cavity, the anterior wall of the inguinal canal was slit up to the internal ring; the peritoneal process was separated from the cord from just above the testis to the inner ring, where it was tied off and cut away. It was then seen that the length of cord below the external ring would allow the testis to rest in the scrotum without any stretching, so the inguinal canal was sutured up. A small vertical incision was now made at the bottom of the scrotum, and artery forceps were passed upwards in the fat under the strap of skin left undivided to the external ring, where they caught and drew down the peritoneal sac (the new tunica vaginalis) and the testis into the scrotum. A stitch was passed through the bottom of the sac and made to fix this to the skin of the perineum at the back of the scrotum to ensure it retaining its position. The skin was sutured with horsehair, and cyanide gauze dressing used. The wound healed by first intention and the testicle maintained its position well.

Second Operation.—A fortnight later a similar operation was done on the right side and a similar state was found except, as before stated, the testis was in the inguinal canal. Here after the peritoneal sac had been divided the cord separated and stretched it was found that the testis could be brought into the scrotum and treated as before. The result was again satisfactory, and his condition has remained so since. What the cause of this arrangement of the sac is I cannot say. Some have held that the ill-development of the scrotum is the cause, but it is more probable that this is the effect of the non-descent.

RETENTIO TESTIS.

In dealing with the second part of my subject, retentio testis, where the descent has stopped in the normal line, this may occur in the following forms:

(a) *Abdomino-lumbar*, where the testis is retained in relation with the posterior abdominal wall in the neighbourhood of its original site; it may be fixed or free to move, this depending on the length of the mesorchium. This form is rare, and attention might be drawn to it by the presence of a small abdominal swelling and absence of testis elsewhere.

(b) *Iliac*, in which the testis is in close relation with the internal ring resting on the psoas.

(c) *Inguinal*.—Here the testis may occupy any part of the canal, being near the external or internal ring. In many of the cases the peritoneal sac has not severed its connection with the abdomen so that a hernia complicates matters. Often the testis is very mobile, and if in the outer part, near the internal ring, it may pass to and fro into the abdominal cavity. When near the external ring, if this is of fair size, the testis may pass just outside to occupy the position of the next form. An interesting group is the interstitial variety, where the sac extends between the structures of the abdominal wall. Such a pouching may take place under the external oblique, between it and the internal, or in a deeper plane in the subperitoneal tissue, when it may press on the iliacus or inwards behind the horizontal ramus of the pubes towards the bladder. Included in these forms will be the *hernie en bissac* of the French.³ These variations in the form of the sac are possible sites for deviation in the course of the testis.

(d) *Crural-scrotal*.—This is differentiated by Godard as the form when the testis stops just outside the external ring, over the pubic crest and symphysis, and would need careful diagnosis from the ectopic forms, pubo-penile, and the higher-placed variety of the perineal.

As to the cause of retardation many explanations are offered, such as defective contraction of the gubernaculum, contracted external ring, shortness of the vessels of the cord and the vas, and in the abdominal form intrauterine peritonitis. It is conceivable that the interstitial form may be developed by the pressure of a truss.

The treatment of these cases varies, of course, with the position of the testis. Where the gland does not descend through the external ring it is obvious that it is very unlikely to be able to be brought into the scrotum. In a young child, when it is near the external ring, it might be attempted to press the gland down by a truss with a concave margin. In an adult, however, where the gland is atrophied and, as is usual, complicated by hernia, the best treatment is a radical cure with castration.

In the cases where the testis remains in the canal about the internal ring, the only practical course is castration; if a truss be applied the interstitial form might result or the gland be irritated by pressure. When the testis is in the abdomen or in the iliac fossa, in most cases no treatment is undertaken, but in some instances such may be imperative under very unfavourable conditions, as in gonorrhoeal inflammation of the gland. The great risks of a fatal peritonitis in gonorrhoea, or of a possible carcinomatous change in the retained gland, which has been considered frequent, may be powerful factors in favour of castration.

Should the testis be outside the ring attempts may be made to bring it into position by operation. As a means to this end additional length has been gained by stretching the cord structures so as to bring the vas nearer to the mid-line, or even it might be attempted by operation to displace the vas in the subperitoneal tissue by dividing the deep epigastric artery, and so to effect the desired lengthening. Again, the epididymis may be dissected from the vas, and the gland turned upside down, thus increasing the distance by the length of the testis.

In all these procedures the lower part of the gland must be fixed to the perineum behind the scrotum to keep it *in situ*; it must be remembered that it will be of no avail to fix it to the scrotal skin, for the testis will retract and invert the scrotum. The cord may also be fixed to the pillars of the ring to prevent this retraction.

Lastly, help has been obtained from various forms of cradles that have been devised to effect the same result. It is desirable not to get the testis fixed over the front of the pubes, for here the gland is most liable to injury.

REFERENCES.

- ¹ *Lancet*, July 14th, 1894. ² *Med.-Chir. Trans.*, vol. xlix, p. 189. ³ Holmes and Hulke, *System of Surgery*, vol. ii, p. 801.

THE AMOEBA DYSENTERIÆ: ITS RELATION TO TROPICAL ABSCESS OF THE LIVER.

BY CAPTAIN D. G. MARSHALL, I.M.S.,

Late Officiating Professor of Pathology, Lahore Medical College.

TROPICAL abscess of the liver, and especially its association with the presence of the amoeba dysenteriae, is a subject which has received but a small amount of attention in this country, though the disease is probably far more common among people returning from tropical countries than is generally supposed. In this article the subject will be considered chiefly in its pathological aspect. Clinically it has been most thoroughly treated by Drs. Councilman and Lafleur in the *Johns Hopkins Hospital Reports*.

That the amoeba dysenteriae produces a typical form of dysentery has been conclusively proved by Kartulis's experiments on animals. The doubts which have been thrown on his results are chiefly due to the fact being overlooked that there are several forms of dysentery. That tropical dysentery is frequently complicated with, or followed by, abscess of the liver is well known, but whether the amoeba which causes the dysentery is the cause of the abscess in the liver has been much disputed, though it is difficult to see why a parasite which is admitted to be the cause of destructive changes in the intestine should not be considered capable of producing the same effects in the liver.

As it is admitted that the amoebæ are not the cause of all cases of dysentery, so doubtless many cases of abscess of the liver, even when associated with dysentery, are not due to the presence of the amoeba, and this partly explains why many observers have failed to find them in cases of liver abscess.

Virchow is of opinion that abscess in the liver is caused not by the amoebæ, but by micro-organisms carried in the amoebæ. In their cases Councilman and Lafleur found the amoebæ invariably present, pus organisms being absent, proving that the formation of abscess is due to amoebæ and not to pus organisms. But in the older and larger abscesses, particularly those that have been opened and drained, pus organisms are more frequently found. Many observers (Losch, Koch, Osler, and others) have found the amoebæ in liver abscesses.

The case which yielded most of the sections figured below had an especial interest in that death was caused by a thrombus containing large numbers of amoebæ, a hitherto undescribed pathological condition.

I am indebted to Mr. Stiles both for particulars of the case and also for handing over to me the liver for examination.

CASE. 1.—A strong healthy man aged 27 went to the West Coast of Africa in 1894, and within a month began to suffer from malarial fever. Early in 1895 he had an attack of dysentery, for which he was in hospital three weeks; on leaving he at once embarked for home. During the voyage he improved in health, and on arrival in Scotland was apparently perfectly well. In August, 1895, two months after his return, he was attacked with severe dysenteric diarrhoea, followed by pain in the right shoulder, rigors, fever, and profuse sweating. Abscess of the liver was ultimately dia-

gnosed, and the abscess opened in November, 1895. By the spring of 1896 he had increased 2 stone in weight, and appeared to be in perfect health; against the wishes of his medical adviser he, later in the year, proceeded to Ceylon, and shortly had another attack of dysentery. He returned home; an abscess of the liver was again diagnosed and opened, but three weeks after the operation, while sitting up in bed, he was suddenly seized with intense dyspnoea, and died in a few hours.

On *post-mortem* examination the liver appeared to be of normal size. The surface showed the cicatrix of the first operation, and the opening made at the second operation. On section the abscess was found to be situated in the most common

Fig. 1.—Case of tropical liver abscess. Shows fatty degeneration of liver cells, engorged capillaries, and proliferated endothelial cells. $\times 150$.

situation—the upper part of the right lobe. The cavity, contracted to the size of an orange, was surrounded by firm fibrous tissue; its interior was rugose, and covered with a ragged semi-opaque layer of viscid material. The cicatrix of the opening made

Fig. 2.—Case of tropical liver abscess; amoebae; staphylococci, etc., in necrotic tissue of abscess wall. $\times 1,000$.

at the first operation led down to the abscess, and was distinct from the opening made at the second operation. In various parts of the liver small yellowish necrotic patches were noted. A thrombus partly organised was found firmly fixed in a large

vein just where it joined the inferior vena cava, into which it projected a short distance. Sections taken from various parts of the liver, including the abscess wall and thrombus, were fixed in perchloride of mercury solution, transferred to alcohol (some were treated with osmic acid), and embedded in paraffin. For staining the liver tissue, microcarmine, hæmatin and eosin, and methylene blue and eosin were used. For the recognition of the amoebae, treatment with iron-alum and Heidenhain's hæmatoxylin and counterstaining with rubin and orange was found to be very good, the amoebae in the tissues

Fig. 3.—Large amoeba in blood vessel; liver abscess wall. $\times 1,000$.

and blood vessels being more easily recognised with this method, although they stained well with Ehrlich's hæmatoxylin, methylene blue, thionin blue, and safranin. For micro-organisms thionin blue was used, and also Gram's method.

Fig. 4.—Case of tropical liver abscess; amoeba in blood clot from vena cava. $\times 600$.

Eosin and methylene blue gave the best results with the thrombus.

The sections presenting points of special interest were the following:

1. From the left lobe; the area round the central vein was

seen with the naked eye to be paler in colour than the peripheral zone. Under the microscope the capillaries were seen to be engorged, leucocytes in excess, and there were some few swollen endothelial cells. The liver cells showed cloudy swelling and commencing fatty degeneration, the nuclei having the power of taking on stain.

2. From the right lobe, including one of the yellow necrotic patches, sections showed changes similar to those in No. 1, but much more advanced. The detached swollen endothelial cells, under a high power, were seen to contain masses of pigment, which gave no reaction with ferrocyanide of potassium. The liver cells were markedly fatty and disintegrated, some represented simply by fragments, and many nuclei were unstained. Some of the fragments were swollen and vacuolated, with sharp edges. (See Fig. 1). No amœbæ were found in these areas, the destructive changes being apparently due, as suggested by Councilman and Lafleur, to the action of the chemical products of the amœbæ.

3. Sections from the wall of the abscess showed from within outwards a layer of mucoid necrotic material lining the abscess cavity; in this many amœbæ were found. Next, a reticular layer also containing amœbæ; deeper, granulation tissue containing connective tissue cells and swollen fatty liver cells, and deeper still, firmer fibrous tissue showing compressed liver cells, distorted bile ducts, amœbæ lying both free and in the capillaries. (See Figs. 2 and 3.)

4. Sections of the thrombus, which was partly organised, showed fairly numerous amœbæ and some fragments of degenerated liver cells. (See Fig. 4.)

Amœbæ.

In addition to the above-noted situations, the amœbæ are found, during life, in the sputum and in the fluid removed from an abscess. It should be carefully noted, however, that they are seldom found in the fluid first removed; this is a fact not generally known, and from a failure to find amœbæ in fluid removed by aspiration it has often been erroneously concluded that they were not present in the abscess. After an abscess has been opened the discharge should be carefully examined at each dressing, especially when the drainage tube contains fragments of necrotic material. Certain precautions are necessary in the treatment of specimens to ensure detection of the amœbæ, as they rapidly disintegrate, especially in fluids. Cunningham long ago pointed out that in dysenteric stools they are only found when the reaction is alkaline, and as the reaction becomes acid they disappear often within an hour; fluid removed by aspiration should be placed in a sterilised tube, kept at about 80° F., and examined as soon as possible. If film preparations are made they should be at once fixed with perchloride of mercury or other reagent.

Portions of the liver removed should be at once placed in saturated solution of perchloride of mercury, or if this is not available in absolute alcohol. If this is done the amœbæ are perfectly preserved and easily recognised. Some of the sections of which photographs are shown were made from portions of the liver which had been kept in spirit for over two years.

The fluid removed by aspiration in the case quoted above was carefully examined for organisms, but none were discovered. Gelatine and agar tubes were inoculated, but remained sterile, and no amœbæ were found. The fluid consisted chiefly of granular detritus, fragments of chromatin, pigment granules, and a few blood corpuscles. These characters of the fluid show it to be the result of the necrotic process ascribed to the influence of the amœbæ. Films made from the discharge at later dressings showed the cellular detritus, fragments of liver cells, pus cells, blood corpuscles, and some amœbæ.

The size of the amœbæ varies from 10 μ to 40 μ , usually 24 μ to 30 μ .

Their shape is generally circular, but sometimes oval. By careful focussing the surface is seen to be markedly convex when entire. That they are of considerable thickness is shown by the fact that with the microtome successive sections of the same amœba can be made. They are not flattened discs, but globular masses (see Figs. 2, 3, 4, 5).

They are bounded by a well-defined capsule or ectosarc, which is often seen to be doubly refractile; this gives them the well-defined outline which renders them easily distinguishable, even under a low power, from most other

structures. The interior presents a granular appearance, and in some of the smaller amœbæ this granular material occupies the whole of the space; but some of the larger ones show a well-marked nucleus, or "contractile vesicle," while others do not. Almost all contain well-marked "vacuoles," which vary very much in size, some occupying almost one-third of the space, others being quite minute.

As a result of his work on living specimens Cunningham maintained that there was a true spore formation, though this is of course opposed to all accepted ideas of the mode of reproduction of the monadina, it is a point open to question if these so-called "vacuoles" do not represent sporocysts. In some of the specimens examined the "vacuoles" could be clearly seen becoming extruded through the ectosarc, an appearance quite distinct from the ordinary extension process. (Fig. 5.) The larger amœbæ often contain red blood cor-

Fig. 5.—Amœba in wall of liver abscess.

puscles. These are well seen in specimens stained with eosin and methylene blue. They are said often to contain micro-organisms, but this is not usual. In the accompanying photographs it should be noted that though micro-organisms are in parts numerous, not a single amœba contains any.

How do the amœbæ effect an entrance to the liver? They are so frequently found in the blood vessels (see illustrations) that it can hardly be doubted they reach the liver by the portal circulation. It has however been maintained by certain observers that the path is through the wall of the intestine into the abdominal cavity and so to the liver.

Fig. 2. At the edge of the abscess the amœbæ were often found to be surrounded by bacilli, which morphologically and in their staining properties were identical with the *B. coli*. There were also staphylococci and streptococci, and some cocci single and in short chains which stained with Gram's method.

Consideration of the case described above only confirms what most men practising in India have learnt from painful clinical experience—namely, that a man who has suffered from abscess of the liver and apparently recovered, is still in danger of recurrence, especially if he stays in a tropical climate or returns to it too soon. The importance of the presence or absence of amœbæ, which may be definitely settled by repeated examinations of the discharge after an abscess has been opened, depends on the fact that in the cases in which they are present there is a greater tendency to recurrence owing to the serious and widespread damage to the liver tissue associated with their presence. Moreover, in any case of abscess of the liver the knowledge that a large cavity in the liver, surrounded by a firm fibrous capsule, takes at least a year or more to completely cicatrise, should be sufficient to make us use every means in our power to prevent these patients running the risk incurred by returning to a dangerous climate for at least two years after the abscess has been opened.

NOTE.

¹ The clinical history and an account of the first operation were published by Dr. Byrom Bramwell and Mr. Stiles in the *Lancet*, September 12th, 1896.

THE Duke and Duchess of York have arranged to open the new Homes of the National Society for the Employment of Epileptics, at Chalfont St. Peter, on Friday, June 23rd, instead of June 22nd as previously announced.