An Address

ON

SURGICAL ASPECTS OF SUBPHRENIC ABSCESS.

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DEFINITION.

For the purposes of this paper any localized collection of pus which is in contact with the under surface of the diaphragm is called a subphrenic abscess.

It is not always customary to include hepatic abscesses under the heading of subphrenic, but inasmuch as they frequently thin out the hepatic substance so that their entire upper boundary is formed by the diaphragm, and they then develop along similar lines, and require like treatment, there appears to be no good reason why they should not be classed as subphrenic abscesses as they certainly are.

THE ANATOMICAL SUBDIVISIONS OF SUBPHRENIC ABSCESSES, WITH THEIR SPECIAL ETIOLOGY, SIGNS AND SYMPTOMS, AND TREATMENT.

The chief object of this paper is to emphasize the importance of the anatomical subdivisions of subphrenic abscess.

The under surface of the diaphragm is marked out into

Fig. 1.—From a specimen in the London Hospital, Pathological Department, showing how hydatids and abscesses of the liver become "Subphrenic." H, Hydatid. L, Liver. D, Diaphragm.

four peritoneal spaces and two cellular ones (Fig. 2). The four peritoneal spaces are separated from one another by the cruciform arrangement of the ligaments of the liver—namely, the coronary, falciform, and the right and left lateral ligaments. The falciform ligament divides the subphrenic space into two parts, right and left. Each of these is again subdivided into a larger anterior and a smaller posterior part by the corresponding lateral ligament. The four peritoneal subphrenic fossae may therefore be classified and named as follows:—

A. Intraperitoneal:

- I. Right. 1. Anterior.
2. Posterior.
- II. Left. 3. Anterior.
4. Posterior.

The two extraperitoneal cellular spaces are also right and left, so that the classification may be completed—

B. Extraperitoneal:

5. Right.
6. Left.

A right extraperitoneal subphrenic abscess is between the layers of the coronary ligament, which it separates and opens out, whilst the left originates in the perinephric tissues around the upper end of the left kidney, and afterwards strips the peritoneum off the under surface of the left dome of the diaphragm.

These spaces, and their corresponding abscesses, will now be defined in more detail.

1. A Right Anterior Intraperitoneal Subphrenic Abscess.

Anatomy.—This abscess is situated between the upper surface of the right lobe of the liver below, and the dome of the diaphragm above. The falciform ligament limits it towards the middle line, whilst behind it passes back to

the right lateral ligament of the liver. In front it is shut off from the peritoneal cavity by a line of adhesions which varies somewhat in position. When the appendix infects the cavity from the outside and behind, the anterior margin of the liver becomes adherent to the diaphragm in front, and forms the lower boundary of an abscess which occupies the upper and posterior part of the fossa, and incidentally it may be pointed out that these adhesions prevent the liver from descending as the abscess grows.

When, however, the fossa is infected from below and in front by a perforating gastric or duodenal ulcer, the line of adhesions is, as a rule, formed by the great omentum and transverse colon, and the whole of the fossa is filled with gas and pus, whilst the liver is separated from the diaphragm and pushed upwards and backwards.

This fossa has very important connexions at its posterior and outer part, where it communicates round the margin of the liver and round the extremity of the right lateral ligament with the subhepatic pouch which we are about to describe, whilst at the same point it is in continuity with the right lumbar fossa, which lies between the caecum and ascending colon and the loin.

These connexions are of great importance, for not only does infection usually reach both these fossae from the appendix (Fig. 3) along the right lumbar pouch, but also pus which has originated in the fossa from the liver, stomach, or duodenum, may afterwards spread to its two connexions and pass down the loin into the pelvis. This association should be recognized and anticipated, and prevented by a loin incision when it threatens. I have notes of such a case in which the right anterior subphrenic abscess was due to a perforating pyloric ulcer. It was drained from the right hypochondrium, but subsequently

Fig. 2.—Diagrammatic view of the upper surface of the liver exposed by removing the diaphragm. C.L., Coronary ligament. F.L., Falciform ligament. R.L., Right lateral ligament. L.L., Left lateral ligament. 1., Right anterior intraperitoneal space. 2., Right posterior intraperitoneal space or subhepatic fossa (note it crosses the middle line to the left under liver margin). 3., Left anterior intraperitoneal space. 4., Left posterior intraperitoneal space or small sac of peritoneum. 5., Right extraperitoneal space. 6., Left extraperitoneal space.

spread insidiously to the subhepatic pouch and down the loin to the pelvis, and led to the death of the patient three weeks after the operation.

Incidence and Associations.—Right anterior subphrenic abscess occurred 27 times in 76 cases at the London Hospital. In 11 cases the abscess was simple, and in 15 cases one other fossa was involved: in 9 cases the right posterior intraperitoneal fossa, in 4 the right extraperitoneal subphrenic space, and in 2 the left anterior fossa. In 1 case two other fossae contained pus—namely, the small sac of the peritoneum and the right extraperitoneal cellular space. It is therefore clear that in every case where a right anterior subphrenic abscess has been opened these other fossae, but especially the subhepatic fossa, should be examined daily, lest pus should insidiously collect in them.

Etiology.—The causes of the 27 abscesses in this group were as follows:

10 Appendicitis	...	One of these had pylophlebitis (q.v.)
7 Liver abscesses	...	3 suppurating hydatid.
		1 tropical abscess.
		1 pylophlebitis due to appendicitis.
		1 suppurative cholangitis due to gall stones.
		1 cause not found.
4 Perforated gastric ulcers.		
2 Anterior perforating duodenal ulcers.		
1 Ruptured intestine.		
1 Pyosalpinx.		
1 Pyæmia.		
1 Gallstones; this case had suppurative cholangitis (q.v.)		
1 Followed pneumonia.		
1 No cause was found.		

In nearly all cases due to appendicitis the appendix was external in position and occupied the right lumbar fossa, but in one case the tip of the appendix reached to the subhepatic fossa, and in another lay between the liver and the diaphragm. Other causes are stated to be ruptured liver, pancreatitis, and cancer of the pylorus and colon.

Special Signs and Symptoms of Abscess in the Right Anterior Subphrenic Space.—Clinically this abscess occurs in three forms:

1. Simple infection from behind.
2. Infection from in front.
3. Infection combined with the subhepatic pouch.

In the first of these forms (Fig. 4), in which the cause is nearly always appendicitis, the liver is firmly adherent to the diaphragm in front, and the pus is localized at the upper and back part of the recess. As the abscess grows it expands the diaphragm above, and gives rise to well-marked signs of compression and inflammation at the right base. The signs in the right hypochondrium and epigastrium are very slight, if any, because the liver cannot descend. Local signs will be present as usual in proportion to the size of the abscess.

In the second class of cases (Fig. 5) a gastric or duodenal ulcer has usually perforated, and free gas has escaped into the peritoneum. The liver becomes separated from the diaphragm and drops upwards and backwards,

Fig. 3.—Illustrating the spread of suppuration from an external appendix, A, up the right lumbar fossa, R L F, to the liver margin, where it infects 1, the right anterior intraperitoneal space, and 2, the subhepatic fossa. From the latter suppuration is shown invading 4, the small sac of the peritoneum through the foramen of Winslow, a rare event.

The abscess in typical cases presents, in the hypochondrium and epigastrium, as a triangular area, bounded by: (1) The costal margin. (2) A line joining the ensiform cartilage to the umbilicus. This margin is due to the falciform ligament, and is convex to the left, because the ligament is pushed over by the abscess. (3) Below a band of rigidity and tenderness stretches from the umbilicus to the lower costal margin. It is 1 in. or 2 in. wide, and is placed over the limiting adhesions and peritonitis. The area of the triangle in a fully-formed case bulges forwards, fluctuates, and is not very tender. Above, in the epigastric angle, signs of a gas bubble can usually be found where liver dullness should be present. It is circular in outline, hyper-resonant, amphoric sounds are heard over it, and it passes round the side to the back as the patient is rolled over.

In the third class of cases (Fig. 6), which are usually also appendicular, both intraperitoneal fossae on the right side are simultaneously infected. The liver is adherent to the diaphragm, as in the first class, but the subhepatic abscess bulges forward from below its margin, and forms an abdominal swelling, occupying the right hypochondrium and running back into the loin as low as the iliac crest. In short, the signs of a subhepatic abscess are simply superadded to those described under Class 1.

The Treatment of Right Anterior Intraperitoneal Subphrenic Abscesses.—In appendicitis, when the infection is recent and the abscess is diffuse, the right loin incision should be employed. In recent cases due to perforated gastric and duodenal ulcers which present in the epigastrium, an anterior incision should first be made, and when the perforation has been closed a counter opening may be made in the loin. When the abscess has become well localized after ten or fourteen days it is better to drain it by the posterior transpleural or subpleural method, whether it presents in the epigastrium or not, if the exploring needle can find pus in the lower intercostal spaces behind. The liver should be pressed up by an assistant, so as to close the pleural space, whilst the pleura is incised. Where the exploring needle fails to find pus behind, and an epigastric swelling is present, the anterior epigastric incision should be employed, and the peritoneum opened as high up as possible in the subcostal angle.

2. A Right Posterior Intraperitoneal Subphrenic Abscess.

Anatomy.—The fossa in which this abscess forms is better known as the subhepatic pouch or the right renal fossa. It is a pyramidal space transversely disposed beneath the overhanging margin of the liver. Its base and most capacious part rests against the right lateral

Fig. 4 shows the abdominal signs in the posterior or appendicular variety of right anterior intraperitoneal subphrenic abscesses. The liver, L, does not project nor move on respiration, because its lower and anterior part, A, is adherent to the diaphragm. If a right lumbar abscess, R L A, is present there will be tenderness and rigidity in the flank. The pus is localized in upper and back part of the fossa, R A I A, and gives signs at the right base, R B.

abdominal wall, projecting just below the last rib. The apex is formed by the upward slope of the margin of the left lobe of the liver. The liver and gall bladder are its anterior boundaries throughout. The posterior wall is divided into a right and left part by the projection forward of the lumbar vertebrae in the middle line. The right part of the fossa is capacious, and will hold about a pint of fluid before it escapes below. Its posterior wall is formed by the upper part of the right kidney, and by the lower part and crus of the diaphragm, and towards the left by the common bile duct and duodenum. It is here that the foramen of Winslow leads into the left posterior intraperitoneal fossa (see Fig. 3). To the left of the middle line the fossa is a narrow cleft between the left lobe of the liver in front, and the small omentum and upper and anterior surface of the stomach behind. Above the subhepatic fossa is bounded to the right by the right lateral ligament of the liver and to the left by the transverse fissure. Below the boundary is formed on the left by adhesions between the margin of the liver and the anterior surface of the stomach, and on the right by similar adhesions of the great omentum and transverse colon to the margin of the liver and the anterior abdominal wall. This fossa is continuous at its base with the right lumbar pouch and with the right anterior subphrenic space. At the middle of its posterior wall the foramen of

Winslow connects it with the small sac of the peritoneum, whilst its apex is but feebly shut off from the left anterior subphrenic space (see Fig. 2).

Incidence and Associations.—In 76 cases this fossa contained pus in 10, and always in association with some other pouch—in 9 cases with the right anterior subphrenic space, and in 1 case with the left anterior subphrenic space.

Etiology.—The causes of suppuration in this fossa in the 10 cases which occurred out of 76 subphrenic abscesses at the London Hospital were as follows:

- 6 Appendicitis.
- 1 Gastric ulcer.
- 1 Duodenal ulcer.
- 1 Pneumonia.
- 1 Bronchiectasis.

Other causes are liver abscess and suppuration in connexion with the gall bladder and bile ducts, especially after operative procedures.

The signs that the subhepatic fossa is involved in suppuration are diffuse tenderness and rigidity spreading from below the right costal margin, and running downwards and backwards into the right loin, usually as low as the iliac crest (see Fig. 6). As this abscess has so great a tendency to be combined with others, the signs of a right lumbar

Fig. 5.—The abdominal signs in the anterior or gastric or duodenal variety of right anterior intraperitoneal subphrenic abscess. The abscess produces the "diagnostic triangle" in the right epigastrium. F, Falciform ligament bulging to the left. A, Band of adhesions from umbilicus to costal margin, broad, tender and rigid. CM, Costal margin. P, Pus in contact with abdominal wall bulging, fluctuating, dull, scarcely tender. G, Gas bubble over liver dullness causing tympanitic, amphoric, and coin sounds, moves round chest as patient is rolled over.

abscess, or of a right anterior intraperitoneal subphrenic abscess, must be looked for in addition.

Treatment.—This abscess is best drained by a loin incision as far back and high up as possible below the last rib. The index finger guides the drainage tube transversely below the liver. Should the signs at the right base indicate the presence of pus under the dome of the diaphragm, the index finger should be inserted between the liver and the diaphragm, and a long tube passed up into the right anterior intraperitoneal subphrenic space.

3. A Left Anterior Intraperitoneal Subphrenic Abscess.

Anatomy.—This is also known as an anterior perigastric abscess, or a perisplenic abscess (Fig. 7). This fossa is bounded by the diaphragm above. The left lobe of the liver is below and to the right. The spleen is to the left, whilst adhesions of the anterior surface of the stomach and the great omentum with the abdominal wall limit it below. To the right it is sharply bounded by the falciform ligament. Behind it runs back as far as the left lateral ligament of the liver. This fossa is continuous to the right with the subhepatic pouch below the left margin of the liver, and below with the left lumbar pouch, which lies between the descending colon and the loin. Another fossa, which I believe has not been previously described, connects it with the pelvic fossa. It lies deeply in the left lumbar recess (Fig. 8). To the right it is bounded by

the vertebral column. The descending colon bounds it to the left, whilst it is roofed in by the back of the mesentery. Below, over the left sacro-iliac joint, it communicates with the recto-vesical or recto-uterine pouch. Above it runs up to the duodenal-jejunal flexure, and there the pus passes forward in the splenic flexure to reach the left anterior subphrenic space. A narrow chain of pus can always be found in this situation in cases of general peritonitis when the mesentery is turned upwards and to the right, and this fossa is the line of infection when an ordinary pelvic appendix abscess is followed by an insidious subphrenic abscess on the left side, as in the case of Fitzpatrick, illustrated by Fig. 9.

CASE I.

This man was admitted under my care at the London Hospital in January, 1903, on the seventh day of the disease, suffering from a localized pelvic appendix abscess. Pus was found in an enema the same evening, but as the symptoms did not diminish, the abscess was opened by a suprapubic incision next day, and the abscess was drained by a large tube passed down into the pelvic pouch.

His progress during fourteen days was not satisfactory. His tongue was dry and cracked, he had profuse diarrhoea, he wasted rapidly, and his temperature was persistently raised to 100° to 101° F. No signs could, however, be discovered at the right base or in the lower part of the abdomen. After

Fig. 6.—The abdominal signs when a right anterior intraperitoneal subphrenic abscess is combined with a subhepatic abscess, as often occurs in appendicular cases. The former, RAIA, produces signs of compression and inflammation at the right base, RB. The latter, SA, produces a triangular swelling below the liver margin, limited towards the abdomen by a band of tender rigid adhesions running from the ensiform, E, back into the right loin, usually as low as the iliac crest, IC. Pus or gas are sometimes found in contact with the abdominal wall within the triangle.

fourteen days a large swelling was found in his left hypochondriac region, exhibiting all the signs shown in Fig. 11. This swelling was incised high up in the left epigastrium, and much stinking gas and pus was evacuated from the left anterior intraperitoneal space. He appeared better after this operation, but two days later he suddenly coughed up, with profound collapse and fright, a large quantity of most foul pus and flatus apparently from a left empyema, but no amount of needling could find the pus in the large area of dullness at the left base. After he had evacuated similar material on several occasions, he convalesced and entirely recovered.

I believe this infection spread by the left internal lumbar fossa, for on nearly every day the loins had been examined for a spread of infection, and none could be discovered external to the descending colon.

Incidence and Associations.—The left anterior intraperitoneal subphrenic fossa was involved in 30 of 76 cases of subphrenic abscess at the London Hospital, and of these 26 were simple. In 3 cases one other fossa was involved; in 2 cases the right anterior intraperitoneal, and in 1 case the small sac of the peritoneum. In 1 case two of the other pouches contained pus, namely, the subhepatic pouch, and the right extraperitoneal cellular space.

Etiology.—The causes of suppuration in the 30 cases of left anterior subphrenic abscess were as follows:

- 16 Gastric ulcer.
- 3 Pyaemia and splenic infarct.
- 2 Cancer of stomach.
- 2 Resections of 1 stomach; 1 transverse colon.

- 1 Anterior perforating duodenal ulcer.
- 1 Appendicitis via pelvic abscess and left internal lumbar fossa.
- 1 Typhoid.
- 1 Parturition.
- 1 Hydatid of liver.
- 1 Cancer of pancreas.
- 1 Bronchiectasis, via a liver abscess.

Special Signs and Symptoms of a Left Anterior Intraparietoneal Subphrenic Abscess.—The previous history is very frequently one of dyspepsia, pain after food, vomiting with relief, and perhaps haematemesis. The onset is usually due to a subacute or chronic perforation of a gastric ulcer. The signs of compression, and inflammation of the base of the left lung and pleura are usually present. They are sometimes bilateral. The local signs over the abscess call for no special comment, except that gas is nearly always present.

An abdominal swelling is nearly always present in this variety, and in fully developed cases is very characteristic (Fig. 11). It occupies a triangular area in the left epigastrium and hypochondrium. Above it is limited by the costal margin on the outer side. Its inner margin stretches from the ensiform cartilage to the umbilicus, and is more or less convex to the right according to the size of the abscess. This is of course the bulging falciform ligament. The lower margin stretches from the umbilicus to the lower part of the costal margin. It is a broad, tender, and rigid band, and corresponds to the limiting peritoneal adhesions. The area of the triangle

Fig. 7.—An anterior perigastric abscess occupying the left anterior intraperitoneal space and the apex of the subhepatic fossa, through which pus might readily spread across the middle line to the right.

bulges forward, may fluctuate and be dull on percussion, and is not very tender. At the upper angle where the gas collects as the patient lies on his back, a tympanitic rounded area can be made out where liver dullness should be. Where much gas is present the whole of the triangle is tympanitic, and amphoric and coin sounds can be obtained. When the patient is rolled over, the swelling becomes dull on percussion, and the signs of a collection of gas pass under the left ribs, which were previously dull. Where the quantity of gas is not excessive, the lower part of the triangle is dull even in the supine position.

In those cases in which the abscess has burst into the stomach and freely communicates with it through a large opening, the signs are much less obvious. The abscess is never distended. The temperature is therefore very irregular and often reaches normal. The abscess often contains at one time gas and at other times fluid, so that the signs vary frequently. In some of these cases no abdominal swelling is present, but, as a rule, a rigid, tender tumour, which does not move on respiration, projects from below the left ribs. Sometimes the abscess lies between the liver and the stomach, and the former is found, as usual, in the epigastric angle. These cases are prone to spread to the right beneath the liver margin, and may then track down the right loin. In splenic cases the abscess at first occupies the deep posterior recess of the fossa around the spleen, and the anterior part of the space is obliterated by adhesions; but in nearly all cases the pus at last reaches the epigastric angle and produces a typical swelling.

Treatment.—In the acute and diffuse stage, soon after perforation it is usual to open the abdomen in the middle line and close the perforation. Practice then differs. The abdomen is sometimes sponged out and closed altogether. In other instances a drainage tube is passed into the pelvic fossa through a puncture above the pubes, and the patient is sat up in Fowler's position. Others drain from the anterior incision. I prefer to make a counter-opening in the left loin and pass a tube up to the spleen, and then adopt the Fowler position and the pelvic drain. When the abscess has become localized and points in the epigastrium, it should be opened by a left epigastric incision as high up as possible in the costal angle. A large tube,

irrigation, suction, and position are then usually enough to ensure efficient drainage. Otherwise the abscess may be counter-opened by the posterior transpleural method, guided by a finger in the cavity.

When the abscess has not extended forward to the front, it is nevertheless well to explore it from the epigastrium, and then open it by the posterior transpleural method above the adhesions, avoiding the spleen. The lateral subpleural method is suitable to some of these cases, or a posterior loin incision may be made, and a finger passed up through the adhesions to the spleen, after the general peritoneal cavity has been packed off.

4. A Left Posterior Intraparietoneal Subphrenic Abscess.

Anatomy.—This sac is better known as the small sac of the peritoneum (Fig. 12). At the left extremity of this cavity one surface of the spleen abuts upon it. Even anatomically this pouch extends no lower than the transverse colon, and when peritonitis is present adhesions encroach still further on the space below and drive the pus into the upper and back part of the cavity, where it

Fig. 8 shows the spread of pus from a pelvic appendicular abscess, PA, up both loins to the subphrenic spaces. The right side has already been described under Fig. 3. Up the left side the pus may either pass by the left iliac fossa, LIF, and the left external lumbar fossa, LELF, or it may follow the left internal lumbar fossa, LILF, and reach the subphrenic space at the splenic flexure. RE and LE represent empyemata; RLI, right loin incision; LLI, left loin incision; M, mesenteric attachment.

lies behind the upper and back part of the stomach and small omentum and the liver. Above it is prolonged upwards into a narrow pouch which lies between the posterior surface of the Spigellian lobe and the crus of the diaphragm. The upper part of the posterior wall covers the pancreas, and the upper part of the left kidney, and suprarenal.

To the right this cavity communicates through the foramen of Winslow (see Fig. 3) with the subhepatic pouch, but this communication is so narrow that as a rule it is sealed at the first outbreak of inflammation, and as a consequence infection seldom enters the smaller sac from the subhepatic fossa, nor does it spread in a contrary direction.

Incidence and Associations.—Among the 76 cases of subphrenic abscess the lesser sac was involved in only three instances. In one an anterior perigastric abscess was also present, and in another a right extraperitoneal, and in addition a right anterior intraperitoneal abscess occurred as well.

Etiology.—Of the 3 cases of suppuration in the lesser sac of the peritoneum, 2 were due to posterior perforating

gastric ulcers. One case was due to a cholecystitis, due to gall stones, which after many years' duration produced suppuration in the glands of the small omentum. From the locall of pus the small sac of the peritoneum was infected. It bulged forward between the liver and the stomach, and was opened in the epigastrium, and marsupialized, but at the same time the bile duct became infected, and suppurative cholangitis led to the formation of an abscess between the layers of the coronary ligament, and another in the right anterior intraperitoneal subphrenic space.

Injuries and Inflammation of the Pancreas.—It is said that *appendicular suppuration* may reach the lesser sac through the foramen of Winslow from the subhepatic pouch. *Tuberculous peritonitis* may become localized in this cavity (Osler). It may be infected from the liver, especially if the *Spigelian lobe* is diseased. Finally, infarcts and abscesses in the *spleen* may spread to the lesser sac of the peritoneum.

The Signs and Symptoms of an Abscess in the Small Sac of the Peritoneum.

When the small sac of the peritoneum is the seat of inflammation and suppuration, its cavity is more or less obliterated by adhesions. The abscess may therefore completely distend the sac, as was found in one of my cases; or, on the other hand, a small collection of pus may be shut in between the Spigelian lobe and the spine, in the extreme upper part of the pouch, a condition which occurred in another of my cases. When the whole sac is filled with pus the signs are similar to those of pseudo-pancreatic cysts. The swelling may project forward between (1) the stomach and liver, (2) between the stomach and transverse colon, (3) between the stomach and spleen, or (4) below the transverse colon. When the cavity of the sac is almost entirely obliterated by adhesions, and more especially when the abscess communicates freely with the stomach, the diagnosis is more difficult. Signs may or may not be present at the left base of the lung. The exploring needle may give definite results, but it is hard to hit a small collapsed cavity in so deep a situation. A careful consideration of the history and of the general signs of suppuration, combined with the exclusion of the presence of pus elsewhere, may justify an exploratory incision.

Treatment.—When the abscess points in front it should be cut on and marsupialized and drained, a method which was followed in one of my cases. Posterior perigastric abscesses should be explored from the front, and drained from behind by a loin incision or the posterior transpleural route. The pouch between the Spigelian lobe and the spine must be nearly inaccessible.

5. A Right Extraparitoneal Subphrenic Abscess.

Anatomy.—This abscess forms in the cellular space between the layers of the coronary and other peritoneal ligaments of the liver. (See Fig. 2.) The largest part of this space is on the upper and back part of the liver. It is continued forward between the layers of the falciform ligament to the epigastrium, where it is connected with the deep lymphatics of the abdominal wall which accompany the superior epigastric vessels through the diaphragm to the anterior mediastinal glands. I have seen an abscess between the layers of the falciform ligament, which originated apparently by this route from an appendicular sinus burrowing in the abdominal wall. To the left the cellular tissue of the coronary ligament is continuous with that

contained in the left lateral ligament as far as the oesophagus. To the right there is a similar extension between the layers of the right lateral ligament. Behind, the subphrenic cellular space is continuous with the retroperitoneal cellular tissue, and by this route infection reaches it from the right kidney, posterior surface of the duodenum, and retrocolic appendix cases. Hepatic abscesses very frequently extend up into this cellular space, thinning out the liver substance over them, until they touch the diaphragm and occupy the whole of the space. (See Fig. 1.) When an abscess forms and grows in the right extraperitoneal subphrenic space it expands its dimensions enormously, pushing the peritoneal reflexions on the liver further and further back, and the liver itself lower and lower in the abdomen. This is very different from the right anterior intraperitoneal abscess, in which the liver becomes adherent to the diaphragm early in the process, and cannot afterwards be pushed down, so that the abscess must expand the dome of the diaphragm upwards into the chest.

A right extraperitoneal subphrenic abscess may extend forward between the layers of the falciform ligament until it points in the middle line of the epigastrium, where it may be incised without opening the peritoneum. (Fig. 13.) In other cases the pus may present below the last rib; more usually, however, it perforates the diaphragm above. It is stated that this form of abscess may extend directly under the external arcuate ligament to the posterior mediastinum. Lymphatic extension may involve either pleura, and it is said that both pleurae are more often involved than in the intraperitoneal form of subphrenic abscess. The pericardium, curiously enough, is seldom involved.

Incidence and Associations.

Of 76 cases of subphrenic abscess at the London Hospital, 19 were in the right extraperitoneal cellular space. In 4 cases another abscess was present in the right anterior intraperitoneal space. In 2 cases two other abscesses were present. In one the small sac of the peritoneum was involved, and the right anterior peritoneal space. In the other the subhepatic pouch and the left anterior intraperitoneal space.

Etiology.—The causes of infection of the cellular tissue between the liver and the diaphragm may be divided into four groups. The 19 cases in this series of 76 were arranged as follows, and other possible causes are added in their appropriate places.

I. Liver:

- 7 Suppurating hydatids.
- 6 Tropical abscesses.
- 1 Liver abscess of unknown origin.
- 1 Cholangitis from suppurating hepatic glands from gall stones.
- Pylephlebitis, and pyaemia.
- Actinomycosis.
- Ruptured liver.

II. Right retroperitoneal cellular tissue:

- 1 Congenital cystic kidney.
- Other renal abscesses and perforations of the ureter.
- 1 Posterior perforating duodenal ulcer.
- Retrocolic appendicitis.
- Acute periostitis of lumbar vertebrae.
- Perforation of the common bile duct in its lower part.
- Suppuration in the head of the pancreas.
- Wounds and lymphatic infections.
- Colonic ulcers and cancer.

Fig. 9.—Illustrating the case of Fitzpatrick, in whom pus travelled from the rectum to the mouth with ultimate recovery. A, Appendix. PA, Pelvic abscess. SI, Suprapubic incision. LILF, Left internal lumbar fossa. LSA, Left subphrenic abscess. LE, Left empyema. T, Trachea discharging pus and flatus. LEI, Left epigastric incision.

III. Thoracic:

- 1 Bronchiectasis.
- Abscess of lung.
- Empyema.
- Actinomycosis.

IV. Lymphatics of the anterior abdominal wall:

- 1 due to appendix sinus.

The Signs and Symptoms of Right Extraperitoneal Subphrenic Abscess.—The previous history will be that of the cause, which in many cases is some disease of the liver. The signs of the abscess are not preceded by those of perforative peritonitis, as is usually the case in intraperitoneal forms. The onset is therefore more often insidious and indefinite, and jaundice is often an early symptom. Signs of compression and inflammation are found at the base of the right lung, and sometimes also on the left side. The liver is pushed down from below the costal margin, often as low as the umbilicus, and it moves on respiration (see Fig. 13). The tumour so formed may be tender, but there is not the same rigidity and signs of peritonitis which are found in intraperitoneal forms. This abscess may pass forward between the layers of the falciform ligament and present in the epigastrium as a fluctuating swelling. In rare instances it may reach the tissues of the right loin and present there. This abscess seldom contains gas.

Treatment.—When the abscess points in the epigastrium it should be opened there by an incision strictly in the middle line. In two of my cases I was able to reach the abscess without opening the peritoneum. With a large drainage tube, irrigation, suction and position, counter-drainage is seldom necessary. If the abscess does not point in front, it will probably be diagnosed by puncture between the ribs behind, over the area of dullness. The rule is then to follow the needle and adopt the posterior transpleural method. Should the pus point in the right loin, the abscess should be opened there and a tube be passed up into the subphrenic space.

6. The Left Extraperitoneal Subphrenic Abscess.

Anatomy.—The retroperitoneal cellular tissue is as abundant in the left loin as it is on the right side. It contains the left kidney and suprarenal body, the pancreas, descending colon, and the left lumbar lymphatic glands. There is, however, no large cellular space below the diaphragm upon the left side equivalent to that upon the right. For this reason, when suppuration does occur in the left retroperitoneal cellular tissue, it shows a much stronger tendency to appear in the loin as a left lumbar abscess. In a few cases, however, such an abscess strips the peritoneum from the under surface of the diaphragm on the left side, and forms a large collection there.

Incidence and Associations.—This has occurred four times in 76 cases of subphrenic abscess at the London Hospital, and in none of these cases was any other subphrenic abscess present.

Etiology.—The cause in two of these cases was acute periostitis of the transverse process of the first or second lumbar vertebra. The third case originated in a localized empyema at the left base. The fourth was probably due to a posterior perforating gastric ulcer, and Mr. Mayo Robson has described a similar case.

Other causes are similar to those narrated on the right side under the headings of Retroperitoneal Cellular Infections and Thoracic Infections.

The Signs and Symptoms of Left Extraperitoneal Subphrenic Abscess.—The signs are those of an abscess pointing in the left lumbar region, associated with compression and inflammation at the left base of the lung. In cases which have been overlooked the pus may reach the left iliac fossa.

Treatment.—A left loin incision over the swelling will efficiently drain the pus away.

PATHOLOGY.

The under surface of the diaphragm is subdivided into four peritoneal fossae and two cellular spaces. Infection of one or more of these can be produced by the passage of micro-organisms from the viscera which lie in them, or by extension to them from fossae which are in continuity with them.

Abscesses which occupy the four peritoneal fossae are examples of localized peritonitis. Pathologically they originate as acute infections of the peritoneum. A

profuse but diffused exudation of serum is poured into the fossae, accompanied by the symptoms of acute peritonitis. After a day or two the serum becomes turbid with leucocytes. The stomata in the peritoneum become blocked by proliferation of endothelial cells, and by leucocytes forming a layer of lymph over them and limiting absorption. The margins of the area of infection begin to be defined about the fourth day by a living lymph barrier which localizes and contains the forming abscess. At first the purulent contents are diffused in the irregular spaces and cracks between the organs, but as the lymph barrier converges and contracts upon it, gluing the organs firmly together, the pus is driven into one more or less rounded, well-defined collection. This change is not complete until about the end of fourteen days. This change from a diffuse exudation about the fourth day to a localized abscess from the eighth to the fourteenth day has important practical applications. The transpleural method of drainage, in which a hole is made through the diaphragm into the abscess from above, is most unsuitable for the treatment of the early and diffuse stage of subphrenic suppuration. An abdominal incision (usually in the loin) should be employed in such cases, and a long tube should be passed under the diaphragm from below. At a later stage, when the abscess is well shut off under the diaphragm, the abdominal route is less suitable, for in the first place the liver may be torn in separating it from the diaphragm (see Fig. 16), or some hollow viscus may be opened; or, on the other hand, pus may be admitted to the general peritoneal cavity.

When the collection of purulent fluid is first localized about the eighth or ninth day beneath the dome of the diaphragm, it may be small in quantity, and deeply placed, far from the surface, and covered by important organs and cavities. The nature of all abscesses, however, is to increase in size. The diaphragm is driven upwards and outwards so that the lower part of the pleural cavity is obliterated, and often closed by adhesions, and the lung is pushed up. The viscera which bound the abscess cavity below are pressed downwards as far as their adhesions will permit, so that the abscess can now be opened at a lower and lower spot on the thoracic wall, should the transpleural operation be adopted, or it may even appear as a fluctuating swelling in the epigastrium directly beneath the abdominal wall. For these reasons it is often advisable to await the growth of a well-localized subphrenic abscess, from, say, the eighth to the fourteenth day. This evolution of a subphrenic abscess is best illustrated by pus in the right anterior intraperitoneal space (Fig. 16). When this follows an appendicitis, it is often at first a small localized collection about the size of a tennis ball, beneath the dome of the diaphragm on the right side, and opposite the sixth or seventh intercostal spaces in the line of the angle of the scapula, and covered by the lung. It cannot well be opened from below, for the liver would probably be torn in separating it from the diaphragm. If the transpleural route be adopted, the pleura must almost of necessity be opened about the seventh space, and the lung collapsed, and even then it may not be found possible to drag the diaphragm up to the chest wall, and fix it with stitches before opening the abscess. This actually happened in one of my early cases, in which I tried to evacuate a diffuse subphrenic collection by a transpleural route, after resecting the seventh rib in the scapular line on the fourth day. It is therefore better to wait three or four days until the abscess has spread down to the level of the ninth or tenth space, and has obliterated the pleural cavity, and pushed up the lung.

When the infection is in one of the two cellular spaces, the pathological processes which produce the abscess are those of lymphangitis and cellulitis. The lymph spaces of the cellular tissue become distended, first with serum, and then with leucocytes. The centre of the area of infection is liquefied, necrosed, and converted into pus. In the meantime the reaction of the tissues around has produced the granulation tissue barrier which demarcates and contains the collection of pus.

The Reason why Pus tends to Collect beneath the Diaphragm.

It is usually stated that the causes are the suction action of the thorax, especially during inspiration, and the

normal circulation of lymph from the peritoneum through the stomata of the diaphragm to the pleural cavities. The recent investigations of surgeons in connexion with the treatment of diffuse peritonitis have shown that the main cause of subphrenic accumulations is gravitation. As a patient lies flat upon his back in bed the posterior extremity of his subphrenic spaces are only separated from the mattress by the skin, the ribs, and the diaphragm, which together do not make up much more than $\frac{1}{2}$ in. of tissues. The pouch of Douglas, or the recto-vesical pouch in the male, in a similar way, are only separated from the mattress by the skin, the coccyx, and the width of the flattened rectum. Between these two dependent pouches the thick muscles and tissues of the loins, with the kidney and the perinephric fat, rise as two elevated mounds. When the general peritoneum is infected a profuse flow of serum is poured out, and this gravitates upwards into the subphrenic spaces, and downwards into the pelvic pouch. If the patient is well propped up on pillows, or is supported by an efficient bed-rest (Fowler's position, Fig. 14) this fluid will run from beneath the diaphragm over the loin mound into the pelvic pouch, from which it may be drawn off by a tube passed to the bottom of that fossa from a puncture above the pubes. This method is only effective in preventing subphrenic abscesses whilst the exudate is diffused. When it is shut in and localized special measures must be adopted to evacuate it.

The Micro-organisms found in the Pus of Twelve Subphrenic Abscesses.

The examination of the pus was carried out in the Pathological Department of the London Hospital by Dr. William Bulloch.

Sterile ...	...	...	3 cases.
<i>Bacillus coli communis</i> ...	...	...	3 "
<i>Staphylococcus aureus</i> ...	...	...	2 "
<i>Streptococcus</i> ...	...	...	1 case.
<i>Pneumococcus</i> ...	...	...	1 "
<i>Bacillus pyocyaneus</i> ...	...	...	1 "
<i>Bacillus typhosus</i> ...	...	...	1 "

Many other micro-organisms have been recorded by other writers.

The Bursting of Subphrenic Abscesses.

Twenty-three of 76 cases ruptured spontaneously. They were distributed as follows:

Into a bronchus ...	...	...	4 cases.
Into the pleura (right) ...	...	...	2 "
Into the pleura (left) ...	...	...	3 "
Into the general peritoneum ...	...	...	1 case.
Into the stomach ...	...	...	8 cases.
Into the intestine ...	...	...	1 case.
Into the colon ...	...	...	2 cases.
Through the skin, one at the umbilicus and another in the right hypochondrium ...	...	...	2 "

Some of these cases demonstrate the possibility of a natural cure, but experience shows how extremely rare this is.

The Age of 75 Cases of Subphrenic Abscess.

I have arranged 75 cases of subphrenic abscess in which the age was stated in decades, and the result is as follows:

0-10	10-20	20-30	30-40	40-50	50-60	60-70
6	5	29	15	13	6	1

The curve is no doubt due to the age incidence of the chief causes—namely, gastric ulcer, appendicitis, and hepatic suppurations, which, as already stated, account for two-thirds of the cases.

The Sex of 76 Cases of Subphrenic Abscess.

Of the series of 76 cases of subphrenic abscess at the London Hospital, 1900-7, 43 were males (56.6 per cent.), and 33 were females (43.4 per cent.), so that sex does not appear to exercise any great influence.

(To be continued.)

THE German Roentgen Ray Society will hold its fourth Congress at Berlin on April 26th under the presidency of Dr. Gocht of Halle. The principal subject on the programme is the value of radiography in the early diagnosis of pulmonary consumption; the discussion will be introduced by reports from Professors Rieder of Munich, and Krause of Jena. An exhibition, partly of a historical character, will be held in connexion with the Congress. The Secretary is Dr. Immelmann, 72, Lützowstrasse, Berlin, W. 35.

PRELIMINARY NOTE

ON

THE EXISTENCE OF AN ACUTE TUBERCULOUS FEVER IN INDIA WHICH HAS BEEN CONFUSED WITH CONTINUOUS AND REMITTENT FEVERS.

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THE common opinion of medical men in this country is that a good deal more light requires to be thrown on the remittent fevers of India. We get a number of cases which, for want of a better diagnosis, we call malarial or non-malarial remittent fever, simple continued fever, atypical typhoid, etc. Of late many attempts have been made to determine how many of these are Malta fever, or forms of paratyphoid. The writers have not been able to find that the latter two designations embrace a large number of the many cases of remittent or intermittent fevers that have shown no malarial parasites and have not yielded to the administration of quinine. Moreover, the cases do not show the marked symptoms of enteric or the signs of Malta fever. The writers maintain that a large proportion of the cases, now indefinitely classified, will be cleared up by the recognition of the cause as an acute invasion of the tubercle bacillus, and that this bacillus is found during the period of fever, and for a long time subsequently, to be excreted with the urine. The diagnosis, therefore, rests upon their detection in this fluid. The clinical signs after some experience will, however, enable the practitioner to make his diagnosis, as these signs are sufficiently well marked, even should he be without a laboratory to assist him.

There is a continued period of pyrexia of a remittent or intermittent type, lasting from a week to four weeks or more; the liver is often enlarged, the spleen not so; the bowels are constipated, generally obstinately. The abdomen shows some amount of meteorism, though this never reaches the extent seen in enteric fever. Vomiting and nausea are marked though not continuous. The most distinguishing feature of this fever is pain and tenderness in the epigastrium, and it is on this that special stress must be laid in order to assist in the differential diagnosis. Some cases have acute exacerbations of pain, others only tenderness, which, if it be associated with hepatic enlargement, makes the diagnosis from liver abscess very difficult; but the detection of tubercle bacilli in the urine clears up all doubt. The mind is clear, generally remarkably so, except that when the temperature is high there may be some delirium at night. It is interesting to note that patients after recovery give a very clear account of their illness, mentioning the temperatures and symptoms, thus contrasting with the mental confusion of the typhoid state—making the memory of the illness a blank. The initial enlargement of the spleen in enteric contrasts with the want of enlargement in acute tuberculous fever. The tongue is furred, but its condition does not remind one of the "typhoid tongue." The skin is dry and hot; there are no hectic or malarial sweats. The urine is highly-coloured and contains no albumen. The writers think that this fever is completely recoverable from, and also maintain that it marks the launching of the patient on a tuberculous career. It is the beginning of a long period of ill health of an indefinite kind—dyspepsia of a flatulent type, relapses of fever, periods of general depression with a temperature below normal if frequently and carefully taken, a loss in weight, and in some cases anaemia. This general malaise is not continuous; the condition is varied by periods of good health. Practitioners have been apt to consider this as due to Indian climate and conditions, and recommend a change to Europe or the hills; in fact, just the class of case that does improve under this treatment, and improve immensely, perhaps never to recur.

Another set of cases develop obvious tuberculosis—tubercle of the lungs, kidneys, etc. The initial acute