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Contributors

Richardson, Maurice H. 1851-1912.
Bryant, Thomas, 1828-1914
Royal College of Surgeons of England

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A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

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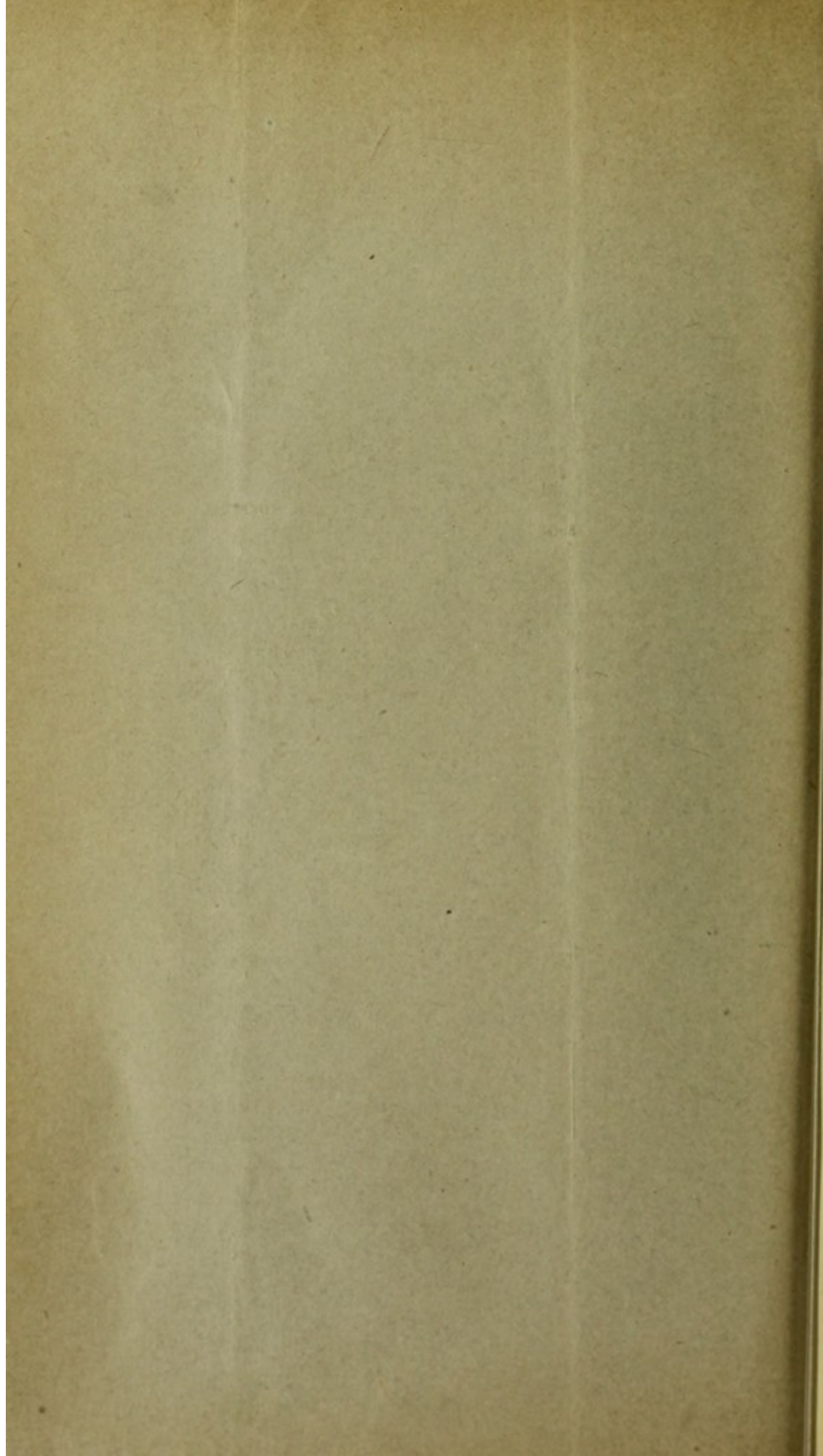
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A CONTRIBUTION TO THE SURGERY OF THE
GALL BLADDER.

By MAURICE H. RICHARDSON, M.D.,

OF BOSTON.

VISITING SURGEON, MASSACHUSETTS GENERAL HOSPITAL; ASSISTANT
PROFESSOR OF ANATOMY, HARVARD MEDICAL SCHOOL.



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THE following communication is based largely upon personal experience and is intended briefly to discuss, from the standpoint of the anatomist and surgeon, those affections which concern the gall bladder and extra-hepatic biliary passages.

While this field is one of the most brilliant and promising, anatomical and pathological considerations give it distinct limitations. It is seldom possible to cure, or even to relieve, malignant diseases involving the gall-bladder or the gall-ducts. With a few brilliant exceptions operations are of questionable value in most cases of chronic obstruction to the bile flow from causes other than stone. Unless the obstruction is situated below the point where the cystic empties into the common duct, so that the flow may be deviated by way of the gall-bladder into the duodenum, surgery offers little or no relief to a permanent cholæmia. On the other hand, the varied manifestations of biliary calculi—the discomforts and disabilities of a mild cholelithiasis, the prolonged sufferings caused by large and impacted stones, the recurring agonies of biliary colics and the frequent perforations from pressure-ulcerations—all these conditions may be safely and permanently cured by the devices of modern aseptic surgery.

Pathology.—From the brief pressure upon the biliary passages caused by the obstruction of an acute catarrh, material changes in the gall-bladder and its ducts seldom if ever occur. In chronic

¹ Read before the American Surgical Association, May, 1893.

obstructions, whether caused by the impaction of calculi or by cicatricial stenosis, marked changes take place which have a very important bearing upon the question of surgical methods. In most instances there is an extensive dilatation of the gall-bladder and ducts by which surgical manipulations are materially aided, whether the gall-bladder be opened, extirpated, or made to communicate with the duodenum or colon. In other cases the gall-bladder is contracted, thickened and friable—a condition generally, though not always, caused by accumulations of stones, and one which makes operations upon this organ at times extremely difficult. The common and hepatic ducts in a state of chronic dilatation are much more easily recognized and operated upon than when in their normal condition.

Catarrhal processes in the cystic duct may obliterate that passage and result in a chronic enlargement of the gall bladder from the accumulated discharges of its mucous membrane. Dilatation from this cause alone, without a history of previous gall-stone attacks and uncomplicated by an impacted stone, or by a new growth, is very unusual and has never come under my observation.

From the pressure of tumors on the common duct, or upon the cystic and hepatic ducts, we may have remote changes similar to those caused by simple stenosis. Such effects may be recognized during life, though it may be difficult or impossible to make out their exact cause.

Cancer in the gall bladder and in the biliary passages is generally secondary to that disease elsewhere. At times, however, cancer is confined to the gall-bladder itself and admits of total extirpation with some chance of permanent cure. Palliative operations are not justifiable unless the new growth is complicated with troublesome stones. At times the cancerous wall of the gall-bladder is contracted upon a collection of calculi—a condition I have found once. In such cases it is hard to tell whether the pain is caused by the gall-stones or by the new growth, and, therefore, the value of surgical interference is doubtful.

Very rarely we may find benign tumors pressing upon the biliary passages, or growing from their mucous surface in such a

way as to cause symptoms. These uncommon conditions should be borne in mind, though it is, of course, impossible to demonstrate or even to suspect them before exploration. Many of them from their nature and their situation admit of complete relief by operation.

Gall-stones when confined to the gall-bladder as a rule cause no pathological changes, and hence no symptoms. They usually remain harmless in the gall-bladder unless small enough to get caught in the cystic duct.

Changes in the gall-bladder brought about by the local action of stones may be limited to a simple distention of that organ from an impaction of the cystic duct. More frequently the prolonged efforts of the gall-bladder to rid itself of these bodies result in an hypertrophy of its walls, which I have often found firmly contracted upon a mass of stones. The peritoneal covering, irritated in the course of this process, becomes inflamed and adherent to the surrounding structures. Frequently, therefore, we find a thickened and contracted gall-bladder buried in firm adhesions that extend to the colon, the duodenum and even to the pylorus. These attachments may be so firm and extensive that the gall bladder is found and exposed with the greatest difficulty. The process of contraction may go on until, having expelled all the stones, or all but one or two, the gall-bladder projects from the under surface of the great lobe as a small, hard knob. The mucous surface of the gall-bladder at this time is not free from chronic catarrhal processes that may end in ulceration, or even perforation.

In two such cases stones and bile escaped from the gall-bladder while I was separating its adhesions.

When thickened and contracted the walls of the gall-bladder in a living subject are friable. Digital dilatation is almost invariably accompanied by longitudinal tearing. I have known this to occur in spite of every precaution until the whole side of the gall-bladder has been torn far into the dilated cystic duct. In the condition of contraction and thickening there is also dilatation of the arteries supplying the gall-bladder; hence we find considerable hæmorrhage after cutting through its walls. In

one case the hæmorrhage from this source, moderate at the operation, recurred with fatal violence on the ninth day. This is the only case in my experience in which secondary hæmorrhage was observed, even where the jaundice has been pronounced.

Obliteration of the cystic duct from chronic catarrh or from other causes may result in a distention by which the gall-bladder may at times attain enormous proportions, so that the tumor may fill the whole right half of the abdomen and extend even into the pelvis. This condition is usually the result of a complete occlusion of the cystic duct by cicatricial obliteration or stone impaction. The contents of the tumor may be purulent (empyema of the gall-bladder), or colorless from absorption of the biliary pigments. A cyst with this origin, must not be confounded with similar tumors of the kidney, pancreas, mesentery, or even of the ovary. The distended bladder may become inflamed and adherent to the surrounding parts and spontaneous evacuation may take place into the intestine, or even through the skin.

But it does not follow that these conditions of the gall-bladder, to which I have alluded, cause any unpleasant or dangerous symptoms. A gall-bladder may be very much enlarged, its functions may be entirely destroyed, and it may contain a large number of stones without causing any symptoms whatever. While it is justifiable to relieve this condition of simple dilatation, to avoid possible future complications, interference is not essential in the absence of pain and of local and constitutional disturbances. But, on the other hand, if stones get caught in the cystic duct, the patient must undergo at least the great suffering of a biliary colic, with possible impaction; and it is, therefore, a fair question for discussion whether to remove from the gall-bladder all calculi as soon as they make their presence known, or to leave them to a process of nature by which they may become fixed in places hard to expose and in positions where they may excite the most serious local troubles.

Impactions in the common duct may result in a universal jaundice, which may become pronounced and fatal. The gall-bladder and biliary passages become distended. Chronic inflam-

mation of the duct itself and of the surrounding parts is generally present. Perforations frequently occur with escape of bile into the peritoneal cavity and death; or a spontaneous cure follows rupture into the intestine, the stone still remaining fixed in the canal. At other times the stone makes its way by ulceration into the intestine, and permanent recovery results. The impacted calculus, often very large, is usually rough and in its outer layers brittle, quite unlike the unimpacted stone, wherever found, with its rounded angles and polished facets.

The occasional presence of a stone in the hepatic duct I have observed clinically. It has always been associated with stones in both the cystic and common ducts, and probably has had the same origin.

The effect of an impaction in the common duct is a great dilatation of the hepatic duct. This must be borne in mind in removing stones from the gall-bladder and cystic duct by digital dilatation and instrumental exploration. In two such cases (one of Cabot's and one of my own) the stone was pushed ahead far into the great fissure of the liver, where it lay hopelessly lost.

It is interesting to conjecture how cicatricial stenoses of the common or cystic ducts originate. In certain instances no stone or other cause is found, and yet a very serious obstruction to bile-flow exists. In one such case (Elliot's) the constriction consisted of a cartilaginous ring at the duodenal orifice sufficient to cause a persistent and fatal jaundice. In this instance the cause of the constriction probably lay in an old duodenal ulceration. Strictures in the common duct, as well as in the cystic, generally take their origin in an old gall-stone impaction, though they may be due to diphtheritic or catarrhal ulceration.

From the pathological standpoint, therefore, we may say that the dangers and discomforts which result, even remotely, from the presence and passage of gall-stones would be safely obviated by their early removal while still in the gall-bladder; for we should avoid not only the terrible pain of an occasional colic and the possible local changes in the gall-bladder, but also the remote dangers of stricture and perforation.

In addition to the common local changes alluded to above,

we must be prepared to find occasionally one of those conditions which are so rare that we eliminate them from practical consideration.

Diagnosis.—Operations on the gall-bladder and the biliary passages should not be undertaken until every means at our command to make a diagnosis has been exhausted. While it is impossible in many cases positively to exclude malignant disease, we should make every effort to avoid unnecessary explorations, for the simplest procedures in cases of advanced organic disease, whether malignant or not, are, in my experience, hazardous to life.

In some cases the presence of malignant disease, or of fatal organic disease not malignant, can be shown clearly enough to justify a let-alone policy; but at times it is impossible to understand so clearly the existing conditions that it is justifiable to abandon attempts at relief.

The diagnosis of gall-stones in the gall-bladder is generally easy. Attacks of biliary colic, with or without a brief jaundice, followed by periods of complete remission, point with precision to the presence of calculi in the gall-bladder. Persistent pain, with occasional exacerbations, accompanied by jaundice, indicate with sufficient clearness a stone passing slowly from the cystic duct to the duodenum. The discovery of a gall-stone in the fæces establishes positively the diagnosis. Persistent jaundice, with more or less persistent pain, following a history of brief attacks of less severity, indicates with considerable precision a stone in the common duct. The frequent association of malignant disease with gall-stones, however, should be borne in mind, and we must, therefore, be prepared at times to find calculi associated with cancer in the immediate vicinity of the gall bladder. The youth of the patient helps us in excluding malignant disease in cases of this kind.

Between a stone impacted in the common duct and malignant disease, with prolonged and marked cholæmia, the diagnosis is often impossible. Even in the absence of an irregular or other tumor in this region it is impossible to say that the case is one of gall-stones alone. Exploration frequently shows that the jaundice is due to the pressure of a malignant growth upon the common duct, especially if the disease is situated in the head of the pan-

creas. Malignant disease situated here most closely simulates an impacted stone; for we have not only the same persistent pain, but a jaundice dependent very often upon a growth so small that it could not have produced any serious effect upon the general health. There is absence, therefore, of that cancerous cachexia so significant in extensive cancerous infiltration, whether of the liver alone or of all the parts about this region. Obstructions of non-malignant origin, not associated with concretions, cannot be diagnosticated with certainty, though the absence of pain favors some simple obstructive condition.

When the objective symptoms are jaundice and emaciation, we may have a complete obstruction of benign origin, a hopeless, intra-hepatic disease, or the pressure of an extra-hepatic, malignant tumor. In determining the cause under such conditions the completeness of the obstruction should be taken into account. In intra-hepatic disease causing jaundice there is always a certain amount of biliary secretion, though it may be very slight. Examination of the *fæces* will show the presence of minute quantities of bile. On the other hand, a mechanical obstruction to cause profound jaundice must be complete and must be extra-hepatic; the bile flow is totally shut off, and careful chemical tests of the *fæces* fail to show biliary pigments. Moreover, in mechanical obstructions there may be a temporary letting up of the stricture, with the sudden appearance of bile in considerable quantities in the duodenum. In progressive intra-hepatic disease, the diminution of bile is also progressive, but it is never completely absent. In practice, however, one is seldom unable to exclude organic disease of the liver.

It is not always easy to exclude tumors of the kidney and the pancreas, or even of the stomach, where a dilated gall-bladder unaccompanied by jaundice is suspected. Here the most important diagnostic points are the shape and location of the tumor, and the directions in which it can be moved. Confirmatory or convincing evidence may be gained from examinations of the urine and the gastric juice—or, in the case of cysts, from an examination of the aspirated fluid. The gall-bladder may be so

tense as to seem solid, and in this respect not to be distinguished except by aspiration from a pancreatic, renal, or hydatid cyst, or an ovarian tumor with long pedicle. At times a tumor of the omentum, or of the transverse colon, suggests a possible gall-bladder origin. With solid tumors, however, the same importance for differential diagnosis does not exist, because, being generally malignant, hard and irregular, their nature admits of little doubt, and the uselessness of exploration is generally clear. Yet we may have solid tumors of the kidney, or localized benign growths in the liver, undistinguishable, except by exploration, from tumor of the gall-bladder.

In gall-stone cases, except in rare instances, the gall-bladder cannot be felt, and, moreover, local physical signs are often entirely wanting; hence, it is necessary sometimes to consider the possibility of a cirrhosis of the liver, associated with jaundice. The diagnostic features of this disease are usually sufficient to make its presence or its absence certain. I have never found this condition in any of my cases.

As already stated, we must be prepared to find at times one of those unusual conditions which from their rarity we exclude in the process of eliminative diagnosis; such, for instance, as localized abscesses associated with jaundice, hydatids, foreign bodies which have migrated from the alimentary tract, and so forth.

In the majority of cases, however, the conditions demanding investigation are sufficiently clear to direct with certainty the surgeon's course, one class comprising the hopeless and inoperable, another promising almost invariable success, immediate and remote, and a third, between the two, justifying exploration, but offering only moderate hope of relief.

Indications for Operation.—The indications for exploration should be clear. Prolonged pain in the region of the gall-bladder, without jaundice, is a sufficient cause for investigation in the absence of a certain diagnosis of hopeless organic disease. Cholæmia without pain, in the absence of positive evidence of organic disease, demands interference. Pain that is intermittent and infrequent, explained by the discovery of gall-stones in the fæces, justifies, but

does not demand, an operation on the gall-bladder, unless it is evident that there is a large number of stones, and unless there is serious disability. In other words, nature may be trusted to take care of small stones if we can afford to pay the price she exacts—occasional and transitory attacks of violent pain. But even if the stones are small, and if the attacks of biliary colic are short and severe, there is a limit to the endurance of the patient, which he himself must fix. The danger from the occasional passage of a small stone through the cystic and common ducts is slight; moreover, we have, in most instances, the case under constant control, because we can apply the surgical remedy the instant impactions become serious—when persistent jaundice and continuous pain menace the patient's health, or even his life. On the other hand, as I have already stated, there is a serious objection to the policy of non-interference under these circumstances—an objection which becomes conspicuous when we contrast the ease of exploratory gall-bladder incisions with the difficulties of opening and closing the common duct. Moreover, it is not possible to judge of the average size of gall-stones remaining in the gall-bladder by the specimens found in the faecal discharges. I have found in many instances, in the same gall-bladder, calculi no larger than a pin's head, and others as large as an English walnut. Furthermore, chronic obstructions, especially of calculous origin, may aid in the development of cancer.

A nodular mass in the liver, with cachexia, is a sufficient contra-indication to this operation. A marked diminution in the size of the liver, associated with ascites, is also sufficient; yet, in spite of the history and local signs, it is often impossible to say that the condition is hopeless. The differential diagnosis cannot be made with sufficient accuracy. In my own experience, malignant disease has been found instead of gall-stones quite frequently, and the presence of gall-stones has explained symptoms thought to be of malignant origin by our very best diagnosticians. The exploration should be undertaken, therefore, in cases of doubt where the bodily health is seriously compromised either by jaundice, or by pain, or by both. It

should not be undertaken in the cases where the disability and pain are slight and transitory, unless the attacks become very numerous; nor in the presence of malignant disease; nor in pathological lesions that are evidently hopeless. If it can be demonstrated that the gall-bladder is full of stones, and if they cause repeated colics, or other persistent local symptoms, they should be removed: first, because the operation is very simple, and its dangers slight; and, secondly, because the stones may get forced into the cystic and common ducts, there to cause much greater pain and danger than in the gall-bladder.

Anatomy.—The region of the gall-bladder till very recently has been described only by the pathologist and the anatomist. The time has come when an intimate practical knowledge of the relations of the gall-bladder, common, hepatic, and cystic ducts, with the portal vein, vena cava, and hepatic artery, is as essential as a familiarity with the classical regions of the neck, or of the groin. To some of us the new field is even more important. In the past two or three years I have explored this locality much more frequently than I have the neck or the groin; and yet the standard works in applied anatomy have had very little to say about this most interesting region.

Just to the right of the rectus muscle, opposite the tip of the cartilage of the tenth rib, the abdominal wall consists chiefly of skin and fasciæ. In most subjects the transversalis fibres pass behind the linea semilunaris at this point. Explorations may be made here with great ease, an opening into the peritonæum large enough to admit the finger requiring an incision through the skin of not more than an inch and a half. Digital examinations may be made of the gall-bladder and vicinity with great facility; and if subsequent procedures seem best the incision may be extended upwards along the border of the rectus, and outwards and downwards parallel to the border of the ribs.

The following brief description of this region is based upon twenty or more dissections made at the Harvard Medical School in April of this year:

The right upper quadrant of the abdomen, containing the liver, gall-bladder, and portions of the kidney, stomach and

duodenum, is separated from the peritoneal cavity below by the transverse and ascending colon, with their mesentery. The colon is usually in contact with the abdominal wall from the ileo-cæcal valve to the splenic flexure. Extravasations will be immediately opposed by this intestinal and mesenteric barrier, which may, however, be avoided by traveling downward along the right border of the ascending colon. In extensive extravasations the fluid will easily overcome any such obstacle, but in the slow escape of bile the opposing surface will be sufficient to prevent, by rapid adhesion-formation, any considerable infection.

Above and toward the median line the stomach and duodenum act as more or less efficient barriers. Posteriorly the fluid may enter the lesser cavity of the omentum through the foramen of Winslow.

The gall-bladder is situated under the great lobe of the liver, to which it is usually attached by areolar tissue, though it may be separated by a considerable interval, and have a distinct mesentery.

Variations in the shape and size of the gall bladder have been observed, and occasionally it is wanting. There have been few if any observed variations in the position. Keen has reported one case in which he found the gall-bladder behind the pancreas. In the state of ordinary distention the gall-bladder is in contact with the abdominal wall at a point opposite the tip of the cartilage of the tenth rib. Unless unusually distended or tense it cannot be felt in this position.

The relations of the gall-bladder in the right upper quadrant are usually shown on the post-mortem table by the staining of bile. This gives in the very best way its relations with surrounding organs. In a state of distension the gall-bladder is in contact with the abdominal wall, with the liver, the hepatic flexure of the colon or a portion of the transverse colon, with the duodenum, and often with the pylorus. It is therefore possible to make a communication between the gall-bladder and the colon or the duodenum. The facility with which this communication may be made, however, must depend somewhat upon the size and mobility of the gall-bladder itself, as well as upon similar conditions in the duodenum and colon.

The gall-bladder is entirely covered by peritonæum except at its posterior surface. In some cases a fold extends from its lower portion, across the foramen of Winslow, to become expanded upon the duodenum. In about half the dissections I have found this fold constant; in other cases there is a reflection from the under surface of the great lobe of the liver itself to the duodenum; in others this fold is absent. In such cases the peritonæum extends to the kidney, covering the anterior surface of that organ; thence it is reflected over the inferior cava to the vertical portion of the duodenum. These folds are of great importance in operations upon the common duct and upon the duodenum. A vertical incision, carefully made so as to avoid the subjacent vessels, followed by digital separation, permits the exposure of the head of the pancreas and the under surface of the duodenum, with the whole length of the common duct and its outlet through the duodenal mucous membrane. These folds are exposed, with the foramen of Winslow, duodenum and kidney, by drawing the stomach, transverse colon and duodenum down and toward the left. If the body is placed in the erect position the intestines fall and leave this space free. For this purpose the Trendelenburg table, reversed, is of great assistance. The peritoneal folds thus briefly described are of great importance in operations upon the cystic, hepatic and common ducts, and upon the head of the pancreas and the posterior wall of the duodenum.

The gall-bladder itself, attached by areolar tissue to the under surface of the liver, has walls that are more or less variable in thickness within the limits of health. In cases of prolonged contraction the gall-bladder is thickened by an hypertrophy of its muscular coat; in cases of simple distention, unaccompanied by chronic contractions, they may be extremely thin, and even translucent. This I have seen in simple distentions of the gall-bladder from obliteration or plugging of the cystic duct. In the normal gall-bladder, however, the walls are quite thick, filled with blood-vessels, somewhat friable, and easily manipulated. The blood supply is derived from the cystic branch of the hepatic artery. The cystic artery itself is

of considerable size, at times as large as the radial. When cut, its branches, spreading over the surface of the gall-bladder, give rise to considerable hæmorrhage.

After separation from the under surface of the liver by a dissection of the areolar tissue, the gall-bladder remains attached only by the duct artery and veins, nothing further being necessary in cholecystectomy except the application of a single ligature to the pedicle. It would be not only unnecessary, but impracticable to turn in the edges of the cystic duct to prevent the escape of bile.

The cystic duct varies in length from an inch to an inch and a half. In conditions of health it lies in shape a double curve, like the letter *s*. The diameter of the cystic duct is small. It is impossible to pass a probe through it into the common duct, not only on account of the shape of the double curve, but because the mucous membrane is made up of numerous transverse folds, each forming a sufficient obstacle to the passage of a blunt instrument. Even when the cystic duct is put upon the stretch it is impossible to pass any instrument whatever through it; after dilatation instruments of considerable size may be passed without difficulty. I have passed the forefinger often into the common and hepatic ducts through the dilated cystic. The cystic duct lies in front of and below the structures making the anterior wall of the foramen of Winslow. It is in relation with the cystic branch of the hepatic artery, lying in front and below. It is loosely connected with the other structures in this immediate region. At its point of entrance with the common duct it lies in front of the lower surface of the portal vein, from which it is separated by loose areolar tissue. Incisions into the cystic duct, either external or internal, should be made with great care and should be directed downward and outward. Incisions made backward and upward may wound either the cystic artery or the portal vein, or both.

The hepatic duct, made up of two large branches in the great fissure of the liver, proceeds obliquely downward and inward, to be joined with the cystic duct about two inches from the great fissure. It is much larger than the cystic, though not

so large as the common duct; the average diameter of this vessel is about a fifth of an inch. In chronic obstruction it may be dilated so as to admit easily the forefinger. The mucous surface of the hepatic duct is smooth, and presents no obstacle whatever to instrumentation. It is in close relation with the portal vein and with the hepatic artery. In all the dissections I have found the relations with the portal vein the same, the duct resting upon this enormous trunk. It is crossed by the cystic branch of the hepatic artery in some instances; in others the artery lies behind the duct. Incisions should be made, therefore, with the greatest care, and only after demonstrating the situation of the cystic artery. This may be done by exposing the artery or by recognizing its pulsations. All posterior incisions in the hepatic duct, as well as in the cystic and common ducts, are extremely dangerous, and no cuts should be made without seeing what is done; blind instrumentation on all these ducts must be very dangerous, owing to the close relations of the enormous main body of the portal vein. The main direction of the portal vein, hepatic and common ducts, and the hepatic artery, is the same—from the great fissure of the liver downward and toward the median line. The common duct, receiving the hepatic and cystic ducts about two inches from the great fissure of the liver, proceeds in an almost straight line to its communication with the posterior surface of the duodenum. In the beginning of its course the common duct lies directly in front of the portal vein. There is a slight deviation, however, from the parallel, the duct being inclined slightly less horizontally. The result is that the common duct is no longer in front of the portal vein when it enters the head of the pancreas. The duct is loosely connected with the surrounding parts by areolar tissue; it may be separated from the vein and from the artery with the blunt point of the closed scissors, or even with the fingers. Care must be taken, however, not to use sufficient force to tear the portal vein. Inferiorly, the common duct, before it enters the pancreas, crosses the inferior cava at an acute angle. The foramen of Winslow separates the structures in front from a portion of the inferior cava. After passing the foramen, however, the relation

is much more intimate. Above, the portal vein separates the inferior cava from the middle part of the course of the common duct. Between the inferior cava and the common duct there is loose tissue, which may be separated with the finger or any blunt instrument. The course of the common duct through the head of the pancreas may be demonstrated on the living after separating the reflections of the peritonæum already described. The mucous membrane of the common duct does not prevent instrumentation. Its size varies. At times, in normal condition, its diameter may exceed that of a common lead pencil, though it is generally smaller. The length varies according to the point of insertion of the cystic duct and according to the individual. The orifice in the duodenum admits the passage of a probe or director without much difficulty. Anatomically, the common duct may easily be exposed and incised, having cut through the peritonæum, by pulling the duodenum toward the median line. In this way the under surface of the duodenum is exposed, as well as the head of the pancreas, through which the incision may be carried as far as the posterior surface of the duodenum.

The relations of the colon to the gall-bladder make it almost invariably possible to connect them. It is more difficult, at times, to bring the duodenum into easy contact with the gall-bladder. A large and movable gall-bladder, with a large and movable duodenum, makes the operation comparatively easy. A thickened and contracted gall-bladder, with a small duodenum, makes the operation extremely difficult. At times the pylorus is very movable, so that it can be brought in contact with a small and fixed gall bladder. At other times it is very difficult to bring and keep them in contact.

Cholecystotomy.—Gall-stones limited to the gall-bladder being the most frequent occasion for surgical interference, cholecystotomy is the most common of the surgical procedures. In the normal condition of the gall-bladder no operation could be simpler than this. Through the small exploratory incision I have recommended, the presence and position of the stones may be demonstrated. If the stones are limited to the gall-bladder the wound should not be enlarged, for

there is great liability to hernia in an extensive scar. The gall-bladder may be sewed into the wound and incised at once, or the opening may be deferred a day or two. The so-called ideal operation, which I have been able to perform but once, consists in opening the gall-bladder immediately, removing the stone, inverting the peritonæum and closing the wound by the interrupted Lembert stitch. The gall-bladder may then be dropped back into the peritoneal cavity. A somewhat safer way is to sew the fundus to the edges of the wound, after closing the cut in the gall-bladder. This provides for the only danger by this method—giving way of the stitches and extravasation into the closed peritoneal cavity. This operation, with the suggested modification, I have performed once with very gratifying success. The convalescence was short and the cure has been permanent. This procedure, when practicable, is better than leaving the gall-bladder open in the wound with permanent drainage. In one case of my own a permanent biliary fistula has resulted from the latter method. For several days after the operation the bile flow was carried on almost entirely through the cystic duct by siphonage. There has been, for a year and a half, a persistent biliary fistula, which is extremely annoying, though not in any way interfering with the patient's health. While in this case it is possible that there may be some interference with the bile flow, its abundant presence in the fæces shows that there is no material obstruction. Yet a second operation is necessary to close this annoying fistula. In this case the gall-bladder was sewed to the edges of the fascia by so broad a margin that it will now be possible to separate its walls, invert them, and sew them together without opening the peritoneal cavity.

When the gall bladder is contracted so that the fundus cannot be brought in contact with the abdominal wound, immediate incision with drainage or total extirpation are the alternatives. This condition has existed in most of my operations for calculi. At my first operation of this kind, September 9, 1890, I placed a glass tube in the remains of the gall bladder and tamponed about this tube, and below the bladder, with gauze. Drainage was excellent by this method, and convalescence

became soon established. (Eventually the patient died of sepsis from retained gauze-sponge.)

The selection of method in cholecystotomy depends upon the importance given to drainage. It seems to me that drainage is desirable for a few days after operating upon the biliary passages. Not that siphonage is essential in all cases, for it is quite obvious that nothing is to be gained if the ducts are in a normal state. But in many cases one feels more secure in making provisions for possible extravasations.

Unless we extirpate contracted gall-bladders, drainage must be resorted to as a matter of course, for it is impossible successfully to suture the ragged edges of the cut.

The method of drainage in these cases, which I have more fully described elsewhere,¹ is very efficient and safe. No complicated manipulations are necessary. The method first used by Abbe in 1889 of double glass drainage tube, with gauze packing for leakage, answers the same purpose admirably. Both methods are efficacious and successful in the treatment of deep wounds in the biliary passages, when suture is impracticable or inadvisable. In my later operations I have preferred rubber tubes to glass, on account of danger from pressure with the latter.

Cholecystectomy.—Extirpation of the gall-bladder in certain cases is desirable. Where the walls are friable and contracted we may avoid extensive extravasations at the time of operation by tying off and removing the gall-bladder entirely. This procedure should not be attempted unless the gall-bladder can be easily separated from the adjacent structures. Besides lessening the dangers at the operation, this method shortens convalescence. Yet, even after extirpation of the gall-bladder, drainage and gauze tamponage is necessary. As soon as the ligature becomes absorbed from the pedicle we may have a considerable flow of bile. It is unsafe, therefore, to leave the stump in the abdominal cavity without some provision for this expected flow, even after cauterization of the duct.

After the removal of an impacted stone, whether through

¹ Boston Medical and Surgical Journal, April 28, 1892.

the gall-bladder, by dilatation of the cystic duct, or by incision of the common duct, it is advisable to establish siphon drainage in order to allow the inflammation of the mucous membrane to subside. Clinically I have observed that it takes some time for the bile to resume its natural channels, probably because there is an inflammation-stenosis. Extirpation of the gall-bladder has seemed to me necessary but once. In that case the gall-bladder had become so thinned and friable that the stone escaped through its walls during the operation. The torn remnants were separated from the liver and removed after ligature of the pedicle. A good recovery followed.

Convalescence usually is not protracted, even in cases of excessive biliary flow. As soon as the sinus becomes established the parts close in upon it on all sides, the long tract from the duct to the wound becomes obliterated early and its place is taken by a mass of cicatricial tissue through which it is impossible for the bile ever to break. Drainage, therefore, with or without entire removal of the gall-bladder is followed by an earlier and more satisfactory cure than in those cases of cholecystotomy, where, after siphon drainage, the bile persists in escaping from a permanent sinus. After incision and drainage a contracted gall-bladder becomes practically obliterated, and serves no longer either as a receptacle for bile or a quarry for stones. A complete obliteration of the gall-bladder and the cystic duct takes place.

In malignant disease, total extirpation of the gall-bladder is the only operation possible for permanent cure. Where the disease complicates the liver or any adjoining structure, cholecystectomy is unjustifiable unless the gall-bladder contains stones; even then cholecystotomy, with subsequent suture or drainage, is a preferable operation.

Operations upon the Cystic, Hepatic and Common Ducts.—There are few conditions of the cystic duct which admit of operative manipulation. In health it cannot be explored through the gall-bladder. At times, however, a stone may become impacted in the duct and shut off from the gall-bladder. In such cases, if it is impossible to dilate the duct through the gall-bladder so

as to reach the stone, it will be necessary to incise externally. As in the hepatic and common ducts, a stone in this position may be crushed, care being taken not to bruise the walls of the duct enough to cause gangrene. Incisions into the cystic duct should be on the anterior and inferior surface to avoid the cystic artery above, and portal vein behind. Internal incision should be made in the same direction for the same reason.

The cystic duct, after apparent obliteration, becomes pervious at times as soon as the gall-bladder is opened. This fact I have observed in several cases where, apparently, no bile had entered the gall-bladder for a long time. At the end of twenty-four or forty-eight hours, in these cases, there has been an abundant discharge of bile through the tube left in the gall-bladder. This interesting fact must be explained by the subsidence of the inflammatory stenosis caused by the long-continued irritation of these stones. One must always make provision for this flow, which at times is excessive.

Operations upon the hepatic duct and upon the common duct are indicated when stones become hopelessly impacted in either, and cannot be removed by dilatation of the cystic duct or by reasonable efforts at crushing. Care must be taken in both external and internal incisions to avoid the hepatic artery and the portal vein, as I have suggested in the anatomical considerations. After incising these ducts they may be closed by suture. The facility with which this operation may be performed depends somewhat upon the build of the patient, upon the thickness of the abdominal walls, the depth of the wound, the extent of inflammatory adhesions, the reflections of the normal peritonæum, and upon the conditions of the duodenum, stomach and colon. Even when the sutures have been applied with the greatest success and precision we must still make provision for the escape of bile.

More frequently than not it will be found impracticable to sew up the incised duct. A rubber or glass drainage tube should then be placed in the duct with siphonage, and the whole protected with gauze. This method, which may be applied almost universally, has many advantages, chief of which is the

transfer of the biliary flow, for the time being, away from the seat of the obstruction.

Not that it is always unnecessary to sew up the incisions in the common, hepatic and cystic ducts, but I should not do this when it is so difficult to apply the stitches that the operation will be materially lengthened. When it is possible to drain through the incision by means of a tube with gauze tamponage the results are quite as good as in suture. It may be impossible, however, to apply a drainage tube to an incision made low down in the common duct; for instance, where the duct is incised through the head of the pancreas. It might be possible with a proper curve to apply a glass tube to the common duct at this point. Whether it would be safe in cases of this kind to pack the wound with gauze, trusting to capillary attraction for drainage, I cannot say. It seems to me, although I have never had occasion to sew up the common duct, that it is essential in all such cases to put a tube into the duct. But in all cases where the duct is left without suture it is essential to leave a drainage tube. If a tube is inserted which approaches in size that of the duct, siphonage will remove the bile as fast as it flows toward the incision, and atmospheric pressure will collapse the duct upon the side of the tube. For two reasons, then, the escape of bile around the tube will be very slight, and this will be abundantly provided for by the gauze tampon. This method of siphonage, however, is not always as efficient as could be wished, yet the results are the same. In many cases, siphonage proving insufficient, the bile has escaped entirely around the tube and has been sucked out by the capillary attraction of the gauze. No evil results have followed in any such case. In no case of operation upon the gall duct, bladder, or biliary passages, and in no exploratory operations, has death followed remotely or immediately the result of biliary extravasation. Provided the drainage, whether by tube or by gauze, can be made satisfactory, the cystic duct may be left to the processes of nature, like the urethra in perineal section.

In my earlier operations I used glass tubes for siphonage. In several instances there was evidence of ulceration by pressure. I therefore now use rubber tubing alone.

I have seen in many operations extensive extravasations of bile. The bile differs, under varying conditions, both in consistency, in color, and in innocuous or septic qualities. In cases of contracted gall-bladder, where the cystic duct has been occluded for a long time, the bile is dark green, thick, viscid and tenacious, and often contains small and distinctly-formed calculi, flocculi and mucus. At other times there is, after chronic obstruction, an enormous flow of the bile which has been for a long time backed up in the radicles of the hepatic duct. In such cases large quantities are extravasated, and in spite of every precaution all the parts about the under surface of the liver are bathed in this secretion. Under these circumstances the bile is thin, non-tenacious and yellowish-green. In spite of the great extent of the extravasations and of the impossibility of removing entirely the fluid that covers the intestines, stomach and duodenum—some of which probably runs back through the foramen of Winslow—I have never observed in any case the slightest evidence of subsequent septic infection. It must be stated, therefore, from my experience, and I believe this fact is confirmed by the experience of most men, that bile is harmless when extravasated during the manipulations of an operation. The result, on the other hand, is quite different when through ulcerations the biliary passages have become perforated, and large quantities of bile escaped into the peritoneal cavity. In such cases we must expect the same fatal results which occur in perforations of the intestine. Yet it does not follow necessarily that a biliary extravasation will be fatal. In one case operated upon by Dr. Worcester, of Waltham (personal communication), the gall-bladder had become ruptured and the peritoneal cavity was filled with bile. Some hours or days after rupture Dr. Worcester opened the abdominal cavity and bailed out the bile, and a satisfactory recovery followed. The fact probably is that, as in the urinary bladder, the bile occasionally contains pathogenic micro-organisms. In such cases extravasation is followed by as serious or fatal results, as in extravasations containing septic material elsewhere. At other times the bile is free from septic contamination, and its escape into the abdominal cavity is not followed by

immediately fatal results. The only case in my experience where a fatal termination has followed ulceration and extravasation, a gall-stone impaction of many years' standing resulted in a general peritonitis. In this case I advised an operation upon an impacted stone. The patient was not willing to undergo the operation, and lost her life.

That bile acts upon the peritonæum as an intense irritant, I have observed many times, for even with slight extravasations inflammatory adhesion-formation is very rapid and efficient—a fact proved by the invariable success following the use of gauze tamponage.

Cholecystenterostomy.—In chronic organic non-calculous obstructions between the liver and the duodenum we must expect a for the chronic and fatal cholæmia, unless we can provide artificially escape of bile either externally or into the intestine. One of the most interesting applications of modern surgery lies in the operation of cholecystenterostomy. Physiologically an anastomosis between the gall-bladder and duodenum would seem most desirable, and, when possible, it is to be preferred. Anatomically this is at times impossible, the local conditions preventing an easy approximation. Deviation of the bile-flow into the colon seems compatible with health, and is often more feasible than the duodenal route. Chronic obstructions of this sort are almost always accompanied by a dilatation of the gall-bladder, so that approximations to either duodenum or colon are practicable. Juncture with the duodenum is preferable when possible. The anastomosis may be made by the aid of Senn's plates or Murphy's buttons, or mechanical devices may be omitted altogether. The essential point is to have an opening large enough to ensure permanence. Abbe recommends one and a half inches.

The diameter necessary to give exit to the normal secretion is very small. I have seen vast quantities of bile escape through an opening in the skin no larger than a pin-head. The normal papilla has as small a hole. The contraction after anastomosis must, therefore, be practically complete to arrest the natural daily flow.

If the gall bladder for any reason cannot be used for anas-

tomosis, the common duct may be isolated, under favorable conditions, and inserted through a slit into the side of the duodenum. This, as far as I know, is a theoretical procedure, but anatomically possible, even easy. It is inapplicable unless the obstruction is situated in the pancreatic portion of the duct.

Operations upon the common duct by way of the internal surface of the duodenum may be practiced under very exceptional circumstances, as in McBurney's case of gall-stone impacted near the duodenum (removed by incision of the duodenum and subsequent suture, with recovery). In one case (J. W. Elliot's, unpublished) the obstruction was caused by a cicatrix at the papilla. Anastomosis is certainly preferable on all grounds to enterotomy in similar cases.

Obstructions situated in the hepatic duct above the point of junction with the cystic admit of no relief, except occasionally by the formation of a fistula, though theoretically the duct above the constriction, if long enough, might be inserted into the gall-bladder. Even after external drainage it is doubtful whether the long sinus would remain patent.

Prognosis.—The prognosis after simple explorations is good, but we must bear in mind that there is a very considerable mortality in advanced organic disease.

After cholecystotomies, extirpations and operations upon the ducts, recovery takes place in a very large proportion of cases. In my fourteen cases, including all methods of gall-stone extraction, I have had two deaths, one from an avoidable sepsis and the other from hæmorrhage. In six exploratory operations in which cancer was found there were two deaths.

In most of my cases, whether exploratory or completed, there has been a marked and long-continued jaundice. In none has hæmorrhage been an important factor at the operation itself, and in but one has there been a secondary hæmorrhage. I believe that hæmorrhage is a real danger in cholæmia, but its frequency and importance are much exaggerated.

