

The Incidence and Causes of Death Following Surgery for Nonmalignant Biliary Tract Disease

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In the 46-year period from September 1, 1932 to September 1, 1978, 11,808 patients were operated on for nonmalignant biliary tract disease. In 80.1% of these patients, the disease was considered chronic, and in 19.9%, acute inflammation was superimposed on the existing condition. There were 207 postoperative deaths, a mortality rate of 1.7%. Advanced age, acute cholecystitis and common duct stones were the principal determinants of operative mortality. Cholecystectomy for chronic cholecystitis was performed in 7,413 patients with an operative mortality of 0.5%. Choledochotomy in search of residual or recurrent common duct calculi was performed in 341 patients with a mortality of 2.1%. Detailed analysis of the causes of death in 105 patients who died during the years 1962 through 1978 revealed that cardiovascular disease, especially myocardial infarction, was the most frequent cause of death. Liver disease, most commonly cirrhosis, was also a major factor in operative mortality.

ON THE EVE OF the centennial anniversary of the first cholecystectomy, it is appropriate to record the successes as well as the failures of the surgical treatment of biliary tract disease. The wide acceptance of surgical therapy for these conditions is the result of many factors including the availability of accurate methods of diagnosis, the safety and ease with which operations are accomplished and the satisfactory relief of symptoms and interruption of the pathologic processes involved. Until recently, surgery provided the only effective therapy for calculous disease of the biliary tract. The successful dissolution of gallbladder calculi with chenodeoxycholic and ursodeoxycholic acid and the endoscopic approach to the common bile duct through the ampulla of Vater require that the safety and efficacy of these new nonsurgical modalities be compared to a standard of achievement using an operative approach.

Our interest in the safety and efficacy of biliary tract disease dates back several decades. In 1934, Heuer³ reviewed 21 reports from European and American hospitals recording the mortality of 36,623 cases operated on prior to 1932. There were 2,453 deaths,

a mortality rate of 6.6%. The most frequent causes of death were far-advanced biliary tract disease and liver insufficiency, errors in surgical management and pulmonary complications usually related to anesthesia. In 1952, Glenn and Hays¹ reported on 63 fatalities following operations for nonmalignant biliary tract disease on 3,439 patients at The New York Hospital-Cornell Medical Center from 1932 through 1950. This number of deaths represented a mortality rate of 1.8%. Thus there was a significant improvement in the safety of biliary tract surgery during this 18-year period. In addition, the proportion of deaths due to advanced biliary tract disease decreased, and deaths due to degenerative diseases increased. In 1963, Glenn and McSherry² reported an additional 2,358 patients with 39 postoperative deaths (a mortality rate of 1.6%) treated from 1950 through 1962. Analysis of these deaths indicated that a greater proportion of patients 65 years of age and older were operated on than in previous decades, and this fact was largely responsible for the predominant role of cardiovascular disease as a cause of death following biliary tract surgery. This present report will update our experience from September 1, 1962, through August 31, 1978, and summarize the experience for the years 1932 through 1978.

Clinical Material

From September 1, 1932, through August 31, 1978, there were 11,808 patients operated on at The New York Hospital-Cornell Medical Center for nonmalignant disease of the biliary tract. There were 207 postoperative deaths, a mortality rate of 1.7%. Operative mortality correlated with age. There were 5,367 patients under 50 years of age and 19 (0.3%) postoperative deaths; 4,007 patients aged 50-64 years and 67 (1.6%) deaths; and 2,434 patients 65 years and older

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Submitted for publication: August 28, 1979.

TABLE 1. *The Mortality Rates Attendant on the Operative Procedures for Chronic Disease of the Biliary Tract*

	No. Cases	No. Deaths	Mortality Rate (Per Cent)
Cholecystectomy	7413	35	0.5
Cholecystostomy	92	7	7.6
Choledochotomy plus cholecystectomy or cholecystostomy	1378	48	3.5
Choledochotomy alone	341	7	2.1
Procedures for strictures and miscellaneous conditions	237	20	8.4
Total operations	9461	117	1.2

with 121 (4.9%) deaths. The operative procedures performed during this 46-year period included cholecystectomy, 9,056; cholecystostomy, 432; choledochotomy, as an independent operation or in conjunction with a gallbladder procedure, 2,083; operations for the treatment of strictures, 132; and miscellaneous procedures for benign conditions of the choledochus, 105.

Of the 11,808 patients, 9,461 (80.1%) were operated on for chronic (nonacute) disease of the biliary tract. The operations performed and the mortality rates associated with them are depicted in Table 1. The overall operative mortality for chronic disease was 1.2%. Included in this group were 7,505 patients operated on for chronic cholecystitis. Table 2 lists the mortality rates associated with cholecystectomy (0.5%) and cholecystostomy (8%) by age and also details the incidence of calculi in this group of patients. Common duct exploration in addition to cholecystectomy was performed in 1,368 patients with 44 (3.2%) deaths (Table 3).

There were 2,347 patients (19.9%) in this group of 11,808 operated on for acute cholecystitis and 90

TABLE 2. *The Operative Mortality for Chronic Cholecystitis in Relation to the Surgical Procedure Performed, Age and the Presence or Absence of Calculi*

	Number of Cases/Deaths		
	Stones	No Stones	Total
Cholecystectomy			
50 years or older	3409/26	201/5	3610/31
under 50 years	3596/3	207/1	3803/4
subtotal			7413/35 (0.5%)
Cholecystostomy			
50 years or older	77/5	6/1	83/6
under 50 years	6/1	3/—	9/1
subtotal			92/7 (8.0%)
Total			7505/42 (0.6%)

TABLE 3. *Common Duct Exploration Performed in Conjunction with Cholecystectomy in 1368 Patients with Chronic Cholecystitis*

	Number of Cases/Deaths		
	Stones Recovered	No Stones Recovered	Total
50 years or older	580/29	330/11	910/40
Under 50 years	237/3	221/1	458/4
Total			1368/44 (3.2%)

postoperative deaths, a mortality rate of 3.8%. With respect to age, there were 63 fatalities among 643 patients 65 years and older, a mortality rate of 9.7%. Of the 1,704 patients less than 65 years, there were 27 deaths, a rate of 1.6%. Table 4 depicts the mortality rates for cholecystectomy and cholecystostomy in 1,983 patients with acute cholecystitis in relation to age and the presence or absence of calculi. The operative mortality for cholecystectomy was 1.3% and for cholecystostomy, 10.6%. In addition, 351 patients underwent common duct exploration in addition to cholecystectomy, and there were 27 postoperative fatalities (7.7%). Thirteen patients had common duct exploration plus cholecystostomy, and there were five postoperative deaths (38.5%). The causes of death for the 207 fatalities in this group of 11,808 patients operated on from 1932 through 1978 are shown in Figure 1. Cardiovascular disease, most commonly myocardial infarction, was the leading cause of death. Disease of the liver and biliary tract, principally cirrhosis, was the next most frequent cause of death. The major cause of extrahepatic but intra-abdominal fatal complications was pancreatitis.

The etiologic factors of importance in 102 of the 207 deaths that occurred during the years 1932 through

TABLE 4. *Mortality Rates for the Surgical Treatment of Acute Cholecystitis**

	Number of Cases/Deaths		
	Stones	No Stones	Total
Cholecystectomy			
50 years or older	832/17	46/2	878/19
under 50 years	723/2	42/1	765/3
subtotal			1643/22 (1.3%)
Cholecystostomy			
50 years or older	224/25	57/9	281/34
under 50 years	47/1	12/1	59/2
subtotal			340/36 (10.6%)
Total			1983/58 (2.9%)

* The overall mortality for this group of patients was 2.9%.

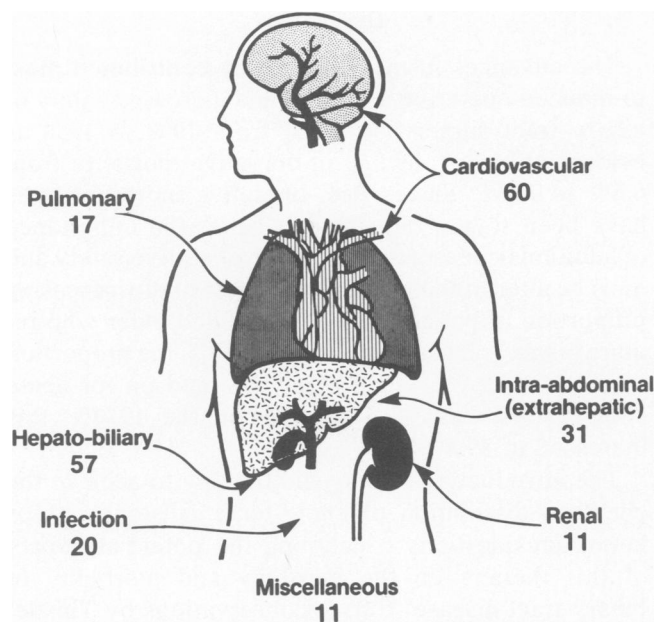


FIG. 1. The causes of death in 207 patients operated on for non-malignant biliary tract disease during the years 1932-1978. Cardiovascular disease was the most frequent cause of death.

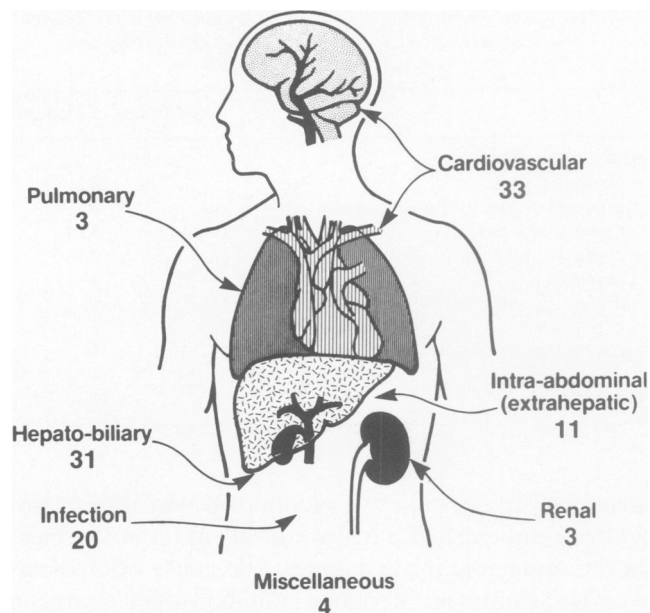


FIG. 2. Etiologic factors of significance in the death of 105 patients operated on for nonmalignant biliary tract disease from 1962-1978.

1962 have been reported in previous communications.^{1,2} This report describes the causes of death in the 105 patients who died after 1962. There were 54 males and 51 females whose age ranged from 44 to 90 years. Insulin-dependent diabetes was a coexistent condition in 13 patients. In 10 patients, biliary tract disease and its clinical manifestations were a complication of another operative procedure, and in four additional patients, the biliary tract operation was performed incidental to other intra-abdominal procedures.

The indications for operation are listed in Table 5. Acute cholecystitis and its sequelae were present in slightly more than one-half (53.3%) of the postoperative deaths. Determination of the cause of death was based on both clinical and postmortem findings. Autopsy

TABLE 5. The Indications for Operation in 105 Fatalities following Biliary Tract Surgery During the Years 1962-1978

Acute cholecystitis		39
calculous	27	
acalculous	12	
Acute cholecystitis and choledocholithiasis		18
Chronic cholecystitis		23
calculous	22	
acalculous	1	
Chronic cholecystitis and choledocholithiasis		13
Common duct stricture		8
Cystic duct remnant and choledocholithiasis		3
Choledochotomy (secondary)		1
Total		105

was performed in 55 of the 105 patients (52.4%). Figure 2 depicts the causes of death in these patients. Cardiovascular disease and disorders of the liver and biliary tract were the most frequent causes of death.

The specific lesions identified in the 33 patients who died from cardiovascular disease are listed in Table 6. The 14 patients who died from coronary occlusion ranged in age from 57 to 81 years. Severe coronary artery disease evidenced by angina or recent myocardial infarction was present in eight of the 14 patients, three of which were diabetic. Six of the seven patients who succumbed to cerebrovascular lesions were over 70 years of age, and one was diabetic.

There were 31 deaths classified as hepatobiliary in etiology (Table 7) of which 18 were caused by cirrhosis. The cause of the cirrhosis in eight of these patients was presumed to be due to biliary tract ob-

TABLE 6. The Cardiovascular Causes of Death in 33 Patients*

Cardiovascular	
Coronary occlusion	14
Cerebrovascular lesion	7
Pulmonary embolus	5
Congestive heart failure	2
Mesenteric artery occlusion	2
Postop cardiopulmonary bypass for mitral valve replacement (1) and repair of ventricular septal defect (1)	2
Ruptured thoracic aortic aneurysm	1
Total	33

* Coronary occlusion was the most frequent lesion diagnosed in this group.

TABLE 7. The Hepatobiliary Causes of Death Following Biliary Tract Surgery in 31 Patients Operated On During the Years 1962 Through 1978

	Number of Patients
Hepatic	
cirrhosis	18
retained common duct stones	4
hepatic abscess	3
common duct injury	2
hepatitis	1
dissecting aneurysm hepatic artery	1
hepatoma	1
carcinoma bile duct	1
Total	31

struction. In six patients, alcoholism was implicated, and one patient had a history of hepatitis in the past. In the remaining three patients, the cause of cirrhosis was not identified. Retained common duct stones in four patients and injury to the common duct in two others initiated a sequence of additional complications which eventually resulted in death to these individuals.

Infection was the proximate cause of death in 20 patients. Cholangitis, an important clinical feature of their disease in many patients with a fatal outcome following biliary tract surgery, was the immediate cause of death in 12 patients. In two of these patients, the cholangitis was suppurative, *i.e.*, the contents of the common duct were frankly purulent, and in five additional patients, blood cultures yielded gram negative bacteria, most frequently *Escherichia coli*. There were three deaths due to subhepatic abscesses and one each from pseudomembranous enterocolitis, retroperitoneal abscess, gangrene of the abdominal wall, burn sepsis and wound infection. This last patient with a wound infection had *Proteus vulgaris* septicemia.

Other intra-abdominal but extrahepatic causes of death included pancreatitis in seven patients and gastrointestinal bleeding in four. Pancreatitis was associated with acute cholecystitis in six patients, four of whom also had choledocholithiasis. One patient was operated on because of a cystic duct remnant and common duct stones from which developed pancreatitis postoperatively. The causes of gastrointestinal bleeding were stress ulcers and hemorrhagic gastritis in three patients and reflux esophagitis in one patient.

Three patients died of associated chronic renal failure and three from pneumonia. Two of these pulmonary deaths were due to aspiration. There was one death each from myelogenous leukemia, multiple myeloma, wound dehiscence and endoscopic perforation of the esophagus performed to evaluate the cause of upper gastrointestinal bleeding.

Discussion

The advances in medicine which contributed most to reduced operative mortality and increased safety of biliary tract surgery occurred from 1930 to 1950 as evidenced by the decline in operative mortality from 6.6% to 1.8%. Since 1950, operative mortality rates have been stable, but this fact belies the importance of additional measures to improve operative safety and must be interpreted with an awareness of the increasing proportion of patients age 65 years and older who require biliary tract surgery. In the 1930's, the proportion of patients 65 years and older operated on for acute cholecystitis was 5.3% whereas in the 1970's, this increased to 39.8%.

The introduction of bile acid therapy to achieve the chemical dissolution of cholesterol gallstones poses important questions concerning the potential impact of this therapy on the mortality and morbidity of biliary tract disease. Current observations by Thistle⁵ suggest that chenodeoxycholic acid is effective in dissolving gallstones in approximately one-half of patients. Unpublished preliminary data from the National Cooperative Gallstone Study Group indicate a "drop-out rate" of about 25%, *i.e.* patients who fail to complete the course of bile acid therapy most often as a result of persistent or increasing biliary symptoms or disinterest in continuing daily medication. Recurrence of gallstones following the cessation of successful bile acid therapy is estimated at 25–30%. It seems unlikely therefore to expect a reduction in mortality rates associated with biliary tract surgery, especially cholecystectomy, as a result of the introduction of chemical dissolution. Indeed the converse may occur; mortality rates might increase because of the delay in surgical therapy. The incidence of acute cholecystitis and choledocholithiasis increases with the duration of gallbladder calculi and these conditions increase the operative mortality of cholecystectomy.

The operative mortality for cholecystectomy in patients with chronic cholecystitis less than 50 years of age is approximately one per 1,000 patients. Further reduction of operative mortality rates in this group of patients must await new developments in anesthetic techniques. In contrast, patients 50 years and older have an operative mortality of slightly less than one per 100 patients. Death in this group of patients is most commonly the result of associated cardiovascular disease, often not detected by preoperative studies performed to assess operative risk.

Cholecystectomy performed for acute cholecystitis is associated with a higher operative mortality rate than for chronic cholecystitis for all patients, both young and old. The impact, however, is more signifi-

cant in patients 50 years and older. Similarly patients that required choledocholithotomy also had an increased operative mortality rate that is age related. Common duct calculi appear to adversely affect the operative mortality rate of cholecystectomy to a degree greater than acute cholecystitis. The comparative mortality rates of cholecystectomy performed for chronic cholecystitis versus acute cholecystitis or performed in conjunction with choledocholithotomy provide a major consideration for those physicians whose counsel is sought by patients with asymptomatic gallstones.

Choledochotomy was performed as an independent procedure in search of residual or recurrent calculi in 341 patients with seven postoperative deaths—an operative mortality rate of 2.1%. This group included 50 patients with cholangitis and 22 with pancreatitis. In this group of 72 patients, there were three deaths. If patients with pancreatitis and cholangitis are excluded, the mortality rate for secondary choledochotomy would have been 1.2%. The importance of this figure is that it permits an accurate comparison of the risks of surgery and endoscopic papillotomy performed for the removal of residual common duct stones or stenosis of the papilla of Vater. The endoscopists, *e.g.* Safrany,⁴ are in agreement that pancreatitis and cholangitis preclude the safe performance of papillotomy, and with these exclusions, their mortality rate is 1–2% and morbidity, 6–8%. The causes of death following endoscopic papillotomy are hemorrhage,

cholangitis and pancreatitis. Our conclusions are that the mortality rates of secondary choledochotomy and endoscopic papillotomy are comparable and that the eventual role of the latter procedure will be determined by its efficacy and long-term results. Its acceptance on the basis of less mortality and morbidity in comparison to surgical therapy is unjustified.

The data presented clearly identify the aged patients as the group at greatest risk of fatal complications following biliary tract surgery. The incidence of acute cholecystitis and choledocholithiasis increases with the duration of gallstone disease and age. The need for more extensive operations and the higher incidence of associated cardiovascular disease are responsible for the relatively increased risk of operation in this group of patients. Accurate preoperative assessment of risk which permits elective as opposed to urgent or emergent operation can result in diminished mortality and morbidity.

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