

tions treating of those affections are the primary causes, therefore, of the stenosis. The lumen of the duct becomes absolutely imperforate in the inflammatory varieties, and the occlusion may extend over a variable length, though it most frequently exists in the common duct. The lumen is not completely occluded in cicatricial stricture, but is impermeable, and is not unlike a urethral stricture. Local or extended thickenings of the duct causing stenosis are due to a connective-tissue hyperplasia, which originates in a previous catarrhal inflammation. The cicatrix of a duodenal ulcer sometimes includes in its grasp the duodenal opening of the common bile duct.

Carcinoma of the biliary passages will be treated of in a separate section. The perihepatitis, which includes in its course the investment membrane of the ducts, is caused by general peritonitis, by right-sided pleurisy, by affections of the liver and adjacent organs, which set up irritation (as, for example, cancer, cirrhosis, ulceration, etc.). As the peritoneal thickening and the new inflammatory tissues grow in age, they contract and thus encroach on the lumen of the ducts. Syphilis is said to be a cause of this local inflammation.

3. External pressure is caused by disease or displacement of contiguous organs. Named in their order of frequency, it is often found that affections of the pancreas, the lymphatic glands in the hepatic fissure, the duodenum, the stomach, the omentum, and the kidney are the sources of pressure. Carcinoma or hypertrophy of the pancreas, carcinoma, tuberculosis, amyloid disease or lymphosarcoma of the lymphatic glands, carcinoma of the stomach, duodenum and omentum, and tumors of the kidney (hydronephrosis or carcinoma) are the essential pathological conditions which lead to the occlusion. Aneurisms of the aorta (Hatton) and of the hepatic artery (Gairdner) cause obstruction. Very rarely tumors of the ovary and uterus, and fecal tumors, are the cause of occlusion.

The anatomical sequences of occlusion and stenosis of the biliary passages are dilatation of the ducts or gall bladder behind the obstruction, catarrhal or suppurative inflammation of the ducts, enlargement of the liver, at first from the excessive dilatation of the canals, and then from a hypertrophic or biliary cirrhosis, and subsequent atrophy of the liver from pressure of the ducts on the secreting tissue, or destruction of the cells by the connective-tissue overgrowth.

The dilatation of the duct is often extreme. The common and hepatic ducts may be as large as the intestine, and their walls thin, although rupture rarely takes place. The ducts in the liver are also dilated to the size of the finger throughout their extent, even to the surface, causing it to have a vesicular appearance. The walls are not greatly thickened, and are lined with columnar epithelium. The mucous membrane is pale and smooth. The ducts terminate in large pouches, and numerous recesses are seen in the course of the cylindrical canal. Retention cysts are often found. At first the biliary channels are filled with bile only, but after a time this fluid is replaced by a secretion from the glands of the mucous membrane, which is limpid, viscid, and serous in character. The chemical and microscopical examination of the fluid gives no indication of bile constituents. The reaction of the fluid is neutral; it contains albumin. When this fluid is found in the bile ducts, bile is not secreted in them, and the mucous membrane of the ducts is in truth a cyst wall. Whatever bile is secreted is at once absorbed.

The liver is icteric and anæmic; flaccid at first, cirrhotic afterward. The cells undergo atrophy, contain bile pigment and minute oil globules; while cloudy swelling of the protoplasm is observed. The changes peculiar to "hypertrophic" cirrhosis are observed later.

A description of the changes in the gall bladder is reserved for the section on Enlargement of the Gall Bladder.

The *Symptoms* are complex, and include the symptoms of the primary cause and those of biliary obstruction. Aside from the physical signs and symptoms of the causal disease, jaundice is the first symptom. As a rule,

the yellowish tinge gradually changes to a deep olive-green color, and with it the changes in the urine take place; gastro-intestinal dyspepsia is developed, and finally a veritable catarrh supervenes, with its full train of symptoms. Early in the disease weight and tension in the epigastrium and hypochondriac region are complained of, and enlargement of the liver and gall bladder is observed. After a time pruritus comes on, and in from two to four months hemorrhages ensue. Loss of flesh and strength rapidly takes place. Soon, if death has not in the mean time resulted from the original cause or from some intercurrent disease, the symptoms of cholæmic intoxication are likely to arise, and death results from this condition.

One cannot, within the limits of this article, discuss in detail all the forms of biliary stenosis and occlusion, and their differential diagnosis; persistent jaundice, the absence of bile in the stools and its presence in the urine, clearly indicate obstructive jaundice. There are some organic diseases of the liver, however, which give rise to jaundice in some other way than by means of occlusion. They should be distinguished from other forms of obstructive jaundice, on account of the opposite methods adopted for their treatment. Reference is made to atrophic and hypertrophic cirrhosis, to carcinoma, to simple and multiple abscesses, to simple and multiform hydatid disease, and to amyloid disease. The recognition of any of these is not difficult. The atrophic variety of cirrhosis is easily recognized by its well-known symptoms, but not so the so-called hypertrophic cirrhosis. The jaundice is intense, the liver enlarged and smooth, ascites is absent, paroxysmal pains occur, and irregular fever is present.<sup>8</sup> In other forms of obstruction the liver is not so large, the gall bladder is enlarged, while a distinct cause for the jaundice—as, for example, a tumor—may be discovered.

Having discussed the question of occlusion due to any one of the etiological factors previously noted, we may now be permitted to refer briefly, for diagnostic purposes, to these causal conditions.

1. FOREIGN BODIES.—If the obstruction be due to worms, the latter may be recognized by the age of the patient, and by the presence of the parasite in the ejecta. Their presence is further indicated by an attack of hepatic colic, but an absolute diagnosis cannot, and practically need not, be made. This, however, is not so in the case of hydatid cysts, which burst into the bile ducts, with symptoms of hepatic colic. The diagnosis, under these circumstances, can be more readily made: first, by the previous history and physical signs of an hydatid tumor; second, by the disappearance of the tumor after the colic; third, by the subsequent occurrence of fever and local inflammation; and lastly, by the appearance of sacs or hooklets in the vomited or aspirated matter.

*Gall Stones.*—It is of the utmost importance to determine the presence of biliary calculi. To accomplish this, is sometimes a very difficult matter; in fact, it is often a task impossible of accomplishment. The varying symptoms of cholelithiasis are so many that it is not possible to name one of them, or to present a group of them, for the purpose of making a diagnosis, without being able to give an exception to each and every one. The only absolutely definite sign is to see or feel the calculus. If one has been passed by the rectum, it probably was the cause of the obstruction; if it have facets, a fellow-calculus may be the cause.<sup>9</sup> If it is not detected in the stools, exploration of the gall bladder and bile ducts may be resorted to by opening the abdominal cavity. Martin-Solon (*Jour. des Conn. Méd.-Chir.*, Paris, 1849, xxxiii.) reports a case in which the stones could be detected on palpation if the patient took a forcible inspiration, the hand being on the gall bladder. He considered it a new mode of diagnosis.

Aside from these positive methods, a correct conclusion cannot be arrived at without a study of the case in its entirety; the age and sex of the patient, the habits, the family history, the temperament, all are important elements to be considered. If these circumstances are fa-

vorable, and if, in addition, the patient has had previous attacks of hepatic colic, followed by jaundice and the symptoms of duodenal catarrh; if constipation and putty-colored stools accompany the jaundice, the diagnosis is very probable. Then if, after impaction has taken place, the nutrition of the patient remains good for a long time, and the liver enlarges only slightly, while the gall bladder increases appreciably in size, it is scarcely possible to name any other affection as the probable cause of the symptoms.

Campbell (*Brooklyn Annals*) suggests that if, after aspiration of the gall bladder, bilious stools are present, calculi may be assumed to be the cause of the obstruction. The relief of the tension allows the stone to recede and the bile to escape.

2. DISEASES OF THE DUCTS.—*a.* Congenital closure. In an infant, a jaundice that continues for over four weeks, with supervening cholæmia, is due most frequently to this condition. *b.* Closure of the ducts by chronic catarrh of the duodenum, by adhesive inflammation of the ducts, by the cicatrization of an ulcer in the duct or at the duodenal orifice, and by fibrous bands. The first may be recognized partly by the history of the case and partly by the exclusion of attacks of catarrhal jaundice. Adhesive inflammation of the ducts is due either to the passage of biliary calculi or to a previous catarrh. The respective symptoms of the two must be considered in each case.

Ulcers in the bile ducts are due to gall stones, or are secondary to cancer or an infectious fever, as typhoid or cholera. In the former case, in addition to the symptoms of gall stones, we have, accompanying the ulceration, irregular chills and fever and extreme exhaustion, conditions not likely to be present in the early stages, at least, of simple impaction. If the symptoms of occlusion become developed after such phenomena or after an infectious fever, the exciting cause is probably the cicatrization of an ulcer in the duct. The well-known symptoms of duodenal ulceration precede for a long time the symptoms of obstruction of the biliary passages from this cause, and while it may be said that the gall bladder is enlarged under such circumstances, it is not necessarily so when the seat of ulceration is in the duct. Closure of the ducts by fibrous bands may be inferred, if the cause (as syphilis) and the symptoms indicate a perihepatitis, and if other evidence of previous inflammatory trouble be present, as atrophy of the liver, or ascites, etc., due to pressure on the portal veins.

3. DISEASES EXTERNAL TO THE DUCTS.—*a.* Carcinoma and other neoplasms of the liver and surrounding organs. A recognition of these affections can be obtained by the exclusion of other causes of obstruction, by the presence of tumors or nodules, and by the physical signs discoverable on palpation, etc.; also, when these are present, by the alterations of the functions of adjacent organs, and by the presence of the symptoms of malignant disease of these organs; and finally by the duration of the disease, the stenosis from carcinomata being of shorter course than that due to other causes. *b.* Enlarged lymphatic glands. Obstruction from this cause is probable, if there be elsewhere present any of the well-known causes of hypertrophy of these glands, as carcinoma, tuberculosis, amyloid disease, etc. Amyloid disease but rarely causes jaundice, except in this way; its symptoms are too well known to be detailed in this article. *c.* Aneurism. This rare form of occlusion may be recognized by the pressure symptoms of a tumor located in the region of the duodenum, and by the physical signs of aneurism.

The *course* of the disease, in occlusion of the biliary duct, is a chronic and most frequently a progressive one. It is a gradual march to death, except in cases in which foreign bodies cause the occlusion. Under these circumstances their removal by ulceration or the escape of bile around them may be followed by recovery. Death is the result of the original cause of the disease in many cases. Exhaustion or cholæmia often brings about a fatal termination. The duration varies with the cause, and is modified by the onset of accidental complications.

Complete occlusion may terminate in recovery even after a lapse of six years. The prognosis is unfavorable, depending on the nature of the causal lesion. Hemorrhages render the prognosis very grave. The supervention of symptoms of cholæmia is serious. The return of color to the stools is of more favorable import than is a change in the skin discoloration.

The treatment is mainly directed to the relief of symptoms. Medicinal remedies are of but little avail, and resort must be had to surgical measures. The regulation of the diet is of the utmost importance to the conservation of life (see section on *Catarrhal Inflammation*, etc.). Means must be taken to overcome the gastro-intestinal symptoms that result from the absence of bile in the intestines. The bowels must be regulated, the secretion of the kidneys kept active, and the activity of the cutaneous glands promoted. Cholecystotomy, with the establishment of a permanent fistula, may be resorted to, and it may, by relieving pressure in some cases of gall stone or parasitic obstruction, promote a cure. Cholecystoduodenostomy has resulted in success in some instances and the advisability of resorting to it should be considered in a case of complete occlusion.

IV. ENLARGEMENT OF THE GALL BLADDER.—Under this caption all forms of enlargement of the gall bladder will be described, as it is by the clinical study of this manifestation of the disease that we, to a large extent, determine the nature of the ailment and the indications for treatment.

The gall bladder is enlarged from the accumulation within it of bile, of pus, of mucus, and of gall stones, and from disease of its walls—carcinoma. Increase in size from bile, pus, or serum is usually styled simple dilatation. Carcinoma of the biliary passages will be treated of in a separate section. Accumulation of the fluids just indicated is due either to obstruction of the duct, or, in rare cases, to a paralysis of the muscular coat of the gall bladder from overdistention. The dilatation from bile or pus may be temporary, and in such a case is caused by an obstruction catarrhal in nature, or by the presence of a gall stone, which acts as a ball-valve in the lumen of the ducts. Enlargement from accumulation of bile is not common, but may occur with a concretion in the common duct. It is usually of short duration, the bile being absorbed and replaced by mucus.

The walls of the gall bladder are uniformly distended and thinner than normal, the mucous membrane is smooth, and there are no adhesions to the surrounding parts. Sometimes the dilatation is extreme. From a patient of Babington's, three wash-basinsful of fluid were withdrawn, and in another case the gall bladder was so distended as to give the patient the appearance of having an ascites (Coupland). Lawson Tait and Kocher report cases in which distended gall bladders were mistaken for ovarian cysts. Waring mentions a specimen in which the lower end of a distended gall bladder formed the contents of a sac of a femoral hernia. The contents may consist at first of bile, but as the obstruction continues, this becomes more and more intermingled with mucus.

If serum accumulates, causing enlargement (hydrops cystidis felleæ), the obstruction is usually one that has existed for a long time. The inner surface of the mucous membrane is like a serous membrane in appearance, and the accumulated fluid is the result of secretion from this membrane. Adhesions are also absent in dropsy of the gall bladder, and the walls of this organ are much attenuated. It is usually found that in cases of obstruction by gall stone in the common duct the gall bladder is small and contracted, due probably to repeated irritations from stones, the subsequent fibroid changes successfully resisting distention. Distention of the gall bladder with marked jaundice is more frequently met with in new growths of the bile ducts or of the head of the pancreas. The chemical character of the fluid has already been described in section III.

Empyema or abscess of the gall bladder results from an infection by micro-organisms, either following upon some obstruction or irritation, or developing spontane-

ously. The condition is most frequently associated with gall stone, but tumors of the bile duct, typhoid and other fevers may be predisposing factors. Robson considers that "infection by pyogenic organisms is probably in every case the true exciting cause." The same anatomical changes are presented as have been described in the section on Purulent, Ulcerative, and Croupous Inflammation of the Gall Bladder, etc. The walls of the organ are friable and easily ruptured. Adhesions to the surrounding parts are usually formed, and a fistula is established. Pus, or pus and bile, and almost always gall stones, make up the contents. The accumulation of gall stones in the gall bladder, causing enlargement, is not uncommon.

**Symptoms.**—The presence of a tumor in the region of the gall bladder is common to all forms of enlargement. The nature of a tumor observed in this region is determined by its position, size, and shape, by the characters revealed by palpation, and by the nature of its contents. The gall bladder may be known to be enlarged when it is situated under the free border of the ribs, at a point where it is crossed by a line drawn from the tip of the right shoulder to the symphysis pubis (Janeway). As enlargement progresses, the direction which it takes is usually toward the umbilicus, or into the iliac fossa. An area of resonance intervenes between the tumor and the liver, and the intestines are never in front of the organ. The tumor may be pyriform, oval, semiglobular, reniform, or heart-shaped. The size of the tumor varies from that of a walnut to that of a child's head; it may even distend the ribs on both sides (Coupland). On palpation, the tumor may be found to be fixed or movable, tender on pressure, firm, elastic, and fluctuating. If enlarged by gall stones, a grating sensation may be experienced on palpation, and the mass will be hard and firm.

The general condition of the patient and the symptoms presented depend on the cause of the obstruction (see the section on Purulent Inflammation, etc.).

**Diagnosis.**—A differential diagnosis must be made between enlargement of the gall bladder and many forms of abdominal tumors—hepatic, gastric, duodenal, pancreatic, and lymphatic tumors (see section on Occlusion, etc.). Abscess of the liver and hydatid disease must be excluded. In the former, the cause, the general and local symptoms, the absence of jaundice, the induration, and then the softening and fluctuation of the swelling, should be noted. The painless, slow course of hydatid disease, the broad base of the cyst, the fremitus, and the result of tapping will serve, if taken with the negative symptoms of enlargement of the gall bladder, to render the recognition of this disease possible. In multilocular hydatid disease the tumor resembles an enlarged gall bladder containing calculi; like the latter, it is nodulated, hard, and tender, but it is associated with early jaundice, ascites, an enlarged spleen, oedema of the lower eyelids, great emaciation and prostration, with rapid decline of the patient's general health—conditions which, excepting jaundice, are not likely to be present in gall stones. Floating kidney and renal and ovarian tumors have been mistaken for enlargement of the gall bladder. Such an error will not often be made if it be remembered that the enlarged gall bladder is more movable at the lower than at the upper portion; that one end is larger and more rounded than the other; that fluctuation may be present, and that biliary symptoms generally exist; while the absolute sign of floating kidney, an abnormal area of resonance in the renal region, is absent. Tapping would also be invaluable as an aid. In sarcoma of the kidney, in hydronephrosis, and in pyonephrosis, there are changes in the urine to call attention to them. Those renal tumors at first always have the intestines in front of them; they are not influenced by respiratory movement, nor is their area of dulness on percussion continuous with that of the liver; in hydronephrosis a previous renal colic and possibly frequent discharges of urine followed by diminution in size of the tumor occur. These questions of diagnosis arose in the study of the case of Kocher. He relied much on the results of exploratory puncture, as previously discussed. A connection between the tumor

and the uterine appendages and the seat of origin and direction of development of the growth are the points in favor of ovarian tumor; in addition to which, if the fluid be characteristic, the diagnosis of such a tumor would be doubtless correct. A recognition of the various forms of enlargement of the gall bladder can be made by attention to the results of palpation and exploratory puncture and by a consideration of the history of the case. A cancerous tumor of the gall bladder is fixed, painful, not very large, and is attended by gastric symptoms and cachexia.

**Course, Duration, Prognosis.**—These all depend upon the cause. Abscess of the gall bladder is manifested by active symptoms and runs a rapid course. It may terminate favorably by communicating with the exterior, or the stomach, or the intestines, although long-continued discharge from the fistula might be serious. The prognosis of this condition depends on the direction in which the pus may burrow. Accumulations of bile are serious, on account of the cause of the collection, and the course and prognosis depend upon the concomitant pathological phenomena. Dropsy of the gall bladder is latent and chronic; the prognosis is not unfavorable.

**Treatment.**—Tapping of the gall bladder is indicated in cases of accumulation of bile or serum, although to-day a surgeon will prefer to open directly into the gall bladder; purulent collections are practically always to be treated in this manner. At the same time a supporting and stimulating line of treatment must be carried out. The same indications are to be met in accumulations of bile in the gall bladder as in occlusion of the biliary passages.

**V. MORBID GROWTHS OF THE GALL BLADDER AND GALL DUCT.**—Here and there may be found an isolated report of a case of polypus, fibroma (submucous), myxoma, or tuberculosis of the biliary channels, but they are uncommon. Rolleston reports an instance in which a papilloma of the bile duct in intimate association with a stone was removed; some months later the patient returned with a growth in the same region, probably malignant. Bishop (*Lancet*, July 18th, 1901) described a large, non-malignant, cystic growth of the gall bladder and cystic duct. The epithelial lining of the cavities was regularly formed and no sign of cancerous formation could be detected. Kelynack (*Med. Chron.*, November, 1897) has collected instances of fibroma, myxoma, adenoma, and papilloma, though he considers most of the latter to have been epitheliomata. Primary cancer is more frequent than is generally supposed, the secondary form is very common. One of the writers (Musser) has tabulated seventy-eight cases of primary cancer of the gall bladder, and ten cases of cancer of the bile ducts. Kelynack amongst 4,278 cases of cancer finds 8 instances of the former and 2 of the latter. Fütterer (1897) and Rolleston (*Clin. Journ.*, 1897) have reviewed this question.

**Primary Cancer of the Gall Bladder.** (Musser: "Cancer of Gall Bladder and Bile Ducts.")—**Etiology.**—The age was not recorded in 8 cases. Two cases occurred under thirty; 13 between forty and fifty; 19 between fifty and sixty; 14 between sixty and seventy; 13 between seventy and eighty, and 1 in a patient over eighty years of age. The variety of carcinoma was not recorded in 28 instances. In the remainder, at no period of life was there any remarkable tendency to one variety rather than to another. The extreme age at which the growths were found is noteworthy. The sex was recorded in 75 cases, of which 61 were in females and 14 in males. The varieties were equally distributed among the men. Among the women, 18 had encephaloid, 8 scirrhus, 6 epithelioma, 5 colloid, and 2 villous carcinomata; 2 others had sarcomata. Occupation, heredity, and habits played no part in the etiology. Nor did previous health, mental states, or accidents in any way predispose to the disease. Four cases were recorded with antecedent history of gall stones. In the reports of the autopsies, however, it is noted that in 52 of the 78 cases gall stones were found. Kelynack's article (*Med. Chron.*, November, 1897) includes the most valuable collections of

cases up to this time; very complete statistical reports are given.

**Symptoms.** (Musser: "Cancer of Gall Bladder and Bile Ducts.")—Jaundice was present in 51 cases. It developed rapidly in 1, was slight in 6, recurring in 1, and continued for periods varying from one week to three months. The cancerous cachexia was observed in 12 cases. Pain was present in 39 instances. It was seated in the right hypochondrium in 22 cases. Nine suffered from epigastric pain. It was described as colicky (8 cases), as lancinating, as paroxysmal, as wandering, as constant, and as severe. Tenderness on pressure was elicited in a few instances. Fever was present in a large number, viz., in 13 cases. It was intermittent in 2, continued in the others.

The gastro-intestinal symptoms were marked. Nausea was noted in 5 cases, and vomiting in 30. The appetite was lost in 14; constipation was present in 19 cases, diarrhoea in 11. Ascites developed in 16 cases; oedema, appearing late in the disease, in 9. Exhaustion ensued in 15; emaciation continued and became excessive in 36 instances. Hemorrhages occurred, late in the disease, in 5 cases, and grave cerebral symptoms in 7. Physical signs: A tumor was observed in 34 instances; hard and firm, 19 times; irregular and nodular, 8<sup>10</sup>; round, oval, pyriform, cylindrical, and smooth, were the terms used to describe it. In 8 it was movable, in 6 fixed. It disappeared on pressure in 1 instance. It varied in size from a hazelnut to a child's head. Ten times a record of pain in the tumor was made; 4 times the tenderness was marked. The tumor was said to be situated in the region of the gall bladder (10), in the umbilical region (7), in the right hypochondrium (10), or in close proximity to these situations. The liver was enlarged (21), atrophied (1), hard (2), irregular (2), nodular (3), or tender (2). The veins over the surface were enlarged in 2 instances.

In fine, emaciation, jaundice, cachexia, pain in the region of the gall bladder, with fever, nausea, vomiting, and loss of appetite, with or without diarrhoea, are the prominent symptoms of cancer of the gall bladder. To corroborate the surmise of its presence, a tumor in the right hypochondrium, tender on pressure, and the seat of pain, and nodular in character, would usually be found.

**Morbidity Anatomy.**—The encephaloid variety is found most frequently, the scirrhus next, and then the epitheliomatous, colloid, and villous. Kelynack gives epitheliomatous growths the first place in order of frequency, with scirrhus next. The growth begins at the junction of the cystic duct with the bladder and involves the entire organ, leaving scarcely a trace of it, or infiltrates the coats and encroaches on the cavity. Again, a few nodules are seen underneath the mucous membrane, or a dense thickening of the walls, caused by new formations, takes place, especially at the cystic duct, or finally the gall bladder is represented by a nodular mass. The mucous membrane is destroyed entirely or ulcerated at various points over the cancer, or is the seat of intense inflammation. Fungoid cauliflower or villous excrescences grow into the cavity of the bladder, or the surface of the mass may be covered with papillae with bulbous extremities. The tumor may be dense, firm, without juice, or a soft, pulpy mass. In some instances the gall bladder is reduced in size, very often it is enlarged, even enormously distended. The peritoneal investment is intimately adherent and thickened; subperitoneal nodules are seen, or the external surface in the colloid variety partakes of its peculiar characters. Adhesions are formed between the diseased gall bladder and the adjacent organs; degeneration of the walls, and at times rupture, take place. Ulceration and perforation are very common. Fistulous communication is thus established between the gall bladder and the duodenum, the colon, or the stomach. In the course of the disease gall stones are often discharged in this way. The centre of the carcinomatous mass is made up of soft, pulpy detritus, or of a thick, creamy matter. In it gall stones are also found, sometimes firmly encapsulated by the growth; or, if the cavity of the gall bladder remains,

it is filled with calculi, with pus, bile, blood, or mucus, singly or combined. In 52 instances out of 78, gall-stones were present. The new formation spreads to contiguous structures;—thus the liver, colon, stomach, etc., may be involved. Changes are found in the liver and in the ducts, due to obstruction of the large bile ducts. (See Sections II. and III., for description.) Peritonitis (local) is usually present; an acute inflammation is set up by rupture. Secondary deposits may also be found in the abdominal lymphatic glands, the omentum, the suprarenal bodies, and the pleura.

**Diagnosis.**—The marked symptoms detailed in the clinical history are to be borne in mind. The character of the tumor, its seat, its mode of growth, its immobility, pain, and tenderness, are important. The occurrence of jaundice and vomiting, the passage of calculi (by a fistula leading to the colon) per rectum, without relief to obstruction, and the occurrence of emaciation, make a diagnosis almost positive. The age and the sex are important factors, and a history of the jaundice is of aid in the diagnosis.

**Relation of Gall Stones to Carcinoma.**—This is believed to be causal. The frequent occurrence of this disease in the same sex in which biliary calculi are most common, is strong evidence. But a case of Quetsch's (*Berl. klin. Wochenschrift*, 1885, No. 42, p. 672) confirms this opinion more decidedly than does any previous clinical evidence. The patient, a female, was subject to biliary calculi, and a biliary cutaneous fistula had been formed. Subsequently, a carcinoma of the gall bladder developed in the presence of the calculi which did not pass, and, no doubt, were the cause of the local irritation. Zenker found gall stones in 85 per cent. of cases of cancer of the gall bladder. Similarly high percentages were found by Courvoisier, Brodowski, Gayle, Bertrand, and others; Siegert, in 95 per cent. of primary carcinomas of the gall bladder, found stones associated, but in only 15 to 16 per cent. of secondary carcinomas was this the case. In 4 cases of primary carcinoma of the liver, reported by Beadles, stones were also present, while none were seen in 36 secondary hepatic carcinomatous growths. Others believe that the calculi develop secondarily from stagnation of the bile and precipitation of its constituents.

**Duration.**—This has been placed at several years by Villard; in other cases death occurred within three months after the first symptoms developed.

The prophylactic treatment consists in the removal or prevention of formation of the calculi, and the treatment of the disease, after it is once manifested, is purely symptomatic. Robson, however, has removed the gall bladder and part of the liver in five cases, with more or less encouraging results in four of them. As one of the cases was shown at operation to be a chronic inflammatory condition of ducts, gall bladder, and adjoining viscera instead of carcinoma, the value of an exploratory operation is certainly suggested.

**VI. PRIMARY CANCER OF THE GALL DUCTS.**—It may develop within the liver or in the larger ducts. The most common point of origin is at the mouth of the common duct or at the junction of the cystic and hepatic ducts. A firm mass of newly formed tissue surrounds the duct or invades its walls. The lumen is almost or completely obliterated; its inner surface is the seat of ulceration, at certain points, or of papillary growths. A fungous growth projected from the mouth of the common duct in a case reported by Stokes. The anatomical changes of occlusion and stenosis are seen in the liver and ducts. Secondary deposits are found generally in the liver only, along the ducts. Kelynack<sup>11</sup> discusses primary cancer of the ducts and has collected 26 cases. A diffuse growth was most frequently met with post mortem. Edes<sup>12</sup> and Rolleston<sup>13</sup> are more recent contributors to the subject, dealing particularly with cancer of the extreme end of the common bile duct. Halsted<sup>14</sup> has removed a columnar-celled carcinoma from the ampulla of Vater.

The symptoms common to carcinoma and to biliary obstruction are present. Rarely is the growth large enough to be recognized by palpation. Death is rapid

and due to occlusion of the ducts, leading to bile intoxication or purulent inflammation.

**VII. CONGENITAL DEFECTS OF THE GALL BLADDER AND GALL DUCTS.**—The gall bladder may be absent entirely, without serious inconvenience; a shrivelled pouch or a contracted tube takes its place. In atresia of the ducts, jaundice, umbilical hemorrhage, and marasmus are present during life. The jaundice is present at birth, or makes its appearance a few days afterward, persists, and deepens. The stools show an absence of bile; the urine is bile-tinged. There is from the first a tendency to hemorrhages, and this increases ecchymosis under the skin; bleedings from the mouth, nose, or bowels take place.

Umbilical hemorrhage, occurring after the separation of the cord, is especially marked. As the child grows older it loses in flesh, becomes extremely weakened, and dies of cholera or exhaustion, in spite of an ability to take much nourishment. At first the liver is normal, but if the child lives it becomes very large, and the spleen is likewise increased in size. Ascites may develop. If hemorrhages do not occur, the child lives many months. In a case reported by Lotze, the child lived seven months.

R. Lomer<sup>15</sup> reports a curious case. It was one of congenital obliteration of the right hepatic and the cystic ducts. The whole right lobe had undergone cystic degeneration and was shrunken, the gall bladder was obliterated, but the left lobe remained normal. He analyzes a series of cases, and, from the fact that usually the parents are syphilitic and several of their children are similarly diseased, he holds that an intra-uterine hepatitis of syphilitic origin is the cause of the disease. This is the usually accepted explanation of the pathology of congenital disease of the ducts. The obstruction, which is fibrous, may be in a main duct or in one of its branches. The gall bladder may be normal, but contains a serous fluid. It may be obliterated or remain as a fibrous cord. The ducts in the liver may be dilated, or some may appear like fibrous cords. Sometimes the portal fissure is the seat of local perihepatitis, and usually the surface of the liver is involved. The liver is icteric, the seat of connective-tissue overgrowth, or atrophied. Some parts become cystic. Rolleston and Hayne<sup>16</sup> describe a congenital obliteration of the bile ducts giving rise to an advanced hepatic cirrhosis; Thompson (Allbutt's "System of Medicine" and Thesis, Edinburgh, "Congenital Obliteration of Bile Ducts") has collected fifty such cases. Ford<sup>17</sup> gives cases of congenital obstruction producing the so called biliary cirrhosis.

The jaundice due to congenital defects of the ducts is to be distinguished from that jaundice-like discoloration of the integuments, conjunctiva, etc., that is physiological. In this condition, which is common in new-born infants, bile is present in the stools. Jaundice of the simple catarrhal variety also occurs in infants. It usually responds promptly to treatment, and has not the malignant aspect of disease dependent upon deficiency of the ducts. Then, again, a pylophlebitis occurs sometimes in infants. In this case fever and the usual evidences of pyæmia are present.

**VIII. PARASITES.**—They may develop within the biliary passages (distoma), they may emigrate from the intestines (round worm), or they may find their way into the ducts by ulcerative action (echinococcus). Rarely, the latter develop within the ducts.

1. *Distoma hepaticum* (large liver fluke) and *Distoma lanceolatum* (small liver fluke).—Common in sheep and cows, rare in man. The large fluke is found in the gall bladder or large bile ducts; the small one generally in the finer ducts. Both species may occur in the same subject. The latter variety produces the most notable changes in the liver.

The presence of these parasites sets up a chronic catarrhal and suppurative inflammation of the ducts. Enlargement of the gall bladder and ducts occurs secondarily. A fibrous inflammation of the walls takes place, with secondary calcareous degeneration of the products of inflammation; the ducts become much enlarged and

thickened, and the lumen is dilated. Occlusion of the ducts results on account of the inflammatory disease and the presence of the parasites in the canal. By necessity, therefore, we have the symptoms, previously noted in this section, of the above anatomical changes, and of obstructive jaundice. In addition, nervous symptoms of a reflex nature—as syncope, convulsions, or aphonia—may be present. A positive diagnosis can be made only by finding the parasites in the vomited matter, or in the feces. Death occurs sometimes on account of the inflammatory complications, or from exhaustion.

2. *Round Worms (Ascaris lumbricoides)*.—They usually wander from the intestines, and are found with their head toward the liver. Rarely, after adhesive inflammation and fistulous communication between the gall bladder or ducts and the intestine, worms are found in the biliary passages. The number of them varies—from one to three or four, usually. They are often found alive on making an autopsy, or have died before the death of the patient, and are soft and macerated. Their presence excites catarrhal inflammation, causes occlusion and, secondarily, a purulent cholangitis, a dilatation of the ducts, and subsequent atrophy of the liver, or the formation of multiple abscesses. When limited to the gall bladder, they cause enlargement and inflammation of that organ. The dilatation of the ducts is usually general; sometimes local sacculated dilatations are observed, in which worms lie rolled up.

The symptoms—if the worm has recently migrated into a duct—are like those of hepatic colic. Later, the symptoms and signs of obstructive jaundice occur, and then those of purulent cholangitis. A history of an attack of worms, the presence of the parasite in the ejecta, and the age of the patient furnish valuable corroborative evidence. Further, intestinal and nervous symptoms due to worms are said to be present.

3. *Echinococcus (Hydatid Disease of the Bile Ducts)*.—Either an hydatid cyst may press upon one or more of the ducts, causing occlusion of them, or complete obliteration of their lumen, or entire destruction of them (Leroux); or the sac may ulcerate into the ducts or bladder, and the vesicles pass by this route into the intestines, with symptoms of hepatic colic; or, finally, it may cause occlusion, dilatation, and inflammation of the biliary passages. This process may terminate in suppuration and gangrene of the cyst, and is usually fatal. The symptoms of obstructive jaundice of a high degree, and of the local inflammatory changes, indicate this pathological condition. The presence of hydatid hooklets in the ejecta from the stomach or bowels, a previous history of a painless enlargement of the liver, and the results of tapping or exploratory puncture, would confirm one's opinion of the presence of hydatid disease. Finally, the gall ducts are seriously invaded in that rare manifestation of hydatid disease known as multilocular echinococcus. In this instance the walls of the ducts are thickened, hard, and rigid, and the lumen is effaced, by the presence of the vesicles in the tissues. Secondary inflammation, suppuration, and dilatation, etc., may arise in these cases. The symptoms of this manifestation have been considered in the section on Occlusion of the Ducts.

It is interesting to note that the bile, some authorities believe, is capable of killing these parasites.

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Norman B. Gwyn.

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- <sup>2</sup> Boston Med. and Surg. Jour., August 4th, 1898.
- <sup>3</sup> See Trans. Path. Soc., vol. viii., and Am. Jour. of the Med. Sciences, July and October, 1884, for cases of chronic catarrhal jaundice by the writer.
- <sup>4</sup> Deutsch. med. Wochen., 1895, No. 15.
- <sup>5</sup> Amer. Jour. of the Med. Sciences, November, 1901.
- <sup>6</sup> Bulletin of University of Pennsylvania, September, 1901.
- <sup>7</sup> Jaundice is used in a general sense. For a further discussion of symptoms and effects, see *Icterus*.
- <sup>8</sup> See Pathological Society's Transactions, Philadelphia, 1877-78, Am. Jour. of the Med. Sciences, July, 1884.
- <sup>9</sup> In cases of cancer of the gall bladder and ducts, calculi are often passed.

<sup>10</sup> Numbers record frequency of the presence of a stated fact in the seventy-eight cases.

- <sup>11</sup> Loc. cit.
- <sup>12</sup> Boston Med. and Surg. Jour., March 7th, 1901.
- <sup>13</sup> Lancet, February 16th, 1901; Med. Chron., 1896.
- <sup>14</sup> Johns Hopkins Bulletin, January, 1903.
- <sup>15</sup> Lomer: Ueber einen Fall von congenitaler partieller Obliteration der Gallengänge. Virchow's Arch., Band 99, p. 130.
- <sup>16</sup> Brit. Med. Jour., March 30th, 1901.
- <sup>17</sup> Amer. Jour. of the Med. Sciences, January, 1901.

**GALLIC ACID.**—By exposure, to the atmosphere, of galls in the presence of water, chemical conversion of the tannic acid of the galls takes place, resulting in the formation of gallic acid,  $\text{HC}_7\text{H}_5\text{O}_6, \text{H}_2\text{O}$ . This body is official in the United States Pharmacopœia under the title *Acidum Gallicum*, Gallic Acid, and presents itself as "white, or pale fawn-colored, silky, interlaced needles, or triclinic prisms; odorless; having an astringent or slightly acidulous taste; permanent in the air. Soluble at 15° C. (59° F.), in 100 parts of water, and in 5 parts of alcohol; in 3 parts of boiling water, and in 1 part of boiling alcohol. Also soluble in 40 parts of ether, and in 12 parts of glycerin. Very slightly soluble in chloroform, benzol, or benzin" (U. S. P.). On heating, the acid first loses its water of crystallization, then melts, and finally is decomposed, and consumed without residue.

Gallic acid is purely but feebly astringent, and seems practically devoid of any other physiological property. Taken internally, it does not poison, nor constipate, nor even disorder the stomach unless in excessive dosage. It does not coagulate albumin, and so, when swallowed, is readily absorbed. After absorption it appears speedily in the urine, as is demonstrable by chemical tests. Therapeutically, the only reputation of gallic acid is for internal giving for the control of hemorrhages from inaccessible parts—for which purpose the efficacy of the medicine is esteemed very differently by different practitioners. Since, in the application in question, the acid must act by local contact as presented to the bleeding vessel in solution in the blood, it is evidently necessary for success that the charge of acid to blood shall be as great as possible. Full and frequent doses, therefore, are required by the indication. Gallic acid has been given without untoward effect in dosage of 0.65 gm. (gr. x.) every three hours, unremittingly, for three weeks. It may be prescribed in pill, powder, or mixture. Edward Curtis.

**GALLICIN** [ $\text{C}_7\text{H}_5\text{COOCH}_2(\text{OH})_2$ ] is prepared by heating a methyl alcohol solution of gallic or tannic acid with strong sulphuric acid, or by passing dry hydrochloric acid gas through the solution. It crystallizes in rhombic prisms or fine needles, which are freely soluble in water and alcohol. It is used as an antiseptic, non-toxic dusting powder, and, in solution, in conjunctivitis.

W. A. Bastedo.

**GALLOBROMOL**—dibromogallic acid [ $\text{C}_7\text{H}_3(\text{OH})_2\text{COOH}$ —] is a colorless or slightly grayish-red powder, composed of fine acicular crystals, and obtained by the action of bromine on gallic acid. It is slowly soluble up to ten per cent. in cold water (Merk), and dissolves readily in boiling water, alcohol, or ether. It has been used as a bromide in neurotic conditions and epilepsy, but has been found by Lépine to cause in a dog slowing of the heart, depression of respiration, fever, hæmoglobinuria, convulsions, and death. It is of more use locally, as an antiseptic and astringent, as in eczema, or in gonorrhœa, cystitis, or epididymitis. For cystitis it is used as an irrigation in two to four per cent. solution; for urethritis as an injection; and for eczema as a lotion, ointment, or dusting powder of one to two per cent. strength.

W. A. Bastedo.

**GALLOFORMIN** [ $\text{C}_7\text{H}_5(\text{OH})_2\text{COOH}(\text{CH}_2)_6\text{N}_4$ ] is a condensation product of gallic acid and hexamethylene tetramine. It forms very hard, refractive, acicular crystals, soluble with difficulty in water, alcohol, ether, and glycerin, and insoluble in benzol and fixed oils. It is very unstable, readily yielding formaldehyde gas, so is

used as an antiseptic both internally and externally. It is decomposed by heat, acids, or alkalis.

W. A. Bastedo.

**GALL, OX.**—*FEL BOVIS*.—"The fresh bile of *Bos Taurus* L. (class *Mammalia*; order *Ruminantia*)," (U. S. P.)

A brownish-green or dark green, somewhat viscid liquid, having a peculiar, unpleasant odor, and a disagreeable, bitter taste.

Specific gravity: 1.018 to 1.028 at 15° C. (59° F.).

It is neutral, or has a faintly alkaline reaction on litmus paper.

A mixture of 2 drops of ox gall and 10 c.c. of water, when treated, first, with a drop of a freshly prepared solution of 1 part of sugar in 4 parts of water, and afterward with sulphuric acid, cautiously added, until the precipitate first formed is redissolved, gradually acquires a brownish-red color, changing, successively, to carmine, purple, and violet.

*Purified Ox Gall, Fel Bovis Purificatum* (U. S. P.).

Fresh ox gall, three hundred cubic centimetres. . . . 300 c.c.  
Alcohol, one hundred cubic centimetres. . . . . 100 c.c.

Evaporate the ox gall, in a tared porcelain capsule, on a water bath, to about one hundred (100) grams, then add to it the alcohol, mix the whole thoroughly, and set it aside, well covered, for three or four days. Then decant the clear solution, filter the remainder, and, having mixed the liquids and distilled off the alcohol, evaporate the remainder to a pilular consistence.

A yellowish-green, soft solid, having a peculiar odor, and a partly sweet and partly bitter taste.

Very soluble in water and in alcohol.

A solution of 1 part of purified ox gall in about 100 parts of water behaves toward sugar and sulphuric acid in the same manner as the solution mentioned above.

An aqueous solution of purified ox gall should be clear, and should remain transparent upon the addition of an equal volume of alcohol (evidence of proper purification).

This complex substance in its crude condition consists of about ten per cent. of solids and ninety of water.

The most important solid constituents are the sodium salts of *taurocholic* and *glycocholic acids*, and several not very well distinguished coloring matters (*bilirubin*, *biliverdin*, etc.). Besides these it also contains a number of decomposition products, *cholesterin*, *urea*, etc., and some *fats* and *mucus*.

Further than to show its practical identity with that of the human subject, the study of the specific composition of ox gall is unimportant.

For the same reason the study of its action pertains wholly to physiology. We know that bile has no business in the stomach, although it appears that its entrance there, in certain morbid conditions, may exert a stomachic effect, without seriously inhibiting digestion, and its therapeutic use may be serviceable in this way. It must, however, be remembered that the properties of the bile itself are subject to change in the stomach, so that suitable measures must be taken in its administration (see below), when the intestinal action is desired.

It is equally well established that bile in the circulation acts as a poison, although there are some facts to suggest that its antitoxic action there may at times more than counterbalance such objection.

It is then in the intestine and in the liver that we must look for the beneficial effects of the administration of bile. In the former it is a valuable antiseptic, peristaltic stimulant, chemical synergist of certain purgatives, and promoter of the absorption of fat. None of these processes requires discussion. All can be effected by ox gall, properly administered, as by the natural secretion. Upon the liver, the drug has the effect of a direct chologogue, that is, an agent increasing the actual secretion of bile, and about the only one known. Since the constituents of the bile decomposed in the intestine are returned to the liver to be again recombined, we should naturally expect this increase to be produced. It appears, how-