of the rib. Primary tuberculous abscess of the rib is an extremely uncommon condition.

Lumbar caries.—An abscess in this region may pass

(1) in front of the aorta; lumps in the abdomen on either side of the middle line are very common.

(2) into the psoas sheath

(3) into the Quadratus Lumborum sheath

(4) along the lumbar nerves

(5) into the triangle of Petit.

When these abscesses get secondarily infected by septic organisms they change the clinical picture. Thus the patient may die due to secondary infection or if he survives, disease may supervene. Also there is always the danger of miliary tuberculosis. The main importance of these abscesses lies in the pressure effects they produce on the spinal cord and the fact that they may be the first sign which leads to the diagnosis.

Involvement of the Spinal cord.

(1) **Gross Incidence.**—Involvement of the Spinal cord or Pott's paraplegia occurs in 10 per cent of spinal caries and constitutes a very grave complication. (Albee 5 per cent; 186 out of 801 cases Butler and Seddon). In Madras the incidence is greater as the patients come in the very late stages of the disease.

(2) **Age.**—60 per cent occur in children.

(3) **Level of disease.**—In 84 per cent of cases the caries was in the dorsal region (157 out of 186 cases of Pamplegia (Butler and Seddon).

(4) **Pathology of Paraplegia.**—Though very occasionally paraplegia is due to the spinal cord being pressed upon by a cold abscess, by a large sequestrum or as a result of pathological dislocation of a vertebra (a very rare event too!), in the great majority of cases cord involvement is due to oedema and vascular changes, associated with thickening of the duramater in contact with the diseased vertebræ. It must be remembered that except in the upper cervical region the cord depends for its blood supply upon small segmental vessels which reach it by passing along the nerve roots from vessels in the extradural space. Consequently when the extradural spaces are filled with tuberculous material, the corresponding segments of the cord are very liable to congestion and oedema. In these cases, the duramater is often thickened and fibrous and formerly regarded as the site of Tuberculous pachymeningitis; recent observations make it clear however, that the duramater is rarely tuberculous and indeed it generally offers a very resistant barrier to the spread of the disease.

Paraplegia is generally of the spastic type since the vascular changes in the cord tend to involve the anterior columns first. At first, the gait is unsteady and there is a sensation as of walking on a Persian carpet; later a typical spastic paraplegia develops. Contractures may develop owing to the unopposed action of muscles. In severe cases, there may be (1) loss of sphincteric control with its attendant risks of ascending urinary infection (2) trophic loss with

risk of bed sores (3) sensory paralysis and (4) flaccid paralysis. These complications gravely affect the prognosis and the mortality for Pott's paraplegia which is over 30 per cent" (Dick and Illingworth). The following is a summary of the studies of Butler and Seddon.

Clinical types.—(1) Early onset type (2) Late onset type. These two groups are about equal.

Early onset type.—It may be the first sign of the disease in cases of concertina collapse.

Type I.—Typically early in onset, usually within the first two years of the disease. This type persists and diminishes in direct relationship to the Tuberculous infection of the spine. Typically a complete paraplegia, and recovers completely if the patient survives. Generally this type is due to oedema and vascular changes in the cord, supplemented in many cases by compression by granulation tissue, or pus. Under treatment shows signs of recovery within 6 months.

Type II.—Paraplegia of early onset with early active disease but persists permanently even if the tuberculous infection of the spine has become quiescent. In most cases indistinguishable in early stages from type I. Typically a complete paraplegia of rapid onset. Rapid onset is due to concertina collapse or acute thrombosis of vessels supplying the cord. But frequently showing some degree of recovery before passing into a state of permanent paralysis. Generally this class of cases are due to the pressure of a large abscess or a sequestrum or to a pathological dislocation of the vertebræ (or concertina collapse of a Vertebral body) or rarely due to thrombosis of the vessels supplying the spinal cord. The vertebral canal is quite spacious.

This is due to the failure to treat Type I and the underlying change is avascular cord degeneration from too long and persistent reaction to the disease and most patients have had inadequate treatment. Subarachnoid Lipiodal will not differentiate the exact cause of the paralysis.

Late onset type.—Type III.—Appears at any time up to many years after apparent quiescence of the disease. They are generally due to mild vascular changes in the cord and almost always a very partial paraplegia. Etiology is unknown. There is a high percentage of permanent paralysis. Tuberculous lesion may be silent or active. In this type there are two sub-groups depending on their recovery.

Type III-a.—Recovers under conservative treatment as for active spinal caries ;

Type III-b.—Late onset not recovering under any form of treatment ;

Incidence.—Type I 40 per cent
Type II 10 per cent
Type III 50 per cent
Type III-A 33 per cent
Type III-B 17 per cent

It is difficult to give exact percentage of figures for Madras; type I is met with equally commonly in children and adults.

Prognosis.—The prognosis in Pott's paraplegia can be classified as follows:—

A. Very favourable if—

(1) Paraplegia in extension.—This indicates an incomplete lesion of the cord. In 80 to 85 per cent of such cases, the recovery is complete since the lesion is incomplete.

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(2) Voluntary control never lost or absent for not more than 6 months.

(3) Absence of sensory loss.

(4) Absence of sphincteric involvement.

B. Unfavourable if:—

(1) Sphincters are involved.

(2) Urinary infection.

(3) Pregnancy.

C. Hopeless if —

(1) Paraplegia in flexion indicating that the whole cord is involved.

(2) Flaccid paralysis except in Cauda equina and brachial lesions.

(3) Loss of voluntary control for more than 6 months.

(4) Loss of vibration sense; this is only lost when the compression is so severe that the posterior columns are involved.

(5) Old age.

Prevention and treatment.—(It will be easier if the treatment is dealt with here itself since the reader will have a connected idea).

Prevention.—Is not always possible but hyperextension treatment in an uncomplicated case of spinal caries is of definite value in preventing the onset of paraplegia.

Value of hyper-extension in treatment.—This is necessary as long as there is radiographic evidence of active spreading disease. When the activity of the disease is checked as recognised by clinical signs and radiograms, hyper-extension is discontinued and the diseased vertebræ allowed to fall together. Healing

occurs then Fewer vertebral bodies are destroyed by this method of treatment than by treatment under simple recumbency.

Treatment.—The treatment of this complication is in the first instance that of the spinal caries itself and in most cases as the spinal condition improves and becomes quiescent under the influence of complete rest, immobilization and recumbency, the paraplegia gradually diminishes and disappears. A weight extension applied to the legs is especially useful in this condition while extra care in the nursing must be taken to prevent bed sores and its attendant septic absorption. In cases where the sphincters are involved, catheterization under strictest possible aseptic precautions is essential, for the risk of ascending infection is very great. Cases where the paraplegia is due to oedema recover rapidly under this treatment, while those due to pressure, due to granulation tissue or abscesses may take some months to recover. If however at the end of six months rigid treatment there are no signs of the paraplegia improving, on theoretical grounds it is advisable to recommend a laminectomy to relieve the pressure: Laminectomy in two of my adult cases after a year's conservative treatment was of no benefit at all.

The treatment may be classified as follows:—

Type I. Prevention not always possible but hyper-extension is of definite value in preventing the onset of paraplegia.

Treatment.—A. Primarily conservative.

B. Costo-transversectomy in any severe case likely to become Type II, due to continued activity of disease; this is of definite

value in posterior mediastinal abscess. In these cases if the abscess comes to the surface and bursts the paraplegia begins to clear up.

C. Incision and closure of abscess in cervical cases particularly if there is marked oesophageal obstruction or inspiratory dyspnoea.

This is of definite value; aspiration is also practised.

D. *Laminectomy*, as a routine procedure for severe paraplegia is to be condemned. Very definite indications for this procedure are:—

1. Where the cord is stretched over a bony ridge in the floor of the spinal canal and nothing less than the removal of the hump over which the cord is stretched will be sufficient.

2. Where the caries affects chiefly the neural arches or laminæ.

3. Where six months rigid treatment has failed to relieve the paraplegia.

4. Where nervous symptoms come late in the disease.

Dangers of Laminectomy.—The spinous processes and the laminæ are often solidly fused and this is the only factor preventing gross dislocation of a severally damaged spine. If laminectomy without subsequent grafting is performed, the bony spine is virtually transected and subluxation may occur and so lead to even more extensive damage to the cord than was present before operation. The removal of epidural granulation tissue or simple decompression of cord for late onset paraplegia is not often followed by recovery. Another danger is if the dura is opened. Tuberculous meningitis may supervene and this is a real danger and has happened several times.

Laminectomy is never required in children, as the paraplegia always clears up under rest.

Type II.

1. In cases of paraplegia due to acute thrombosis of vessels supplying the cord, neither prevention is possible nor laminectomy is indicated as a treatment.

2. If due to "concertina collapse", laminectomy is indicated. This type can be prevented by hyper-extension.

3. Paraplegia due to spinal tumour syndrome due to continued activity of disease can easily be prevented by costo-transversectomy while the paraplegia is still in the stage of Type I. Once this stage has set in, costo-transversectomy may be tried.

4. Paraplegia due to compression by a sequestrum may be prevented by hyper-extension from the commencement. Once this is diagnosed, the removal of the sequestrum should be attempted.

5. Paraplegia due to pathological dislocation can be prevented by hyper-extension. Once the indication has supervened, removal of the bony ridge is the only treatment.

6. Paraplegia due to posterior spinal disease, i.e., caries of laminæ and neural arches, laminectomy is the treatment.

Type III.

Prevention depends upon early and efficient treatment of spinal caries itself. Once paraplegia has set in, in mild cases conservative treatment

may be adopted; in severe cases, laminectomy with bone graft may be tried; while in cases of mechanical compression, removal of tuberculous material or of bony ridge may be tried.

It may be mentioned here as a warning that in case of Pott's paraplegia, lumbar puncture should never be done, since the needle may carry the epidural tuberculous granulation tissue into the subarachnoid space with grave danger of meningitis. I have met with four cases where Lipiodal had been injected intrathecally to exclude tumour Syndrome. The plain radiographs showed clearly tuberculous affection of the vertebrae: all the three cases showed spinal block. These patients did not recover from their paraplegia; one of them lived for two years after lipiodal. In any inflammatory lesion, lipiodal injection for diagnostic purposes is definitely contraindicated.

Signs and Symptoms of Tuberculosis of Spine.

General symptoms of Tuberculosis like loss of weight, loss of energy, temperature in the evenings and a feeling of tiredness may be present. Often, the earliest sign is an awkward gait with a marked tendency to tire easily and discomfort in the back rarely amounting to pain and this may exist some weeks before the onset of the classical signs and symptoms to be enumerated.

It is an insidious chronic affection. Its early symptoms may fail to attract attention, because they are irregular or intermittent. It is often after a fall or violent play that the evidences of pain or weakness can no longer be overlooked, so that injury is likely to occupy a prominent place in the history. This is a very common history in Madras. Constant elevation of the temperature would be present only if the disease is active or when an abs-

cess is approaching the surface but the positive value of the symptoms in early or quiescent cases is doubtful. Generalised enlargement of lymph glands is commonly met with as a sign of Pott's disease.

a. *Pain*.—This is a symptom which is very seldom absent and in the earliest stages may take the form of stiffness which limits movements although the patients are clear that this is not due to pain. This stiffness is due to the fixation of the muscles overlying the disease. Some times it may take the form of a dull aching or a feeling of weakness. Stiffness is followed by pain, which is a most constant and characteristic symptom of the disease. The pain is of two types, viz., local and referred.

1. **Local pain** is due to pressure on bone, periosteum and soft parts. This pain is constant and of dull aching character. It is particularly increased by movement and especially by jarring or jolting of the spine in such actions like jumping or blows on the head or shoulders. Thus pain in the back going downwards or knocking up against a stone on a level road is said to be pathognomonic of this disease. Children may cease to play and will avoid jumping, may walk on tip toe to avoid jarring through the heels, sit, or lie about or may take peculiar attitudes by which the weight is taken off the spine. Painful cramp is sometimes a prominent symptom.

2. **Referred pain** is due to irritation of the nerve roots exerted at or about the level of intervertebral foramina by oedema, congestion of the sheath or pressure of the tuberculous debris, and referred along the course of the nerves. Thus it may be referred to the arms or sides of the chest or to the legs and mistaken

for intercostal neuralgia or lumbago or for sciatica; in the epigastrium, it may be mistaken especially in children for "bellyache", etc., and into the back of the scalp. All these types of referred pain are extremely common and patients coming with these complaints should be subjected to a thorough systematic and careful clinical examination of the spine and a radiographic examination; congenital torticollis is extremely rare and so also Sciatica. Mistakes occur commonly even under eminent men and there may be temporary amelioration of symptoms with a wrong diagnosis too.

It may be mentioned here that night cries in Pott's disease are rare. *Explanation*:—The muscle spasm does not disappear even in sleep and hence there are no night cries.

(b) **Rigidity**.—Rigidity in the early stages of the disease, is usually marked and is due to reflex contraction of the local muscles which is of a protective nature. It is nature's attempt at splinting to give rest to the spine. This rigidity is entirely due to muscle spasm and is strong evidence of activity of the infection. The affected portion of the spine is held stiff and rigid and if the spinous processes are palpated while the patient bends down, it will be found that several vertebræ move en bloc. This rigidity is easily detected in the lumbar region. Every one knows the well known Coin test for finding out the rigidity of the spine.

Significance of Coin test.—It is to test the lower region of the spine for the symptoms of weakness and stiffness. The ability to perform the act with ease does not exclude disease of the spine in the regions not directly involved in the movements of stooping or turning of the body.

In a child with spinal caries, if the child is laid on the face and the extended legs lifted up it will be found that dorsiflexion and lateral mobility are greatly limited. Very little flexion occurs in the dorsal region and the common test of forward flexion may fail to reveal a focus in the upper dorsal region; in these cases rotation is always diminished.

Rigidity in the late stage is due to ankylosis which is an evidence of recovery. This rigidity can be distinguished by the fact that there is no element of muscle spasm at all. Muscular wasting is present in this disease as in certain tuberculous joints, but it is not easily demonstrated as it is largely symmetrical.

C. Deformity.—All premonitory symptoms may be absent until the appearance of deformity especially in cases of concertina collapse. This is not an early feature though an important sign, although patients may not seek aid till deformity sets in. It must be remembered that it occurs only after considerable destruction of vertebræ. As mentioned earlier, it usually takes the form of kyphosis while lateral deviations are not uncommon. In the lumbar region, the normal lordosis may be flattened or straightened out. Compensating curves may appear and changes may also be noted in the thorax and pelvis. Deformity is not common in the adult periosteal type since there is not much of bony destruction. Same is the case in disease of the spinous and transverse processes. In concertina collapse, the deformity is a form of kyphosis which is somewhat angular, one spinous process is more prominent than the rest though 2 or 3 spinous processes may be prominent.

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Deformity may be divided into 3 types:—

1. Muscular deformity as Torticollis;

2. Bony deformity

and 3. Compensatory deformity as lateral deviation due to destruction of the side of a vertebral body or erosion at one or other extremity of the spine on effect of muscular contraction or due to simple weakness in which case it is a transient symptom.

d. Abscess.—This is also a fairly late sign but in some cases it may be the first sign which gives us the clue to the diagnosis. These abscesses should be searched for at the characteristic sites mentioned earlier.

e. Nervous Symptoms are by no means uncommon in this disease and occurring in about 10 per cent of cases. The pathology and treatment has been discussed earlier.

The Ritual examination of a case of Tuberculous disease of Spine.

Follow a scheme and so miss nothing.

1. *Observe General appearance and nutrition.*

2. *Observe Body Attitude and Gait.*

"Spring" attitude"—flexed joints.

Local peculiarities.

Cervical

Dorsal upper

Dorsal Lumbar "Alderman's" gait

Lumbar spondylolisthesis

12th rib on Iliac crest.

3. **Inspect the Spine**—reveals

Post. angulation

Lateral deviation

Flattening—simulated by very few diseases.

Abnormal degree of lordosis—Kyphosis compensated for by lordosis above and below.

4. **Take Permanent record of deformity.**

Kyphosis - mould strip of lead on spine 18" x 3/4" x 1/8" trace on paper.

Scoliosis—Plaster 3" broad—stick on and dot out spines—remove—back with paper and preserve.

5. **Examination Movements of Spine.**

N.B.—Muscular spasm and rigidity.

Cervical—place child on his back, face and sides and head will drop if no T.B. to opposite side.

Older child—nodding—lateral rotation.

Dorsal—Ask child to sit—pick something of floor Test extension by placing child prone.

Lumbar—spasm of psoas with spinal flexion.

6. **Examine for Cold abscess formation.**

Certain parts of body invariably examined.

Pharynx.

Neck.

Iliac fossa.

Loins.

Poupart's ligament.

Scarpa's triangle.

Mediastinal

Prevertebral

Psoas

Percussion.

X-ray.

Rigidity of psoas,

preventing hyperextension of spine.

7. Examine for Paralysis.

Motor rather than sensory.
Bladder and rectum rarely involved.
At first spastic then flaccid.
Trophic disturbances—bed sores.
Vasomotor disturbances—cold perspiration.

8. Comparative changes in Cranium. Thorax. Pelvis.

9. Changes in Heart and Vessels.

10. X-ray Examination.

History.

1. Of tuberculosis of lungs or of other organs amongst immediate relatives—shows predisposition to disease and affects prognosis.

2. The usual health of the child—Robust or tedious recovery from ordinary ailments.

3. When was the child last perfectly well? History of measles, Diphtheria.

4. Character of the injury and its relation to symptoms.

5. Onset acute or chronic; tuberculosis is a chronic disease; its exacerbations may resemble the symptoms of acute disease or even injury.

Examination should be made on a table, bench or the floor and not on a soft bed. The patient is stripped and the general condition, gait and attitude examined. The examination must be purposeful:—

Note—1. Stiffness.

2. Weakness—loss of walk, refusal to stand, desire for support.

3. Change in the attitude of patient.

4. Contour of the spine. Normally there is no break in the contour of the spine, but even in early case of spinal disease a slight irregularity is discoverable due to local rigidity; the spine no longer forms a long regular curve when the body is bent forward, but the outline is broken at or near the seat of the disease. Stiffness rises in degree with the state of underlying disease. It may fix the spine or it may check only extremes of motion, but it is always present, preceding deformity and accompanying it till cure is established.

5. Examination with face downwards and test hyperextension and lateral flexion.

6. Examination with the back towards the surgeon for side bending movements; hold the pelvis and rotate the trunk in either direction. This will show up the disease of middle and upper dorsal region.

7. Test movements of the neck.

8. Ask for referred pain as ear-ache, stomach-ache, Sciatica pain, Lumbago.

9. Examination of chest for pulmonary tuberculosis and dorsal abscess.

10. Examine abdomen for Tuberculous glands psoas abscess.

11. Test for psoas contraction, indicative of beginning psoas abscess.

12. Examine for paralysis—knee and ankle jerks.

13. Routine X-ray.

N.B.—In early cases a negative X-ray cannot be accepted as establishing the absence of the disease.

Much patience is required in early cases and several examinations are necessary before the presence of

absence of disease can be definitely determined.

Regional examination of the lower region:—Painful stiffness is usually evident long before the stage of bone destruction.

Characteristic attitude—Exaggerated lumbar lordosis. Prominent abdomen.

Psoas contraction.

Painful cramp.

Lateral inclination of the body.

Examples of stiffness, weakness and pain in this region:—Inability to turn in bed, awkwardness in rising in the morning, changing from an attitude of rest to one of activity; refusal to stoop. Preference to stand rather than sit as in sitting more weight is thrown upon the sensitive vertebral bodies.

Lateral inclination of the body is often present particularly when the disease is at the lumbo-sacral articulation. It is a symptom of unilateral psoas contraction and abscess of unilateral contraction of the trunk muscles or in later stages due to collapse or destruction of one side of vertebral body: This is commonly seen here in Madras.

Examination of the range of passive motion.—The patient is placed at full length, face downward, on a table and the range of extension and of lateral motion is tested by lifting the legs and swaying the body gently from side to side. **In testing the lumbar region, thorax should be fixed by the hand. The spine is very flexible in childhood and rigidity is early demonstrated.**

Then examine for psoas contraction:—The pelvis is pressed firmly

against the table with one hand, while the leg, held in the line of the body, is gently lifted by the other. **The normal range of hyper-extension at the hip joint should permit raising the knee two or three inches from the table. Restriction of extension of both thighs indicate a slight degree of Psoas contraction and is very common in Lumbar Pott's disease.** When the restriction is marked and especially if it is unilateral, a deep abscess may be suspected. Unilateral Psoas contraction is demonstrated by placing the child on the neck, allowing the limbs to hang over the edge of the table, when the unaffected thigh will drop below its fellow.

General flexion of the spine is much more restricted in the early stage of the disease than is extension; this is demonstrated by placing the child on its hands and knees and lifting its hands and knees and lifting it from the floor, when the body instead of bending over the supporting hands, retains almost its original contour.

Look for fullness about the spinous processes or a slight irregularity in the line.

Examine for pelvic abscess.

Examination.—1. General appearance and nutrition of the patient should be noted. Many patients have an anxious appearance while some may give a history of marked deterioration of health. In small children who cannot give an account of their symptoms, special attention should be paid to the mother's observation. Thus a one time bright child becomes dull and looks tired and is not inclined to play. The patient's clothing is removed except for a T bandage and then the examination proceeds.

Body attitude and gait.—To avoid jars and jolts to the spine, the patient

takes up the "Spring" attitude in which the knees are kept slightly flexed. The attitude also varies with the site of the disease. In the *Cervical region*, the head takes up the position of wry neck and may be mistaken for rheumatic torticollis. In a few cases the head is kept extended and rigid. In the *upper dorsal region*, the neck may appear as though sunk into the chest and may be mistaken for congenital Brevicollis. In the middorsal region, the patient seems to have relatively long arms compared to the chest and is due to kyphosis. In the *lumbar region* due to the lordosis, the abdomen becomes protuberant and the twelfth rib touches the iliac crest. The patient takes up the Alderman's gait. General stiffness of the joints may also be noted in early spinal caries.

Exaggerated lumbar lordosis, prominent abdomen and a peculiar swagger are early symptoms.

2. Spine.—Generally the irregularity takes the form of kyphosis especially in the dorsal region. There may be compensatory lordosis above and below the kyphosis. In some cases, scoliosis may be noted and may be the first sign noted, in 22 per cent of Madras cases this symptom was met with. This scoliosis differs from simple scoliosis in that it is of rapid onset, it is not like the smooth curve of scoliosis but is a leaning of the whole spine to one side above the lesion, this is due to inequality of muscular spasm on the two sides and accompanied by muscle spasm and pain. A slight lateral curvature is formed in the lumbar region with every step in walking. In the cervical and lumbar regions, the normal lordosis is obliterated or flattened out. This flattening or

boarding is characteristic of caries of the lumbar vertebræ.

In considering diagnosis, and in fact, treatment and prognosis, one should divide the spine into 3 sections to correspond with function.

1. The neck part, that permits free motion of the head, ending at 3rd dorsal vertebra.

2. The rigid thoracic part, which includes the 3rd and 10th dorsal vertebra.

3. The lower part made up of the lower two dorsal and the lumbar vertebræ, in which the principal movements of the trunk are carried out.

Movements of the spine.—All the three movements of flexion, extension and lateral rotation have to be examined. Also both active and passive movements have to be examined. Active flexion is tested by the well-known "coin test" where the patient picks up a coin from the floor without flexing the knees. This will also bring out the rigidity of the spine. By placing the patient on his face and lifting his both legs, the movement of the spine as well as muscular spasm may be noted. Ask the patient to bend his back forwards and backwards with the knees kept close together. If the movement is slow and imperfect and limited to the hip and knee joints, it must excite grave suspicion, especially if the attempt to bend the spine backwards is a failure and causes the patient to groan. There can be no doubt if there is pain on axial pressure in addition. On pressing upon each separate spinous process, the detection of the diseased vertebra is easy. Rubbing the spine with a hot sponge may localize the affected vertebra.

Percussion hammer or shaking the spine without undue violence or pain on actual concussion by the patient coming down forcibly on to the buttocks—if all these tests point to the same vertebra then there is organic disease. If all these tests are negative, we may safely exclude the presence of active caries. These tests are not necessary and may be required only in an early case. To test for cervical caries in a child, place it on its face, sides and the back and if there is no lesion the head will drop to the opposite side. Similarly, the legs can be raised off the couch when the child is on its face up to an angle of about 45° and the back makes a smooth concave curve behind.

4. Cold abscesses.—These should be looked for at the special sites mentioned. Even in the early stage a symptom very significant of tuberculous abscess in the neck is the situation of the swelling behind the thyroid and behind the carotid. In case of *Psoas abscess*, the earliest sign of involvement of the muscle is loss of movement of extension of the hip joint. Thus locomotion is interfered with. Test the patient prone or raise the pelvis when the patient is supine, when the normal dropping of the thigh from gravity is not seen on the diseased side. Mediastinal abscess is generally diagnosed by means of an X-ray. Cases of retropharyngeal abscess may be seen with symptoms of interference with respiration and Deglutition; in the thoracic region pleurisy and empyema may simulate as mediastinal abscess.

5. Nervous Symptoms.—Motor symptoms are generally seen earlier. Paralysis is usually a late symptom but if the disease begins in the centre of posterior part of the vertebral body

it may implicate the spinal cord before deformity is apparent.

6. Changes in thorax and pelvis.—These have been mentioned earlier. "Barrel shaped" and tilted pelvis are characteristic.

7. Changes in Heart and Vessels.—Generally the heart is displaced and in some cases may be dilated. More commonly, the heart becomes tubular and this is well seen in an X-ray.

8. Radiographic Changes.—X-ray affords valuable evidence in connection with this disease as regards its site, nature and extent. Generally a lateral view gives us more information than an antero-posterior picture. The earliest radiological sign is narrowing or even complete disappearance of one or more intervertebral spaces. Later on, generally two contiguous vertebræ and the space are affected. Carious foci may be seen as clean areas in the X-ray. In advanced cases, the collapse and abscess formation may be noted.

Absence of radiographic signs does not negative the presence of disease; Radiograms of Spondylitis cases gives difficulty in interpretation; new bone formation under the anterior common ligament does not negative the absence of disease. Senile tuberculosis of the spine is fairly common in Madras. **Spondylitis may co-exist with tuberculous disease of the spine.**

Radiographic pictures are of comparatively little importance from the standpoint of early diagnosis of Pott's disease in childhood because the symptoms usually precede the destructive changes in the bone. They are of value in determining the exact extent of the disease.

Diagnosis.—Difficulty in diagnosis is practically limited to the period

before the appearance of the characteristic symptom, *viz.*, an angular curvature. Tuberculous caries without a definite curvature and without a burrowing abscess occurs more frequently in adults than in children because the diseased vertebra soon softens in children and the curvature develops early in a pronounced form. Cicatrization and consolidation occur much earlier in children than in adults. A careful examination will in most cases give us the diagnosis while in some cases the X-ray will greatly help us.

If an infant is brought with the complaint that its entire behaviour has changed, that it is in marked distress, that it has become helpless, that it avoids any rapid movement of the body, that it cries even if lifted out of bed, we should at once think of Spinal disease. It should be remembered that these are certainly not early symptoms.

The most common cause of back-ache is tubercle of the vertebra and hence in every case of back-ache, spinal caries should be eliminated first. Pain is a very characteristic symptom and should not be treated lightly as rheumatism or lumbago. In adults, the onset of spinal caries is very often with pain low down in the lumbosacral, although the caries may be in the dorso-lumbar region. **This pain is eased by rest at first and it may be benefitted by massage; exercises and counter-irritation may give relief.** At this stage, the doctor should not have a false sense of security and treat the case as one of simple sciatica or "rheumatic" pain. The pain later on, becomes severe when the patient rises in the morning, wears off as the spine is used, to become more severe again in an hour or two. This pain should not be

treated as a relapse of rheumatism. If there is pain in the back and if muscle spasm is present we may safely diagnose it as spinal caries even though the X-ray may not show anything abnormal. We must not absolutely negative spinal caries because the skiagram is negative, since fungating tuberculous changes may exist in the vertebral joints, just as in other joints, without affecting the bony structure and the clinical symptoms may be present long before any radiological evidence can be obtained. **Considerable difficulty in diagnosis arises in cases where the X-rays are negative, the results of the tests are variable and where localization is indefinite.** Four possibilities are present in such types of cases:—

1. There may be a small focus of the disease which become evident in the course of a few months.—in one of my cases it was nearly a year before radiological changes were noted in the vertebræ.
2. There may be tubercle of the lung and the pain in the back may be due to disease in the hilus of the lung.
3. The pain may be due to tubercular toxin where there is tubercle of the lungs, with no focus in the spine.
4. The pain may be entirely neuropathic.

To sum up, spinal caries should be clinically diagnosed at the stage when pain and muscular spasm alone are present. The diagnosis should not be delayed until such signs as deformity and abscess formation develop. Every case of back-ache should be examined on a systematic plan and caries should be eliminated at the outset. Similarly, in every case of sciatica, the lumbo-dorsal region should be scrupulously examined for any evidence of tubercle. It will not be in vain to emphasise once more, that

a negative skiagram by no means excludes an early tuberculous disease of the spine and in most cases, clinical symptoms are present long before any radiological evidence may be obtained.

Differential Diagnosis.—

Disease of the cervical region may be divided into two sections:—

(a) Superior or occipito-axoid section and (b) inferior part. Occipito-axoid section is peculiar in that it contains no vertebral body nor intervertebral cartilage. Occipito-axoid disease is relatively more frequent in adult life than in childhood.

Because of free motion in the cervical region, fixation of the upper articulations is often overlooked when the disease is of the subacute type.

In the tubercular disease of the lower cervical region, the neck seems short and the head is tilted backward. The entire back shows a compensatory flattening, yet no deformity is apparent until the occiput is raised and drawn forward; then the deformity becomes apparent. There may be slight bulging or infiltration of the tissues about the seat of the disease. The affected vertebræ are usually sensitive to direct pressure and deep fluctuation in the suboccipital triangle may be made out. Abscess in the posterior wall of the pharynx may cause symptoms of obstruction as snoring, change in the quality of the voice, difficulty in swallowing or spasmodic attacks of so-called croup. The same symptoms may be caused by adenoid growths and by enlarged tonsils. In torticollis the chin is turned away from the contracted muscle, while in Pott's disease it is turned towards the contracted muscle. The contraction in Pott's disease is the result of muscular spasm that checks painful motion. If the head be

grasped firmly by the hands and if gentle traction is made, the distortion may often be overcome without discomfort to the patient.

A. For Cervical Caries.

Torticollis.—Since in cervical caries, the head may be kept in the "Wry neck" position, it may be mistaken for congenital torticollis. The diagnosis is obvious, since in congenital torticollis, the muscle stands out as a subcutaneous prominent band without any associated symptoms like pain, rigidity and tenderness in the cervical spine.

2. **Brevi-collis or Keipped-Feil Syndrome** is easily excluded by a skiagram which shows that the lower cervical vertebræ is one solid mass without any segmentation. Generally congenital defects like hare lip, etc., are present.

3. **Gumma of the spine.**—This is most common in the cervical region. The differentiating point from tubercle are:—

- (a) Deformity is not marked because the destruction of the vertebral bodies is not extreme.
- (b) No abscess formation.
- (c) Other signs of syphilis are present.
- (d) Onset is more sudden.
- (e) Progress is more rapid.
- (f) Wassermann reaction is positive.

4. *Sprain of the neck.*
5. *Enlarged lymph nodes.*
6. *Rheumatic affections.*

B. **In dorsal caries** the normal movements of the spine in the dorsal region is slight; disease of this region may not interfere to a noticeable

degree with the general functions of the spine. As this part of the column curves backward, the deformity often unattended by severe symptoms is mistaken for round shoulders. Deformity quickly follows the disease. Patients are not often seen before the deformity is present. The attitudes are not specially significant. In disease of the upper part, the apparent elevation of the shoulders is caused by deformity which shortens the neck and lowers the head.

One of the secondary effects of the spinal disease is a Pigeon chest for which the parents may consult the doctor. The early symptoms of disease of the thoracic region are pain and laboured or grunting respiration; pain is referred to the abdomen and to the front and sides of chest. **Laboured or grunting respiration is pathognomic of Pott's disease.** Grunting respiration is an evidence of the more acute type of disease but it is noticed even in mild types of the disease when the patient is fatigued or during play.

The respiratory movement of the entire thorax may be lessened in range. In rare instances abscess may press upon the trachea or bronchi and cause spasmodic attacks of dyspnoea resembling asthma.

An aimless cough may be symptomatic of disease of upper dorsal region and spasmodic attacks resembling asthma are not uncommon.

Occasionally tuberculous disease of the thoracic region in adolescence is practically painless.

Congenital kyphosis is due to disappearance of anterior part of intervertebral discs and narrowing of anterior part of contiguous vertebræ; in radiograms there is no decalcification.

1. **Simple adolescent kyphosis and scoliosis** is differentiated by the following points:—

1. Absence of pain.
2. Absence of muscle spasm.
3. Rotation of the ribs on the convex side while it is opposite in tubercle.

2. **Cases of Round shoulders** and of

3. **Inflammation of abdominal lymph nodes** may simulate dorsal caries.

4. **Rachitic Kyphosis** is differentiated by the following points—

1. Absence of pain.
2. Absence of muscle spasm.
3. Absence of rigidity.
4. Kyphosis is regular and even.

5. **Spinal or Intercostal Neuralgia.**—is generally seen in young nervous girls and is characterised by (1) the pain being very severe (2) the pain being superficial (3) remarkable absence of rigidity or spasm and (4) the pain coming in spasms.

6. **Osteomyelitis of the Spine**—is seen between the ages of 5 to 15 and is commonly due to staphylococcus pyogenes aureus. The condition is acute. The processes are affected more commonly than the bodies, thus differing from tuberculosis.

7. **Typhoid spine** commonly occurs during convalescence or occasionally during the course of the disease. There is kyphotic deformity and the widal test is positive. The X-ray shows superficial osteomyelitis unaccompanied except in rare cases by suppuration and followed by new

formation. There is roughening of adjacent surfaces of the vertebræ; the intervertebral space becomes narrowed and finally obliterated while osteophytic outgrowths develop at a later date. Only one case of typhoid case was seen in a child of 5 though typhoid fever is very common and nearly 500 cases are treated in a year while periostitis of skull and arthritis of elbows have been met with after typhoid commonly.

8. **Spondylitis deformans.**—Here there is considerable limitation of movement. The intervertebral discs become absorbed and disappear, lipping occurs at the top and bottom of the bodies, while ultimately these bodies become fused together by a complete layer of new bone which runs all down their anterior surfaces and looks like cement. Hence it is easily diagnosed from spinal caries in the later stages of the disease. Tuberculous disease may co-exist with Spondylitis in early stages.

(9) (a) **Neurasthenia of spine bases** are met with as early as at the age of 20.

(10) **Kummel's disease** is a post-traumatic rarefying osteitis. Generally the history of trauma is present. Skiagram shows that there is crumbling or collapse and the vertebra is wedge shaped.

(11) **Compressive Fracture of the Spine.**—This condition is so characteristic that it need not be discussed.

(12) **Calve's disease**—is only an osteochondritis of a vertebra and occurs in children between the ages of 5 to 10 years. The intervertebral disc on either side is not affected. In tuberculosis the discs are almost invariably affected early.

(13) **Scheurmann's disease** which occurs in adolescents, is only a vertebral epiphysitis. Most commonly occurs in the dorso-lumbar region. Since the epiphysis are affected there is increased thickening of the lower and upper margins of the vertebræ while the body might itself be eroded. This disease except for giving rise to pain and tenderness over the spine produces no other symptom. This condition is rare and was met with only once in an Anglo-Indian boy of 15.

(14) In rare cases an aneurysm of the aorta which is eroding into the sides of the vertebra will give rise to pain in the back. It may also produce paraplegia. But this condition is so characteristic that it will not be discussed further. It has been mentioned already that one case gave rise to considerable difficulty in diagnosis on account of the absence of pain.

(15) **Tumours of the vertebræ** may be divided into 1. Primary and 2. Secondary.

Primary.—The body is most commonly affected. Only one case of sarcoma of cervical spinous process was seen in a man aged 35.

Sarcoma of the body gives rise to paraplegia and the sacrum is the region commonly affected. The other characteristics of the tumour are present. One child was seen with a sarcoma at the dorso-lumbar region and the diagnosis was verified histologically.

Multiple myelomata may also be seen. Several cases have now been diagnosed in Madras.

Secondary tumours are fairly common; I have noticed that pain has been

complained off nearly six months or one year before secondaries are proved to be present radiologically.

Carcinoma.—Secondary to carcinoma of (1) Breast (2) Thyroid (3) Prostate (4) Hypernephroma (5) Bronchogenic carcinoma. Secondary tumours are characterised by the onset of rapid pressure symptoms. All these tumours are osteolytic except those of prostate. As mentioned earlier, the chief point in diagnosis is that the intervertebral discs are not affected in secondary tumours; Areas of rarefaction due to the pressure of secondaries are seen in the posterior portions of the bodies.

(16) **Spinal cord tumours.**—Majority develop slowly and there are few pressure symptoms. Frazier describes three cycles in the life history of such tumours.

(a) **First or root cycle.**—This lasts for a very long period. Symptoms are unilateral in the early stages. First there is irritation and then compression of the nerve roots.

(b) **Second cycle.**—A typical Brown Sequard syndrome develops. This is only seen in extramedullary tumours.

(c) **Third cycle.**—is characterised by paralysis of organic reflexes and deep reflexes. Vaso-motor and tropic disturbances occur.

C. Lumbar Caries.—Differential diagnosis of Pott's disease in the lumbar region:—

1. **Tubercle of the Hip.**—In tubercle of the Hip all the movements are limited and painful while in lumbar caries it is not so. Psoas contraction and the consequent limp with pain in the limb is a symptom of hip disease; but by further flexing the

thigh it will be seen all hip movements are free and painless. In these rare cases where there is spinal caries with secondary tuberculous infection of the Hip, it is very difficult to diagnose without the aid of a skiagram.

(2) **Rachitic spine.**—Rounded curvature of lower part of spine—no spasm—other signs of rickets.

(3) **Sacro-Iliac disease** is diagnosed by the presence of local tenderness over the joint and by the compression test; Radiographic examination is of great value; The condition is often mistaken for disease of the hip than of the spine.

(4) **Spondylo-listhesis.**—The skiagram is characteristic it is uncommon in children; the condition may simulate disease at the Lumbo-sacral articulation.

(5) **Lumbago.**—Sudden onset with local pain and sensitiveness of muscles themselves.

(6) **Strain of the back.**—simulates Pott's on account of stiffness and limitation of motion, but onset sudden, pain is localised and is relieved by rest and the restriction of motion is voluntary. In Pott's disease the pain is neuralgic, often worse at night and the rigidity is due to reflex spasm.

(7) **Sciatica.**—is unilateral; usually confined to the distribution of the nerve which is often sensitive to pressure; movements of the limbs that cause tension of nerve are painful; sciatica simulates Pott's disease because in some cases of long-standing lumbago-sciatic neuralgia, lateral deviation and even rigidity of lumbar spine are present. Pain of Pott's disease, if referred to limbs is bilateral.

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(8) **Spondylitis deformans**—is confined to adult life.

(9) **Bilateral congenital dislocation of the hip** simulates Pott's disease on account of the hollow back, the prominent abdomen and the swaying gait.

(10) **Muscular dystrophies** bear a superficial resemblance to Pott's on account of the disinclination to stoop and limitation of motion.

(11) **Differential diagnosis of Pelvic abscess and other pelvic conditions in women and a distended bladder** even is required in some cases of low "back-ache."

8. **Prognosis.**—The prognosis in spinal caries is grave since the mortality rate varies from 40 to 50 per cent. But it should be pointed out that it does not necessarily mean that it is incurable. Thus if the case is diagnosed early and the patient is at rest and in hygienic surroundings, there is a very strong tendency towards repair, the tuberculous granulation tissue becoming fibrosed and the vertebræ bound together by fibrous adhesions which ensure firm fixation.

Causes of death.—In children, the most common causes are meningitis and generalized tuberculous dissemination. As age increases, death is due to persistent suppuration and increasing kyphosis which in turn leads to compression of the viscera in the thorax and abdomen. Later there is distortion and diminished calibre of the aorta, hypertrophy of the heart and a fateful termination of some otherwise trivial illness.

Mortality.—Of those who pass from the early stages of spinal caries into the stages of deformity very few

reach old age. 20 per cent of all patients die during the progress of the disease in the first two years, from causes directly or indirectly dependent upon the local lesion.

Mortality.—

Lowest in the cervical region - 25.3%
Highest in the Thoracic region - 46.3%
In the Lumbar region - 34.5%

Death rate was highest among patients who were less than 20 years of age and lowest amongst those between 20 and 30 years. Tuberculosis of the spine is the gravest of the joint and bone affections so far as the risk to life is concerned. Tuberculous meningitis, which occurs more often in connection with the tuberculosis of the hip, is frequently common in disease of spine also. In adults, the danger to life is real, the mortality is high and the disease is difficult to control by treatment.

Treatment:—Serums, injections and special paste mixtures have never proved successful. Massage and native methods of so-called Malabar treatment are dangerous.

General antituberculous measures.—These consist in abundant fresh air, and residence in a suitable locality where the climate is dry and bracing. In addition, as in any tuberculous condition, the patient must have plenty of good food, special attention being given to the supply of plenty of fats (eggs, milk, cod liver oil). General measures like direct exposure to sunshine either real or artificial and tonics should be tried. The sun treatment is the most effective and curative agent with the exception of fixation of affected parts. This treatment is always in conjunction with fixation by frames, traction and other apparatus. Dr. Rollier at Leysin treats

cases by placing the patients upon their face and giving judicious sun treatment only. He does not interfere with abscesses which in his opinion are a rich source of anti-bodies. He has obtained excellent results and the treatment of a case extends from 3 to 4 years. *Tuberculin* has not been tried in this series of cases; **all available money must be utilised in securing absolute rest and enough food for the patient.**

Local treatment.—Efficient and early local treatment of the spine should be given. This consists of **absolute rest by immobilization, with freedom from weight-bearing—and absence of interosseous pressure between the vertebra while measures will have to be taken to limit or correct the deformity.** The local treatment is divided to four stages:—

- (a) Mechanical treatment.
- (b) Treatment of deformity.
- (c) Treatment of complications.
- (d) Operative treatment.
- (e) After-treatment and care.

First stage or the stage of complete recumbency.—In this stage the patient's spine is immobilised in a completely recumbent position and in a hyper-extended state, until the vertebræ become ankylosed by new bone and the disease is quiet.

How does hyperextension differ from simple rest in recumbency?—

(a) Treatment in hyperextension decreases the amount of bone destruction.

(b) Accidents which may occur from flexion of the spine during the active stages of the disease are prevented; hyperextension definitely diminishes paraplegia.

(c) The bodies of the vertebræ adjacent to the diseased area may show the compensatory overgrowth phenomenon. This overgrowth tends to lessen the gap produced by the bone destruction and is therefore of value in limiting the deformity.

How long to continue hyper-extension?—It must be continued until the disease is quiescent, i.e., by radiogram it must be determined that bone destruction is at an end for more than six months.

The next stage is to allow the vertebræ to fall together and fuse.

This is done by nursing the patient on his face in a plaster shell.

Development of compensatory curves.—Compensatory curves are the best insurance against reactivation of the disease and a late increase of the deformity.

The compensatory curves should be as near the lesion as possible; this is done by adequate padding while the patient is on the posterior frame. Compensatory curves should be fully developed before the patient is allowed up. They must be maintained and the healed lesion protected during ambulatory treatment.

In this state, thus neither movement nor weight bearing is allowed. **Generally this stage lasts from 18 months to 2 years. Every case should pass through this stage.** Recumbency removes one of the chief exciting factors, namely the superincumbent body-weight. Since absolute fixity of the spine is difficult to secure, many methods and splints have been devised to obtain that end. Immobilization

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may be effected by the following means:—

Satisfactory recumbency cannot be secured with an ordinary bed—even on a firm mattress resting on fracture boards as it is difficult to secure adequate fixation of the segments of the spine above and below the diseased area; the immobilization is constantly interrupted when the child is moved for nursing purposes.

(1) **Bradford or Whitman's frame.**—Immobilization can be attained easily, effectively and comfortably by putting the patient upon an apparatus such as a Bradford frame. This frame is rectangular and is made of steel tubing 3/4" diameter and covered with canvas. The patient lies on canvas which is tightly stretched between the two sides of the frame and is laced on the under surface. The canvas is usually applied in two sections, with an interval in between to allow for the bedpan and to provide facilities for nursing. The frame may be raised by two wooden blocks placed under each end. The advantages of this frame are that it permits of extension being applied to the head, enables the patient to be carried or wheeled about. Side bars prevent lateral movement. *Whitman's frame* differs from that of Bradford's in that the frame is only 4/5 as wide as the patient, the side bars lying opposite the glenoid fossæ and acetabulum and is bent at any desired angle, so that the spine may be hyperextended. This is useful in cases with deformity or nervous symptoms. Legs must be bandaged firmly to prevent movement of the spine. Head must also be strapped. If the head is left free the child usually twists and turns so freely that the diseased area never obtains rest. Patients should either be strapped by means of straps or an anterior

plaster cast should be given. This is specially useful in unruly children. No pillow is allowed and pressure points are protected by small rubber ring pads. It must be emphasized that if the patient sits up even for a single day, it will undo all the treatment. Traction on the head or lower extremities is carried out in the early stages of the disease and in all cases with paraplegia. This is the method ordinarily adopted in this series; the cost of the frame is about Rs. six for a child and Rs. twelve for adults.

(2) **Plaster boat or bed.**—This produces the most perfect immobilization than any other method. The patient is placed upon the plaster boat, which is moulded on to him while he lies on his face with hyperextension and the plaster bed with the patient in it is later placed upon a wooden frame to support it. This method is useful in adults and may be used from the early stages of the disease. While in the plaster bed, periodic examination must be made, both as to general condition and also to see whether signs of abscesses or paraplegia are present.

Application of Plaster Jacket.

Position—is suspension in Sayre's tripod. The arms are extended over the head and the hand clasps the strings. Thus the chest is expanded to its full limit.

Seamless shirt fitting.—Application of linen or other material as singlet about 3 inches in width and three feet in length is placed, beneath the shirt in the front and back. These are called Scratchers.

Plaster jacket.—If the disease is above the 10th dorsal vertebra, it is well to carry the plaster bandages

fixes the head in slight extension is used.

The duration of complete recumbency is usually about 6 months in the cervical region while in the dorso-lumbar region it is about 18 months to 2 years.

Stage II or Ambulatory Stage.—This stage is reached when the following signs and symptoms are present:—

1. X-ray shows signs of recalcification and is proceeding favourably.

2. Clinically complete disappearance of pain

(a) of spontaneous pain

(b) of pain on direct or axial pressure.

(3) of referred pain.

3. Complete disappearance of signs of medullary compression as elicited by reflexes.

4. Deformity shows no sign of increase.

5. **General condition** (weight and normal temperature for some months) improves.

6. Locally there is complete fixity and lack of movement.

7. Attempts on the part of the child to get up.

In this stage, weight-bearing alone is permitted. No movement of the spine is allowed. To prevent movement of the spine and to give support to it, a well fitting brace like Taylor's brace (1863) is given. For strong subjects celluloid apparatus lined with chamois leather is given while

for weaker patients and children, corsets with steel rods and supports under the axilla is given. In these apparatuses, the principal point of support is the axilla, **the object of the brace is prevention of forward bending.** If the disease is above the tenth dorsal vertebra the head and the neck must also be supported by a jury mast or a Thomas's cervical collar. If the disease is above the tenth dorsal region, the shoulders must be included. The change from the recumbent to the ambulant should be gradual. If there is recrudescence of local pain the patient should once again be put back on the Bradford frame. When the period of hyperextension immobilization is completed, inflexion is permitted and encouraged. The patient is nursed in the prone position and the back muscles are massaged and the patient is encouraged to begin contracting the muscles without inducing movement. Development of compensatory curves is encouraged. After some months when the tone of the muscles has been restored and the atrophy of the muscles due to the hyperextension period has been overcome, compensatory curves should be made to develop above and below the lesion. This is achieved by placing the patient in the Bradford frame for short periods each day, the frame being provided with narrow pads adjusted so as to create the necessary curves. They disguise the degree of the gibbus and they are regarded as providing an insurance against the reaction of the disease. The duration of ambulatory treatment depends on the region affected being longest in the mid-dorsal region where it takes 18 months.

Celluloid jacket is expensive.

Essentials of a spinal support.—

1. A fixed point from which pressure may be exerted, preferably the pelvis.

2. Pressure should be exerted along the transverse processes of each side, especially in the region of the Kyphosis.

3. No compression of lateral chest walls.

4. Compensatory pressure on the upper portion of the anterior chest wall and the pubic and pelvic regions.

5. If the disease is located between the 8th and 10th dorsal vertebrae, the support must extend above and in front of the shoulders. If above the 8th dorsal vertebrae, the support must include the head and neck.

The support costs Rs. forty to fifty to be done in Madras.

Head Support—

1. Jury mast.

2. Thomas collar.

Taylor's brace should be worn both day and night; under no circumstances should the patient sit erect when the brace is not applied.

The stage of convalescence.—This stage lasts for 3 to 4 years and the patient is carefully watched. Regulated and moderate degrees of movement are allowed. Convalescent treatment is started when the consolidation of the collapsed vertebrae is complete. Also pain and muscle spasm should have entirely subsided. During this stage, a light celluloid jacket or a Taylor's brace should be worn.

N.B.—It is very important that pregnancy should be avoided and patients

require clear and unequivocal instructions on this point.

Treatment of complications.

Abscesses.—Whenever a cold abscess forms, it should be aspirated since, if it bursts and secondarily infected, it will give rise to many complications. Generally such abscesses are aspirated through a valve like opening through healthy skin and in a non-dependent place. If the pus is very thick, a modifying fluid which contains ether and thymol may be injected into it and later the pus aspirated. Chronic tuberculous retro-pharyngeal abscess should be aspirated at the posterior border of the sterno-mastoid while a Psoas abscess should be aspirated just medial and above the anterior superior Iliac spine. In a case of mediastinal abscess, costo-transversectomy is the only ideal choice.

Cold abscess.—As a general rule, a cold abscess should be left alone. The sterile semi-fluid debris is innocuous and does not cause any discomfort. The abscess disappears when the bone or joint lesion is cured.

Indications for aspiration:—

1. Mechanical interference with function.

2. Evidence of pressure necrosis and thinning of its wall with danger of sinus formation.

3. Discomfort from tension.

4. Evidence of secondary infection.

General rules for aspiration:—

1. Recumbency and gravitation prior to operation.

2. Rigid asepsis and use of gloves.

3. In evacuation of a large cold abscess pointing in two locations as loin and hip, aspirate the one on a higher plane and not the dependent one.

4. Select the thicker portion of the wall and the needle is introduced gently and obliquely.

5. Avoid injuring the granulations lining the cavity as this minimise the danger of a post-operative hæmatoma. Hence express the contents gently. A hæmatoma is a more favourable culture medium for bacteria than the innocuous material.

6. No instrument should be introduced into the abscess cavity.

7. Recumbent position is required after aspiration; injections of germicidal solutions are not necessary.

(2) **Paraplegia** has been discussed earlier and will also be discussed under operative treatment.

(3) Deformity—

(a) **Hyperextension method.**—Good results are obtained by this method. The patient is placed on a Whitman's hyperextension frame and gradually the hyperextension is increased for some weeks when the spine can be completely straightened in the early cases. No attempt at violent correction of the deformity must be made as this is very likely to light up the disease.

(b) **Calot plaster jacket method.**—Rapid correction under anæsthesia must never be done. Correction by Calot's method is useful where there is marked angular deformity and when it is recent and not fixed by bony ankylosis. The correction is done by putting the patient into a plaster

jacket with a diamond-shaped aperture opening out at back opposite the summit of the deformity. Thick layers of vaseline and cotton wool are applied through the aperture to press upon the angular projection and firm bandaging employed to press upon the projection. The padding is continually renewed and thickened generally once in 5 days until the deformity is corrected. The disadvantage of this is that by preventing deformity the natural process of consolidation of the collapsed vertebræ is prevented.

Operative treatment.—The operative treatment for Pott's disease aims at the production of bony ankylosis of the posterior or unaffected portion of the spine. The operations are (1) the operation of Hibb's and (2) Albee operation of bone-grafting.

General features.—The commission appointed to investigate the results of ankylosing operations upon the spine, found that in 80 per cent of cases, ankylosis of the operative field was present and the percentage varied with the age of the patient. It is a fact that both Hibb's and Albee's cause fusion of the laminæ and cannot be disputed. After Hibb's operation the fused laminæ forms a solid sheet of bone and after Albee's operation the bone of the graft was indistinguishable from the bone of the spinous process to which it had adhered. (See notes of No. 2 Pathology specimen).

This ankylosis of the graft does not indicate cure of the disease but it is a good internal fixation splint. **The operation is only an incident in the treatment** and External splint support should be persisted in after the operation, until the disease in the bodies of the vertebræ has ceased to be active. Complete fusion of the vertebræ is the ideal end result and is a cure; it

occurred in 18 of 96 cases examined by the American Commission and these were cases 4 to 5 years after the 1st X-ray. Posterior spinal fixation, since it acts by leverage and stabilization and does not produce direct suspension, is a form of splintage. It helps to protect but cannot replace the natural process of healing. The results of the operation are most favourable when the disease is in the dorso-lumbar and lumbar regions. Though Albee urges operation at all ages, it is now completely abandoned in children. Gauvain recommends operation in children with poor musculature to prevent deformity and to be done at the time of discharge. When the mechanical treatment is continued for a long period following the operative method, cases as a whole show much less deformity than those in which mechanical treatment is abandoned early or inefficiently carried out. Abscesses disappear after fixation of the diseased segment by a long graft.

Fracture of the graft.—In cases where fracture of the graft occurs the symptoms usually reappear. American Commission reported one case of fracture 3 years after operation following which active symptoms again developed; in another case fracture occurred 18 months after operation while the patient was lifting a heavy weight. Fracture is likely as a complication if rotatory movements are permitted too soon. A prolonged and careful after care is necessary whatever method of treatment is adopted. Should fracture of the graft occur the patient must be kept immobilized on a frame for about three months to promote union of the fracture.

No results were so disastrous as those where a thorough surgical

operation was done, the wound opened in the front and at the back, mopped out with gauze and drained by tube for a long time.

McKee after a full analysis of cases treated by conservative and operative methods comes to the conclusion that cases treated by the non-operative means give better results and are much less liable to develop late abscess formation. He also concludes that the place for operation is at the end stage.

Both these operations should be followed by a period of recumbency with absolute fixation of the spine and this is best obtained by placing the patient prone on a plaster bed. The duration of rest and recumbency need not be as long as in the cases treated by conservative methods and probably a period of six months recumbency and then one year with a spinal support suffice.

Albee's Operation (1911) consists in cutting a large bone graft from the crest of the tibia, splitting the spinous processes of two or three vertebræ, above and below the diseased segment and wedging the graft firmly into the split spinous processes where it unites and secures posterior fixation within three months. The area fused should not be confined to the region of the kyphosis, but should also include the adjoining compensatory curves. In some cases the graft becomes loose. In Albee's opinion, the main indications for the operation are:—

1. Pain.
2. Muscle spasm.
3. Increasing deformity.
4. Abscess formation.
5. Paraplegia.
6. Localisation of the disease to one, two or three vertebræ.

Contraindication.—Activity of the disease is a definite contraindication for operation and also secondary infection with high fever. It has been pointed out that in the present series of cases several cases had multiple foci in several vertebræ; such cases require conservative treatment.

It must be pointed out that grafting shuts the door on laminectomy if it has to be done for paraplegia. In such cases laminectomy should be done first and should be followed by bone-grafting.

Hibb's operation (1911)—consists in exposing, removing the periosteum and fracturing a number of spinous processes and turning them down so that they interlock with one another. Bony ankylosis occurs in three months. The support of the spine should be continued for 6 to 18 months.

Objects of spinal fusion.—Spinal fusion should not be performed with the object of cutting down the time required for the subsidence of the disease; the object is to protect the newly consolidated lesion from trauma, to maintain the compensatory curves at their optimum and to prevent the progressive deformity which occurs in vertebræ even after the bodies of the vertebræ appear to be soundly fused. A spinal brace does not prevent this progressive deformity.

Contra-indications for spinal fusion.—(1) Activity of the disease both in children and adults is a definite contraindication because

(a) there is no consolidation at the site of lesion.

(b) absence of compensatory curves.

(c) operation is severe and may weaken the individual.

2. **Children.**—No fusion would take place as the spinous processes are partly cartilaginous.

H.B. percent, Total R.B.C. count, Blood Sedimentation test must be satisfactory before the operation is performed. The patient with a normal pulse rate and an apyrexial chart with disease limited to one or two vertebræ from which the patient is recovering through the conservative treatment are the most suitable cases. It is not to be regarded as a short cut in the treatment of the disease.

A few days before the operation a posterior plaster bed is prepared and kept ready.

One of the important causes of the failure of the operation is the wrong selection of cases; it is evident that there are a large number of cases with multiple lesions in the vertebræ; that the lesions may be, far apart; a complete radiogram of the spine is essential; a thorough overhauling examination to exclude other retractive lesions as in epididymis, lungs, lymph glands.

The following are the recent cases of osteo-synthesis operation; a previous study of osteo-synthesis cases showed one death 6 months after operation, one developed paraplegia 3 years after spinal fusion; 4 were keeping well and 4 could not be treated; out of these 4 non-traceable cases one has now developed tuberculosis of lungs.

V—aged 14—had tuberculous disease of the 5th lumbar vertebra and being a poor boy was fixed with an Albee graft. After eight months in bed he did very well. The sedimentation test showed a steady improvement.

S—aged 14—had tuberculous disease of the first and second and third lumbar vertebræ of the three years' duration. After conservative treatment an Albee's operation was performed, the disease was arrested and after 9 months he was permitted to move about; the abdominal cold abscess had calcified.

R—aged 30—had tuberculous disease of the 2nd lumbar vertebra with involvement of the 3rd for over two years; there is new bone formation and fusion of the vertebræ. He was kept in bed for 8 months after the Albee's operation and was fitted with a spinal brace.

T—aged 25—had tuberculous disease of the ninth, tenth, eleventh and 12th dorsal vertebra; there was bony ankylosis of the eleventh and the tenth in the intervertebral region.

Albee's operation was done in March 1938. She was seen last in January 1940; the graft was well consolidated. She was pregnant then and it was quite likely she would go down till after delivery.

K—aged 20—had disease of the 12th dorsal and first lumbar vertebra; she was operated in February 1934; in January 1937 the part of the graft appeared in width, texture as the original part of the graft; the lower part of the graft was replaced by new bone which had fused the spinous processes; there was still disease of the head of the 12th rib.

K—aged 40—had tuberculous disease of the twelfth dorsal and first lumbar vertebra; she had an Albee's graft put on; six months after operation she felt a crack in the graft exactly opposite the site of disease. If the graft absorbs or breaks, it is

generally at the site of lesion and this demonstrates that the consolidation of the previously diseased area is not complete.

S—Male aged 30—admitted on 26th March 1940 with disease of fourth and fifth Lumbar vertebræ of one year duration with no abscess; osteo-synthesis operation (Albee's method) was done on 5th April 1940.

M—Male aged 14—Low back-ache of eight months' duration; right-sided Scoliosis; Radiogram showed multiple foci in 10, 12 Dorsal vertebra and first and second Lumbar vertebra; Albee's graft operation was done on 3rd April 1940; two other recent cases are not included in the series.

One case of a male aged 25 died 6 months after operation.

One case of a male aged 45 developed paraplegia 3 years after spinal fusion; the graft had consolidated very well; it is extremely difficult to perform laminectomy after spinal fusion.

In the case of a woman aged 30 who had an Albee's graft but on in 1939, the patient improved up to a point and then broke down in health. She was an old tuberculous patient with multiple foci in the body. She developed a cold abscess in the thigh and discharged the graft three years after operation.

Two patients are quite well and are doing duty. Recuperative powers of nature are great and patients exhibit a strong tendency to fight out the disease. A boy aged 12 had cold abscess with disease of the 11th and 12th dorsal vertebræ and was in hospital for over a year; the abscess was aspirated forty times. Six years

after the onset of the disease, the radiogram shows normal appearance of the vertebræ except narrowing of the intervertebral disc; and there is no new bone formation. On the other hand one is impressed that the disease is a general constitutional affection, the patients have had some previous manifestations in lymph glands, pleura or peritoneum. Therefore a thorough conservative treatment and a careful selection of case is necessary.

Indications for costo-transversectomy.—If the abscess enlarges, the tension may become so great that the Oesophagus, the trachea, and the left recurrent laryngeal nerve may be pressed upon or paraplegia may result from the pus finding its way into the spinal canal. If the above complications occur in spite of efficient rest treatment, operation becomes imperative.

The technique of Stiles gave good exposure.

Before concluding, it is important for the profession to realise that as there is no state or private hospital exclusively devoted to the disease in Madras or India, the effort of the individual doctor for this class of patient is the only help available; that the members of the profession must become alive to the importance of early diagnosis of the disease in their private or dispensary or hospital practice; there is no native method of treatment for the disease or serums and injections are not of any value.

Removal of the children from open tuberculous parents or grand-parents and other relations and proper convalescence after exanthemata are important prophylactic measures. The economic loss to the family is great as the patient not only loses his wage-

earning capacity but an attendant is also required to look after the primary needs of the patient.

Conclusions.

According to Whitman, of 1259 cases, 85 per cent of the cases occur under ten years of age and the incidence appears to be commonest at the age of five. Of 180 cases by Lannelongue, 50 per cent occurred between 2 and 5 years and 89 per cent before 10 years.

There is a marked discrepancy in the age incidence in Madras: 57 cases out of 191 occurred before the age of 10; there is a high incidence between the age of 3 and 5, but there is a level of high incidence between 11 and 20 and between 21 and 50. On account of the very high infantile mortality in this country it is possible that many weaklings die before the age of 1; there is again a high mortality before the age of 5 from pyrexias—a high percentage of which may be tuberculous. This view cannot be corroborated from autopsy findings as there are very few autopsies done here.

Sex.—Boys are more affected than girls.

Localisation of the disease in this series.—

Cervical	30
Dorsal	91
Lumbar	71
Lumbo-Sacral	2
Disease in two regions	19

Disease in two regions separated by a number of healthy vertebræ 6.

Although the dorsal region of the spine is the part most frequently affected, the proportion in the lumbar

region is very high. I am not able to offer any explanation to this discrepancy. Of 1355 cases analysed by Whitman, 100 were in the cervical region, 854 in the dorsal region and 317 in the Lumbar region.

8 to 12th dorsal vertebræ are those most often involved in the tuberculous process; the maximum number is at the 12th dorsal vertebræ and in this series 12th dorsal vertebræ was involved singly or in combination in 45 cases.

On the formation of new bone.—It is often remarked that there is practically never any subperiosteal new bone laid down except in the later stages. New bone was noted in one-sixth of cases and in 2 museum specimens. The museum specimens corroborate the clinical findings that multiple affections of the vertebræ are common, that the articulations of

the heads of ribs are more often involved than are thought to be.

Regarding the type of lesions, there are more cases of central types, than the periosteal even in the adult. The spread under the anterior longitudinal ligament does occur, but there are more cases of multiple foci in many vertebræ, with probably more destruction in one or two bodies. This is an important finding as absolute immobilisation is essential in all cases during the early stages and only suitable cases should be selected for internal fixation treatment. I have seen spread of the disease to other vertebræ when the patient had an internal fixation graft with absolute immobilisation in plaster bed under the best hygienic conditions.

I am indebted to Lt.-Col. G. R. McRobert, I.M.S., Superintendent, Government General Hospital, Madras, for the kind permission to publish the article.

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Some Recent Advances in Therapeutics

BY RATHNAVELU SUBRAMANIAM, M.B.B.S.,

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Sir Patrick Manson-Bahr in his introduction to his Text Book of Tropical Medicine has written that the student in the tropics has ample opportunities for research unlike the students in the west where the prevailing diseases have been exhaustively studied by masters in medicine and very little can be added to the work of those great men. The last year or two has witnessed remarkable advances in Therapeutics proving the scope for advancement of knowledge of treatment even in the west. Particularly the advancement in Neurological diseases has been remarkable and as Russell Brain remarks it can no longer be said that the Neurologist can only diagnose but cannot treat.

The advances that have been included here are yet to stand the test of time and are not included in the ordinary text-books.

The most notable advance is the introduction of M & B 693 (Sulphapyridine) a sulphonamide derivative for the treatment of Lobar Pneumonia. This like the other sulphonamide derivatives has got to be given in large doses to start with. The recommended dosage being 9 grams or 18 tablets during the first 24 hours. 4 tablets administered stratum and thereafter 2 tablets every four hours by night and day and the patient be woke up if asleep and the drug administered. It has been found that the time interval of

4 hours must be rigidly adhered to keep the drug in sufficient concentration in the circulating blood as the drug is rapidly eliminated. The drug can be reduced on the 2nd day to 6 grams or 12 tablets and 2 tablets administered every 4 hours and this dose is maintained till the temperature comes down by crisis, when the dosage can be reduced to 3 grams or 6 tablets, one tablet being administered 4th hourly and then gradually stopped. It is very essential while stopping the drug to gradually tail it off and not abruptly stop it, as it has been reported in a number, of a fatal relapse occurring and the drug does not effectively control the relapse. The drug acts almost like a specific in Pneumococcal infections and number of recoveries from Pneumococcal meningitis has already been reported—a disease which was invariably fatal before the introduction of this drug. It is customary to advise the avoidance of eggs and sulphates during the administration of this drug as with other sulphonamides but recently Professor Micks writes there is no experimental basis for such an advise.

The drawbacks with the drug are that it cannot be given to cases with leucopenia but some authorities advocate the administration of Sodium-pent-nucleotide (nuclein) injections simultaneously with this drug. The writer has seen one bad case of broncho-pneumonia with severe leucopenia treated on this line with

gratifying result. In susceptible persons M & B 693 produces a profuse rash as in measles, hæmaturia, nausea and vomiting. Fortunately nausea occurs rarely for once this occurs it is not possible to administer the drug and nothing seems to control the nausea excepting the suspension of the drug. Though the makers claim that oxygen and other routine treatments are unnecessary yet it is advisable to give oxygen in a case of cyanosis and where there is difficulty in breathing and such other symptomatic treatment as is suitable for the case. The drug itself produces cyanosis. The cause of this cyanosis is not definitely known and cyanosis is no contraindication for stopping the drug. Beaumont has reported 8 per cent mortality rate with cases treated with M & B 693 as opposed to 27 per cent mortality of the control cases in a series of 200 cases treated under identical conditions.

* * *

Sodium Diphenyle Hydantoinate—marketed under various trade names as Epanutin, Dilantin, Alepsin, Hydantin, etc., has been introduced in the treatment of epilepsy. This drug is for the treatment of idiopathic epilepsy only. It is a barbiturate derivative. It is available in capsules of 0.1 gr. Three to four capsules a day are administered. 0.4 gr. is the maximum therapeutic dose and 0.5 gr. produces toxic symptoms. Thus this drug has only a very small margin between the therapeutic and toxic dose. This has got to be given along with the other anti-convulsant drugs as Bromides and luminal. This has been found to be very effective even in patients who were getting severe convulsions almost every day in spite of ketogenic diet, bromides, luminal, etc., but the drug may fail to act in a small percentage of cases and the fits

that occur in cases, receiving this drug are much severe than normally or when the fits occur when the patient is under the influence of other anti-convulsant drugs. Cyanosis is also greater in seizures under Epanutin therapy. Epanutin has no depressant action on the central nervous system like the barbiturate group. So long as the toxic symptoms are present no convulsions are noted. Great reduction of fits with isolated outbursts of severe attacks. "It may be that whereas the bromides modify the response of the nervous system to the factor initiating a convulsion the hydantoinate suppresses this cause without modifying nervous activity. If so the hydantoinate would be producing its effect at an earlier stage in the epileptic process. When the cause of the convulsions reaches dimensions too great to be controlled by hydantoinate however it seems to activate a completely undepressed nervous system, and so causes a maximal response". From this statement it is evident the necessity for supplementing the Epanutin therapy with bromides or luminal.

Toxic symptoms are many and are giddiness, tremors ataxia, blurring of vision, slight nausea, delusions, hallucinations, prolonged confusion, clonic spasm, agitation, mental depression and reactivation of suicidal tendencies. It has been recorded in a series of 91 cases, two patients developed status epilepticus and died. On account of the toxic symptoms it is advisable to treat cases of Epilepsy in an institution to start with and to work out a suitable dose and the concomitant bromide dose as well and after discharging the patient advising him to report once a month for recording the progress and to prevent toxic effects since the toxic manifestations of the drug may be put down as due

to some other source by the patient. In the course of treatment if toxic symptoms manifest it is advisable to stop Epanutin and bromides and then resume bromides and later Epanutin on a smaller dose than previously. Denis Williams in *Lancet* has reported a series of 91 cases of Epileptics who did not respond to other anticonvulsants. Average trial period with Epanutin was 6 weeks to 10 months. Average previous treatment was for 6.4 years. Fits reduced in frequency in 79 per cent of the subjects with grandmal and 63 per cent of those with petitmal. In 19 per cent improvement was dramatic and maintained for over 5 months. Toxic symptoms occurred in 36 per cent and 2 died in status epilepticus while under treatment.

* * *

Vitamin E: This is got mainly from wheat-germ oil and is marketed under various trade names as Fertitol, Ephynol, etc. This vitamin was discovered in animal experiments and was found to be necessary for the normal functioning of sex glands and deficiency caused abortion in pregnant female rats. It has not been worked out as to how far it is necessary for human beings but is empirically tried in repeated abortions and functional sterility. "The therapeutic application of Vitamin E is still in the experimental stage. Limited clinical evidence indicates that it may be of some value in certain cases of functional sterility resulting from inadequate development of male-germ cells, resorption of fertilised ovum or impaired placental function and in defective lactation". It has recently been proved Vitamin E therapy gives remarkable benefit in Muscular dystrophies and amyotrophic lateral sclerosis. The dosage is 3 to 6 m. gr. daily and even larger doses are advocated and no ill effects have been

noted clinically by administering large doses.

Nicotinic Acid: This is now administered for Psychoses of old people with failure of attention and memory. (Vitamin B complex) Thiamin hydrochloride is equally effective. Also useful for muscular weakness, asthenia and loss of appetite. It has clinically been proved that Vitamin B administration is a very powerful therapeutic agent for producing appetite. The exact mechanism of its action is not known. This Vitamin B complex has also been tried for muscular atrophy, dystrophy, paralysis agitans and cerebral arteriosclerosis with benefit.

Vitamin K: This has been named the coagulant factor and has been separated from Vitamin C. Lack of this vitamin causes blood clotting time to increase from a few minutes to many hours. Addition of concentrated preparation of this vitamin is capable of restoring the blood clotting time to normal. This vitamin is prepared from Alfalfa plant. In a large series of cases of post-operative bleeding in cases of Gastro-enterostomy some American workers have shown that the administration of this Vitamin K arrests the hæmorrhage where the orthodox line of treatment has failed, and the mortality rate was far less in a controlled series of cases.

Sodium Pentothal: This is an analgesic and narcotic drug introduced for the alleviation of labour pains. This is administered as capsules, 4 to 6 gr. capsule is given to start with and later 2 gr. capsule every $\frac{1}{4}$ to $\frac{1}{2}$ of an hour. Maximum of 30 grains can be given. Even up to 65 grains have been given without bad results. It is reported as an ideal analgesic as under

the influence of this drug the patient is just relieved of the pain and with each contraction of the uterus she awakes and realises she is in pains but does not complain of pain and she willingly co-operates with the obstetrician and can give a coherent reply to questions. This drug has no action on the uterus and does not interfere with uterine contraction. The only contra-indication for this drug is a severely damaged kidney. No bad effects on the foetus has occurred so far in the reported cases.

Atebrin: Is a dye product introduced by Bayers for the treatment of Malaria. It has recently been found by some Italian workers that Atebrin administered in the same dosage as for Malaria (i.e., 0.1 gram three or four times a day) effectively cures Giardia Lamblia infection. This observation has since been confirmed by workers in Bengal. Giardia infection can be demonstrated by aspirating the

duodenal juice and centrifuging the same and mounting the deposit.

Potassium Chloride: For the treatment of Meiere's disease 6 grams of Potassium chloride in 25 per cent solution per day. This has also been found very effective in Familial periodic paralysis.

Benzedrine: This is an ephedrine derivative. This is supposed to produce insomnia in somnolent condition and acts as an hypnotic in pathological insomnia. Clinically it is useful in cases of narcolepsy, paralysis agitans, and Catatonic Schizophrenia. Benzadrine is very useful in cases of Alcoholic addicts who want to give up alcohol as during periods of depression and craving for alcohol administration of Benzedrine produces euphoria and the patient does not desire for alcohol. Professor Micks advocates Benzedrine for functional eneurisis. I have also tried Benzedrine in a case of functional eneurisis with benefit.

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Early Hepatic Cirrhosis following Vaccination.

BY A. V. S. SARMA, M.B.B.S., D.CH. (London).

The following account relates to a case of enlargement of the liver after vaccination with vaccinia virus.

Baby Krishnan. One year and two months old (on 23rd September 1939, male).

Brahmin. Vegetarian. Middle class.

Complaint.—Whitish motions and protuberant abdomen.

Duration.—One month (from 23rd August 1940).

History of present illness.—The child was vaccinated in the seventh month and about a week after the date of vaccination he developed generalised eruption. An area of deeply pitted scars after the eruptions had healed on the left thigh is reproduced. Dr. T. R. R. Erode, who referred the child to me, remarked that the child became greatly 'upset' by vaccination.

Previous history.—Mother's pregnancy and labour normal. The child was breastfed and supplemented also with cow's milk. He was given castor oil for over coming constipation. Weaned in the tenth month with rice and rice combinations.

Family History.—Father of the child was formerly asthmatic and now is migrainous. Patient is the fifth child in the family and the others are described belows:—

1st is a girl of 12 years—healthy.

2nd is a girl of 7 years—healthy.

3rd is a boy who died of "liver complaint" in the 3rd year.

4th is a boy of 4 years. Had eczema at 1½ years and now is healthy.

Clinical condition of the patient.—The child has a protuberant abdomen. Discharging nose; antritis present. Clean tongue. Teeth and bones appear normal. No jaundice or anæmia.

Abdomen.—Liver enlarged 2" below the right costal margin—in the mid-clavicular line. Uniformly enlarged and soft. Spleen not enlarged. No evidence of ascitic effusion.

Chest.—Right hilar dullness present (elicited by percussion).

Treatment.—Diet. Equal parts of milk and barley water with Glucose. Plenty of orange juice allowed. Rice stopped for the present.

Drugs.—Dried extract of adrenal cortex five grains per day, given from 24th September 1939 to 10th October 1939. Also Adexolin (vitamins A and D) 3 drops twice a day.

Progress:—

2nd October 1939.—Weight of the child is 17 lbs. The bowel action including the colour of the motion has become normal.

6th October 1939.—Liver is 1½ inch enlarged only below costal margin. Diet has been increased by a small quantity of twice-boiled rice with milk. Motions are healthy.



Baby Krishnan
23-9-39
Hepatomegaly after Vaccination



Baby Krishnan
30-9-39
(Note the marks of generalised eruption on the thigh)



Baby Krishnan
16-4-40



Baby Krishnan
X-ray of chest showing LUNG fields
11-12-39



Baby Krishnan
X-ray of chest showing LUNG fields
17-4-40

Early Hepatic Cirrhosis following Vaccination

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10th October 1939.—Liver is just palpable below the costal margin in the midclavicular line. Weight of the child is 16 lbs. On this date the child has been sent home (Erode).

17th October 1939.—The child is reported to be quite normal.

11th December 1939.—The child was examined by me because of respiratory signs. X-ray of the chest taken on 11th December 1939. Observations, Hila show infiltrative changes with mottlings. These are suggestive of an *exudative* type of lesion. The supraclavicular glands appear involved.

15th December 1939.—Weight of the child is 19 lbs.

Diet.—Twice-boiled rice with butter-milk twice a day. Ovaltine, milk and barley water. Orange and tomato juice. Fleshy vegetables allowed.

Drugs.—Six injections, each $\frac{1}{2}$ cc. of colloidal calcium with vitamin D, have been given at bi-weekly intervals. Also Elixir lactated pepsin (P. D. & Co.) has been given orally twice a day in 30 minim doses before feeds—for 3 months Nicotinic acid, 30 milligrams per day, is given orally in divided doses.

15th February 1940.—The child has, as per report of Dr. R. a monthly recurrence of 'cyclic diarrhoea'—fat intolerance? Another course of calcium was given. Nicotinic acid is also continued. Teaspoonful doses of Ostomalt thrice a day are given from 17th October 1939 to 17th April 1940.

16th April 1940.—The child is specially examined. Weight 24 lbs.; age now is 1 year and 11 months. Liver is $\frac{1}{4}$ " below the costal margin in the midclavicular line. The child

looks healthy and active. No cough is observed.

17th April 1940.—X-ray of the chest taken and observations are that the right lung field shows irregular opacities which are much smaller than in the previous picture. The left lung is quite clear. Thus the lungs have improved. The X-ray pictures are reproduced.

Observations and Comments.

The diagnosis of this case is obviously hepatomegaly after vaccination in a susceptible child with allergic diathesis. I have observed that some children have gone on to the stage of hepatic cirrhosis with ascites and jaundice after vaccination.

The case under report has been spotted out early and the prognosis has been obviously very favourable.

The child is being watched further for the manifestation of any allergic disturbance in later life.

The respiratory involvement and its treatment with a balanced diet and parenteral calcium are also described. Pressure by the enlarging liver on the lungs, avitaminoses, and toxic action do all seem to contribute to the respiratory damage that occurs in infantile hepatic cirrhosis, which in a large proportion of cases is also influenced by the allergic diathesis present in these little patients.

Oral use of adrenal cortex has been shown to be effective in overcoming the visceral damage produced by vaccination in the case under observation. The action of the cortical extract seems to be polyvalent, *i.e.*, (a) as an *anti-allergic*, (b) as an *anti-marasmic*, and (c) as a *hepato-tonic*, regulating the carbohydrate, protein and fat metabolisms.

"The Auto-Biography of Jhon Murphy"

BY LIONEL DAVIS

A book which would be read with pleasure and profit by every Medical Student. The following notes taken from his life would encourage every one to read it from cover to cover.

By 1878, then, both schools were firmly entrenched in the American medical battleground. However, even as late as 1876, two years before J. B. was to come to Rush, it was possible to graduate from one of the best medical schools in the country after attending two identical courses of lectures without having looked through a microscope, without having seen a case of labour, utterly devoid of practical training in physical diagnosis, without ever having taken a medical history, and without the slightest bedside instruction. In those facts some idea of the snail-like progress of medical education may be conveyed.

"First there is pain in the abdomen, sudden and severe, followed by nausea or vomiting, most commonly between three and four hours after the onset of pain. Then there comes a generalized abdominal sensitiveness most marked on the right side and more particularly over the appendix; next there is an elevation of temperature, beginning from two to twenty-four hours after the onset of pain."

What he had to say seemed the right and fitting thing to Nettie, but she had to stop the rehearsals because J. B.'s voice, rising as he became eloquent, wakened Cecile, the new baby.

In his paper for the Denver meeting of the American Medical Association

J. B. emphasized the basic thought which he believed to be the underlying principle in the cure of these diseases: "Allow the walls of the abscess to collapse, to empty thoroughly, and it will heal as other abscesses of the same pathologic character; this I believe is the keynote to the successful treatment of pulmonary cavities." His conclusion was, "Tuberculosis of the lung might be treated as we treat tuberculosis of the joints—by immobilizing and enforcing physiological rest."

"Organized Medicine: its Influence and its Obligations."

"It is the purpose of every man's life," he began, "to do something worthy of the recognition and appreciation of his fellow-men. The span of man's activity is so short that many who are most worthy cannot receive this honour; that you should have conferred it upon me affects me profoundly."

Walking straight into that area where angels fear to tread, J. B., in this, his first address as president of the largest body of medical men in the New World, said that one of organized medicine's obligations was to educate the public—in other words, he advocated publicity. Could this have been his conviction all along? Was there reason here for all his persecution?

It is not quite in keeping with the larger economics of to-day," he went on, "that the American Medical Association should annually gather a large number of medical luminaries and have them depart without leaving lasting impressions on the public mind. Advantage should be taken of these occasions (annual meetings) to produce spirited public awakening in medical and health truths. There should be an extensive and accurately planned course of instruction on health and disease by the master teachers of the profession through lectures, exhibitions, lantern demonstrations, and moving pictures. These should be free from technicalities and pedantry, and should bristle with information, but should be presented in a simple, comprehensive, and attractive manner. . . .

"The first and all-pervading idea of our medical heritage is the public—the people—and, concretely, the patient. The latter is the centre of the medical universe, round which all our works revolve and towards which all our efforts tend. For centuries the medical profession has criticized the public for its lack of judgment in its selection of doctors. The public has employed the quack; it has employed the irregular or sectarian; it has employed the psychopathic and Christian Science healer; it has employed the bone-setter and the chiropractor. These are employed not alone by the ignorant, the foreigner, or the poor, but by the so-called intelligent, reasoning, educated, and wealthy people of every community. They place a greater amount of confidence in all these healers and more enthusiastically support them than they do the regular members of the medical profession. Why? Are they more skilful? Are they more worthy

of confidence and support? Not at all! But they give the patient some kind of explanation or reason or working hypothesis for the results they attempt to obtain or claim to secure.

"In other words", he went on, "they educate the people in their theories, beliefs, or sophistries; and that is what the public wants—in fact, what it demands. What has the regular medical profession done to educate the public in the last three centuries? Nothing! We have demanded of the public our acceptance on blind faith, and the age of blind faith in individuals is passed. What have we taught them of the real truths or principles of scientific medicine? Nothing! What beacon have we set for the layman to assist him in the selection of a skilful practitioner? None! Still, we daily condemn him for his lack of judgment in these matters."

His audience sat up. Here was a man with ideas and the courage to express them. In this day, where there is so much talk of a Federal department of medicine, it is interesting to note that J. B. had the same idea; he asked for a different kind of legislation, however—a legislation not to supply remuneration for the doctor, but protection for the public from quacks.

"I am using this high office," he said—"the presidency of the most powerful medical organization in the world—to say to legislative bodies that the horrible cost of poor medical service in invalidism and mortality falls on the community, and that for this the community is greatly to blame, because its legislators have almost universally failed to enact sufficiently strict State laws controlling the practice of medicine; notwithstanding the repeated and urgent

requests made by the profession for their enactment they have not demanded, through their respective State boards, a high standard of education for licence to practise; they have not prohibited quackery in all its forms by an adequate penal code; they have not supported the medical profession in its altruistic efforts to render to the people a better service.

"The remedies I can only touch on lightly. They lie in a better equalization of the supply of an demand for medical men; better preparation for the art of practising medicine to be brought about by better medical colleges, supported by private endowment, or by the State if necessary, and the legal suppression of incompetent ones."

In his comprehensive speech J. B. touched on medical research too, defending doctors in their experiments on animals. Unbelievable as it is, it is true that medical men to-day are still in the same position of having to fight alone for the right to defend humanity against disease. There are no laws to help them—in fact, quite the contrary: there are laws to hinder them. There are still those who believe that doctors should not use domestic animals—or, for that matter, any dumb animals—for experimentation. Their argument is: "They (the animals) haven't done anything. Cut yourself open if you want to experiment."

On this subject Murphy said: "The right to conduct animal research is fought for by medical men almost single-handed. The contest for a national department of health for the prevention of disease has been made in the main by medical men. The struggle for health legislation is made mostly by medical men. Can anyone doubt the sincerity of the medical

profession in these struggles when their accomplishment means a great reduction in its revenue?"

"The opponents are ill-balanced sentimentalists—people with limited capacity for estimating educational or health factors; people without capacity for perspective—such as the anti-vivisectionists and anti-vaccinationists—and people with less intellect or integrity than any of these.

"The gross and unpardonable indifference of the people to their own physical welfare and that of their children and neighbours is more discouraging and a greater barrier to progress than active opposition. It requires some great calamity to rouse the dormant public mind to an appreciation of its interests and its responsibilities and to the penalty it pays for inactivity."

The President recommended the establishment of a health journal for distribution to the laity. He believed that such a publication would make people understand that the obligation is theirs more than the medical professions. And yet in spite of this very potent suggestion twelve years of sluggish time had to drag on before *Hygeia* was published to fill this aching need.

His old bogey—the question of medical men splitting fees, which had plagued him throughout his term as President of the Chicago Medical Society—came in for an airing in his speech. He took the profession to task in no uncertain terms for such a wretched practice.

"The medical profession," he said, "should be the unquestioned forerunner of humanitarian undertakings. Our sacred calling should be exemplified in our acts so that each individual citizen may have every possible

opportunity for the conservation of his health and the preservation of his life regardless of his ability to compensate the physician. There is a common, insidious, and deadly parasite eating at the root of public medical confidence, and that is the practice of medical fee divisions, commission-paying, and the sale and purchase of patients. We should see to it that no man of our profession barter to the highest bidder in commission and fee divisions. He who offers or gives is morally as guilty as he who requests or receives, and no sophistries should be accepted in justification of this atrocious practice. The money-changers of the profession must be driven out of the temple of Aesculapian as they were from temple of religion."

His final words to the Association carried in them his own philosophy of medical progress:

"The physician or surgeon is not in competition with his fellow practitioner at all, but is in competition with the average standard of the medical qualification of his time. This standard is the line dividing mediocrity and incompetency of varying degrees from knowledge and efficiency. He who keeps above the standard desires companionship. Therefore, if we elevate the ethical and educational average we increase the brotherhood of the profession and enhance the percentage of efficiency to the public. The effect of capital and labour organization has been to lessen individual exertion and reduce men to a common or mediocre level, where their decadence is inevitable. The ideal of medicine, on the contrary, must be the stimulation of individual exertion to the highest degree and the establishment of a standard, the attainment of which should be the one great desire of every member of our profession, each to assist the other in his upward progress.

"Advancement is retarded by the failure of the individual to utilize and avail himself of opportunity. We are all spendthrifts of time; we all overlook great opportunities. Many are ruminants on their imaginary disadvantages in the contest; these never become producers. The demand of the times is that we level every opposition and make smooth the way for general progress, enlightenment, education, and the higher ethical obligations. The individual is responsible for his own position and, to a limited but positive degree, for that of his fellow-practitioner. When given a diploma from a medical school or a licence to practise, we are all supposed to be equal. But no insignia makes men equal in medicine more than in any other line of endeavour. By their own superior intellectual qualifications, their fidelity to purpose, and above all by their indefatigable labour the few become leaders."

It was a strong address which the public, as well as the profession, could understand. He had not confined himself to a scientific subject, but had set a precedent for future presidential addresses in attempting to bring the public and the profession into close relation—a noble, if overwhelming aim.

Dr. Keefe wrote:

"I want a post-mortem made after my death. You will find plaques of calcification in my aorta and destruction of its lining membrane. Those changes have been produced by an infection of long standing somewhere in my body. There are two other points I want checked carefully: my appendix, because I had appendicitis when I was a boy, and when I was in Germany studying I had a kidney infection, so look carefully at my kidneys."

A Population Policy for India.

RADIO TALK BY MR. P. K. WATTAL, M.A., F.C.S.,

Accountant-General, Lahore, Punjab.

I regard it as a happy sign of the times that the All-India Radio is arranging a series of talks, of which this is the fourth, on the problem of population. It is now realised that any scheme of national planning must include the planning of population. Any attempt to draw up a programme of national planning without considering the size and the annual growth of the population would, to my mind, be as futile as it would be for a housewife to cater for a dinner party without knowing how many guests were coming. It is, therefore, very gratifying to know that a Sub-Committee of the National Planning Committee is engaged on the study of the question of a population policy for the country. I propose in this talk to offer a few suggestions which seem to me pertinent to the formulation of a sound policy in relation to our population.

The problem which we have to face is quite different from that of Western countries. European nations are afraid of a steady decline in numbers. Accordingly, their population policies are designed to give every inducement to their people to marry and beget children. They have tried various measures, such as government loans and subsidies, exemption from taxation, family allowances, preference in public services, etc. The latest device which seems to find favour in France, and which will perhaps make a special appeal to communally-minded people in India, is to give an extra vote to every French father for each one of

his children. This prize for family men makes the proud father with ten children the ballot box equal of eleven bachelors. It makes triplets a political force.

The population of India, on the other hand, has been steadily increasing and the rate of increase in recent years has been as high as one per cent per annum. It is confidently expected that we shall have, including Burma, a population of 400 millions in 1941. That will be the largest population of any country in the world, even China not excepted. If the present rate of increase were maintained, by 2001 A.D. we shall be 700 millions. It is not my desire to frighten you with astronomical figures, but one has necessarily to take a long view in dealing with questions relating to population. For the population of to-day is the outcome of policies and practices pursued during the last 30 years or so, and even if we were to-day to set in motion a new population policy, its effects would not be really felt for very many years to come. We have, therefore, to plan now and plan wisely for the future.

An increase in population, however large, need not cause any alarm, provided there is a simultaneous improvement in the physical and economic condition of the people as a whole. When we look at the physical and economic condition of our population, what do we find? India has almost

the largest death rate of any civilised country in the world and the mortality among infants and young mothers is frightful. In addition to the wastage caused by death, there is the wastage caused by sickness, which is also terrible. Those of us who live, live for the greater part of our lives at a sub-human level. How many of you, who are listening to me can say, as many Englishmen and Englishwomen can say, that they have never suffered from fever at any time? Our average expectation of life at birth is only 27 years, whereas it is 58 years in England, or, in other words, our vitality at birth is generally half that of an Englishman. It is well known that insurance companies charge a higher premium on an Indian life than on a European life. In England a large portion of the population is well nourished; in this country more than half is badly nourished.

Such are the facts relating to our physical condition. What about our economic condition? Our standard of living is the laughing stock of European countries. The average income per head in this country has been variously estimated by officials and non-officials, but all are agreed that it is deplorably low, as compared with other countries, not excluding Japan. Agriculture supports more than two-thirds of the population, but at a miserably low level of living. The pressure on the land is steadily increasing with the growth of the population. There has been no corresponding increase in the cultivated area, as in the majority of provinces there is no room for any substantial extension of fresh cultivation. The result is that the acreage under food crops per head of the total population has been steadily diminishing from census. It stands to-day at about three-fourths of an acre, which is

insufficient to support human life according to any decent standard. Agriculture has ceased to pay over a considerable part of the country; one of the main reasons for this is that the land has far too many people to support. The imperative need of the country is to arrest the tendency to ruralisation which is now in full swing and to redress the balance of our economy by inducing a large and speedy transfer of population from agriculture to industry.

What is, however, the position with regard to industry itself? It is to-day supporting about 9 per cent of the total population, which is much too small. Though the proportion of population supported by industry has been steadily diminishing from census to census, and past experience of industrialisation holds out no hope that it will afford an outlet for our entire surplus population, still the only hope of the country is in the development of industries as rapidly as possible.

It will be obvious from what I have said above that the aim of our population policy should be two-fold:—(i) to slacken the general rate of increase; and (ii) to raise the vitality and general standard of living of the people. I do not think the country can afford for any length of time the high rate of increase we are having at present. How is this desired result to be brought about? The rate of increase of a population is determined by the excess of the birth rate over the death rate. A slower rate of increase can be obtained either by reducing the birth rate or raising the death rate or both. Our death rate is already very high and no body would be so inhuman as to suggest that the death rate should be raised. So, obviously, one step should be a reduction of the birth

rate. Our present birth rate is 35 per thousand. I think we should aim at its reduction to 20 per thousand. What about the death rate? I have no doubt that it must be reduced. With fewer children the vitality of the mother and the economic resources of the bread-winner will be subjected to a less severe strain, and, as has happened in other countries, a fall in the birth rate will be followed by a no less corresponding fall in the death rate. But this will not be enough. Simultaneously, with the effort to bring about a reduction in the birth rate, there should be a vigorous public health and fitness campaign on a much bigger scale than we have had. Some success has already attended the efforts of the Public Health Department in reducing the death rate. Our death rate used to be as high as 30 per thousand in 1914 and is now in the neighbourhood of 23 per thousand. But even this is too high. I suggest that the Public Health Department should try to bring it down to at least 16 per thousand.

With a birth rate of 20 and a death rate of 16 per thousand, we will have a rate of increase of 4 per thousand, instead of 12 per thousand at present. Or, in other words, our rate of increase will be reduced to one-third of its present figure. We will, however, still have an increasing and not a decreasing population, of which some people have a genuine dread.

The second aspect of our population policy, namely, the improvement of our vitality and general standard of living is one on which every body will be agreed. The National Planning Committee is aiming at doubling the standard of living within 10 years. It is a stupendous task requiring the wholehearted co-operation of every one in the country,

official or non-official. Its dimensions will be realised when it is known that it is proposed to bring about a transfer of no less than 50 million people from agriculture to industry. Only by some such means can we hope to have a well-balanced economy, with something like 55 per cent supported by agriculture and at least 25 per cent supported by industry.

As our low vitality is due to poverty and ignorance, it will to a certain extent be improved with a rise in the general standard of living which industrialisation will bring about, but ignorance will still remain. We have first to examine all the causes which are at present responsible for our low vitality and attack them one by one. For this purpose nutrition surveys should be undertaken in each province, in colleges and schools to begin with at any rate. The defects in nutrition thus brought to light should be capable of correction by well-conducted propaganda where they are within the means of the parents of the children to correct. Where the parents cannot afford the diet or the treatment necessary, the government or the local authorities will have to foot the bill, as in European countries.

No policy can, however, be continuously pursued, unless the subject of population is made the concern of a regularly constituted department of government. At present, the Public Health Department does this duty, but the question has many aspects which do not fall within the purview of public health authorities. The first step, therefore is that in each provincial secretariat there should be a department charged with the duty of studying the position with regard to the question of population and bringing

to the notice of government such measures as appear to be necessary to keep the development of resources in harmony with the growth of the population and specially to see that the standard of living of the population not only does not fall, but also to bring about a gradual rise therein. It is the task of statesmanship to see that any maladjustment that may occur in the relation of population on the one hand and development of resources on the other is put right at an early date. And that can be done only when, first there is a sound policy in the matter and, secondly, an efficient agency to put that policy into effect.

The Madras Medical College Magazine.

H. E. THE GOVERNOR'S APPEAL.



THE past students of the College are doing their best in the war. Portions of H. E. the Governor's appeal in the Sheriff's meeting of the 6th instant in Madras are herewith published.

Help to Counteract German Propaganda

His Excellency said that there were people of goodwill in thousands who could not join the armed force, but who were longing to help in every way to see that the war was brought to a successful conclusion. There were several ways in which they could help and one was to counteract the insidious German propaganda. "We can all, every man, woman and child, band ourselves together to counteract that propaganda and give the lie direct to the news that come over the German wireless. We can tell everybody, whatever may be his views on politics, that this is a war which has got to be brought to a successful conclusion and that successful conclusion means

a clear-cut, overwhelming victory for Great Britain, India and the Empire, to see that Nazism never raises its head again".

This war would probably be a long one, continued His Excellency. In order to defeat Germany, we had got to have adequate munition tanks, aeroplanes and other weapons and to provide these money was necessary. And everyone of us, great or small, poor or rich, can do something to contribute to that war effort.

"Contribute to the War Fund"

His Excellency said that he had started a War Fund and it had, even in the first few days, a magnificent response. People of all classes were contributing big and small amounts and he might say that no contribution was too small to make. "Those who had any conscientious objection to contribute for actual weapons of war could ear-mark their contributions for Ambulance and Red Cross work".

—The Hindu, 7th July 1940.

Personal.

We congratulate the following who were successful in the M.S. Degree Examination of the Madras University which was held in April 1940.

Dr. C. Ragavachari, F.R.C.S. (Edin.)

Dr. C. K. Padmanaba Menon.

Dr. D. R. Vaidya.

Dr. Ananthachari, M.D., was the only successful candidate in obtaining the M.D. Degree Examination of the Madras University which was held in April 1940.

We congratulate Dr. T. Bhaskara Menon who was conferred the F.R.C.P. (Lond.) recently.

Dr. Lazarus, W.M.S., is posted as the Principal of the Lady Hardinge Medical College, Delhi.

Captain S. Shone, M.D., left us for Military duty.

Captain S. Thambiah is Physician, General Hospital and Additional Professor of Medicine.

Dr. D. Narayana Rao is the Additional Professor of Bio-Chemistry.

Annual Report of the Madras Medical College Association 1939—1940.

After a restful summer the College reopened with life full of freshness. The new academic year commenced and it was clear that the activities of the Association when viewed in its entirety, had been taking a slightly divergent course from those of previous years. The responsibilities had been increased by the introduction of new schemes within the sphere of its activities. The Association had already given birth to the Madras Medical College Co-operative Club which required careful nursing in its infancy. An year of experiment had just been over. It was time it made its progress on more definite basis aided by the experiences that were gained in the previous year. The tendency for improvement and to make the Association a strong and useful instrument that could be turned to the tastes of the students had been more and more realised. The strength of the College had increased and together with it the size of the Association. The Magazine Committee with its enthusiastic editors realised that many improvements could be effected. The students of the Stanley Medical College linked to this institution through the Central Institute of Anatomy and Physiology were given the option of Membership in the Association. On the Graduates' Reception Day all of them were invited to attend. Dr. A. L. Mudaliar had assumed charge as Principal of the College and in the light of the interest that he had been taking even before the assumption of office it was clear that the Association had in its new Pre-

sident an ardent well-wisher and a strong personality to guide it in difficulties. The New Vice-Presidents Dr. Ramachandra Rao and Dr. Mannadi Nayar brought in a new life with their lively interest and personal contact. The Vice-Principal Dr. S. Ramakrishnan who is the Vice-President of the Co-operative Club having taken great interest was watching with enthusiasm the progress of the Association and Dr. K. N. Krishnan, the Treasurer kept up a careful steering all the time.

Election of Representatives.

The Association unanimously elected Mr. K. V. Pillai to be the General Secretary for the year 1939—40 at its valedictory meeting held at the conclusion of the previous academic year.

The following members of the Executive and Magazine Committee were elected during the inaugural general body meeting held in July 1939 with the Principal on the chair.

Staff.

Dr. A. L. Mudaliar, Principal, *Ex-officio President*.

Dr. A. S. Mannadi Nayar, Professor of Bio-Chemistry, *Vice-President*.

Dr. P. Ramachandra Rao, Professor of Pathology, *Vice-President*.

Dr. R. V. Rajam, Venereal Department, *President, Magazine Committee*.

Dr. N. S. Narasimhan, Orthopedic Department, *General Editor (re-elected)*.

Dr. K. N. Krishnan, Physiology Department, *Honorary Treasurer (re-elected)*.

(Dr. Govinda Reddy, Pathology Department was elected Associate Editor on a subsequent occasion).

Students.

Mr. S. Ranganathan, III year, *Assistant Secretary*.

Mr. P. Umamaheswara Rao, V Year, *Student Editor*.

Mr. A. P. Babu, IV Year, *Student Editor*.

Miss Mugaseth, III Year, *Lady Representative*.

Mr. D. S. B. Stephens, V Year, *Military Pupil*.

Mr. Mugaddam, Pre-Registration, *Class Representative*.

Mr. T. J. Cherian, I Year, *Class Representative*.

Mr. P. S. Babu Naidu, 2nd Year, *Class Representative*.

Mr. A. Augustus, 3rd Year, *Class Representative*.

Mr. M. Ragupathy, 4th Year, *Class Representative*.

Miss Lily Salem, 5th Year, *Class Representative*.

Mr. Aravamutham, B.S.Sc. and Pharmacology Student, *Class Representative*.

An account of the activities of the Association during last academic year can be given under five main heads.

1. Those confined to the requirements of the current year.

2. Those concerned with the requirements of a more permanent character.

3. Activities of its constituent bodies such as the Magazine Committee and the Co-operative Club.

4. Social activities such as excursions, annual dinner, etc.

5. Educational activities like weekly meetings, debates, institution of prizes by the Magazine Committee, introduction of more journals in the Reading Room, etc.

1. Those confined to the requirements of the current year :

(a) The Graduates' Reception, the one main annual function of the College was held in August 1939. The Principal presided. Dewan Bahadur S. E. Runganathan, Vice-Chancellor of the Madras University spoke a few words of advice to the New Graduates. Dr. P. Ramachandar represented the New Graduates. Many words of appreciation have been recorded in the previous issues of the Magazine about last years, Graduates' Reception. On behalf of the Association I take this opportunity to convey to all those who took part in its celebrations the warm congratulatory statements that have been pronounced by one and all who attended the function. It was undoubtedly an occasion where hearty co-operation, originality and histrionic talents found their full expression.

(b) *Farewell meetings*.—A farewell meeting was held in March 1939 to present an address to Dr. T. Satakopan, M.D., formerly vice-president of the Association and Honorary Physician, General Hospital, Madras. The Principal presided. After tea party Mr. Padmanabha Iyer of the final year entertained the audience with a few Indian songs. Mr. K. N. Alva, and Mr. S. G. Rajagopal spoke a few words of admiration about the retiring chief.

Another was held in February 1940 on the occasion of the costume dinner

on the eve of Sports Day celebrations to bid farewell to Dr. A. Vasudevan. A silver Tray was presented to him after a short account of his services by the Secretary.

A third farewell meeting was held in March 1940 to present an address to Lt.-Col. M. M. Cruickshank, I.M.S., Superintendent of the General Hospital and Professor of Surgery, Madras Medical College, who was leaving Madras to take charge of the new post of Civil Surgeon, Delhi. Dr. A. S. Mannadi Nayar, Vice-President of the Association presided. Mr. R. Ananthanarayan represented the students. Lt.-Col. G. McRobert said a few words in appreciation of the services of Lt.-Col. M. M. Cruickshank.

Condolence Meeting.—The Association passed a condolence resolution in March 1940 regarding its sympathies for the demise of Rao Sahib Dr. G. Rama Rao, retired Professor of Anatomy and the first Indian to hold that office in the history of Medical College, Madras. The resolution was sent to the bereaved family.

2. Activities Pertaining to Permanent Requirements:

A few improvements have been brought about through the efforts of the Executive Committee of the Association. The reading room has been improved with more dailies. The ladies' waiting room that was denied in previous years the privilege of seeing through the dailies due to various inconveniences were enabled to do so by a system of distribution of journals by rotation. The long felt necessity of a clock in the students' waiting room has been accomplished by the kind and ready co-operation of the president to whose enthusiasm the new cycle shed owes its existence.

The Principal has patiently listened to the many suggestions given by the Executive Committee many of which are sure to attain fructification in the near future. Extension of cycle shed, extensions and improvement of the dining room, extension of the canteen to the adjoining room, introduction of a catalogue in the library, investigation and betterment of the existing conditions regarding admission of medical students as inpatients into the General Hospital, Madras, etc., are a few suggestions that have been made by the Executive Committee. The Principal has often explained the difficulties that confronts him at every step he takes in the execution of those suggestions.

3. Activities of its Constituent Bodies:

The Magazine Committee.—The Magazine Committee met under the presidency of Dr. R. V. Rajam. Resulting from its deliberations, a few useful prizes have been instituted to encourage the students to give case reports and also general articles and cartoon. The possibility of the institution of a debating society has been contemplated upon and the Principal has promised to go further into the matter. With further efforts the college might be proud of a debating society as in other colleges and can thus enjoy a change that will break the monotony of Professional study. A Dramatic Society and a Microphone of its own are objects of distant vision.

It has been felt by the Magazine Committee that Senior students could take more interest and provide more articles and case reports.

The Co-operative Club though lock-stitched to the Association is slowly

developing into a separate body, but its interests are those of the Association on which depends its strength, both being reflections of the students' enterprises in this College.

(4) Social Activities.

(a) **Excursions.**—With the busy and tedious curriculum of the Medical study, it has been a matter of experience that attempts at organising long or short distance excursions by representatives have not been properly encouraged by the members. When once it is realised that these picnic parties are to be conducted during one's academic career and never more in his busy after life beset with innumerable uncertainties these excursions are sure to find a more important bearing upon college life.

During last year one excursion was arranged to Ennore and more than sixty students including ladies and gentlemen participated. Another was arranged to Mahabalipuram by Mr. Mugaddam of the first year.

(b) **Class Socials.**—The representatives of various classes and groups of students belonging to various clinical units of General Hospital arranged evening parties in the premises of the College, each one consisting of group photo, tea, entertainment, and few interesting speeches, both the staff and students mixing together freely. These are the few occasions when the teacher and the taught get an opportunity to hear their hearts blend in unison.

(c) **Annual Dinner.**—The annual subscription dinner that was organised on the Sports day stand unique as being the first of its kind in the history of the college. More than four hundred students and almost all the staff attended the function. The costumes

for the disguise competition were of a high order, most of them forcing the onlooker's sides out with laughter.

The dinner was arranged in the open air and was beautifully illuminated. The success of the function was mainly due to the combined effort of the Sports and Association Committee which were temporarily amalgamated for the purpose, appointing a sub-committee to be in direct charge of the proceedings.

On behalf of the Association, I thank the Principal and Vice-Principal for their ready assistance and advice.

(5) Educational Activities.

1. **Meetings.**—Meetings were arranged under the auspices of the Association on Friday's between 5 and 6 p.m. All were well attended. The following is the list of lectures that were delivered.

Dr. Varadarajan, M.D., M.R.C.P., Cardiologist, General Hospital, Madras, on *Prophylaxis in Heart disease*.

Dr. Dinker Rao, M.D. Physician, General Hospital, Madras, on *Pathology of Diabetes Mellitus and treatment of diabetic coma*. (2 lectures).

Dr. C. P. Viswanatha Menon, M.S., F.R.C.S., Honorary Surgeon, General Hospital, Madras, on *Surgery of rectum and anal canal*.

Dr. R. V. Rajam, M.B.M.S., M.R.C.P., Venereal specialist, on *Recent advances in the treatment of venereal diseases*.

I record the deep debt of gratitude that the Association owes to the above speakers who on all occasions consented readily to the Secretary's request.

2. *Debates.*—The following students represented the association in the debates that were held in the Presidency College, Muhammadan College and in the Anderson Hall.

Presidency College:

R. Ananthanarayan, B.A. V Year.
C. Balakrishnan, B.A. IV Year.

Muhammadan College:

R. Ananthanarayan, B.A. V Year.
Lonappan. I Year.

Anderson Hall:

C. K. Ramachandran III Year.
Miss Muthu Lakshmi II Year.

(3) *College Magazine.*—The Magazine Committee, according to the suggestions made by Mr. Uma-maheswara Rao, one of the student editors, has instituted prizes for best articles and case reports. It is hoped that members will show keen enthusiasm in contesting for these prizes. The Committee is taking all possible steps to remove the general feeling that the journal is unduly scientific. Interesting accounts, short stories, poems, etc., from students are always welcome.

To conclude; last year the activities of the association are mere reflections staff and students members of the executive and magazine committee. It deserves to be mentioned that a few who were not strictly within the body of the committee lent a

strong support merging themselves with the representatives without any distinction. Their assistance has always been invaluable. The Principal, the Vice-Principal, and the two Vice-Presidents have been in close contact with every detail of the working of the Association and their timely instructions on many an occasion have proved immensely helpful in the execution of the various projects of the Association. In Mr. Ranganathan, the Assistant Secretary with whom my contact was more immediate, I found a capable representative accomplishing his duties with credit.

The efforts of the editors in bringing out the Magazine has not been easy. Support from students with articles and case reports has not been forthcoming in insufficient numbers. Credit is due to the General Editor who has always been encouraging the students. It is the duty of the latter to give a good colour to the Journal in general. We hope for better response in coming years.

The Valedictory Meeting:—This was held in March 1940. In the contest that took place between Mr. P. C. Reddy and Mr. P. S. Menon, the former won the election and was declared duly elected as the General Secretary of the College Association and student director of Co-operative Club.

K. V. PILLAI,
General Secretary, (1939-40).

Prem*

(BY "AQUARIUS")

It was the summer of 19...and Prem, the lovely third year B.Sc. student was home for the vacation. The month was May. For some days she had been eagerly expecting a letter from her chum Mohan but in vain. She had a strange foreboding of some evil coming to her, which made her feel uneasy. Prem's brother and sister noted in her a definite change which worried them very much. When they asked her what the trouble was, Prem gave them some excuse or other, and still everyone could see that there was something wrong with her. Prem herself was not able to diagonalise her feelings and the poor girl underwent sleepless nights and the tortures of a hell. One Saturday morning Prem, as usual, was reading 'The Hindu', and on one of the pages she saw the photograph of a newly married couple published. At first she thought that her eyes were playing false to her. But there it was the photograph of Mohan and his bride. She could not control her feelings as at once she could not give way to them before her sister and brother who were quite ignorant of the tragedy in Prem's life. She wanted to be alone and so with the excuse of a severe head-ache, Prem left the drawing-room for her room upstairs.

Once in her room, Prem threw herself on the bed and burst into silent tears. Believing his words to be true she had given up to Mohan the most precious gem of maidenhood. Mohan to gain his end in view had given her

all sorts of vain promises of marriage. He had a pleasant time of his days of friendship with her. She had trusted him and in the end he threw her away as he would have done a faded flower after enjoying the perfume of it. She was ruined for ever.

Marie Antoinette was guillotined on the very alter of her greatest desire in life. In all grades of society history repeated in the past, repeats itself in the present, and will do so to eternity till we are able to realise our own absurdities. The cause for great tragedies in the lives of most of us is that we think too much of ourselves, and in that very act lose sight of realities. We are marking time to the dance of Mammon, and to most of us "The garage has become our spiritual home". Poor Prem had lost sight of these facts. An idealist and a believer in the "comradeship of body and soul within the bonds of marriage," Prem had shut her eyes to the rank materialism of Mohan. "Clothes, comfort, and luxury" were "the Trinity" in which Mohan believed. She believed him to be her sincere friend, or rather had come to regard him as a spiritual companion in life. He threw her away the moment he was not in need of her. My God! how many of us do really know the telling truth of this and yet we march along the road thinking that the sky is blue and the landscape is green because we have friends, companions, and slumber in a fool's paradise. Vanity of vanities! 'Friendship, society, and love' as revealed by

* Neither incidents in real life nor living personalities are referred to.

Mohan are not 'divinely bestowed upon Man', but are mere words and a mockery to civilisation.

The College reopened after the vacation and Prem returned from home. Mohan too came back to the College. She eagerly expected him to come and see her at least for the old-time sake. But he did not. Some of their friends who had noted the warm feelings between Prem and Mohan were rather surprised to see at the turn of affairs. Everyone of Prem's friends, save one or two who knew the real Prem, began to look her at askance and to shun even. One or two even told her "See didn't I tell you that he would turn you down the moment you are not need of him. Forget lassie forget". But then how could Prem forget Mohan who had absorbed her whole being. Some thought that she was a fool and others that she was a stupid girl. As someone has rightly remarked "we talk lightly of knowing someone, when in reality we know nothing of the quality of that person's life. As a rule we know only his or her circumstances. . . . It is what a traveller becomes on his pilgrimage which is important, not where he has lodged on the way".

Days rolled on into months and four months passed after the college reopened. One Sunday, Prem all of a sudden complained of a severe pain in the abdomen. Nothing could stop it. Finding no relief she was rushed to the General Hospital. The doctors could not trace the cause for it, and they all finally decided that the abdomen should be opened to find out the real cause for the trouble. The necessary declaration was obtained from the patient and an abdominal operation was performed on Prem. Most unfortunately the medical

science met with a failure. Prem was shifted to one of the beds in the Wenlock Ward. The hostel authorities sent a telegram to her parents telling them of the operation and asking them to start for Madras by the earliest train.

Some of Prem's friends were by the bed-side and none save one or two knew the real cause for her suffering. Her condition was becoming worse, and her friend Vimla, who was also by the bed-side, was one who knew the real cause for Prem's suffering. She could not control her tears when she saw the agonies of the soul that suffered. Every now and then Prem asked of her parents, friends, and of Mohan too. Vimla begged her not to think of him who had actually ruined Prem's life. Then Vimla heard Prem say in feeble tones "V...i...m...u..... perhaps...you....wonder....at....me..... oh'.....I...feel.....a...terrible pain..... Vi.....mu.....Iwant.....to see him.....though...he.....has...killed... me.....I...cannot hate.....him... Vimu.....please do.....send for...him ...Vimu.....please.....Vimu....." Vimla was very much afflicted to see the sufferings of real love. She sent a note to Mohan that Prem was seriously laid up in the Wenlock Ward and that she wanted to see him very much. The messenger came back with the word that Mohan was not at home and that he had gone to the cinema with his wife. Prem as always asking for him, and she was told he was coming.

By our actions we may make others believe that we do not like, or that we even hate a person for whom we had a warm feeling for some time; we may even succeed in trying to make ourselves believe that that person is nothing to us; but in rare moments our hearts will know the

Prem

truth; for is there not a touch of divinity even in the most villainous of mankind? For all his materialistic outlook in life, love of pleasure and luxury, Mohan too had a heart and he was not a villain. When he came to know that Prem was seriously laid up in the hospital he could not stop at home, though he returned late from the cinema.

The night was advancing hour after hour and Prem was nearing the journey's - end. Dim darkness prevailed over the wards. The nurses talked in hushed tones. Vimla was looking at the frail figure on the bed with tear-stained eyes. Prem was lying with closed eyes in a semi-conscious state. Her lips were moving and in feeble tones the name of

Mohan was heard. The mid-night passed and the life was ebbing fast, Vimla, the house-surgeon, the nurses, all were there silent with sorrow at the approaching end of the lovely Prem. Prem opened her eyes and saw Vimla and believing her to be Mohan said "Mohan.....have...y...o...u..... come.....I...long...to.....see y...o...uI....." and Mohan who had come running to the hospital just then entered and stood beside the bed. Grief choked him and he could not control his tears. He saw her and said "Prem....." and could utter no more. Prem saw him, gave a feeble smile, and struggled to say something but the silent city heard the Central clock chime the hour of two. Heaven met hell.

Founder's Day, Medical College, Calcutta

ADDRESS OF ACHARYA P. C. RAY.

LADIES AND GENTLEMEN,

When your Principal very kindly requested me to preside over this function I was somewhat taken aback. I asked myself: what right have I, rather a layman, to inaugurate this ceremony when there are so many mighty Aesculapians all round me who have far better right than myself. But your Principal was generous enough to give me a choice over the subject of my discourse and I accepted the invitation with pleasure. Let me begin with Chemistry.

Chemistry as you all know first originated as a handmaid of medicine and its various processes were evolved out of the attempts at the preparation of the Philosopher's stone and Elixir of Life. Even in India the Science of Chemistry also had its inception in the preparation of various tonics which would ensure and perpetuate long life and prolonged vitality (रसायनञ्च तद् द्वेयं यज्जरा व्याधि विवृत्ति मेवञ्च) as Sarngdhar has it. That is to say the science which has for its object the preparation of medicines calculated to preserve life from senile decay is known as *Rasayana Sastram* or *Rasayani Vidya*. In Europe Paracelsus the Great is credited with the introduction of mercurial preparations in medicine, which was regarded as a very bold step. Before the time of this precursor in Chemistry, galenic preparations consisted generally of vegetable decoctions of various kinds and of herbs and simples. The Faculty of Medicine of Paris specially regarded with horror the introduction of

metallic and particularly mercurial preparations and banned them. In India, however, we find Chakrapani Datta recommending the use of black sulphide of mercury (कज्जली) for various diseases, which in the crystallised form is known as *Rasasindur* or *Makar-adhwaj*. He flourished in the middle of the 11th century. He, again, admits that he owed his preparation to Vrinda who must have preceded him by at least a couple of centuries. In Europe, however, the black sulphide of mercury was first prepared by *Turquet de Mayerne* in the 15th century. In fact, the Tantric period, as I have designated it in my History of Hindu Chemistry first published 38 years ago, deals with various preparations of metal. Here it is only necessary to dwell upon Charaka and Susruta, the great repertoires of our Ayurvedic system, **which considering the age in which they were composed, must be regarded as marvels of medical lore.** In Susruta we have a graphic description of the method of preparation of caustic alkali तीक्ष्ण क्षारः as distinguished from मृदु क्षारः or mild alkali. The former was used for cauterisation. The method is so detailed and scientific that it can be bodily transferred to any treatise on modern Chemistry. Royle, in his *Antiquity of Hindu Medicine*, and Wise, in his *Commentary on Hindu Medicine*, and latterly Udoychand Dutta, in his *Materia Medica* of the Hindus, have drawn pointed attention to the claims of India as a precursor in this field and Kanailal Dey also wrote a treatise on the indigenous drugs of India.

But I am afraid I am looking behind me and this has been, to a great extent, the bane which has checked the progress of the country. We must now look forward and judge where we stand in the present world which is based on scientific civilisation. Although I have referred to the Ayurveda, I should say that the policy of passing off the indigenous systems of medicine as scientific systems of medicine after putting a veneer of modern sciences like Physiology and Anatomy on them does not seem to me to be the correct course. The policy should rather be to accept the Western scientific system of medicine as the nucleus round which the tested knowledge derived from indigenous systems of medicine may be gathered. All our knowledge should be accumulated on scientific lines.

You will permit me as a man of science, to whom research has been the love of his life, to refer to the great need of such scientific medical research in this country. Both Indian and foreign systems of medicine have arisen empirically out of the needs of man, but during the last few centuries in the Western countries medicine has been steadily bursting the bounds of empiricism and developing into a science. The methodology of science and the conscious and systematic application of the discoveries in the exact sciences of Chemistry and Physics have led to phenomenal advances in medicine in both curative and preventive aspects. I need hardly remind you that Louis Pasteur, who laid the foundations of Bacteriology and Immunology, was himself a chemist, who brought a supremely scientific mind and scientific methods to bear on the problems with which he was confronted. Leeuwenhoek's discovery of the microscope, again, made much of Pasteur's work possible. Roentgen's discovery of the rays

which go by his name, the discovery of radium by Madame Curie, the discovery of artificial radioactivity by her daughter in collaboration with her husband within recent years—all those have led and are leading to great advances in the methods of diagnosis and therapy. The preparation of artificially radioactive elements by means of the cyclotron by Prof. Lawrence in California has led very recently to their use in studying complicated processes of metabolism. For instance, sodium phosphate with radioactive phosphorus as a component has been fed in order to explore the course of phosphorus metabolism in the body, both in normal condition and also in the pathological condition of rickets. Similarly, the isotopes of nitrogen and hydrogen have been used as components of amino acids in studying the course of protein metabolism by Schœnheimer, Dr. Vigneaud and others in America. The elements concerned carry a label, so to speak, which enables their detection in course of their journeyings through the body, much as fluorescein has been used in following the courses of rivers. I would invite your attention to the romance of such studies, which have so great implications in biology and medicine. I am not a scientific Jeremiah but I have the feeling that some of the greatest advances in future will be in the direction of the application of discoveries in subatomic phenomena to biological processes. The baffling problem of life and cell-division still stands as a beleaguered fortress which may yield in future only to combined offensives on the physical and chemical fronts by the new strategy which is now being fashioned.

May I also refer to the great advances in medicine which have followed from researches in Bio-chemistry in

order to illustrate the benefits that have accrued to medicine from what may be called basic research? The synthesis of vitamin C in the laboratory has led to its extensive use in diseases, besides scurvy, and the recognition of nicotinic acid as an anti-pellagra vitamin has led to its industrial production in the United States of America for fighting pellagra. Concentrated preparations of the vitamins made by modern scientific methods are being used by the Soviet Government for the routine feeding of their people in the northern regions, where fresh fruits and vegetables are scarce. Recently, press reports indicate that Richard Kuhn's synthesis of vitamin A has led to its industrial production in Germany, where vitamin A-containing materials like butter are getting scarce. In the field of hormones it has been lately possible even to synthesise substances in the laboratory which are far less complex than the hormones built in Nature's laboratory and which are yet considerably more potent. These are only some instances to illustrate the powerful weapons that systematic scientific investigation has added to the armoury of medicine.

In our country medical research has not yet attained the position that it ought to. In the daily routine of medical practice, medical men are apt to ignore the need of the constant supply of new knowledge, the need of maintaining the fountain of medical research as a perennial spring. This has been so in all countries and particularly so in this country where the critical and curious research mind is all too absent. There have been a few medical men in India who have made important contributions to knowledge (and all honour is to them) but the tradition of medical research has hardly been built and the organisational and financial implications of medical research

have not been adequately considered. The Rockefeller Foundation of America annually spends over 10 crores of rupees on research, most of which is medical and in England donations like the princely benefactions of Lord Nuffield are fairly frequent. The Medical Research Council of Great Britain spends annually sums of the order of 25 lakhs of rupees, sanctioned by Parliament.

In our country it is necessary to re-organise and broaden the Indian Research Fund Association on the lines of the British Medical Research Council and place far more funds at its disposal for financing researches, having direct or indirect medical application to be carried on both in official and in non-official institutions. I know from direct experience that medical research in this country does not receive the attention it deserves, as I am myself President of the Governing Body of the Indian Institute for Medical Research, the scope of whose work is greatly limited by paucity of funds in spite of the excellence and efficiency of their work. It is time that the State, the constituted public bodies and the generous citizens of this country realised the paramount need of medical research for a nation's well being and contributed adequate funds for its promotion on a vast scale on scientific lines. In this connection I would urge that medical research should not be understood only in the relatively narrow sense of clinical research, whose importance is undoubted, but should also embrace both basic and applied research in the fundamental sciences ancillary to medicine, including Chemistry and Physics. As I have pointed out above the greatest advances can be expected in future only from such co-ordinated researches.

I would now beg your leave to dwell a little on the position of medical men in relation to society. Nothing is more symptomatic of the lop-sided nature of our present day society than that the medical profession as a profession can earn much less than what the speculators can get in the *fatka* market. To my mind the medical profession is the noblest profession, whose contribution to social well-being is second to none among the different professions and yet can we say that our society takes care of them or utilises them to the best advantage of the masses, who, after all, constitute the bone of our bone and the flesh of our flesh? At present we have got only about 90,000 scientifically trained medical men in this country. If we had one medical man per 1,000 of the population (which is just adequate) we would require 4 lakhs of medical men. Of these 90,000, again, the vast majority are in the cities and towns, while India practically lives in the villages. The reason for this anomaly is simple. The rural population is too poor to be able to support our medical men, who, on their part, have a right to claim from society a decent standard of living, so that vast millions to-day are going without scientific medical assistance. The remedy for this state of affairs lies in planning on a comprehensive scale and in the re-construction of society in such a manner that the State itself should provide a decent living to the medical men and distribute them evenly throughout the country. That is what the Soviet Union is doing according to the 5-year plans and, as is wellknown, their efforts have been crowned with great success. This might involve a radical re-organisation of society in which the interests of the masses and not of the vested interests will be the

motivating forces but such an ideal should not frighten those who wish sincerely to solve the problem and not to shirk it.

Finally, I would invite your attention to the frustration of science which an unjust and unscientific social order is causing on an unparalleled scale at the present time. Science, which properly applied, could have raised the stature of humanity to undreamt-of heights, is being used for destructive purposes. Medical men who have had the benefit of scientific training, which is denied to millions of our own people for no fault of their own, medical men who constitute the most loved profession in every civilised society, medical men who have been the torchbearers of knowledge since the earliest times—such medical men owe it to society to use the personal contacts that they get from day to day in all strata of society for making a scientific attitude of mind and for a general uplift of the cultural level. This education is of paramount importance and medical men have got exceptional opportunities in this regard.

It has been truly said that there is only one temple of God on earth and that is the body of man. Medical men are the priests at that noble shrine and as such they command the greatest regard of the entire society. Let us hope they will maintain and strengthen their noble traditions and let us direct our united efforts to the progress of our country, which is our common love, and help to build up a healthy, happy and invincible India.

—Advance Therapy, January 1940.

The Madras University Union.

The above Union is housed in "The Pavilion," Spur Tank Road, Egmore, near the Presidency Training School for Women. There is a branch of this Union at the University Examination Hall on the Marina, near the Presidency College. A Pavilion on the latest style has been built within the Union Playing Field in Spur Tank, and will be opened early in July.

The object of this Union is to promote the corporate, social and cultural life of the students of the University and this is secured by providing for its members the usual amenities of a first class club, holding debates and arranging lectures, giving entertainments, organising indoor and outdoor games and a tour.

Ordinary membership is open to students 'in Statu Pupillari' when a member of the Union 'leaves' the college or institution, such member shall be allowed to continue as member till the end of the year for which subscription has been paid. Lady students are also admitted as members. Admission will be made from 1st July of every year. The membership subscription is Rs. 3 annual but special subscription will have to be paid for Tennis.

There is a small library attached to the Union which has a good collection of select books. Lectures and Debates

are held in the spacious hall at the Marina Branch. There are two good Reading Rooms, one in each branch with nearly 30 periodicals, journals and magazines.

Among the outdoor games there are cricket, hockey, volley-ball, badminton, foot-ball and tennis. Turf-pitch for cricket has been laid and it will be ready for this cricket season. Tennis subscription is Rs. 2 monthly or Rs. 5 quarterly, and Rs. 15 annual, quarter beginning from July. Table-tennis, carroms, chess, draughts and billiards are the chief among the indoor games. There is also a catering department, attached to and subsidised by the Union. Aerated waters, tea, coffee and light refreshments can be had there.

The present building is fitted with sanitary installation and provides facilities for shower baths. The office will be pleased to give more details if required.

May I now appeal to you, Ladies and Gentlemen, to popularize the Union by becoming members as early as possible and thus make our University lead other sister universities even in this aspect of student life.

M. P. VITTAL IYER,
General Secretary.



AMMA'S LIFE BY APPAH.

We asked the artist to draw something and he gave us this: It is a pleasant transformation indeed from the howling brat to the sweet young thing in the counting chamber, but the artist has not told us what she is counting! The bent bus stop notice is very suggestive! But when the young lady examines a female patient through layers of bedsheets, etc., one asks "what is the world coming to?" And the propaganda against the female of the species in the last picture surely the modern medical girl is a true democrat!

Student Editor.

Reflections of the Student Editor.

In closing, I would like to make a few confessions about the conduct of our College Magazine.

While facing our Job it was our purpose to make the magazine, more of a College one than of a Medical Journal. Having had the privilege of being in intimate contact with the Association for the last few years, I have watched with keen interest and zeal the enthusiastic effort of our doctors in trying to have this change effected.

We, for our own part, have been striving hard to make these changes and we must frankly admit that the success was due to a lot of co-operation offered to us by our General Editor. This had been his aim; but what can he or we do? Our idea was to make the College Magazine one of a student enterprise and for the student, by our students. Of course the staff also contributed its quota by sending in worthy articles. We are very glad to announce the zeal and enthusiasm, which confronted us at the beginning of this year but the few sparks of enthusiasm, were soon buried. A lethargic stage was reached when all possible efforts were gathered but little response came from the students. But one thing we were rest assured, i.e., when the magazine was published, we could see people rushing to us and asking "Has the magazine come out?" After rapidly turning a few pages, you can find them all putting this curious question. "What articles have you published? Are there no more good articles?" The only next best thing is to lend a very patient hearing to all their outpourings.

The members of the staff also showed some waning interest and more inclined to shove all the responsibilities on to the young and tender shoulders of the student editors. The outcome was that the concerned people of the magazine were in a dilemma, waiting for articles which never came.

Indeed, one must realise that this is the transitional period which is the most critical period in the life history of an individual. The Magazine through the good wishes of several of its readers have successfully pulled through this period and I hope it will be able to hold its ground in the future.

I will only appeal to the fresh blood to come forward and give their best efforts and feel assured that in most of the quiet going youngones burns the FLAME of Literary genius which needs very little amount of fuel to flare forth into great dimensions. It will be no exaggeration and impertinence on my part to remind these who are impregnated with knowledge in the back of their minds that the medical students from time immemorial have always risen to the occasion especially when such is demanded of them to uphold these noble traditions and customs of our college which has made its name IMMORTAL. Shall I on this occasion beseech the fresh addition of staff and the newly stepped in doctors to contribute articles of interest both medical and general as frequently as possible which will also help them to be in touch with ALMA MATER.

In thanking the members of the staff for the enthusiasm they have

shown and for the advices given, may I solicit them to continue their zeal and interest and benefit us by their mature experience. Sincerely I take this opportunity of thanking those who have kindly contributed articles willingly and unwillingly to our Magazine and confidently believe they will keep it up. Though not had much of acquaintance, at least, by convention, I must also express my thanks to the Ladies' Representative who has given her co-operation willingly.

Our newly elected Associate Editor Dr. Govinda Reddy, has not been failing in giving us his lightning views and willing co-operation.

Dr. N. S. Narasimhan was the very life of the Magazine. Though he is in his forties, he is still quite young in spirits. His unfailing energy, and unceasing effort, his frank and sympathetic nature were the chief factors that kept up the life of the Magazine in spite of the many odds from the envying few.

We are really fortunate for having Dr. R. V. Rajam in the staff as President and whose long association with

our Magazine is a great asset. We remember his services to the Magazine with feelings of gratitude.

Dr. K. N. Krishnan, the Honorary Treasurer, had always his fingers on the pulse—I mean the finance—of the Magazine and he without fear or favour, with stubbornness assured us that we are stronger than ever as regards the finance, though due to war troubles and trade depressions, many of the firms are shirking their patronage to give their advertisement to the Magazine.

GOOD-BYE.

Mr. Uma and myself sever our active connection with the Magazine with the present issue and we wish to say GOOD-BYE to all our readers, contributors and other patrons. We deem it our sweet privilege to have been connected with the Magazine and we hope always to watch with interest its progress

May the College Magazine live long in all prosperity!—is the earnest wish of,

BABU, A. P.

Student Editor.

Psychic Development.

BY S. A. MUQADDAM, 1ST M.B.B.S.

Nature in my opinion is an inexhaustable store house of force of incalculable potency, in itself this force is neither good nor evil, it destroys and saves with equal ease and indifference. Good and evil come from direction and manipulation, the same force in the hands of a beginner leads to hallucination, insanity, disease and death, becomes in the hands of the master, the beneficent instrument of health and healing of mind and body. It is necessary to know "good and evil", for knowledge is the safeguard against danger unheeded and pitfalls unknown. It is a pity humanity has been so persistently hypnotised by the pharisees and scribes of the warring sects of theology that the exercise of faith or true spirituality has been distorted into a spacious form of credulity utterly subversive of the laws of nature and the first principle of human understanding. The more you see of life, the more you inculcate the importance of systematic self-discipline development of character and acquirement of mental and physical vigour; side by side with investigations of truth. This is spiritual growth, as distinguished from erratic psychic manifestations. The path leads to life; the other to destruction. The right road is often far from easy to see, much more to follow. With excellent intentions and resolute perseverance it is not difficult to lose the way. Time is short and obstacles are many. *A clear-defined cannon of discipline with rigid rules for dealing with will; imagination and concentration is indispensable for practical success.*

It is hoped this article will prove of interest to the readers and stimulate them to something more than

curiosity; whilst those who are desirous of taking the great problem of self-development seriously in hand, are advised to take the course in some recognised institutions. It is indeed very hard to practice and to realise in one's own life one's ordent aspiration after the ideal. It is easy enough to speculate and theorise. To practically transform oneself to higher state is difficult. But though difficult it is possible, provided the road is faithfully followed.

However with the clue presented in his essay, none need not despair of finding a way out of the maze of alleged facts of determining the possibility or otherwise of various beliefs and legends that may before have appeared to him to owe their origin to the darkness of ignorance.

I now deal with a point which requires very careful handling indeed, if we mean to hold the scale even between the two extremes of gross credulity and superstition on the one side, and unreasoning scepticism on the other. The phenomena to be met with are so various startling and removed from the ordinary surface current of life, that to many people, the only solution of the problem is to regard them as nothing but gratesque phantasmagora of a hideous dream.

Imagination is scientifically defined as the power of the mind to form images. This image making has been characterised by the great German Philosopher, Hegel, as the ordinary condition of thought of the generality of men and women.

The conclusion then is arrived at that our own minds are incessantly forming images of some kind or other,

according to the nature of our thought for the time being. Thus if we think of someone, a friend or an acquaintance an image of that person, more or less vivid according to the intensity of our thought is instantaneously formed by the mind.

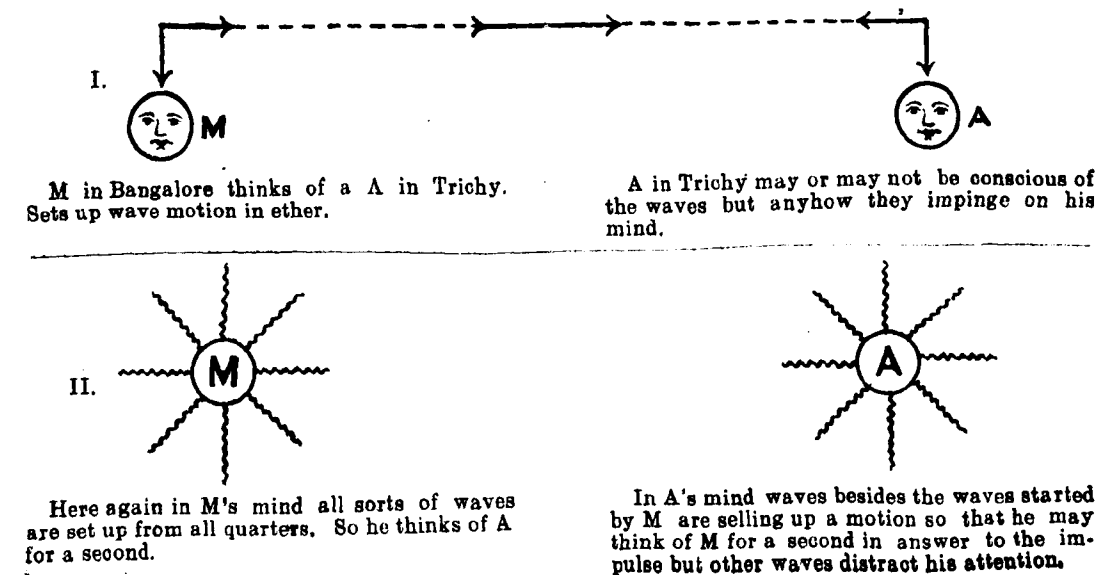
Now the question naturally arises what relation, if any, exists between the mental image we have formed and the person thought of. This in reality, is the crux of the whole question; for, if it could be shown that this mental image has nothing whatever to do with the person about whom we are thinking, shortwork be made of the whole of what has been called magic, witchcraft and sorcery. Till quite recently modern science maintained the attitude of incredulity towards the subsensual world, for it was of opinion that there was no connection whatever between the two—the image formed in the mind of one person, and the person thought of at a distance.

But now tables are turned. Modern science can today conclusively demonstrate that thinking sets the ether in motion and that consequently a

wave of force is started which impinges on the brain of the person thought of.

We have still another point of great importance to ascertain. What effect can this wave of etheric force produce upon the other person's mind? Science again settles the points conclusively:—fora of anykind is affected in the production of results by two principal factor—the amount of power exerted and the amount of resistance to be overcome.

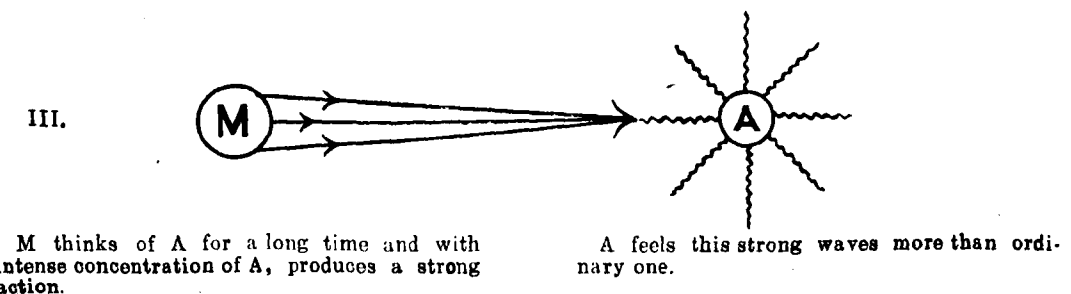
Applying this test to the action of one mind upon another we can determine the effect likely to be produced on the mind of the person thought of when another mind at a distance forms an image; without any hesitation whatever we can decide that in ordinary circumstances the effect is very small indeed, so small that for practical purposes, it is not worth taking into serious consideration. But though small, it is not nil. For scientific purposes it is often absolutely necessary to measure infinitesimal quantities; for when we add together, they amount to formidable proportions.



Thus in ordinary circumstances neither M nor A could be expected to effect each others mind.

Let us now proceed a step further and examine what would take place if M thought of A for a long time, and with intense concentration. It is clear in the first place, that M's

thought sphere is different now from what it was when he thought of A only casually. The other etheric waves are overpowered by one wave of great force, which is directly towards A. In the second place, A's thought sphere must be affected by this cumulative force, and is bound to feel it more than a single casual wave.



It is said by paracelsus "The imagination alone is the means of fulfilling the attention." The imagination of man comes from the heart, which is the sum of the microcosm and out of the microcosm proceeds the imagination into the great world. Thus the imagination of man is a seed which is material. Determined imagination is the beginning of all magical operation. Fixed thought is also a means to an end (*the image formed in the mind must not be dissipated by other images*). I cannot turn my eye about with my hand, but the sternly fixed imagination turns it wherever it will. A curse may be realised when it springs from the heart and when anyone will lame or stab another he must first in imagination thrust the weapon into himself.

The human spirit is so great a thing that no man can express it; as God himself is eternal and unchangable so also is the mind of man. If we rightly understood the mind of man nothing would be impossible to us on earth. The imagination is invigorated and perfected through faith, for it really happens that every doubt breaks the

operations (this can be explained on the principle that two waves in any medium—air or other—when not perfectly synchronised are known to scientist to nullify each other).

Hence the gist of the aforce is that out of every body proceed etherical images, which diffuses themselves though infinite space. On this account bodies can operative on other's at the most remote distance by means of all pervading ether and one can communicate with another at any distance.

Readers of this article will now understand that the real efficacy of the living world is not in the actual sound or its pronunciation but in the imagination and will of the individual who invokes. I do not want it to be meant that I attribute no potency at all to the words as combination of sound such for instance, as the sound OM. giving due allowance for the effect of sound in itself, every thinker must come to the conclusion that "in the Divine Power asleep within man lies the real force", otherwise,

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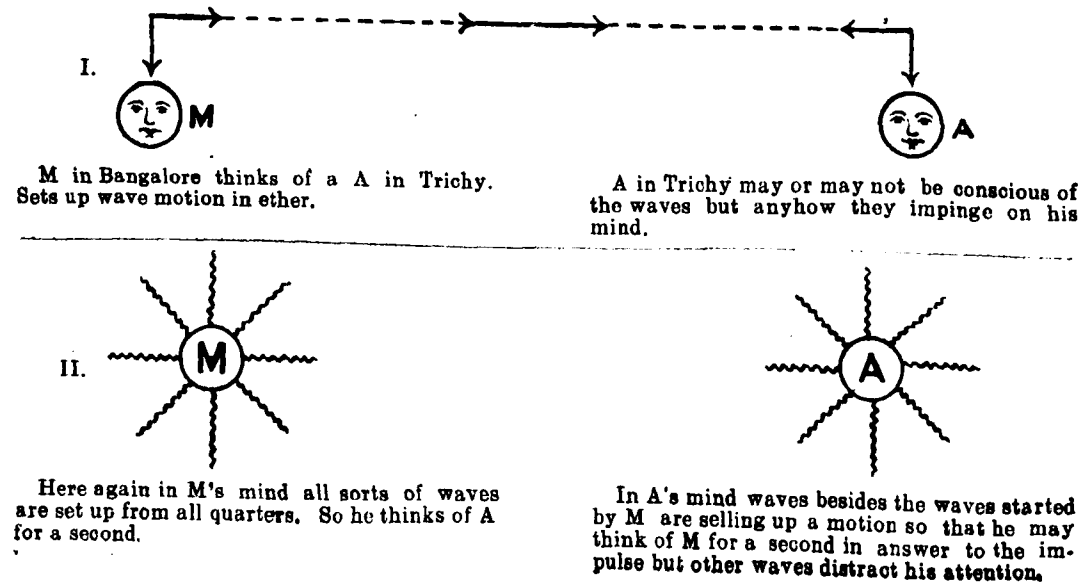
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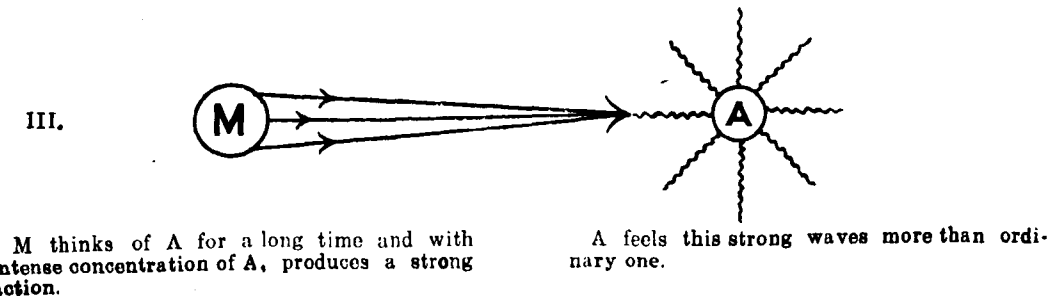
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how can identical results be produced by uttering different names as O.M., Allah or Jesus.

When the imagination is not vivid and will is not powerful, no amount of invocation of the ineffable name will produce the desired effect.

It should be emphasised on the mind of person that if a man makes up his mind or determines to do a thing nothing is impossible for him. Man is the incarnation of the universal power and nature is the outward manifestations. So it is not theoretically impossible to achieve master over one'sself. Then your thoughts will be directed to the question whether you are taking any step to control your life or whether you are drifting helplessly on the ocean of existence without a rudder or compass.

Everything that we see, hear, feel, touch or smell leaves its picture on the sensitive organisation. This picture by a natural law, tends to influence the individual to pull him down or build him up; to retard him on the road to perfection, or speed him in his way. That being so ought not the individual be careful to select to the very utmost of his power what he sees and hears? At a given moment a man's action, if thoroughly analysed will be found to be the product of the totality of the images which have been recorded in the mind of himself and of his ancestors. That is the reason why one is a timid,

another brave; why this is a rascal that an honest man.

The important thing to understand is that by constantly presenting to the mind images of a certain nature, the character of the individual will be forced ultimately to correspond to them. Thus a timid man can become brave and courageous, by being surrounded by images that convey to him the ideas of bravery and a brave man becomes timid by being surrounded by images that convey to him the idea of cowardice.

Hence Nature is the mode of motion, and the fundamental law is that one mode of motion tends to produce its like. If the mind is full of images of a debasing character, the natural tendency is to work down to the physical plane. If the mind is full of ennobling images, the natural tendency is equally strong.

This is the secret of progress. Avoid the low in thought and you will eventually be compelled to avoid the low in action. Contemplate only the high, the noble, the ideal in thought, and you will eventually be compelled to work out in daily action the high, the noble, the ideal or rather you will not do it; nature will do it for you. The result attained is perfectly natural, whether you sink to the lowest depth or vice and bestiality; or whether you soar on high to the divine. But remember that you cannot do both; even the most secret actions, which you think no eye can see, tell their tale to all who can read.

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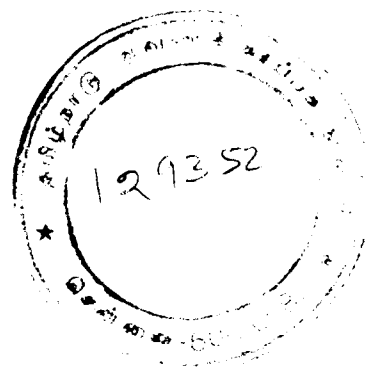
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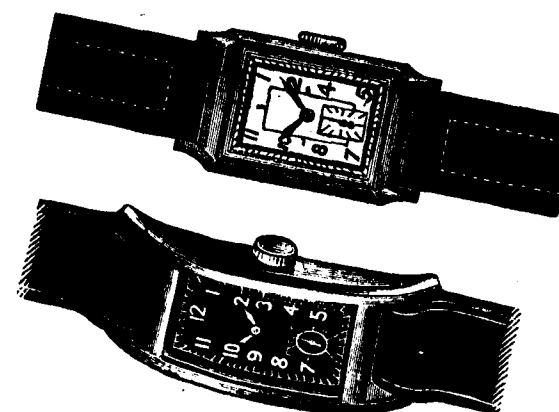


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