

## DANGERS INCIDENT TO CHOLECYSTECTOMY\*

AN ANALYSIS OF 575 CASES OF CHOLECYSTECTOMY AND CHOLECYSTOSTOMY

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THE advent of the Graham method of cholecystography as a definite aid in the diagnosis of disease of the gall-bladder has already resulted in, and no doubt will continue to cause an increase in the number of cholecystectomies performed by all surgeons, good and bad alike. Numerous contributions advocating (and justly so) cholecystectomy as a procedure of choice in most instances of cholecystitis except in the presence of jaundice or an acute inflammatory process, has also shared in this increase of gall-bladders removed. Yet it is well to remember that the surpassing merits of cholecystectomy holds true only in the hands of an experienced abdominal surgeon. How infrequently failures are recounted and yet it is not from the perfect operation, easy excision of the viscus without alarming post-operative rise of temperature or prolonged bile drainage that much is learned; it is from those cases where we err in diagnosis, have a stormy post-operative course, and deaths that we really gain in knowledge and feel that we go ahead.

This article proposes to point out a few dangers of cholecystectomy and to analyze immediate post-operative results, laying particular stress on a group of cases in which the cause of death is unknown. From January 1, 1910 to April 1, 1926 a period of sixteen years and three months, there have been performed on the Second Surgical Division, Roosevelt Hospital 470 cholecystectomies and 105 cholecystostomies. Immediate operative mortality (patient dying while in the hospital) 35 or 6.08 per cent. of the combined groups of 575 cases; 241 have had a recall note since being discharged from the hospital; a percentage for recall of 41.9 per cent. The results of our follow up on the 241 patients are:

Two hundred and nine had cholecystectomies done, while cholecystostomy has been performed on the remaining 32,

Heard from by letter or verbal note from operating surgeon 165,

Examined at hospital by some member of the staff 76,

Of the 209 cholecystectomized patients 182 or 86.1 per cent. reported being well without symptoms or further operations.

Three of the remaining 27 had been operated upon elsewhere for stones in the common or hepatic ducts; three reoperated for stricture of the common duct and 21 complained of digestive disturbances or pain in the right upper quadrant of the abdomen. No persistent biliary fistulæ reported.

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Of the 32 patients heard from upon whom cholecystostomy was done, 18 or 56 per cent. had to be reoperated, 11 of these 18 having cholecystectomies

last recall note—cured	1 month	after discharge from hospital	30
last recall note—cured	2 months	after discharge from hospital	12
last recall note—cured	3 months	after discharge from hospital	3
last recall note—cured	5 months	after discharge from hospital	6
last recall note—cured	6 months	after discharge from hospital	9
last recall note—cured	10 months	after discharge from hospital	8
last recall note—cured	1 year	after discharge from hospital	29
last recall note—cured	2 years	after discharge from hospital	25
last recall note—cured	3 years	after discharge from hospital	12
last recall note—cured	4 years	after discharge from hospital	11
last recall note—cured	5 years	after discharge from hospital	15
last recall note—cured	6 years	after discharge from hospital	4
last recall note—cured	7 years	after discharge from hospital	6
last recall note—cured	8 years	after discharge from hospital	6
last recall note—cured	10 years	after discharge from hospital	4
last recall note—cured	13 years	after discharge from hospital	2

Total 182

performed and 6 choledochotomy as well as a cholecystectomy. One had a second cholecystostomy six months after the first drainage operation and four months later a cholecystectomy, since this last operation nine years ago he reports by letter that he has had no abdominal discomfort of any kind.

*Hemorrhage.*—By far the most common cause for concern in the process of removal or immediately thereafter is hemorrhage. The reasons for this apprehension are numerous, first—an anomalous vessel is cut and its bleeding stump difficult to locate; second—a normally placed but friable cystic artery that has not been transfixed by ligature prior to removal of the bladder and the vessels slips through the clamp or is troublesome to reclamp and properly ligate; third—inadvertent injury to the portal vein in incising the common duct for exploration (it is much safer to first employ an exploratory needle) or injury to the hepatic artery in an attempt to clamp the cystic artery which has slipped away; fourthly—profuse bleeding from the gall-bladder sulcus.

Where the cystic artery has been clamped, doubly transfixed with chromic catgut and the gall-bladder sulcus carefully sutured over, we have had in our series during the last six months three instances where due to persistent and violent vomiting, troublesome hemorrhage resulted; either from a transfixed ligature that slipped or bleeding from a reopening of the gall-bladder sulcus, necessitating in all three cases blood transfusions with recovery.

Of our thirty-three deaths four have been definitely due to hemorrhage. An obese woman of forty-six years, weighing 260 pounds with a large distended gall-bladder filled with stones, also stones in the common duct, a cholecystectomy with exploration of the common duct with removal of stones, cystic artery and duct ligated together with three transfixion sutures of chromic catgut. Common duct drained. Clamp had to be left on what was taken to be

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an oozing cystic artery. This in all probability was an oozing aberrant artery. Anterior abdominal wall drainage. Patient died from hemorrhage twenty-four hours after operation. Another woman of forty-seven, hydrops of gall-bladder, cystic duct occlusion, cirrhosis of liver, splenomegaly, ascites; opening made into a large vein in exploring hepatic duct, considerable hemorrhage, death twelve hours after operation. The third patient, a woman of thirty-six, enlarged gall-bladder containing stones, cholecystectomy, three transfixion sutures of chromic catgut to stump of cystic artery and duct, died on the fifteenth day post-operative. Comment on course note "Patient undoubtedly a hemophiliac." The fourth patient, a woman of thirty-two with an enlarged thick walled gall-bladder with stones; cystic artery and duct transfixed and ligated with chromic catgut. Drain to Morrison's pouch. Death from hemorrhage in twenty-eight hours.

*Injury to Bile Ducts.*—This mishap only occasionally causes immediate danger to the patient, later as a rule a reconstruction operation on the bile ducts has to be carried out. Knuckling up of a portion of the anterior wall of the common duct in a low ligation of the cystic duct although rarely done, still on increasing jaundice due to partial or even complete occlusion of the duct is attributable to this faulty step in technic.

As far back as 1798, Mathew Baillie<sup>1</sup> described extrahepatic ducts, other than the common bile duct the hepatic ducts and the cystic duct. He cites the finding of a short canal between the gall-bladder and the small end of the stomach which in all probability was a spontaneous cholecyst-gastrostomy. Holman<sup>2</sup> has shown that anomalous branches of the hepatic ducts may be cut in the course of a cholecystectomy and unless discovered may be the source of a distressingly prolonged biliary drainage, also he suggests as another cause of prolonged bile drainage, the opening up of small biliary passages especially so if much liver tissue has been traumatized in removing the gall-bladder from its bed.

Injury to the hepatic ducts to a more or less degree not infrequently happens in trying to dislodge a stone caught well up into the liver end of one of the ducts. Ingenious devices have been brought forward to bridge over or short circuit about defects in the common duct.

In our 470 cases of cholecystectomy the common duct was opened in fifty-four with four deaths two of these four patients that died having previously had cholecystostomies performed. In a report that is to appear later from the Second Surgical Division in regard to the common duct cases, it will be shown that from 1915 to 1925, of the fifty-one choledochotomies done during that period cholecystectomy was done in twenty-five, cholecystostomy in ten, and cholecyst-duodenostomy or cholecyst-gastrostomy in eight.

*Post-operative Pneumonia.*—Post-operative pneumonia was the cause of death in seven of our immediate mortality list. It took its toll anywhere from three to twenty days post-operative in the seven cases. One was in a cholecystostomy for rupture of the gall-bladder, temperature 103.6 when

operation was begun. In two cases besides cholecystectomies being done gastroenterostomies were performed for the presence of duodenal ulcers. The other four followed simple cholecystectomies; however, one of these had had a cholecystostomy done three months previously. Immediately following the last operation her temperature rose to 105 degrees and broncho-pneumonia developed in latter part of the second or early part of the third day post-operative. Post-operative pneumonia does not apply particularly more as a danger in cholecystectomy than it does in any upper abdominal surgical procedure. It is listed as having had a considerable place in our mortality list.

*Peritonitis.*—Peritonitis resulting from the removal of especially acutely inflamed partially gangrenous or ruptured gall-bladders is in our experience a grave danger and in such cases cholecystostomy is the operation of choice. We do not advocate a removal operation in that group known as the acute gall-bladder for the reason that we had several deaths which we considered attributable to this procedure. We at the same time feel the responsibility of allowing a beginning gangrene of the inner coats due to pressure of a large single stone impacted in the cystic duct go to a more complete gangrene with subsequent rupture; yet we believe it is far better that they be observed for twenty-four or thirty-six hours or even longer to see whether or not the temperature, pulse rate and blood count will diminish indicating a "cooling off" as it were of the acutely inflamed viscus and thus making it safe to do a cholecystectomy. If after thirty-six or forty-eight hours the temperature remains elevated, rapid pulse, general appearance not improving, we do a cholecystostomy often under local anæsthesia believing frequently that the least we do is the best we do. In four of our cases peritonitis has been given as the cause of death, one died in five hours where the gall-bladder had already become gangrenous and had perforated, definite right upper quadrant peritonitis, cholecystostomy was performed. The second case, a large distended acutely inflamed gall-bladder in which the cholecystectomy was done, died on the second day. It was thought afterwards that if a drainage procedure had been carried out this patient would have lived. The third case was complicated by a subhepatic abscess present at the time of operation and a spontaneous cholecystoduodenostomy; a cholecystectomy and duodenorrhaphy performed; patient died twenty-four hours post-operative. The fourth case a cholecystectomy, in a woman of sixty with a large distended inflamed gall-bladder; death resulting on the fifth day due to sepsis.

*Immediate Operative Mortality of Unknown Origin.*—In only one instance of our entire list of cases that died while in the hospital was there any note made of there being an autopsy performed. There were three cases that died within forty hours with immediate hyperpyrexia one 107.2 degrees another 106 degrees and the other 107 degrees; hemorrhage, peritonitis, pneumonia, embolism were all ruled out clinically, in all cholecystectomy was the procedure. These were not the acutely inflamed type but simply cases with symptoms of prolonged chronic cholecystitis with calculi in the gall-bladder

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in otherwise healthy women, not jaundiced. In one a cholecystostomy had been done one year previously. According to the operative notes the procedures were carried through without difficulty in fact two noted as being extremely easy. All three were drained, one through the upper angle of the wound, the other through lateral stab wounds with tight closure of the anterior abdominal wound. It seemed that immediately the operation was finished the temperature began to rise and reached exceedingly high levels with an accompanying rapid pulse rate. Although no mention is made of unusual liver traumatization except in one instance we believe these particular cases died from absorption of either diseased or chemically altered liver cells or toxic bile. The appearance or consistency of the liver not noted.

It is a startling and helpless situation to follow to its quick termination one of these catastrophies—the last one of these three here reported occurred in a young healthy vigorous Greek woman of thirty-five, with a definite and classical history of diseased gall-bladder for a period of over three years without jaundice, heart, lungs, kidneys normal, cholecystography revealed numerous shadows indicative of stones in a slightly enlarged gall-bladder. Operation upper right rectus incision and easy and splendid exposure of gall-bladder and ducts; the cystic artery and duct fully exposed, comfortably handled and twice transfixed with chromic catgut before being cut across and the third ligation of the duct and artery made by transfixion and tying after removal of the clamp and the gray-walled, stone-filled gall-bladder; the excision being easily carried out from below upward. The liver bed from which it was removed was rather broad, however, with only moderate oozing, the sulcus sutured over with the stump of the cystic artery and duct securely tucked and sutured into it at its lowermost angle, so dry was the area that it was remarked to be an ideal case for closure without drainage, however, a lateral stab wound to flank, wrapped tube drain to Morrison's pouch and a tight closure of the anterior abdominal wound was done. Immediate precipitous rise of temperature to 106 degrees at the termination which took place in forty hours. Pulse rate rose steadily with temperature curve to 154 no signs of pneumonia clinically or from portable X-ray films, a dressing done the drain loosened and withdrawn a short distance, a slight amount of bile-stained secretion on the dressing. No evidence whatever of hemorrhage.

Heyd and Killian<sup>3</sup> in their thorough and comprehensive monograph on "The Liver and Its Relation to Chronic Abdominal Infection," have observed "three clinical states that supervene after operation on the gall-bladder and biliary system" that are not due to hemorrhage, shock, gastric dilatation or embolism. In their opinion they were connected in some way with an impaired liver function, either a disturbed liver metabolism, a liver dysfunction or a liver insufficiency. Their first group corresponds to the three cases just cited in our series which were not of the infectious class but were of the group where the operation seemed most likely to have "liberated certain deleterious products the whole mechanism suggesting a complete and rapid cessation of liver

function." These patients regain consciousness slowly from the anæsthetic; characteristics of a vasomotor depression appear; although not restless as from bleeding, they early show signs of delirium which by the end of thirty-six hours gradually develops into a coma, and death ensues in the following twelve hours. It is now generally accepted that cholecystitis whether it be acute or chronic is only a part of an infectious process in the liver and pancreas, whether it starts first as a cholecystitis or a hepatitis is a question of dispute. We are quite certain of the existence of an extensive net work of lymphatics between the gall-bladder and the liver, therefore, it seems reasonable to presume that in a gall-bladder removal numerous lymph channels are opened and are so impaired permitting the absorption of toxins from diseased liver cells that the entire lymphatic system of the liver may react unfavorably to this disturbance resulting in a grave dysfunction. Should the operation be difficult consuming much time with a prolonged exposure to the air of the liver surface untoward effects may result in the chemical function of the liver for hours following the procedure. Crile<sup>4</sup> has shown that when the temperature of the liver is reduced one degree, the chemical activity of the organ is reduced 10 per cent. He has demonstrated that when the abdomen is opened, the temperature of the liver falls  $1\frac{1}{2}$  to 3 degrees even though the liver itself is not exposed directly. He furthermore states that "when, as the result of the exhaustion incident to disease, the chemical activity of the liver has been reduced to 10 per cent. of its normal capacity, death will occur if at operation the temperature of the liver is reduced by 1 degree." We believe that these disasters are caused by the sudden liberation of either toxins from or pieces of chemically altered liver cells themselves into the general circulation; or perhaps from a stirring up of infected bile in the intrahepatic ducts due to operative manipulation; followed by rapid absorption which appears to overwhelm the patient with resultant delirium, coma and death. The partial cessation of liver function from the shock of actual removal of the external biliary viscus from its bed and exposure of the liver surface no doubt play a rôle in these cases. The mortality rate following cholecystectomy due to disturbed liver function can be lowered by the proper selection of cases. The Rountree-Rosenthal dye test is of value in determining hepatic function. In surgical cases with jaundice it aids in estimating the activity of the liver parenchyma and should be undertaken pre-operatively in all cases of biliary tract disease in uncertain surgical risks to decide whether a removal or drainage operation should be done. The quantitative estimation of the icterus index is of decided help in measuring the function of the liver. The intravenous injections of 5 cm. of a 10 per cent. solution of calcium chloride as suggested by Walters<sup>5</sup> increases the operability in the jaundiced cases; and the pre-operative precaution of forcing fluids, carbohydrate diet and glucose by mouth has added much to the safety of all gall-bladder operations. Restoration of failing hepatic function is essential if these sudden unexplainable deaths are to be eliminated.

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*Other More Obvious Dangers.*—In our immediate mortality list other causes of death were from pulmonary embolism occurring in four cases; one instance of acute cardiac decompensation on the second day post-operative in a man of sixty-six; one intestinal obstruction, type or actual cause of the obstruction undetermined; another from bilateral post-operative parotiditis in a young woman of twenty-seven; acute nephritis on the fourteenth day claimed another; one put down as a "cardiac death" fourteen hours after operation; another from acute exudative nephritis. A woman of fifty-six years upon whom a choledochotomy and cholecystectomy were done and also the drainage of a pancreatic cyst; necropsy revealed pancreatic cyst, interstitial pancreatitis; fatty necrosis of retroperitoneal tissue; and acute exudative nephritis. One death from sepsis of the anterior abdominal wall on the ninth day, erysipelas having developed, extending to the right from the drainage tract which was at the upper angle of the wound. A man of forty-three with a small contracted gall-bladder, cholecystectomy closed without drainage of any kind. Temperature 105 degrees afternoon of operation; death on fourth day, cause not noted in history, perhaps a peritonitis. This was the only one of our twenty-two cases closed without drainage that terminated unsuccessfully. One died of what was designated as a post-operative colæmia. On the fifth day a cholecystectomy, a choledochotomy and a duodenorrhaphy for ulcer of the duodenum was performed. An acutely inflamed gall-bladder was removed in a woman of fifty-four, death on fourth day, "probable sepsis" entered into record as cause of death. The remaining fatality was attributable to a partial gastrectomy Billroth II for carcinoma of stomach, a cholecystectomy was also done. The patient died seventy-two days after operation, the cause of death exhaustion.

In this list of thirty-five deaths there were only three in which cholecystostomy was performed, an immediate operative mortality of about 5 per cent., comparing this finding with other immediate post-operative mortality charts it seems unusual not to have had a higher mortality from cholecystostomy. All three were desperately ill patients of over sixty-two years of age.

As to secondary operations in which cholecystectomy was performed, we had four cases; previous procedures of cholecystostomy having been done one year, eight years, four months and six months; these four are of course taken from the immediate mortality chart.

The cystic artery was ligated and transected with three different strands of chromic catgut in twenty-seven instances with two strands in only two of the cases, no ligature or suture of the cystic artery in one case due to the friability of the artery; this was in an acutely inflamed partially gangrenous gall-bladder where the cystic artery and duct tore out of the jaws of the clamp and tamponage had to be resorted to. In three no mention was made of the treatment of duct and artery. A subhepatic abscess noted in one case. An abscess between the liver and anterior abdominal wall in another and cirrhosis of the liver in still another. In thirty-two, lateral stab wound drainage was established, the rest were drained through the anterior abdominal wound.

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### SUMMARY

1. Four hundred and seventy cholecystectomies; thirty deaths. Immediate operative mortality of 6.3 per cent., 105 cholecystostomies, five deaths, immediate operative mortality approximately 5 per cent.

2. Follow up on 241 cases—a percentage for recall of 41.9 per cent. Cholecystectomy cases 209, 182 or 86.1 per cent. reported well, symptom-free, six of remaining twenty-seven reoperated. Twenty-one not cured of complaint.

3. Cholecystostomy cases heard from thirty-two; 18 or 56 per cent. reoperated.

4. Four fatalities from hemorrhage. Anomalous arteries and ducts are occasionally encountered. In our 470 cases common duct opened in fifty-four with four deaths.

5. We do not advocate cholecystectomy in the acutely inflamed gall-bladder, preferring cholecystostomy.

6. In that fortunately small but baffling group of cases that end fatally within forty-eight hours of unknown cause, we believe, are due to absorption of the toxins from chemically impaired liver cells or infected bile from the intrahepatic biliary passages,

7. Other causes of death in our immediate mortality list:

Pulmonary embolism .....	4 patients
Acute nephritis .....	2 patients
Intestinal obstruction .....	1 patient
Acute cardiac decompensation .....	1 patient
Bilateral parotiditis .....	1 patient
"Cardiac death" .....	1 patient
Erysipelas anterior abdominal wall .....	1 patient
Exhaustion following partial gastrectomy,	
Cholecystectomy done at the same time .....	1 patient
"Probable sepsis" .....	1 patient
Colæmia .....	1 patient
Bile peritonitis .....	1 patient