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Original Articles.

SUBPHRENIC ABSCESS.*

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A CONDITION which is the complication of a preceding disease possesses an unusual interest. A complication that may follow any abdominal surgical lesion, whether common or rare, demands attention; a complication that is seen but seldom must be recalled to memory lest it be overlooked on the rare occasions of its presence; a complication that when diagnosed offers large opportunity for cure is worthy of careful study. These three aspects appear in the condition known as subphrenic abscess.

Subphrenic abscess is rarely, if ever, a primary disease, but is secondary to an infective process elsewhere in the body. This infection is commonly in the abdomen, rarely in the thorax. Surgical literature of today reveals this complication much less frequently than the literature of fifteen years ago, no doubt because the modern surgical principles of drainage account in part for this improvement. The condition is found most frequently after the perforation of an ulcer of the stomach or duodenum. Appendicitis is second in the list of frequent causes. Other and less common factors preceding subphrenic ab-

*An illustration of this insidious type was the case of a soldier who sustained a perforating bullet wound of the abdomen. He had no difficulty until two weeks later when he developed fever of increasing severity. He was operated upon by the technique here described and discharged cured.

cess are: disease of the gall-bladder and biliary tract; disease of the pancreas, the spleen, and the liver; empyema; wounds of the abdomen and chest; soiling of the abdominal cavity at operation; and septicaemia with localization of infection between the diaphragm and the liver.

The situation of the abscess on the under surface of the diaphragm depends upon (1) the preceding inflammatory process, and (2) the anatomical relations of the liver and the diaphragm. Save for the "uncovered area," posteriorly, the surface of the liver is entirely covered with peritoneum. From the margins of this uncovered area on the right lobe are reflections of peritoneum running to the diaphragm, called the coronary ligament. The right extremity of this coronary ligament has been called the right lateral ligament. The left lateral ligament is a fold of peritoneum running from the upper posterior surface of the left lobe to the diaphragm. The coronary ligament and the left lateral ligament divide the diaphragmatic surface roughly into an anterior and a posterior half. This division is completed by the other peritoneal reflections in this area which form the gastro-splenic omentum and the phrenocolic ligament. A little to the right of the midline of the anterior abdominal wall, the falciform ligament arises. This fold of peritoneum is attached to the diaphragm and passes to the anterior and superior faces of the liver. On the upper aspect of the liver surfaces the two layers of the falciform ligament separate. The right layer passes into the coronary ligament and the

left layer into the lateral ligament. The falciform ligament thus divides the anterior and superior peritoneal faces of the liver into right and left halves.

This arrangement of peritoneal reflections produces four fairly distinct potential spaces between the liver and the diaphragm which are

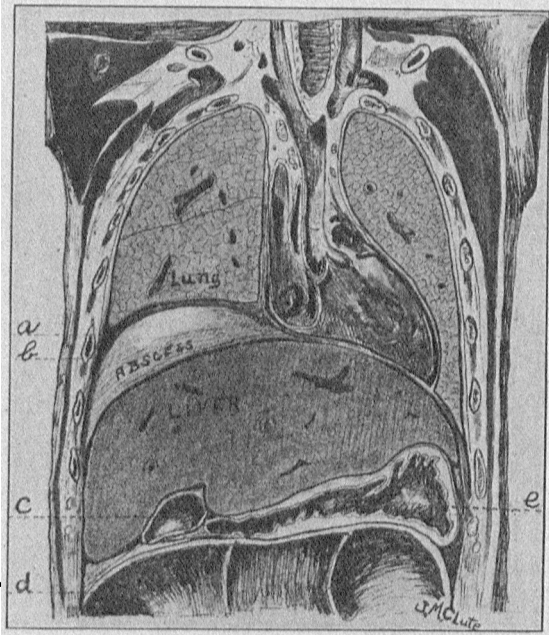


FIG. 1. Drawing showing anatomical relations of abscess in right anterior subphrenic space. (a) represents a small collection of serous exudate in pleural cavity; (b) the diaphragm. Note elevation of diaphragm on right with resulting compression of lung.

(Sketch adapted from "Toldt's Atlas of Anatomy.")

lined by peritoneum. There is only one space, called the "uncovered area" of the liver, in which the liver and the diaphragm are in contact without the interposition of peritoneal surfaces.

The boundaries of these four intraperitoneal spaces are as follows:

The right anterior space has the right lateral and coronary ligaments behind; the upper surface of the liver below; the falciform ligament to the left and the diaphragm above.

The left anterior space has the left lateral ligament behind, the diaphragm above. To the right is the falciform ligament, the stomach and the gastro-hepatic ligament. To the left is the abdominal wall and the spleen.

The right posterior space is sometimes termed the right subhepatic space or right kidney pouch. It is bounded above by the liver, the gall-bladder and the right lateral and coronary ligaments. Posteriorly is the diaphragm. To the left is the margin of the gastro-hepatic omentum and the foramen of Winslow.

The left intraperitoneal space is the lesser peritoneal cavity.

Drainage into one of these spaces is favored by gravity when the patient is lying supine in bed. The products from a perforated gastric ulcer tend naturally to collect in the right an-

terior space. A high lying appendix abscess tends naturally to drain into the right posterior space by way of the lateral colic groove. An ulcer of the posterior surface of the stomach may perforate into the left posterior space. The lymphatics behind the cecum and ascending colon pass upward into the subphrenic area. Infection may readily follow this route.

Barnard pointed out years ago that there was a communication between the lymphatics in the region of the deep epigastric artery with the falciform ligament which leads to the subphrenic region. There may, of course, be abscess formation from the presence of an infection in the blood stream. A pylephlebitis may occur and present as one of its features an abscess about the portal vein just below the diaphragm.

The onset of symptoms of subphrenic abscess may be insidious or stormy. In the cases we have seen, the first sign of approaching trouble has been a steadily rising daily fever with no local evidence of the cause. The patient is convalescing fairly well from a surgical lesion of the abdomen when his chart assumes the so-called "picket fence" appearance. Chills and sweats may accompany the daily rise in temperature. He now loses ground rapidly. His appetite becomes capricious or is absent. His face is drawn and haggard. He loses weight very rapidly. He complains of a sense of discomfort or fullness in the epigastric region. It may be impossible for him to draw a deep breath. Cough and hiccough are present in a great many cases. Pain with deep breathing is a frequent accompaniment of the early stages of the disease from the presence of a diaphragmatic pleurisy. There is frequently considerable gastric distress with belching of gas and sour eructations. Constipation is sometimes marked; diarrhoea is rare. In general, the patient looks and feels very sick, but has little or nothing on which to base his complaints.

Occasionally the onset is much more acute. This is especially prone to happen with a perforation of the stomach or duodenum, which suddenly floods the subphrenic area with irritating products. Here the initial shock and collapse is due to the perforation. The outcome may be a diffuse peritonitis or a localized subphrenic collection of pus with symptoms such as we have set forth.

The physical signs in such a case will vary, first with the situation of the abscess, and second with the type of abscess. There are two types of abscesses. One, containing fluid (pus) alone; the other, containing pus and gas. The gas may come from the lumen of a viscus or from the fermentative activity of anaerobic bacteria present in the pus. We have seen two cases with pus alone and one case with pus and gas. In general, inspection reveals marked limitation of motion of the affected side of the chest. There may be visible widening or bulging of the right lower thorax. Edema over the side or back of the chest may occur. Percussion will reveal flatness over

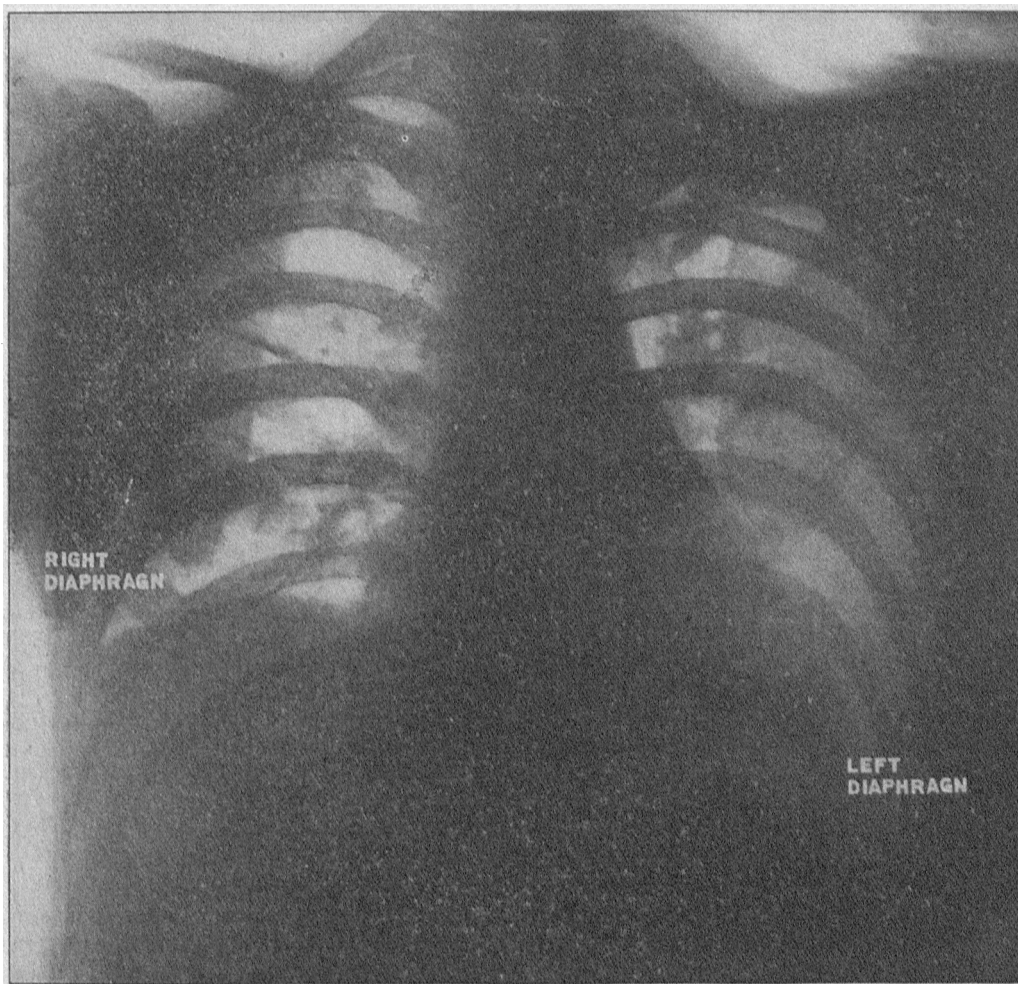


Fig. 2. X-ray in supine position of CASE 3. Note diaphragm high and smoothly rounded on right. Gas bubble not visible in this position. (X-ray with portable machine by Dr. Frank Wheatley.)

the lower chest in front and in back if the abscess contains pus alone. The presence of gas in the abscess cavity will give a tympanitic note to percussion with obliteration of the lower liver dulness. The dulness may extend anteriorly as high as the second rib and posteriorly to the middle of the scapula. Often the line of percussion dulness will descend with deep inspiration quite perceptibly.

Auscultation will reveal absent breath sounds and absent vocal fremitus up to the limit of dulness. Above this level, however, both vocal and tactile fremitus may be slightly increased for a limited distance due to the margin of compressed lung next to the high diaphragm. Occasionally a pleuritic friction rub may be heard over the collection of fluid, but this is not found constantly. When there is gas in the abscess cavity, a succussion splash may be obtained by shaking the patient.

The occasional presence of a varying amount of fluid in the pleural cavity renders the diagnosis more difficult. Simple or purulent pleurisy is frequently diagnosed in these cases. An exploratory needle puncture may be a valuable

aid to diagnosis. It should, however, be done with great care. We may obtain clear straw-colored sterile fluid from the pleural cavity and then when the needle perforates the diaphragm and enters the abscess we find gas and pus entering our syringe. Sterile fluid followed by pus at the same tap is almost pathognomonic of subphrenic abscess.

Palpation may reveal the liver border well below the costal margin. Compression of the chest wall low down or strong "fist percussion" may cause pain. A well marked leucocytosis is generally present though in certain chronic cases there may be a leucopenia.

Very often the diagnosis of subphrenic abscess can be finally made only by x-ray, which offers us the most positive findings in the majority of cases. By the symptoms and physical signs alone, it may well be impossible to determine whether we are dealing with a subphrenic abscess, a pyothorax, or a pyopneumothorax. X-ray plates and fluoroscopic examinations will generally settle the question definitely.

Normally the right diaphragm is one-fourth to one-half inch higher than the left. Each side

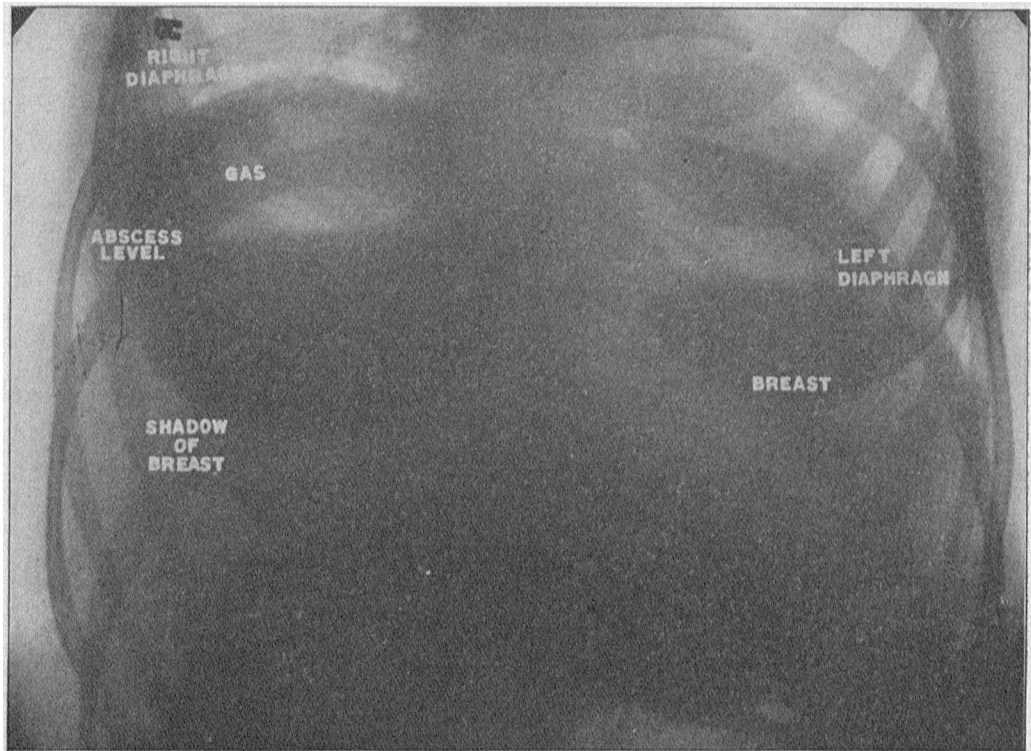


FIG. 3. X-ray of CASE 3, in sitting position. Note persistent high diaphragm on right; straight line level of the pus in the abscess with gas above it. (X-ray with portable machine by Dr. Frank Wheatley.)

moves straight up and down with respiration and there is no flattening of the curve. The normal range of this motion is one-half to three-fourths inch, with quiet breathing, but with forced respiration the range increases to two and one-half or three inches.

Any inequality or fixation of these movements is pathological. In subphrenic abscess we find the diaphragm on the affected side raised and fixed. It does not move with respiration to any degree, while the unaffected side maintains its normal range of motion. The lung above the fixed diaphragm is compressed. The level of the diaphragm may be only slightly raised, or it may reach up to the third rib. The costo-phrenic angle is not obliterated as it is with thoracic collections of fluid.

The line of the diaphragm is a smooth and regular curve, involving the entire course of the affected side. In liver tumors, liver abscesses and adhesions from old pleurisy, this curve is more irregular and localized more sharply to a single area of the diaphragm. A high, fixed diaphragm with a persisting costo-phrenic angle is very typical of subphrenic abscess.

The course of the disease is marked by steady decline. Weight loss is generally very pronounced, as are the weakness and general debility. Without operation, the mortality varies from 82% (Eisendrath, quoted by Lockwood) to 100%. Death results from the effects of the long-continued toxemia or from rupture of the abscess into some neighboring viscus. With

operation, the mortality is about 25% of the total cases.

The treatment of subphrenic abscess is incision and drainage. The anatomical location of the abscess, however, should be carefully considered, for this will determine the method of approach. Abscesses on the left side must always be first approached from the front. In the left anterior space, drainage must be instituted through the anterior abdominal wall. If the left posterior space is found to contain pus, the anterior incision should not be used; but a second incision should be made to approach the collection from behind. This may or may not be below the rib margin. Collections of pus on the right side are drained either (1) from below the rib margins; (2) by incision between the lower ribs; or (3) resection of one or more ribs.

The situation of these abscesses is such that to drain them adequately we must either go through the lower part of the pleural cavity, or we must retract the pleura and go around it. Great care must be taken, in either case, that the pleural cavity is not laid open to the possibility of infection from the abscess. An empyema superimposed on patients already so ill may readily prove fatal.

It is our belief that the drainage of these abscesses should be carried out in two stages. We have done the entire two-stage operation under local anesthesia once, and once with ether for the first stage and novocaine for the second. An incision is made along the center of the

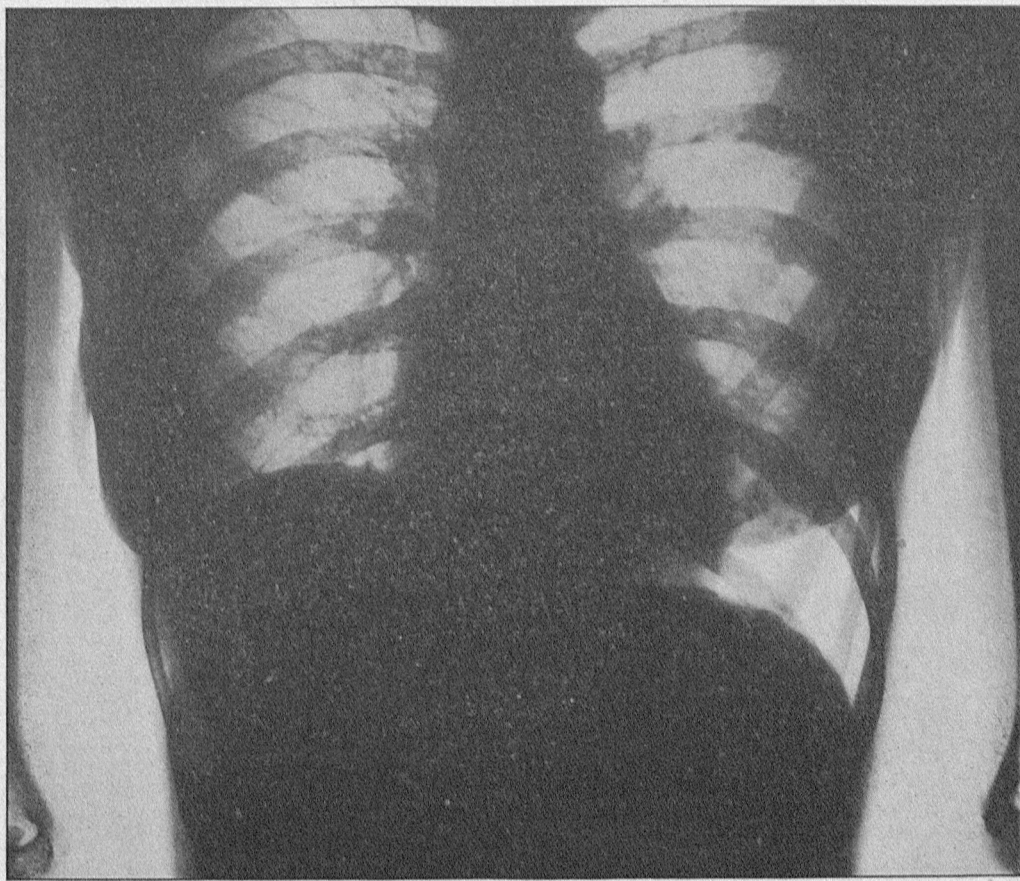


FIG. 4. X-ray in sitting position of CASE 3, 3½ months after operation. Wounds now entirely healed and patient feels perfectly well. Note that right diaphragm still remains high. By fluoroscope the excursion of right diaphragm is still very limited. (X-ray by Dr. Frank Wheatley).

tenth rib, in the mid-axillary line, for a distance of two and one-half to three inches. This portion of rib is now removed and the pleural cavity is opened by an incision parallel to the rib and in the center of its bed. It may be well to pass a suture about the intercostal vessels which are exposed. In one case we cut these and found no anesthesia necessary for the second stage of the operation. The pleural cavity may contain a little straw-colored fluid, which will flow out of the wound. The diaphragm, covered by its layer of pleura, presents in the wound a close approximation to the cut parietal pleura. The borders of the incision in the parietal pleura are now sutured to the diaphragm with a continuous catgut suture. Sterile vaseline is put into the wound and a dry sterile dressing applied. This completes the first stage of the operation. The operator may, before leaving the wound, insert a needle through the diaphragm to locate the abscess, if he so desires. It is better, however, to leave the abscess entirely alone for forty-eight hours after the first stage and thus permit the pleural cavity to be fully walled off by adhesions. The second stage of the operation is relatively simple. Under local anesthesia, unless the intercostal nerve has been cut and the area rendered insensible, an incision is made in the diaphragm parallel to the incision in the parietal pleura.

The edges are retracted and a finger inserted in the direction of the abscess will shortly disclose the presence of pus. A large rubber tube is inserted and held in place with a suture through the skin or fascia.

It is advisable to continue this tube drain for a week or more in large-sized abscesses, and to replace it gradually with rubber dam. Too hasty withdrawal of the tube may result in a secondary local collection of pus.

With this method of drainage, the temperature has rapidly come down to normal in our cases and has remained there. We have had no difficulty from bleeding from the intercostal vessels or from necrosis of the cut rib. We believe that the two-stage operation is safer than the one-stage procedure because it reduces to a minimum the chance of empyema.

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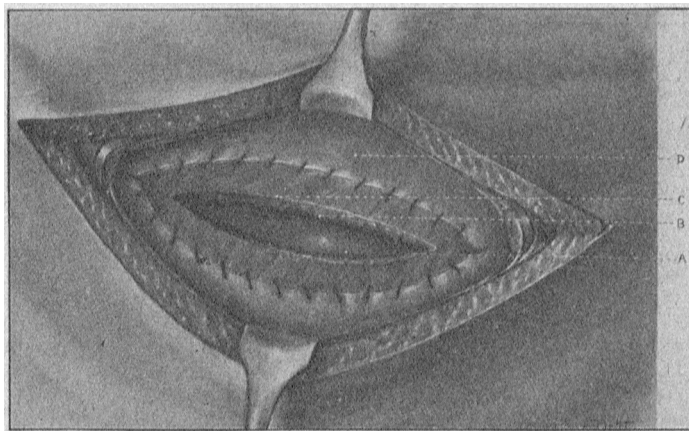


FIG. 5. Drawing showing relations at close of second stage of operation. At first stage of operation the rib is resected and the parietal pleura (d) is sutured to the visceral pleura (c). The second stage of the operation consists of incising diaphragm (b) and draining pus above liver (a). Compare this drawing with Fig. 1, to demonstrate the relations of pleura to abscess.

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CLINICAL NOTES ON THE DIAGNOSIS AND TREATMENT OF GALL-BLADDER DISEASE.*

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THE types of pain which can occur in gall-bladder disease are numerous, varying from the typical severe colic, which is referred in a characteristic way, to a very moderate localized and constant pain. Between these two types there are all degrees of variation.

With a fairly normal gall-bladder containing numerous very small stones, the degree of pain is often almost in proportion to the size of the stones, the very small stones of the size of bird-shot passing through the ducts with pain of only the slightest intensity and of short duration, while stones which are too large to pass the cystic duct may be of proper size to become wedged in the pelvis of the gall-bladder and produce pain of the typical colicky character. It is our opinion that the typical colicky pain is more prone to occur in a patient whose gall-bladder walls are but little involved pathologically.

It is in the old gall-bladders whose walls are thickened from long-standing cholecystitis that the pain of constant type is prone to occur. In this type of gall-bladder disease, there is frequently obstruction in the cystic duct as the result of either stone or exudate and the gall-bladder, distended and thick-walled, contains at times purulent material and at other times merely thick, viscid mucus unstained or only faintly stained with bile, in either case with or without the presence of stones. It is in this type that the pain is apt to be of the constant and persistent variety.

The severity of the pain and, at times, the suddenness of relief have been significant points in the history associated with this disease, sudden relief of colicky pain indicating the slipping back of the stone from the pelvis of the gall-bladder.

Upon the history of soreness over the gall-bladder region after the pain has ceased we

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have also come to depend as being quite indicative of the presence of this disease.

The location of the pain and tenderness has been atypical in many cases,—sometimes in the right lower quadrant with a prolapsed liver, at times to the left of the midline, although in these cases the gall-bladder was demonstrated to be in its normal location. There have been several cases also in which the pain and tenderness have been located so far out to the right as to be almost in the loin. Unlike the above cases, these gall-bladders have been demonstrated at operation to be located far out to the right where the pain and tenderness existed.

As to the reference of pain, there has been but little consistency. In many cases the pain has not been referred at all; in others it has been referred to the left shoulder; in many, straight through to the back, and in the remainder, typically to the right shoulder.

In cases operated early, before the attacks have become frequent, the past history usually contains the story of the occurrence of acute indigestion. It is surprising how often this diagnosis is still made.

The occurrence of jaundice is found in the past histories of those cases where the common duct is involved in only a small percentage of all cases. In our opinion it is desirable that cases should be operated upon, if possible, before jaundice occurs, inasmuch as its presence indicates in every instance one of two very undesirable features; stone in the common duct or infection spreading to the common duct.

Tenderness has been found to vary according to the relation of time of examination to time of attack. Several cases, however, have failed to show tenderness, even immediately after an attack, probably because of the fact that the attacks were largely due to mechanical obstruction without attendant infection.

The diagnostic value of tenderness, unless well marked and definitely demonstrable, is materially modified by the fact that some gall-bladders are located high under a shelving edge of the liver, making palpation difficult and uncertain, as well as by the fact that deep palpation elicits tenderness in many patients in whom no lesion can be demonstrated.

In inflammatory lesions of the gall-bladder, spasm is remarkably often absent—even in those lesions which verge upon gangrene. Likewise marked reactions of temperature are strikingly rare in a definite number of cases, this factor being dependent, of course, upon the degree of cholecystitis present.

X-ray in our opinion is of value only as positive evidence. We are unable to state in what percentage of cases the shadow of the stones has been demonstrated, but we have had a sufficient number of undemonstrated cases to make us willing to operate on those cases with definite histories but negative x-ray findings.

We have published our views as to the value of inferential x-ray evidence in gall-bladder