puzzle. A further point of interest in these cases is Dyke's claim that in his case the hypercholesterolaemia, or lipaemia, was due to the existence of a chronic interstitial pancreatitis. This at once recalls to us the clinical and pathological features of bronzed diabetes or haemochromatosis—pancreatitis; hepatic cirrhosis, and enormous deposition of haemosiderin. Here again are remarkable points of contact, but the puzzle remains to intrigue us.

In Gaucher's, Pick's, and Niemann's diseases the reticulo-endothelial system is involved in the metabolism of lipid substances, which are apparently different, although closely related compounds in each disease. The splenic enlargement is due to enormous hyperplasia of the reticulo-endothelial cells, which are filled with the special lipid characteristic of the disease. Here again we are dealing with diseases involving both liver and spleen, for in the liver the Kupffer cells proliferate enormously, and, unlike Dyke's description of the changes in hypercholesterolaemic splenomegaly, contain the lipid material. In all of this group of diseases the liver cells may be extensively damaged, and hepatic cirrhosis may result. I have referred elsewhere to an unpublished case of A. R. Rich of Baltimore in which not only the liver and spleen were extensively involved, but the bone marrow was so infiltrated with lipid-containing reticulo-endothelial cells that the ivory bone was invaded and a pathological fracture resulted.

DISEASES, ASSOCIATED WITH CHRONIC SPLENOMEGALY, WITH MARKED RETICULO-ENDOTHELIAL HYPERPLASIA AND GIANT-CELL FORMATION

This group has interested me very greatly, since included in it are some of the largest splenomegalies in my own extensive collection. No one, so far as I am aware, has been able to make a complete examination of such cases. My own observations so far are confined to spleens removed by operation, and I am unable to give any histological account of the changes in the liver. It is certain, however, that in several instances the liver was cirrhotic at the time of the operation. The histological changes in the spleen are almost characteristic. There is enormous proliferation of the reticulo-endothelial cells associated with increase in the reticulum, so that, as I have described it, the spleen becomes a large heavy solid organ. In association with these changes giant cells appear, which may be very numerous and may almost suggest the appearance of a myeloid sarcoma. The causation of this condition affecting both liver and spleen is quite unknown, and I have only been able to suggest that the changes might be due to some chronic inflammation of unknown aetiology and of very long standing.

CONCLUSIONS

In these lectures I have tried to interest physicians in a somewhat difficult problem of clinical medicine. It will be observed that my whole thesis centres around "the portal circulation" and some of the organs connected therewith. I have confined myself here to a consideration of two organs—the liver and the spleen—on which I have carried out personal observations, and about which I therefore have something to say. But the scope could obviously be extended to include diseases of the whole intestinal tract.

We know a good deal about the dynamics of the systemic and pulmonary circulations, but far less about the portal. We are familiar with the clinical results of alterations in the systemic and pulmonary blood pressures, but so far we know only the very gross and late effects of increased portal pressure. The metabolic problems with which the systemic and pulmonary circulations are concerned are, on the whole, simple and clear-cut, and

have been very fully investigated. In the portal circulation, in which all the substances derived from the intestine are carried to the liver, the problems of metabolism are much more intricate and difficult to investigate. So far as the liver and spleen are concerned, the liver is obviously dominant in all ordinary metabolic functions; but the spleen, on the other hand, surpasses the liver in its reticulo-endothelial activities.

Much experimental work has been carried out on different aspects of our subject, but, as usual, the results have gone far ahead of their immediate and direct application in clinical medicine. Isolated researches have, however, already given us valuable clues which we must follow. I have collected some of the most important experimental results in my first two lectures, and in my last lecture have attempted to show how some of them may be applied. I am convinced, from my study of diseases of the liver and spleen, that a new chapter in medicine will ultimately have to be written concerning derangements of the portal circulation and their causes.

BIBLIOGRAPHY

- Anitschkow, N.: *Beitr. z. path. Anat. u. z. allg. Pathol.*, 1914, lvii, 201.
 Banti, G.: *Arch. d. Sculo d'Anat. patol.*, Firenze, 1883, ii; *Semaine méd.*, Paris, 1894, xiv, 318; *Beitr. z. path. Anat. u. z. allg. Pathol.*, 1898, xxiv, 21; *Folia Haematol.*, 1910, x, 33.
 Boinet: 1898 (quoted by Rolleston and McNee).
 Boix: 1898 (quoted by Rolleston and McNee).
 Casamajor: *Occupational Diseases and Vocational Hygiene*, Kober and Hanson, 1916.
 Coats, J.: *Glasgow Med. Journ.*, 1889, xxxii, 95.
 Dawson, Lord: *British Medical Journal*, 1931, i, 921, 963.
 Dyke, S. C.: *Journ. Path. and Bact.*, 1928, xxxi, 173.
 Eppinger, H.: *Die Hepato-lienalen Erkrankungen*, Berlin, Springer, 1920.
 Epplen, F.: *Arch. Int. Med.*, 1922, xxix, 482.
 Findlay, M.: *Brit. Journ. Exper. Pathol.*, London, 1924, v, 92.
 Finlayson, J.: *Glasgow Hosp. Rep.*, 1889, ii, 39.
 György, P., and Kleinschmidt, K.: *Zeit. f. d. ges. exp. Med.*, 1927, liv, 23.
 Haberland, H. F. O.: *Ibid.*, 1926, l, 180.
 Herrick, F. C.: *Journ. Exper. Med.*, 1907, ix, 93.
 Hurst, E. W., and Hurst, P. E.: *Journ. Path. and Bact.*, 1928, xxx, 303.
 Kretz, R.: *Wien. klin. Woch.*, 1900, xiii, 271; *International Clinics*, 1905, iii, 289.
 London, E. S.: *Ergebn. d. Physiol.*, 1928, xxvi, 320; Harvey Lectures, New York, 1927-8, xxiii, 298.
 Milne, L. S.: *Journ. Path. and Bact.*, 1909, xiii, 127.
 Muir, R.: *British Medical Journal*, 1908, ii, 1169.
 McIndee, A. H.: *Arch. Path. and Lab. Med.*, 1928, v, 23.
 McNee, J. W.: *Lancet*, 1931, i, 951, 1009, 1063.
 Osler, W.: *Amer. Journ. Med. Sci.*, 1900, cxix, 54; *Trans. Amer. Assoc. Phys.*, 1902, xviii, 429.
 Rolleston, H. D., and McNee, J. W.: *Diseases of the Liver, Gall-bladder, and Bile-ducts*, third edition, Macmillan, 1929.
 Rous, P., and Larimore, L. D.: *Journ. Exper. Med.*, 1920, xxxi, 699.

THE PROGNOSTIC VALUE OF SPINAL ANAESTHESIA IN VASOSPASTIC DISEASES OF THE LOWER LIMBS

BY

E. D. TELFORD, F.R.C.S.

PROFESSOR OF SYSTEMATIC SURGERY, UNIVERSITY OF MANCHESTER
AND

J. S. B. STOPFORD, M.D. MANCH., F.R.S.

PROFESSOR OF ANATOMY IN THE UNIVERSITY

In any study of the circulatory disturbances of the limbs there arises at once the difficulty of estimating with sufficient exactness the degree to which the disease has progressed and the functional value of the circulation in the affected limb.

Viability and function of a limb are possible within a wide range of variations in the amount and pressure of the blood which flows through it. Although colour changes and claudication may indicate roughly that all is not well with the circulation, it is essential to have more exact knowledge as to what extent the diseased vessels are still pervious and remain able to react to nervous im-

pulses. Many vascular diseases exhibit evidence of spasm of unoccluded collateral channels, and the clinical signs may consequently suggest a considerably greater degree of organic arterial obstruction than is actually present. Therefore it is necessary in the investigation of all cases of vascular disease to determine, if possible, the extent of the vasospasm which is superimposed on the completely or partially occluded vessels. Palpation of the main vessels by the finger is of little use excepting for showing that the pulse in the larger arteries is absent or grossly reduced; neither do the various sphymographs or the oscillometer of Pachon give sufficiently exact findings, particularly with regard to the important element of vasospasm. More exact results might no doubt be afforded by plethysmography, but such a method, although used with success in small animals, is not easy of application to an adult limb and may introduce error, since some degree of constriction is necessary to produce a watertight seal.

METHOD OF ASSESSING "CIRCULATORY VALUE" IN A LIMB

In the present state of our knowledge the most exact information as to what one may call the circulatory value of a limb is afforded by the use of a very delicate electrical surface thermometer. This has a special application as a guide to the merits of cord sympathectomy in certain vascular diseases of the extremities. Any rise in skin temperature, however induced, indicates an increased flow of blood to the part. The extent of the rise of temperature signifies the degree of increased blood flow, and so may be used as a measure of the improvement in circulation which may be induced by permanent vasodilatation.

In the disease at present known as thrombo-angiitis obliterans there is a combination of vasospasm with arterial thrombosis. Though many writers appear to regard the spasm and the thrombosis as unrelated conditions we believe, from our investigations into the vascular complications of cervical rib, that the two are essentially one. Vasospasm is the initial lesion, and prolonged severe vasospasm induces thrombosis by interference with the blood supply to the vessel wall. As the disease progresses the area of vessels affected by thrombosis tends to increase at the expense of the area of vasospasm. It is obvious that in any given patient the area of vasospasm can be favourably affected by deprivation of its constrictor fibres—that is, by sympathectomy—whilst on the other hand it is inconceivable that any operative treatment can influence a vessel the lumen of which is completely plugged by fibrous tissue.

In approaching any case from the point of view of suitability for treatment by sympathectomy it is therefore essential to know just how much of the trouble is due to spasm, for this is the part which is curable. Since, as we believe, the spasm is the initial change and the thrombosis consequent upon it, it is possible that removal of the vasospastic state may also prevent further spread of the disease. Adson has definitely expressed the opinion that the improvement in circulation succeeding sympathectomy checks the progress of thrombo-angiitis. If, therefore, a limb gives a distinct reaction, as shown by rise of skin temperature to any agent producing vasodilatation, then sympathectomy is indicated as likely to improve materially the condition of the limb.

A method which has been used to induce the dilatation of vessels in vasospastic disease is the injection of foreign substances, of which typhoid vaccine, acetylcholine, and muscle extracts are examples. The injection of these materials into the circulation causes some degree of vasodilatation, and hence has been much employed in treatment. Its effects are, however, not lasting, and it has

the disadvantage of making the patient ill—in fact, most patients decline further treatment after a few experiences of the injection. As a prognostic test of the value of cord sympathectomy in the lower limb, injection is far inferior to spinal anaesthesia. If a spinal anaesthetic is given so that it takes effect as high as the sixth dorsal segment, it will temporarily put out of action the whole sympathetic supply to the lower limbs. It will do for an hour exactly what a lumbar sympathectomy will do permanently. Hence, if spinal anaesthesia induces a definitely increased blood flow to the diseased limb, as evidenced by improvement in colour and rise of skin temperature, it shows that a considerable number of vessels are still capable of becoming dilated, and it indicates that the operation of sympathectomy is justifiable.

EXPERIMENTAL RESULTS

In order to arrive at a correct estimate of its action it is necessary to know what is the effect of spinal anaesthesia in a normal limb. To this end we have taken for study a large series of operations carried out under spinal anaesthesia. These cases include all ordinary types of operation (appendicectomy, radical cure of hernia, excision of haemorrhoids, etc.) such as occur in the routine practice of a surgical unit. They include patients of all ages, from 11 to 66 years. The skin temperatures were recorded by an electrical surface thermometer applied to the thin skin on the arch of the instep. Readings were taken before administration of the spinal anaesthetic and at intervals of five minutes, until the effect of the anaesthetic had passed off. At the same time the room temperature and blood pressure of the patient were recorded. A survey of the material so obtained brings out the following points.

In all cases where the anaesthesia is up to or above the sixth dorsal segment a marked rise of skin temperature is apparent. This rise is usually about 8° C., but may reach as much as 10° C. It is, as one would expect, more evident in young healthy patients than in older subjects: for example, a strong healthy woman of 22, operated upon for hernia, showed a rise of 10° C. in the right, and of 9.2° C. in the left, foot, whereas a woman of 61 with some arterial degeneration operated upon for haemorrhoids showed a rise of only 3.5° C. on the right side and 6° C. on the left. The nature of the anaesthetic drug used made no appreciable difference—stovaine, heavy durocaine, and percaine gave similar results. It is interesting to note the extreme rapidity with which the drug is fixed; not only does the rise of temperature come on almost at once, but if the anaesthetic be injected with the patient on the left side, the left limb will consistently show the higher temperature, even if the patient is at once placed on his back after withdrawal of the needle. Similarly an injection given with the patient lying on the right side will result in a higher temperature in the right foot throughout the observation. On the whole, our observations show that in a normal patient spinal anaesthesia will induce a rise of temperature which may be expected to reach round about 8° C. as measured on the foot.

In contrast to the above, we have made a series of observations in several cases of thrombo-angiitis obliterans on which we have performed lumbar sympathectomy. We find that the rise of temperature in the feet under the anaesthetic supplies not only a guide as to whether the operation should be done, but affords a very useful indication to prognosis after operation. These cases will form the basis of a separate report, but for the present we may instance the following results in which the subsequent progress of the case is in very close accord with the skin temperatures observed at the time of operation:

Male, aged 59 years. Rise of temperature under spinal anaesthesia 1.6° C. in the right foot and 0.9° C. in the left

foot. The result of cord sympathectomy was poor. The right lower extremity shows some improvement, but the left was amputated two months afterwards for gangrene.

Male, aged 45 years. Rise of temperature under spinal anaesthesia 3°C . in the right foot and 1.6°C . in the left foot. The result of cord sympathectomy is fairly satisfactory, and a gangrenous ulcer on the inner side of the left ankle healed rapidly.

Male, aged 41 years. Rise of temperature under spinal anaesthesia 6.4°C . in the right foot and 5.8°C . in the left foot. The result of cord sympathectomy is entirely satisfactory, and the patient is in active work.

These results correspond closely with those of Adson, who has found, after the injection of a foreign protein, that unless the rise in skin temperature is two or more times greater than the rise of mouth temperature, sympathectomy is inadvisable.

CONCLUSION

In any case of thrombo-angiitis obliterans there is the element of vasospasm, which can be relieved by cord sympathectomy, and there is the element of thrombosis, on which operation is useless. The propriety of operating can be decided only by an endeavour to estimate the relative amounts of spasm and thrombosis. We feel that this can best be done in the lower limbs by a spinal anaesthetic. The method need involve no trouble for the patient, as the spinal injection is given on the operating table and the operation can be undertaken or abandoned on the findings given by the thermometer within five minutes of the injection. These advantages render this method much more attractive, safer, and quicker than those involving the intravenous injection of substances which commonly cause the patient considerable discomfort for some time. Furthermore, the response to a spinal anaesthetic gives an accurate record of what can be expected from sympathectomy, whilst Adson states that the rise in surface temperature induced by fever only "approximates roughly" to that following excision of the sympathetic supply.

A CASE ILLUSTRATING ARTIFICIAL PNEUMOTHORAX, ADHESION CUTTING, AND OLEOTHORAX

BY

F. G. CHANDLER, M.A., M.D., F.R.C.P.

PHYSICIAN WITH CHARGE OF OUT-PATIENTS, ST. BARTHOLOMEW'S HOSPITAL; PHYSICIAN, CITY OF LONDON HOSPITAL FOR DISEASES OF THE HEART AND LUNGS, VICTORIA PARK

The publication of a solitary case, if it concerns treatment, is justly viewed with critical suspicion. My apology, therefore, for thus transgressing is not entirely that the case described is perhaps in some respects unique, but that it illustrates the potentialities of methods of treatment the value of which are still unrecognized by large numbers, if not the majority, of our profession. I must add that I am not advocating what follows as a routine procedure, as the opportunities for its applications may be few; but the indication is fairly definite—that action is compulsory when the patient is obviously declining—unless one is content to adopt an expectant attitude to the fatal end. There is little validity in the criticism of those who say that they have known similar cases recover without special treatment, when the indication, as I maintain, is the failure to recover by means of other treatment. Particularly is this so in tuberculosis of the lungs, where far too often the patient is allowed gradually, steadily, insidiously, to decline, with no effective effort being made to stem this decline, in the hope that some-

thing will turn up, or because of the hopeless attitude that there is nothing to do, or owing to failure to observe that things are going badly.

CASE RECORD

The patient was a child, aged 7, whom I saw in consultation with Dr. C. T. Neve in December, 1930. Her father was dying of phthisis and silicosis. She presented the symptoms and signs of bilateral bronchitis. Sputum was copious, and tubercle bacilli were constantly present. She lived at home

FIG. 1.

FIG. 2.

FIG. 1.—Appearance February 19th, 1931: Showing cavity in left lower lobe, with infiltration around it. Doubtful shadows radiating from right hilum.

FIG. 2.—March 9th, 1931: Showing artificial pneumothorax. Left lung partially collapsed. Cavity held open by adhesions.

on sanatorium lines, but rapidly became worse, the temperature remaining in the region of 101°F . for some weeks. She wasted. In February, 1931, there was bronchopneumonic consolidation of the left lower lobe, and a few crepitations were heard on the right side. X-ray examination revealed a very large cavity in the left lower lobe, and the appearances about the right hilum were very suspicious.

As a forlorn hope it was decided to attempt artificial pneumothorax treatment on the left side. This was done, but the cavity would not close owing to adhesions. It was decided to try to sever them. The child was extremely

FIG. 3.

FIG. 4.

FIG. 3.—May 18th, 1931: The adhesions have been cut. The cavity is almost closed. A small amount of olive oil has been injected into the pleural cavity.

FIG. 4.—July 27th, 1931: The cavity is closed. The lung is kept sufficiently collapsed by oil. The appearance was the same in February, 1932.

highly strung and nervous—so much so, that the usual local anaesthesia was thought to be unsuitable. She was given avertin. Unfortunately not enough was given, and gas and oxygen had to be administered as well. This considerably increased the difficulty of the procedure, as the respiratory excursions were consequently exaggerated and the chest wall was in violent movement throughout the operation. Thoracoscopy revealed a complicated maze of wide adhesions. In the belief that it was a question of completely collapsing the lung or leaving the child to die, it was decided to risk their