Staff Meeting Bulletin
Hospitals of the . . .
University of Minnesota

Gallbladder Disease

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William A. O'Brien, M.D.

I. LAST WEEK

Date: January 28, 1937

Place: Nurses' Hall
Recreation Room

Time: 12:15 to 1:20

Program: Movie: Geological Work of Ice

Abstract: Laryngeal Obstruction. Tracheotomy.

Present: 130

Discussion: L. R. Boise
C. A. Stewart
W. T. Peyton
P. F. Dwan
O. H. Wangensteen
R. R. Sullivan
H. S. Diehl
R. V. Ellis
R. W. Koucky
W. H. Thompson
Herman Kesting

II. MOVIE

Title: Wild Life in Minnesota

Released by: Walter J. Breckenridge
Museum of Natural History, University of Minnesota.

III. OUR GUEST TODAY

EVARTS A. GRAHAM

IV. ABSTRACT

GALLBLADDER DISEASE:
CAUSE OF DEATH FROM
CHOLECYSTITIS

H. Robert Ransom,
George S. Bergh

It has been stated that gallstones occur in 10 to 25% of all adults and that some form of biliary tract disease occurs in a much higher percentage. While the death rate is not high, the prevalence of the disease stimulates interest in the factors influencing the mortality.

Dr. Ransom has reviewed the hospital records for the period of July 1928 to April 1936. During that time, 1,247 cases of biliary tract disease were admitted, and 33 of these died; a mortality of 2.64%. Twenty-seven (81.8%) of the 33 cases had been operated upon, while 6 (18.2%) had not been treated surgically for their biliary tract disease.

In the present study no attempt has been made to study the surgical cases as a separate group. Dr. Manson made such a study on a group of cases operated upon here between July 1931 and July 1935. He included cases of carcinoma of the gallbladder, bile ducts, and head of the pancreas, and found a total mortality of 5.5% following all operations upon the biliary tract. The mortality following simple cholecystectomy is considerably lower (Graham reports it to be around 1% in his clinic).

The mortality in 1,121 uncomplicated cases, including both acute and chronic cholecystitis, was 1.5%. The mortality in the remaining 126 complicated cases was 12.7%. The total mortality was 2.64%.

Autopsies were performed in 29 (87.9%) of the 33 fatal cases. The series is too small to have statistical significance, but the cases have been analyzed to determine the chief cause of death in each instance. The findings are listed in the accompanying table:

Peritonitis	6	18.2%
Subphrenic abscess	4	12.1
Cholangeitis	4	12.1
Pneumonia	3	9.1
Hemorrhage	3	9.1
Pancreatitis	3	9.1
Liver insufficiency	3	9.1
Bile peritonitis	2	6.1
Bilateral atelectasis	2	6.1
Pulmonary embolism	1	3.0
Shock	1	3.0
Cardiac	1	3.0
Total	33	100.0%

Reports in the literature are less detailed than this series, but the following table is submitted to permit comparison of our figures with those from other institutions. Heuer's figures (1934) include 2,453 deaths collected from the literature together with a series of cases from the New York Hospital. The figures of Boyce, Veal, and McFetridge (1936) represent 100 deaths (with 29 autopsies) from the Charity Hospital in New Orleans.

	Heuer		Boyce et al	Univ. of Minn. Hosp.
	New York Hosp.	Literature		
1. Peritonitis			24%	18.2%
2. Consequence of surgical procedure, shock, peritonitis	37%	33%		
3. Gangrene and perforation	11	10		
4. Pulmonary complications	25	20	17	18.2
5. Liver deaths		4	23	9.1
6. Shock and hemorrhage			11	12.1
7. Cardiorenal	10	12	10	3.0
8. Pancreatitis		2		9.1
9. Miscellaneous	17	19		

The general mortality in Heuer's 36,623 collected cases was 6.6%. The individual mortality varied from 2.6% to 10.4%. More recent figures are somewhat lower than these.

Operative mortality is not increased by performing incidental appendectomy at the same time as cholecystectomy.

Among the causes of death from cholecystitis are: sepsis (peritonitis, subphrenic abscess, cholangeitis and multiple liver abscesses, etc.), pulmonary complications, liver insufficiency, hemorrhage and shock, bile peritonitis, cardiac failure, acholic cachexia, pancreatitis, and intestinal obstruction. The most important factors influencing the mortality will be discussed separately.

Generalized Peritonitis

This is one of the commonest causes of death. It may follow operation, or it may result from perforation of the biliary tract, or even from "filtration" through the gallbladder wall. The peritonitis may be of the acute bacterial type, or may be the result of the presence of bile in the peritoneal cavity, the so-called "bile peritonitis."

A. Perforation of the gallbladder will be discussed separately.

B. Postoperative bacterial peritonitis: The infection may arise from material escaping from the gallbladder, common duct, duodenum, or stomach; or it may arise from contamination introduced from the outside. The most recent figures indicate that approximately 15% of deaths following gallbladder surgery are due to peritonitis (our figure, 18.2%, includes cases of rupture of the gallbladder which were not operated upon). Older figures indicated a higher incidence.

Diagnosis: Symptoms and findings of peritonitis are: pain, tenderness, rigidity, nausea and vomiting, distention, elevation of temperature and pulse rate, and leucocytosis. Any or all of these may be absent, and diagnosis may be difficult.

The pain and tenderness may be mild and it is often difficult to evaluate the findings since some pain and tenderness are present as a result of the operative procedure.

Rigidity and nausea and vomiting are reflex phenomena which are usually

present, resulting from irritation of nerve endings in the peritoneum. Hiccough, likewise a reflex, may occur occasionally.

The temperature is often elevated, and the fever may be preceded by a chill. The pulse rate is increased and pulse volume is diminished.

Distention occurs due to the accumulation of gases within the intestines. Leucocytosis, usually from 15,000 to 18,000, is present in most cases.

Prevention: One should avoid contamination of the peritoneal cavity at the time of operation, and the gallbladder bed should be drained. Drainage not only protects against the development of bacterial peritonitis, but also provides an avenue of escape if there should be leakage of bile. Dr. Wangensteen maintains that "Drainage after cholecystectomy is imperative. It is a safeguard and does no harm." It is accomplished by leading a gutta percha drain from the gallbladder region to the outside through a stab wound. Drainage is maintained for about eight days.

Treatment: Should peritonitis develop, the treatment is symptomatic and supportive. Oral feeding is discontinued, and the distention and nausea and vomiting are combatted with nasal suction siphonage. Intravenous fluids must be given. Hot packs are applied to the abdomen.

C. Bile Peritonitis: Bile peritonitis represents a less frequent complication. It may result from perforation of the gallbladder, from leakage from the bile ducts or liver bed following operation, or may occur in the absence of demonstrable perforation of the biliary system. Graham has expressed the opinion that the last mentioned type results from the escape of bile through a perforation of a Luschka's crypt.

Unless the escaping bile is removed, death usually results. The exact cause of death is not always clear, but Harkins, Harmon, and Hudson have recently listed five possible lethal factors:

1. "Local irritant action of the foreign substance producing local plasma loss and secondary shock.

2. Local damage to body tissues with absorption of toxic products thereby produced.

3. Absorption of exotoxins produced by anaerobic organisms or of toxic products produced by the action of these organisms on the foreign substance present or the body tissues themselves.

4. Absorption of toxic products from the foreign substance itself.

5. Action of absorbed products on general vascular permeability furthering secondary shock."

The institution of drainage following operative procedures upon the biliary tract is an important preventive measure against the development of bile peritonitis.

Treatment: If the patient be in shock, no operative procedure should be undertaken until the general condition is improved. Removal of bile by aspiration may temporarily improve the condition. As soon as the shock has been combatted, operation should be undertaken In cases of rupture of the gallbladder, cholecystectomy is the operation of choice. In cases of injury to the ducts, the defect must be repaired. Drainage should be instituted.

Localized Peritonitis

A special form of localized peritonitis sometimes encountered in biliary tract disease is subphrenic abscess, which may result from perforation of the gallbladder, or may follow operation. The abscess may contain pus alone, or pus and gas together.

Diagnosis is difficult. There is a septic type of temperature and leucocytosis. Pain may be slight or it may be severe; sometimes it is referred to the right shoulder. There is often fluid in the pleural cavity above the abscess, and physical signs resemble those of a thoracic lesion. If the subphrenic abscess is large and contains much gas, four zones may be distinguished

(1) zone of lung resonance, (2) zone of pleural effusion dulness, (3) zone of gas resonance, and (4) zone of abscess dulness. The diaphragm is displaced upward and the liver is pushed down by the abscess. In late, large abscesses there may be bulging at the costal margin and tenderness and fullness in the intercostal spaces.

The treatment of subphrenic abscess is drainage. If left untreated, the abscess may rupture into the pleural space or through the abdominal wall--or even into some abdominal organ such as the stomach or colon. Drainage may be carried out through an anterior approach, below the costal margin; through a retroperitoneal approach after resection of the 12th rib (Nather and Ochsner); or through a transpleural approach. The last method is carried out in two stages; the first stage consisting of rib resection and packing of the wound to stimulate the formation of adhesions between the diaphragm and the chest wall, followed a few days later by drainage.

Pulmonary Complications:

Postoperative pulmonary complications account for about 20% of deaths in gallbladder disease, and include atelectasis, pneumonia, and pulmonary embolism.

Following operations upon the biliary tract, the diaphragm is elevated, diaphragmatic excursion is limited, and vital capacity is reduced. Carlson has pointed out that the inhibition of respiration is an important factor in the pathogenesis of postoperative pulmonary conplications. This respiratory inhibition may be combatted by frequent hyperventilation with mixtures of carbon dioxide and oxygen. It should be emphasized that hyperventilation must be carried out properly to be effective.

Perforation of the Gallbladder

Acute perforation is fortunately not common. A correct diagnosis is not often made, and the mortality is high. Rupture of the gallbladder is much more common than rupture of the ducts, but instances have been reported of spontaneous perforation through an area of infection and weakness of the common bile duct following cholecystectomy and common duct exploration. In the gallbladder, perforation usually occurs at or near the fundus. It may occur at any age, but is most common in elderly individuals--presumably because of the poorer blood supply. The usual cause of rupture of the gallbladder is cholecystitis together with obstruction of the cystic duct. Less frequently it may be due to ulceration associated with typhoid fever. Occasionally, it is secondary to thrombosis of the cystic vessels. Perforation may lead to:

1. Localized infection. This occurs when the gallbladder region has been previously walled off by adhesions.

2. Biliary fistula. This subject is discussed below.

3. Generalized peritonitis. Gallbladder perforation with generalized peritonitis is associated with a mortality ranging upward from 50%. Diagnosis is difficult. There is usually a history of sudden severe abdominal pain and the findings are those of generalized peritonitis. Perforated ulcer is usually suspected, but a history of longstanding biliary disease may suggest ruptured gallbladder.

Treatment consists of immediate operation. Cholecystostomy is performed more often than cholecystectomy, but if the general condition of the patient is good and the operation not too difficult, the latter procedure may be undertaken. Postoperatively, nasal suction siphonage should be instituted and intravenous fluids administered.

Biliary Fistula

Biliary fistula may be external or internal and may arise spontaneously or as a result of injury.

External biliary fistula: Spontaneous external fistula is usually associated with cholecystitis with calculi. The

fistulous tract usually opens near the umbilicus or in the right upper quadrant. Occasionally, it opens in the right lower quadrant or even in the thigh.

Traumatic external fistula previously was a common sequel of cholecystostomy; occurring especially in cases in which the mucosa of the gallbladder was sutured to the skin or the gallbladder was fixed to the abdominal wall. At present, external fistula is much less common and usually results from either an overlooked obstruction of the bile duct or an accidental obstruction created at operation or from the development of a stricture.

Complete external drainage of bile produces a condition of rapid emaciation terminating fatally (acholic cachexia or cachexia cholipriva). The administration of minimal amounts of bile by mouth, or leakage of small amounts of bile into the intestine will maintain an individual in good health. Total loss of bile generally results in acute intestinal disturbances with rapid weight loss, general osteoporosis, diminution of bile salt formation, and a purpuric tendency. There is often an associated anemia, and gastroduodenal ulceration may develop. Some of these changes do not appear until several months have passed, and according to Bissell and Andrews, anemia, osteoporosis, and gastro-intestinal ulceration need not develop at all. These authors state the "acholic cachexia is not due to the absence of bile from the intestinal tract with consequent inability to absorb any specific food or vitamins. It is due to a disordered internal metabolism of sterols which inhibits proper utilization of them." The question is still unsettled.

Internal biliary fistula: An internal biliary fistula may arise spontaneously, or it may be established by operation to divert the bile around an irremovable obstruction of the bile duct. The latter type will not be considered here.

Spontaneous internal biliary fistulae arise from perforation of the gallbladder or the ducts into some other organ. The most frequent type is the cholecystoduodenal fistula. (A few of these result from perforation of a duodenal ulcer into the gallbladder.) Less commonly fistulae are established between the biliary tract and other organs. These types include cholecystogastric, cholecystocolic, bronchobiliary, cholecystorenal, and cholecystojejunal fistulae. Still other types of fistulae have been described but are extremely rare.

Common duct obstruction is usually associated with such a fistula, and if the obstruction is relieved the fistula closes.

The clinical picture varies according to the type of fistula present. Gallstones have been coughed up (bronchobiliary fistula), vomited (cholecystogastric or cholecystoduodenal fistula), passed in the stool (all types of gastrointestinal biliary fistulae), and voided in the urine (cholecystorenal fistula). There is usually a long history of gallbladder disease. If there has been jaundice, this usually subsides. Immediately following the perforation, there is a period of relief from symptoms of gallbladder disease. Occasionally, when gallstones are passed into the intestine, gallstone obstruction will develop.

If the fistula remains open an ascending cholangeitis and hepatitis always develop, because lack of a sphincter mechanism permits reflux into the biliary tract. The majority of these ascending infections are not sufficiently severe to produce clinical symptoms, but occasionally death will result from cholangeitis and hepatitis.

Diagnosis is often aided by roentgenographic studies. Dr. Borman has reviewed this subject in a previous bulletin. He has especially emphasized the presence of gas or of barium in the biliary system as a valuable diagnostic sign in gastro-intestinal biliary fistulae.

Treatment consists of removing the biliary obstruction and taking down the fistula. Often a temporary drainage of the bile ducts is also carried out.

Strictures of the Bile Ducts

Benign strictures are either congenital or acquired. Acquired strictures are of

four types:

1. The majority are due to injuries of the ducts during operative procedures. The usual location of such strictures is just above or at the junction of the cystic and hepatic ducts. The damage may be partial or complete severance of the duct, or its inclusions in a ligature. Predisposing factors are unusual anatomical arrangements of the cystic duct or cystic artery. It has also been suggested that denudation of the ducts might injure their blood supply and cause subsequent scarring and constriction.

2. Some are due to cicatricial contraction of ulcers from impacted calculi. These are limited in extent and are usually situated at or just above the ampulla.

3. Another group are due to obliterative cholangeitis. Twenty-five percent of 64 cases reported by Judd in 1926 were of this type. These are generally diffuse and may involve a large part of both common and hepatic ducts.

4. A very small group of benign strictures are due to miscellaneous causes not related to cholecystitis. Among these are: benign tumors, syphilitic inflammation, and inflammatory constriction following perforated duodenal ulcer.

Diagnosis: In acute complete occlusion, as after accidental ligation of the duct, there is a rapid onset of jaundice and hepatic failure. Slowly developing strictures are often associated with external biliary fistulae. Symptoms of jaundice appear intermittently when the associated fistula is temporarily occluded, until after months or years the obstructive jaundice becomes persistent, hydrohepatosis and obstructive biliary cirrhosis develop, and finally death results. In the presence of a fistula, diagnosis may be aided by X-ray study after the injection of thorotrast into the sinus.

In the absence of previous operation, the symptoms of benign stricture are usually gradual development of jaundice with or without intermittent attacks of cholangeitis. There is often a long history of recurrent biliary colic.

Dr. C. J. Watson has pointed out that "if there is obstruction to the passage of bilirubin from liver to bowel, proportionately less urobilinogen is formed and less goes back to the liver." (Normal urobilinogen in urine is 0 - 2 mg. per day and in feces is 40 to 280 per day.)

Prevention: The exercise of care not to injure the ducts at the time of operation.

Treatment: Operative measures for correction of this condition vary according to the location and extent of the stricture. Procedures used are listed by Eliot as follows:

1. "End to end anastomosis after excision of the stricture when the orifices of the duct can be approximated without undue tension.

2. Choledochoduodenostomy when the stricture involves the terminal portion of the common duct.

3. Hepaticoduodenostomy, - gastrostomy, or - jejunostomy when the stricture involves such a large portion of the common duct that either of the preceding operations is impossible.

4. Reconstruction of a new duct by the tube method (Wilms-Sullivan procedure).

5. Implantation of biliary fistula into stomach, duodenum or intestine.

6. Cholecystoenterostomy in strictures of the common duct when both the gallbladder and cystic duct are normal.

7. Dilatation of a stricture with the insertion of a buried tube.

8. Choledochotomy or simple division of stricture. (Generally unsatisfactory)

9. Hepatoenterostomy, i.e. the approximation of denuded liver tissue to duodenum or small intestine where the stricture involves the hepatic duct within the liver, in which dilatation of the stricture cannot be carried out or has failed to give relief."

Eliot adds: "Accurate estimate of the relative value of these different operative procedures is impossible. In general, the selection of the more simple operation is indicated."

While good results are often obtained, failures are not uncommon. Failures may be due to a recurrence of the stricture or to the development of cholangeitis and liver abscesses. In order to prevent the latter complication, the sphincter mechanism (which guards against ascending infection) should be saved if possible and stasis should be combatted by the administration of bile salts.

Multiple Liver Abscesses

Multiple liver abscesses may be secondary to cholangeitis or pylephlebitis. (The suppurative portal vein thrombosis may in turn be secondary to cholecystitis).

Clinically, there is usually fever, with chills and profuse sweating. Weight loss is extreme and the patient is prostrated. There is usually pain or a sense of fullness in the region of the liver, and the pain may radiate to the right shoulder. The leucocyte count is usually very high.

Treatment is not satisfactory and the mortality is 80% or higher. Surgical drainage may be attempted (two stage), but only occasionally effects a cure. Therapy is usually non-operative and symptomatic.

Liver Death

In 1924, Heyd pointed out that a certain number of deaths following operations upon the biliary tract could not be explained by the usual causes of mortality. He classified these as "liver deaths" and divided them into three groups:

Group I: "Hepatic exhaustion." Patients in this group are not jaundiced or acutely ill at the time of operation. Shortly after operation they develop a rapidly rising temperature, delirium, and vasomotor collapse, followed by coma and death, usually within 24 to 48 hours.

Group II: This group includes patients operated upon for relief of jaundice. The immediate postoperative course is satisfactory. After a few days, a change occurs in the character of the bile drainage; it becomes thin, watery, and decreases in amount. The patient becomes delirious, then stuporous, and finally comatose before death occurs. Heyd believes that sudden relief of obstruction may result in acute secondary hyperemia of the liver with failure of liver function.

Group III: This group includes non-jaundiced patients with common duct disease and pancreatitis. The convalescence is satisfactory for 24 to 36 hours. Then the pulse rate increases, and the patient presents the picture of shock associated with vasomotor collapse, followed by oliguria, then anuria, uremia, fever, and finally coma ending in death. Heyd attributed this type to an overwhelming intoxication of pancreatic origin.

The exact nature of these "liver deaths" is still not clear. Many theories have been offered to explain the clinical picture. Among these are:

1. Schutz, Helwig, and Kuhn (1932) state: "There is a definite type of so-called liver death which is due to some toxin elaborated in a diseased liver, which toxin acts directly on the kidneys, producing a profound degenerative change in those organs."

2. Boyce, Veal, and McFetridge (1936) state: "The patient with biliary disease, whether or not gross obstruction is present, always exhibits some degree of liver damage, which is not, however, incompatible with the stress and strain of ordinary life. But when surgery is undertaken, even under the most favorable circumstances, there are introduced other factors, including the anesthetic, the trauma of the surgical manipulation, the associated drop in the intra-abdominal temperature, and changes in intrahepatic and biliary pressure, and with these new factors the liver, already the seat of a pathological process, cannot cope. As a result, its function promptly fails, and the toxic substances which reach it

in the course of normal body metabolism are thrown off undetoxified. Then the liver cells, as they become increasingly unable to function, themselves undergo some necrotic change and themselves discharge into the circulation some additional toxic product which originates in their own cellular substance." These authors further state that the kidney must take up the detoxifying work of the liver when the latter organ fails. It is unable to carry such a load and fails also.

3. Henschen (1932) suggested that this complication might be due to ligation of the hepatic artery during operation. Sutton (1935) produced a similar clinical picture in experimental animals by ligation of the hepatic arteries and stated that the essential lesion of the syndrome is acute necrosis of the liver. He suggested that in clinical cases the arterial occlusion may be due to thrombosis, embolism, or accidental ligation. He recommended that the term "high temperature liver death syndrome" be replaced by the name "acute postoperative necrosis of the liver."

Hemorrhage

The danger from hemorrhage in the presence of jaundice is well known. It has been estimated that 50% of all postoperative deaths in patients with jaundice or liver insufficiency occur as a result of hemorrhage. The bleeding tendency is related to liver damage, but the mechanism of this relationship is obscure. Many factors have been suggested but, although there are variations in these factors, they cannot be correlated with the bleeding tendency. Changes in blood calcium, fibrinogen, platelets, prothrombin, antithrombin, sedimentation rate, bile acids, etc. have been studied extensively by many investigators but no reliable correlation has been discovered. As Ivy, Shapiro, and Melnick have pointed out: "It seems as if the only way at present to determine a bleeding tendency is to see if the patient bleeds."

While the nature of the hemorrhagic diathesis is not understood, clinical experience has revealed that the danger of hemorrhage can be reduced by adequately preparing the patient for operation. Preoperative preparation should include several procedures among which are:

1. Administration of high carbohydrate diet in order to increase the glycogen content of the liver. This may be supplemented by the intravenous administration of glucose. It has been well established that liver function is improved by this procedure. (Graham)

2. Intravenous administration of calcium. A number of investigators have found that this procedure reduces the danger of hemorrhage. The mechanism of the action is not understood. Walters recommends the injection of 5 c.c. of a 10% calcium chloride solution for three days prior to operation.

3. Administration of viosterol has recently been recommended by McNealy, Shapiro, and Melnick. After studying 810 unselected cases of jaundice, they concluded that in cases in which the Ivy bleeding time is normal the prognosis is good, while if the Ivy bleeding time is prolonged the operative prognosis is bad. In the latter group of patients, viosterol for 4 days to 2 weeks will usually reduce the bleeding time to normal. (The authors recommend viosterol 250 D in doses of 30 drops t.i.d.) In complete obstruction, it is necessary to administer bile salts in order to permit absorption of the vitamin D.

The technique of determining the Ivy bleeding time is as follows: A sphygmomanometer cuff is applied around the arm and the pressure is raised to 40 mm. of mercury. Puncture is made in the skin of the volar surface of the forearm near the elbow, over the pronator muscles, by means of a mechanical stylet set at about 2.5 mm. Normally, the venous pressure bleeding time does not exceed 240 seconds.

4. Transfusion before operation is perhaps the most valuable procedure in preventing hemorrhage in jaundiced patients. Transfusion of citrated blood is as beneficial as transfusion of whole

blood. In some cases, it may be advisable to repeat the transfusion after the operation.

Cardiac Failure

Mortality statistics indicate that approximately 10% of deaths following operations upon the biliary tract are due to cardiorenal complications. Some of the deaths occur because of mistaken diagnosis. Cardiac disease may be mistaken for gallbladder disease. On the other hand, there is sometimes improvement in the cardiac condition after operation, indicating that a diseased gallbladder may exert a deleterious effect on the heart. Many investigators have reported a considerable series of cardiac cases showing both clinical and electrocardiographic improvement following surgical treatment of the gallbladder.

Intestinal Obstruction

In a few cases, intestinal obstruction is the immediate cause of death. Occasionally, the obstruction is the result of an adhesive process following biliary tract surgery. The tendency to develop adhesions varies in different individuals. It should be minimized by careful handling of tissue, good hemostasis and peritonealization of the gallbladder bed. In other cases, it is due to obstruction of the lumen of the bowel by gallstones which have passed into the intestine by way of an internal biliary fistula. Dr. Borman encountered 11 such cases in 24 deaths from internal biliary fistula among the University of Minnesota autopsies.

The site of gallstone obstruction is usually the terminal ileum, but may be the jejunum, the colon or even the duodenum (rare). The obstructing stone often progresses slowly down the gut, giving rise to symptoms of partial obstruction, until it finally becomes impacted at some level and gives rise to the characteristic symptoms of acute intestinal obstruction.

Differentiation from other types of mechanical obstruction is difficult. If the calculus contains a high percentage of calcium, it may be demonstrated by x-ray. Only a few stones, however, can be visualized in this manner. In most cases, one must depend upon the history for aid in making the diagnosis.

Wound Separation

It is impossible to estimate the frequency of this complication. The mortality is probably between 30 and 50%. (Reported mortality rates vary from 22 to 80%).

The causes of postoperative wound separation are not completely understood. Undue strain, such as occurs in coughing and vomiting, exerts a deleterious effect. Diseases which affect cellular regeneration unfavorably increase the danger of evisceration. Most investigators have found that the type of anesthesia, the length of the incision, and the kind of suture material are not important factors.

According to Freeman, faulty closure of the wound may result in evisceration. A wedge of omentum protrudes through an opening in the peritoneal layer and gradually forces the wound apart.

Clute emphasizes the importance of careful closure of the transversalis fascia.

Lahey believes that wound rupture is often due to failure to approximate properly the split bellies of the rectus muscle.

If postoperative evisceration should occur, it must be immediately repaired. Any abdominal viscera which have protruded should be replaced into the peritoneal cavity and the wound edges should be reapproximated and held in place by the application of adhesive strapping over a penrose drain. It is believed that this method of repair is less dangerous than secondary suture of the wound.

Acute Pancreatitis

Chronic disease of the gallbladder is present in a high percentage of cases of acute pancreatic necrosis and apparently in some manner predisposes to the development of the later condition.

The actual cause of the pancreatic necrosis appears to be the conversion of trypsinogen into trypsin within the pancreas, and the consequent digestion of pancreatic substance by the active ferment. There has been much discussion concerning the mechanism of this conversion. The following brief summary is quoted from Rich and Duff:

"One theory, which receives but little support, supposes that intestinal juice may, under certain circumstances, be forced into the pancreatic duct from the duodenum, thus introducing infection and activating the ferments of the pancreatic secretion. The possibility is suggested that the pancreas may be infected by bacteria reaching it by way of lymph channels from a diseased gallbladder, or possibly from more distant foci of infection by way of the blood stream. However, the theories which are favored by the majority of writers depend upon the existence of an anatomical arrangement of the duodenal orifices of the common bile duct and pancreatic duct of such a nature that the impaction of a gallstone in the ampulla of Vater, or spasm of the sphincter of Oddi, will direct the flow of the bile from the bile duct into the main pancreatic duct. No good explanation is offered for the occurrence of hemorrhagic pancreatitis in persons in whom the bile duct and pancreatic duct open separately into the duodenum."

Rich and Duff, however, discount all of these theories and state that "the majority of cases of hemorrhagic pancreatitis result from partial obstruction to the outflow of the secretion, causing distention and rupture of acini and ductules behind the obstruction, with resulting escape of pancreatic juice into the interstitial tissue." They state that metaplasia of the epithelium lining the ducts is the most frequent cause of such obstruction.

A few investigators claim to have produced pancreatitis by ligation of the pancreatic duct, especially if such ligation is carried out at the height of digestion, or if pilocarpine be administered after the procedure, but it is well known that experimental ligation usually results in atrophy and sclerosis of the gland. Obstruction of the duct in humans by pressure from carcinoma of the head of the pancreas likewise produces atrophy rather than pancreatitis.

The characteristics of acute pancreatitis are summarized by Henderson and King as follows: " Prostration of the patient; severe, rhythmic, intermittent epigastric pain; recurrent retching and vomiting; softness and distention of the lower part of the abdomen; epigastric tenderness with spasm of the upper part of the abdomen; occasional slight jaundice, and occasional cyanosis. The laboratory findings are: an increased amount of diastase in the urine, a high red cell count, an increased white cell count, and a comparatively low temperature. Glycosuria may or may not be present." An important diagnostic point is that the pain is often chiefly or entirely on the left side.

Until recent years, the treatment of acute pancreatitis has usually been surgical. Drains have been inserted around the pancreas, and cholecystostomy has been performed to relieve pressure within the biliary tract. At the present time, conservative therapy is gaining favor. Dr. Wangensteen advises starvation to inhibit pancreatic secretion; nasal suction siphonage to combat the distention and nausea and vomiting; and hot packs to the abdomen. Saline must be given intravenously, but, according to Lewis, the administration of glucose may be dangerous since an elevation of blood sugar causes an increased flow of ferment-rich pancreatic juice (Babkin).

The mortality of acute pancreatitis is usually reported to be around 50%, but probably it is not actually that high.

Carcinoma of Gallbladder

Cases of carcinoma of the gallbladder have not been included in our statistics, although many surgeons believe that cholecystitis is a factor in the development of carcinoma and have recommended cholecystectomy for all cases of gallstones, even silent cases, as a prophylactic measure.

Impressions

1. The prevalence of gallbladder disease stimulates interest in factors influencing the mortality.

2. The mortality of 1,247 cases seen in this hospital over a period of about 8 years was 2.64%. Our results compare favorably with those of other clinics.

3. The causes of death in 33 fatal cases have been tabulated. Autopsies were done in 29 cases (87.9%).

4. The factors most commonly influencing mortality have been discussed. These are:

a. Peritonitis. At least 15% of the deaths are from this cause. It may result from perforation of the gallbladder or may follow operation.

b. Subphrenic abscess may arise in a similar manner. Surgical drainage is required.

c. Bile peritonitis is an uncommon complication. Drainage of the bile is necessary.

d. Pulmonary complications are common. Inhibition of respiration following operation favors their development. Prophylactic hyperventilation is of value.

e. Perforation of the gallbladder is not common. It may result in generalized or localized peritonitis, or a biliary fistula may be established.

f. Biliary fistulae may be external or internal. Complete external fistulae result in acholic cachexia. Biliary gastro-intestinal fistulae result in ascending cholangeitis and hepatitis because there is no sphincter mechanism to prevent reflux. The administration of bile salts, by overcoming stasis, may inhibit the development of cholangeitis to some extent.

g. Biliary stricture may result from operative injury, contraction of ulcers from impacted calculi, obliterative cholangeitis, or rarely from other causes. Surgical repair is sometimes successful. Failures may be due to recurrence of the stricture or to development of cholangeitis.

h. Multiple liver abscesses may be secondary to cholangeitis or pylephlebitis. Prognosis is poor.

i. Liver deaths are usually divided into 3 types as classified by Heyd. Theories as to their nature are listed.

j. Hemorrhage constitutes a serious danger in jaundiced patients. The risk may be diminished by adequate preparation.

k. Cardiac failure is an occasional cause of death.

l. Gallstone obstruction sometimes occurs when stones enter the intestine by way of an internal biliary fistula.

m. Wound separation is not uncommon following operations upon the biliary tract. In case of such an accident, the wound edges should be reapproximated and held in place by adhesive strapping over a Penrose drain.

n. Chronic cholecystitis apparently predisposes in some way to the development of acute pancreatitis. The mortality of the latter condition is high. Treatment should be conservative.

o. There may be a relationship between cholecystitis and carcinoma of the gallbladder.

5. There has been considerable discussion as to the advisability of immediate operation in cases of acute

cholecystitis. At this hospital, operation is deferred until the acute symptoms have subsided, unless perforation seems imminent.

6. The patient should be adequately prepared for surgery. Liver function is improved by administration of carbohydrates. In patients with jaundice, the hemorrhagic tendency may be combatted by administration of calcium chloride, viosterol, and by blood transfusion.

7. At the operation, the tissues should be handled gently, the gallbladder bed should be peritonealized if cholecystectomy is performed, and drainage should always be instituted. Incidental appendectomy does not increase the mortality.

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V. CASE REPORTS

1. , age 40.
Admitted - 12-4-31.
Expired - 1-3-32.
Total stay - 31 days

History

1928 - Patient began to have attacks of vomiting and jaundice associated with colicky pains in the right upper quadrant. This pain radiated to the back and right shoulder. She also had marked diarrhea during these attacks. They continued intermittently during the summer of 1928. She also noticed clay colored stools. There were no chills. She had a heavy feeling in the right upper quadrant until about 10 months prior to her operation.

Operation

3- -31 - Cholecystectomy was done. The gallbladder was filled with stones. There was a moderate amount of hepatitis present, no stones were palpable in the common duct although the surgeon was of the opinion that the common duct was obstructed by a calculus. Three days postoperatively, the patient noticed jaundice and a steady pain high in the right upper quadrant which required hypodermics for relief.

Pus

4- -31 - While patient was lying down, about a pint of pus suddenly burst from the operative wound. Following this, about once a week, patient had spells of vomiting with pain in the epigastrium.

Jaundice

5- -31 - Became markedly jaundiced; stools were clay colored; had a heavy feeling in the right upper quadrant.

9- -31 - Complained of severe steady pain in right upper quadrant. She again became jaundiced and had vomiting and diarrhea. Jaundice was continuous until admission. She complained of severe itching of the skin.

Admitted

12-4-31 - Physical examination: poorly nourished and jaundiced. Sclerae, markedly yellow. Blood pressure 105/70. Tenderness to deep palpation in right upper quadrant, no rebound tenderness,

no masses palpable, liver enlarged about one fingerbreadth below costal margin.

Laboratory

Blood - hemoglobin 77%, red blood cells 3,750,000, white blood cells 8,650, pmns 80%, lymphocytes 20%. Urine - albumin, light cloud; many red blood cells and white blood cells; bile pigment and bilirubin, positive. Stool - acholic; no bilirubin or urobilin. Icterus index, 112 units. Clotting time, 7 minutes; bleeding time, 2½ minutes.

12-10-31 - Given a transfusion of 475 cc. of citrated blood. Given 10 cc. of 10% calcium chloride intravenously on two occasions.

Operation

12-11-31 - Preoperative diagnosis - stricture of common bile duct. Anesthesia-spinal, reinforced with local infiltration of novocain. Operative findings: The omentum, stomach and duodenum were densely adherent in the gallbladder fossa. It was apparent that there was a very broad stricture of the common duct. The common duct was finally isolated. The common duct was not dilated; on the contrary, its wall was thickened. A small incision was made in the duct, about one inch above its entry into the duodenum. No bile or mucus came out of the duct. The lumen was about of normal size, although the wall was very much thickened. An attempt was made to pass a probe up, but there appeared to be an impassable stricture about one-half inch above the point of incision into the duct. Finally, a probe was pushed through, and both the right and left hepatic ducts could be probed. No mucus or bile recovered. After the ducts were probed, a catheter was threaded up into the common duct for about 3 to 4 inches, perhaps going into the right hepatic duct. This was sutured in place and covered with omentum. Two Penrose drains were inserted. Patient returned from the operating room in good condition. Intravenous fluids, 10% glucose, nasal suction, and a transfusion of 400 c.c. of citrated blood were given postoperatively.

Postoperative

12-17-31 - Complained of gas pains. 10 c.c. of 10% calcium chloride given intravenously. Clotting time, 7 minutes; bleeding time, 5 minutes.

12-18-31 - Abdomen somewhat distended. Tincture of digitalis given, 1 c.c. three times daily. Intravenous 1500 c.c. 10% glucose given. Profuse hemorrhage from wound.

Hemorrhage

12-23-31 - Blood noticed oozing from wound. Blood pressure 90/45. One ampule of coagulin Ciba and 1500 c.c. 5% glucose given.

12-30-31 - Continuous hot packs applied to wound. Condition worse. 500 c.c. citrated blood given.

1-4-32 - Respirations labored and shallow. Patient irrational. Considerable bloody drainage from wound. Expired.

Autopsy

The peritoneal cavity contained about 2000 c.c. of bile tinged fluid. A pelvic abscess was found which was walled off by coils of bowel. There was also an area of localized peritonitis in the left upper quadrant. Liver weighed approximately 1600 grams. Common duct contained a catheter. Gallbladder was absent. There was a stricture of the left hepatic duct. Above the stricture, the left hepatic duct was found to be dilated. The right hepatic duct was very small and appeared like a strand of connective tissue. The liver was very much bile stained, having the appearance of early biliary cirrhosis.

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2. _____ age 62.
Admitted - 8-11-32
Expired - 8-20-32
Total stay - 9 days

History

1926 - Had an attack of pain which started in the back at the lower level of the right scapular region and radiated around to the right costal margin. The pain was extremely severe but lasted only a few minutes.

1927 - Had similar attack, but was more severe and lasted longer. Became nauseated and vomited on several occasions.

Jaundice

7-15-32 - Another attack of right upper quadrant pain radiating to the back and right shoulder. She became markedly jaundiced and suffered with chills and fever. Urine was very dark, and the stools light in color. The jaundice cleared up in about a week. She had four other severe attacks. She observed an incteric tinge to the sclerae on several occasions. Appetite was poor. Had definite food intolerance to fatty, fried or sweet foods. Had considerable belching and distention of the stomach.

Admitted

8-11-32 - Physical examination: much rigidity in right upper quadrant and to a lesser extent in the epigastric region. Tenderness to deep palpation in right upper quadrant only. Physical examination otherwise negative except for blood pressure which was 174/100.

Laboratory

Blood - hemoglobin 81%, white blood cells 12,650, pmns. 54%, lymphocytes 45%, eosinophils 1%. Icterus index, 8 units. Urine - positive bilirubin; normal urobilin. P.S.P., 75% in 2 hours. X-ray of gallbladder showed a poorly functioning gallbladder containing stones.

Operation

8-18-32 - Cholecystectomy performed under spinal anesthesia. Gallbladder was extremely edematous and acutely inflamed. The cystic, common duct and hepatic ducts were filled with stones. The gallbladder was split and the incision extended down to the common ducts. The stones were removed and a T-tube left in the common duct. Patient's condition on the table became grave and she was given a transfusion of 500 c.c. of citrated blood.

Postoperative

8-19-32 - Blood pressure 90/172. Intravenous acacia given. Condition became worse and she was given a transfusion of 500 c.c. of citrated blood. The T-tube was injected with sterile saline but no fluid could be returned. At 5:15 P.M., the abdomen was explored through the incision. The T-tube was found to be folded upon itself in the common duct. This was straightened out and a Penrose drain was left in place. 8 P.M. - 750 c.c. of citrated blood was given.

8-20-32 - Respirations labored. Expired.

Autopsy

Liver weighed 1800 grams and was cirrhotic. Cut surface revealed enormous thickening of periportal fibrous tissue. In the liver parenchyma, the bile ducts stood open as though they were very much thickened. The liver parenchyma itself was mottled, yellowish and white. There seemed to be both fatty and fibrous changes in the liver. In the left portion of the liver, the normal markings were completely obliterated and the appearance of the liver suggested that of a regeneration adenoma. No normal bile could be expressed from any of the bile ducts.

Gallbladder had been removed. A T-tube was in the common and hepatic ducts which were moderately dilated and extremely thickened. No stones found in the hepatic or common ducts.

Pancreas soft, shows on evidence of fibrosis or other changes.

Diagnosis

1. Chronic cholecystitis and cholelithiasis.
2. Hepatitis with biliary cirrhosis and liver insufficiency.

3. Cardiac hypertrophy.
4. Cholecystectomy and exploration of common duct.

VI. GOSSIP

When Internist Frank John Hirschboeck of Duluth was in court recently, he had an unusual experience. He had testified "to the best of his knowledge and belief" by answering all questions fired at him by both attorneys. The jury had listened with great attention. After both sides were satisfied, he was excused and started to leave the building. When near the front door, he was stopped by a court attendant who told him the judge wanted him to come back to the witness box and answer one of the juror's questions. After the usual preliminaries, the judge instructed the juror to proceed. A woman stood up and said, "Doctor, what is good for pain and soreness that seems to start in my shoulder and goes down my arm?" When the hubbub had subsided, the witness was again excused.....The First Annual Clinical Conference of Mid-Western Radiologists will be held at Rochester, Minnesota, February 12 and 13. Radiologists in the territory bounded roughly by Cleveland, St. Louis, Omaha and Winnipeg, feeling the need of getting together oftener than once a year at national or state meetings, organized the present conference. Similar meetings in the East and West have been very successful. The program at Rochester will consist of clinical and radiological presentations by the staff of the Mayo Clinic. Other meetings will be held in various cities within the area at stated intervals with local programs.....Although February 3d was designated as National Social Hygiene Day, the air was silent except in the vicinity of New York. Transcribed addresses by President Ray Lyman Wilbur, of Leland Stanford University and Surgeon General Parran of the United Public Health Service were sent to various sections of the country, but radio officials pondered and decided to wait. The newspapers and magazines, chiefly through paid advertisements by the Metropolitan Life Insurance Company, carried the message about syphilis. The reluctance to discuss venereal diseases in print and over the air is changing. Editors and radio officials believe that in time public policy will change and permit them to do so. It is apparently as difficult to treat the subject of syphilis as a contagious disease as it is to consider sex a simple biological phenomenon. In many sections, cancer education in high schools and colleges is meeting with similar opposition.... .....The third week of the Post-Graduate Medical Institute is now in progress in pediatrics. The fourth and final week in internal medicine will start next Monday the 8th and end on Saturday the 13th. Certificates of attendance will be granted at the end. In Medical School, much time is devoted to discussion of principles (origin, manifestations and outcome) of disease, and very little to technique. In the internship, there is an opportunity for acquiring some technical knowledge and experience. In practice the greatest difficulty is the technical aspect. When our students come back, they are most concerned with how we do things and secondarily why. It seems that our post-graduate institutes will best function as opportunities for learning how to handle certain situations. This is not to be construed as lack of interest in fundamentals which the men to date have been just as keen about as ever. The large number of young men is most encouraging. It is the purpose of the Medical School to continue to offer courses during the balance of the year at intervals.....The Council on Medical Education of the American Medical Association will meet in Chicago, February 14 and 15. Dean Emeritus Elias Potter Lyon will be missed as he was a regular attendant at these gatherings. Last year in his final appearance as an official member of the body, he read his paper on "Swans Sing Just Before They Die." Reports from Florida indicate that he and Mrs. Lyon are having the time of their young lives. Dean Lyon had the unusual distinction among others of having been Dean of the Deans for many years, and serving at one institution (Minnesota) longer than any other Dean.....When Drs. Ransom and Bergh handed in their copy for this week's meeting, it was a question of

Alphonse and Gaston with them. If any mistakes are found, Dr. Bergh insists that Dr. Ransom be given credit for them. Studies of any disease with its complications and outcome is a very difficult matter, as it is often something which cannot be obtained from records. Our co-authors today have done a very fine piece of work in calling our attention to the causes of complications and death in gallbladder disease and also the means of avoiding or treating them. We are indebted to both of them.....The film shown today was one of a series shown at a recent gathering at the house of one of our staff men. It was surprising to know of the large number of amateur cameramen we had on our staff. We saw skaters, deer hunters and duck hunters galore. We were taken on trips in various sections of the country and Bermuda. We heard apologies for over-and under-exposure, jiggling cameras and other technical difficulties but by common consent the films made by Dr. Breckenridge of the Museum of Natural History of the University of Minnesota were the best. The film shown today represents hours of waiting in blinds and the use of special lenses.....The University of Wisconsin authorities are looking for presidential material on our campus and are questioning three or four men. The great mystery (by those not asked) is who they are. I might add that none are in the Medical School.....We have a student in the Medical School who speaks German and French in the morning and Italian during the afternoon. He has arranged his work so that he can be with students who speak these languages. While listening to the radio and phonograph records, he has memorized many operas and knows several in more than one language. He sings for pleasure and also for bread and butter. He never goes to symphonies because he hasn't the price.....The following letter was received by the Hospital this week: "Dear Hospital: as my date to be ther is February 15 i lik to put it of alettel if i can in case ve goot so lot of snow her i mite geet stold on the rod now i vel tell you how i fell and look so you goot somting to go by i fell lik a new man and that sor isent biger then a peen hed now it stase nice and driy all the time bot i do svel alettel of and on bot verre lettel yours verry truley if you fell that you like to see me on the date ples let me know i shurley vil be ther before spring vork so you can cack up on me." It sounds all right when you read it over even though it was not punctuated.....When Dr. Graham spoke last evening in the Chemistry Auditorium, he was never in better form, nor was an audience more receptive. It was a delightful affair in every respect. As a means of summarizing advances in a subject his technique left nothing to be desired. We are very glad that we will again have the pleasure of hearing him this noon.....The Sigma Xi lectures start tomorrow evening, February 5th, with George M. Schwartz speaking on "Rock Formations of Minnesota and Their Significance." The meeting will be held in Northrop Memorial Auditorium and there will be four lectures in the series on "Natural Resources of Minnesota." The medical series of recent date was said to be one of the best from the standpoint of interest.....The Psychopathic Hospital is in the process of being furnished. Director J. Charnley McKinley is having the time of his life examining the various fixtures for possible dangers to patients. It is not well known but Dr. McKinley is one of our most gifted inventors. Anyone interested in a fool-proof hospital bed should visit the 6th Floor and see Dr. McKinley's brain child.....Assistant Superintendent Ralph Rosen of the State Hospital at St. Peter, is a regular visitor each week. Dr. Rosen is still as enthusiastic as ever about his work and the possibilities for research in nervous and mental disease.....The big white shoes worn by the co-eds these days have been a God-send for aching bunions and burning corns, and strangely enough, they are quite the thing to wear.

Adios.