

Recurrent Biliary Calculi

Duodenal Diverticula as a Predisposing Factor

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Several studies indicate a causal relationship between duodenal diverticula and gallstone disease. The diverticula persist after biliary tract surgery, and it is therefore presumed that patients with diverticula have an increased disposition to develop new calculi in the bile ducts after cholecystectomy. To test this hypothesis, the occurrence of recurrent biliary calculi was studied in 101 patients who had cholecystectomy, all with an asymptomatic period of two years or more following the primary biliary surgery. All patients had symptoms, that indicated biliary tract or pancreatic diseases. The incidence of recurrent calculi in patients with diverticula was 87.5% (95% confidence interval, 66.9–95.8). In patients without diverticula, the incidence was 31.9% (95% confidence interval, 21.5–44.3). The difference is highly significant, and the results support the assumption that diverticula in the area of the papilla of Vater dispose to gallstone disease.

VERY LITTLE IS KNOWN about the factors that dispose to recurrence of gallstones, formed in the common or intrahepatic bile ducts, in patients who have undergone cholecystectomy. Duodenal diverticula localized to the area of the papilla of Vater are associated with a high incidence of gallstone disease,^{1,2} and previous studies indicate a causal relationship between diverticula and biliary calculi.³⁻⁶ Since the diverticula persist after cholecystectomy, one might expect an increased frequency of recurrent biliary calculi in these patients. The present study was designed to test the validity of this theory.

Patients and Methods

One hundred one patients entered the study between 1976 and 1980. They had all previously undergone cholecystectomy, with or without common duct exploration, owing to gallstone disease. At least a two-year asymptomatic period had followed the biliary tract surgery. They were examined because of suspected biliary tract or pancreatic diseases. Excluded from the study

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were patients with bilio-intestinal anastomosis or sphincteroplasty. Definitive diagnosis of neoplasms affecting the bile ducts or papilla of Vater also led to exclusion. Carcinomas in these regions may impede the endoscopic diagnosis of diverticula and the ductographic visualization of the proximal bile ducts. Patients who had undergone gastric resections and vagotomy were also excluded as these operations may dispose to gallstone formation.⁷⁻⁹ The patients formed two groups; those with and those without diverticula in the area of the papilla of Vater.² Since duodenal diverticula are uncommon in younger age groups,² only patients 60 years of age or older were included in the study. The two groups were comparable with regard to age, sex, and time since the cholecystectomy (Table 1).

The diagnosis of diverticula as well as recurrent biliary calculi was made by endoscopic cholangio-pancreatography (ERCP). The examinations were performed according to a standard procedure.² The findings of the calculi were verified either by surgery or by repeated endoscopic examinations, followed by therapeutic endoscopic papillotomy.

TABLE 1. Details of Patients in Study

	With Diverticula	Without Diverticula
Number of patients	32	69
Sex	14 M, 18 F	20 M, 49 F
Age		
Median	73.0	71.0
95% confidence interval	71.0–78.0	68.0–74.1
Range	66.0–86.0	60.0–87.0
Time since cholecystectomy (years)		
Median	7.0	6.0
95% confidence interval	5.4–11.6	5.0–11.0
Range	2.0–46.0	2.0–39.0

TABLE 2. *Recurrent Biliary Calculi in Patients with and without Diverticula*

	With Diverticula	Without Diverticula	Total
With calculi	28	22	50
Without calculi	4	47	51
Total	32	69	101

$p < 0.01$.

Statistical Evaluation

All statistical analyses were based on three-decision theory.¹⁰ The p -value is one-sided and related to this decision procedure.¹¹ The results are given as median, with 95% confidence interval. For testing the kind of relationship within pairs of variables, a Fischer-Irwin test statistic was used.¹² The theory of simple Bernoulli sequences was used for estimation of frequencies, with 95% confidence interval.¹¹

Results

Juxtapapillary duodenal diverticula were found in 32 patients. The remaining 69 had no visible changes in the papillary area. Fifty of the 101 patients studied had recurrent biliary calculi. In the group with diverticula, 28 of the 32 patients studied had calculi, whereas 22 of 69 patients without diverticula had recurrent stones in the bile ducts. The difference is highly significant, $p < 0.01$ (Table 2). The calculated probability for recurrent calculi in patients with suspected biliary tract or pancreatic diseases who had previous cholecystectomies is 87.5% in patients with diverticula and 31.9% in patients without diverticula (Table 3). The findings in patients with diverticula but without calculi were normal in two patients, chronic pancreatitis in one, and chirrrosis of the liver in one. In patients without diverticula and no biliary calculi, the findings were normal in 37, suspected stenosis of the papilla in five, carcinomas in the body of the pancreas in two, chronic pancreatitis in two, and pancreas divisum in one.

Discussion

This study shows that patients with diverticula in the area of the papilla of Vater are more liable to develop recurrent biliary calculi after cholecystectomy than are

TABLE 3. *Probability of Recurrent Calculi (Per cent) in Patients with Suspected Biliary Tract or Pancreatic Disease*

	With Diverticula	Without Diverticula	Total
Point estimate	87.5	31.9	49.5
95% confidence interval	66.9-95.8	21.5-44.3	38.7-59.2

patients without diverticula. The high incidence of gallstones in patients with diverticula is well documented.^{1,2} In a series of examinations, it has been shown in the present study that patients with diverticula and gallstones have an insufficient choledocho-duodenal sphincter,⁴ bacterial contamination of the common duct bile,³ and, contrary to other gallstone patients in this hospital, calcium-bilirubinate stones are predominant in patients with diverticula.^{5,6} The most reasonable explanation of these observations is that a bacterial overgrowth of the intestinal contents in the diverticulum and its surroundings,¹³ combined with an insufficient sphincter, disposes to ascending infections from the duodenum to the bile ducts. The bacteria found in common duct bile in patients with diverticula belong to the intestinal flora and are β -glucuronidase-producing bacteria.³ β -glucuronidase derived from bacteria may split bilirubin diglucuronide secreted from the liver cells to form free or unconjugated bilirubin in the bile ducts, which in turn combines with calcium to form calcium-bilirubinate stones.^{14,15} The contamination of the bile ducts by intestinal bacteria will, of course, not be prevented by removal of the gallbladder. Formation of recurrent calculi in patients with diverticula is thus highly probable, provided that the mechanisms described are acting. The present study gives support to this concept.

It is not possible to distinguish with absolute certainty between recurrent biliary calculi and residual stones overlooked at the cholecystectomy. Different criteria have been used for the identification of recurrent calculi.^{16,17} As a consequence, the reported incidence varies widely.¹⁶⁻¹⁸ The criterion in the present study was at minimum a two-year asymptomatic period following the initial biliary surgery. This is in accordance with other investigations.^{16,19}

Most diverticula appear in older age groups.² It is not known whether the diverticula were present at the primary operation or have been formed in the period between the cholecystectomy and the present examination. This question, however, does not influence the conclusion that diverticula in the area of the papilla of Vater dispose to recurrence of biliary calculi in patients who have previously undergone cholecystectomy.

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