

OPERATIVE CHOLANGIOGRAPHY

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ABSTRACT

Retrospective analysis of 174 operative cholangiograms done over a 3-year period confirms its substantial benefit when used selectively in patients with clinical criteria for common bile duct exploration. A low incidental ductal stone rate of 1.6%, together with a 3.3% false positive cholangiogram rate and a case of bile duct injury resulting from the procedure makes its routine application appear superfluous.

Keywords: Operative cholangiography, gallstone

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INTRODUCTION

The most important contribution of operative cholangiography, since its introduction in 1932, has been to reduce the rate of negative common bile duct (CBD) explorations, which exceeds 50% when explorations are based solely on clinical criteria. This reduction in unnecessary CBD explorations has also been convincingly shown by Doyle et al⁽¹⁾ to result in a significantly lower overall mortality rate.

The success of operative cholangiography has prompted its use in all cholecystectomies. Advocates of routine operative cholangiography⁽²⁻⁴⁾ mention its importance in detecting incidental CBD stones and preventing accidental bile duct injury by providing an anatomical 'road map' of the biliary ductal system. Other authors⁽⁵⁻⁷⁾ question the clinical significance of incidental ductal stones and recommend selective cholangiography on grounds of cost-effectiveness, and to minimise the problem of false-positive cholangiograms.

The following retrospective analysis, while attempting to define our stand in this controversy, is intended mainly as an audit of the practice of operative cholangiography in Toa Payoh Hospital with the view of optimizing its use in the future.

PATIENTS AND METHODS

A total of 366 cholecystectomies were performed at the Department of Surgery, Toa Payoh Hospital from June 1987 to September 1990. Of these, 359 records were available for analysis. Incidental cholecystectomies were not included in this study.

Particular attention was given to the presence of criteria for CBD exploration, which include:

- 1 clinical jaundice
- 2 pancreatitis

- 3 cholangitis
- 4 serum Bilirubin > 24 umol/L
- 5 serum Alkaline Phosphatase > 110 U/L
- 6 dilated CBD on ultrasound or at surgery
- 7 palpable CBD stones at surgery

Operative cholangiography was performed according to the discretion of the attending surgeons, routinely by some and selectively by others. The technique of cholangiography employed was quite uniform using a Stoke-on-Trent catheter inserted through the cystic duct. Two to three films are taken with increasing volumes of 50% diluted X-ray contrast (uromiro) introduced through the catheter. The presence of CBD stones on the cholangiogram is suggested by either filling defects within the common duct or failure of contrast to enter the duodenum. In practice the films were interpreted by the attending surgeon. However, for the purposes of this study, these cholangiograms were also read by a radiology registrar.

RESULTS

The 359 patients studied ranged in age from 21 to 95 years, (mean 54 years). Females outnumbered males by 1.6 to 1. Their race composition comprised 82% Chinese, 8.5% Indian, 8% Malay, and 1.5% others.

Operative cholangiography was performed in 174 patients (48.5%) and its results were correlated with the presence of common bile duct stones (Table I). There were 24 cholangiograms which were positive for ductal stones but subsequent exploration was negative in 5 of these giving a false-positive rate of 3.3% of all patients with normal ducts (Table II). Of the 150 cholangiograms that did not reveal ductal stones, 2 were found to have ductal stones on exploration: one was explored because preoperative ultrasound showed ductal stones and the other because retrograde passage of small stones through the cystic duct was noted. None of the patients with normal cholangiograms that underwent simple cholecystectomy presented with retained stones on follow-up. The false-negative rate in our series is therefore at least 9.5% of all the patients with ductal stones. Operative cholangiography was done for 88 patients with previously mentioned clinical criteria.

CBD exploration was avoided in 58 patients, 66% (Table III), who had normal cholangiograms. A further 5 patients had duct exploration despite normal cholangiograms; all of these were negative explorations.

Of all 359 patients, 168 had positive clinical criteria for CBD exploration. CBD stones were recovered in only 57 cases (34%). The sensitivity and predictive value of individual criteria are compared with that of operative cholangiography in Table IV. In the remaining 191 patients who had no clinical criteria, routine cholangiography was performed in 86 patients: 2 were false-positive for duct stones resulting in negative duct exploration while 84 were negative for stones. However, there was one false-negative which was confirmed on subsequent exploration. Of the 104 patients with no clinical criteria, in

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whom routine operative cholangiography was not performed, one patient presented with retained stones seven months later which required surgery while another presented seventeen months later with acute pancreatitis with jaundice presumably from a retained stone which passed spontaneously as ERCP was normal. These 3 cases contributed to an overall rate of incidental ductal stones of 1.6% in patients without clinical criteria. Thirty-three patients had pre-operative diagnosis of CBD stones by ultrasound (9 cases), ERCP (14 cases) and PTC (10 cases) but stones were not recovered in 8 patients (24%): 5 were not explored because of normal operative cholangiograms and 3 had negative explorations. None of these patients had retained stones.

In 9 patients, cholangiography was attempted without success mostly because of inability to pass the cholangiography catheter into the cystic duct. Injury to the common bile duct during catheter placement was recorded in one patient. This was discovered during surgery and required duct exploration and insertion of a T-tube. Subsequent post-operative recovery was uneventful. There was no other cases of bile duct injury.

On review by a radiologist, 28% of operative cholangiograms were judged to be inadequate for complete assessment of the bile ducts. The commonest reasons for this were, suboptimal exposure of films (58%) and incomplete filling of the common bile duct (40%). There was an overall 82% concurrence between radiologist and surgeon interpretation of the cholangiograms. Four out of 5 of the previously mentioned false-positive cholangiograms were correctly read by the radiologist.

The average time taken to perform an operative cholangiogram by individual surgeons was derived by subtraction and ranged from 10 to 27 minutes with an overall mean of 21 minutes.

There was no difference in mortality, complication rate or hospitalisation time in patients with and without operative cholangiography. The overall mortality rate for simple cholecystectomy was 1.8%: all 5 patients had surgery for acute cholecystitis and its complications. The mortality rate rose to 6.4% when the CBD was explored: 5 patients, of which one had a negative exploration.

DISCUSSION

An increase in mortality for cholecystectomy resulting from additional CBD exploration is well documented. Our results show a threefold increase. Our main objective is therefore to formulate a policy which minimises the occurrence of negative duct explorations while keeping the rate of retained stones acceptably low. This can be achieved by the judicious use of operative cholangiography. Cost-effectiveness is a secondary consideration.

Clinical criteria for CBD explorations are notoriously unreliable. In this series, 66% of those with positive criteria were spared CBD exploration on account of a normal operative cholangiogram. This is a sizeable figure comparable to that of other reports (Table III).

Five patients were explored by their surgeons based on clinical criteria despite having normal cholangiograms and all 5 were negative explorations. These 5 CBD explorations with their inherent risks could have been avoided if the surgeons had accepted the result of a normal cholangiogram. Another interesting finding was that even when ductal stones have been diagnosed preoperatively by ultrasound, ERCP or PTC, 24% (8 out of 33) were eventually found to have no ductal stones either by operative cholangiography or negative exploration. This discrepancy is due in part to spontaneous passage while awaiting surgery. The practical conclusion must be that operative cholangiography should not be omitted even when ductal stones have been visualized preoperatively.

Table I - Results of Operative Cholangiogram vs CBD Stones

		Operative Cholangiography		
		+ for CBD Stones	- for CBD Stones	
C B D S T O N E S	CBD Stones present	19	2	21
	Absent	5	148	153
		24	150	174

Table II - Calculated False-Positive Rates

Chart ⁽⁶⁾	7.5%
Seif	7.0%
Saltzstein	4.0%
Shively	3.5%
Pernthaler	2.1%
Mofti	0.8%
Present Study	3.3%

$$\text{Where false-positive rate} = \frac{\text{False-positive}}{\text{False-positive} + \text{True Negative}} \times 100$$

Table III - CBD Explorations Avoided by Operative Cholangiography

	No. of patients with positive criteria	Negative CBD stones on cholangiography
Seif	85	57%
Saltzstein	79	50%
Mofti	147	74%
Pernthaler	171	66%
Present study	88	66%

Table IV - Comparison Of Sensitivity and Predictive Values Of Clinical Criteria vs Operative Cholangiography

Clinical Criteria	Sensitivity	Predictive Value
Clinical Jaundice	73%	43%
Raised Serum Bilirubin	87%	41%
Raised Alkaline Phosphatase	86%	41%
Pancreatitis	12%	30%
Cholangitis	34%	58%
Dilated CBD (U/S or Intra Op)	80%	68%
Palpable CBD Stones	15%	100%
Operative Cholangiography	90%	80%

Sensitivity = % of CBD stones detected by positive criterion

Predictive value = % probability of finding CBD stones predicted by positive criterion

Table V - Rates of Incidental CBD Stones

	% Incidental Duct Stones
Jolly	6.3%
Shively	5.0%
Wayne ⁽⁹⁾	3.7%
Pagana	3.0%
Skillings ⁽¹⁰⁾	0.9%
Mofti	0.0%
Present Study	1.6%

The routine use of operative cholangiography in all cholecystectomies enables the detection of incidental ductal stones which have been reported to occur in 0.9% to over 6% (Table V). However, the clinical significance of such stones has been questioned by Stark⁽¹¹⁾ who estimated that only 1 in 10 unsuspected CBD stones would become clinically significant. Likewise Gerber⁽¹²⁾ reported only one case (0.2%) of retained stones in 438 simple cholecystectomies without cholangiography. Furthermore, with the refinement of endoscopic techniques, the need for open surgery in treating retained stones is diminishing. In our series, incidental ductal stones occurred in 3 cases (1.6%) of which only one patient, in whom operative cholangiography was not performed and had subsequently required a second operation, could have potentially benefited from the routine cholangiography. Apart from its benefits, routine operative cholangiography is also based on the premise that it is a safe procedure. However, this perception should not be biased by failure to appreciate its indirect complications.

The most important drawback of operative cholangiography is a false positive result leading to negative duct exploration. Therefore routine cholangiography can only be justified if this problem is kept at a minimum. Calculated false-positive rates from other reports range from 0.8% to 7.5% of all patients without CBD stones (Table II). Our figure of 3.3% is reasonably low and our observation indicates that it could be reduced further if a radiologist's opinion was

sought for all positive cholangiograms.

Direct complications are rare but common bile duct injury resulting from operative cholangiography has been reported⁽¹³⁾ and did occur in one patient in our series.

CONCLUSION

Our results concur with the universal observation that selective use of operative cholangiography greatly reduces the rate of negative duct explorations. The place of routine cholangiography is less clear. The benefit of detecting a very small number of incidental ductal stones is offset by an equal number of negative explorations and duct injuries. With the additional factor of cost-effectiveness, it would seem reasonable practice to omit routine operative cholangiography as long as patients are fully assessed for clinical criteria prior to surgery.

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