LIVER, BILIARY, AND PANCREAS

A 10 year single centre experience of percutaneous and endoscopic extraction of bile duct stones with T tube in situ

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Abstract

A non-randomised single centre study of 226 consecutive patients referred over 10 years with retained common bile duct stones and a T tube in situ or a cholecystostomy tube are reported. Percutaneous extraction was attempted in 204 and endoscopic extraction in 68 patients. Percutaneous clearance was achieved in 158 (77.5%) patients and endoscopic clearance in 52 (76.5%) patients. Six of 153 (3.9%) patients followed after percutaneous treatment suffered major complications (pancreatitis, cholangitis, or tract perforation). Three of 67 (44%) patients followed after endoscopic treatment suffered major complications (pancreatitis, cholangitis, or bleeding). When the initial method of treatment failed, the alternative was used, resulting in an overall success rate of bile duct clearance of 94.3%. It is concluded that percutaneous and endoscopic methods of bile duct clearance in patients with a T tube in situ are equally effective, carrying similar complication rates. This study has helped to clarify the indications and efficacy of these alternative treatments.

Retained bile duct stones after exploration of the common bile duct is still a common problem despite recent advances in intraoperative choledochoscopy and cholangiography.¹ The incidence of bile duct calculi in patients undergoing cholecystectomy ranges from 7-15%, and the incidence of retained common bile duct stones after positive bile duct exploration from 10-13%.² The incidence of retained stones after bile duct exploration may be reduced to 2% by intraoperative choledochoscopy.³ Re-exploration carries a postoperative mortality varying from 3 to 28%,⁴⁻⁹ and without choledochoduodenostomy a 21% incidence of further operation.¹⁰

Non-surgical methods of bile duct clearance in the early postoperative period are: flushing of the T tube with solvents, percutaneous extraction with specially designed steerable catheters and baskets via the T tube tract, postoperative percutaneous choledochoscopy via the T tube sinus tract, and endoscopic sphincterotomy. Flushing with heparinised saline, cholate, or monooctanoin via the T tube is of limited value.^{9 11 12} Continuous infusion of a modified mono-

octanoin solution (GMOC) alternating with ethylenediaminetetra-acetic acid infusion via a nasobiliary drain may partially dissolve calcium bilirubinate stones.¹³⁻¹⁵ Flushing with methyl tertiary butyl ether (MTBE) via a nasobiliary drain was recently reported to carry a success rate of 80% in 10 patients,¹⁶ but confirmation of the efficacy and lack of toxicity of this method is required. Moreover, MTBE dissolves most T tubes and must be given via polyethylene catheters. MTBE infused via a teflon catheter inserted through the T tube failed to dissolve radiolucent common bile duct stones.¹⁷

Percutaneous extraction of stones via the T tube tract has now been described in around 2000 patients (combined series) and carries a success rate of between 78 and 96%.¹⁸⁻²⁴ The major complications are cholangitis, pancreatitis, and tract perforation, which occur in 2-4% of patients^{21 22} and necessitate further operation in 0.55%.^{19 21 22 24} Death after percutaneous extraction has occurred in two (0.1%) patients and was caused by pancreatitis.^{21 25} Minor complications of percutaneous stone extraction occur in 5% of patients and include postoperative fever, pain, and vomiting.²² One study, showing 'successful' percutaneous extraction in 96 patients, reported two with recurrent biliary calculi that caused biliary obstruction and was treated by further exploration.²⁴

Reports of postoperative choledochoscopy via the T tube tract have come from the Far East. In these, 286 patients with intrahepatic stones and 169 patients with common bile duct stones were treated, with success rates varying from 87-93% and 96-100%.²⁶⁻²⁹ This technique required, on average, 15 attempts at removal for intrahepatic stones and 1.5 attempts for clearance of the common bile duct. Major complications occurred in 4% of the patients and included bleeding and perforation of the intra- and extrahepatic biliary tree and the sinus tract. The western experience of this technique is more limited.³⁰⁻³⁵

There are five reports of endoscopic sphincterotomy immediately after operation. Successful endoscopic sphincterotomy and duct clearance was achieved in 72 of 75 patients in one series, but it is unclear how many of these patients had a T tube in situ at the time of endoscopy.³⁶ In one report of five patients (three with retained stones presumed T tube in situ, one with cholecystostomy tube), successful

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sphincterotomy with duct clearance was achieved in all.³⁷ There are three more detailed studies of 14, 16, and 39 patients respectively with a T tube in situ. In these, endoscopic clearance rates were between 94 and 100%, with complications occurring in 0–8% patients.^{38–40} Finally, the largest study is that reported by Lambert *et al*, in which 73 patients underwent endoscopic sphincterotomy after biliary surgery.⁴¹ Fifty nine of these patients had a T tube in situ. Although the total complication rate was striking, with 19% of patients suffering complications (12% bleeding), no separate analysis of the clearance and complication rates in patients with a T tube in situ was made.

There is no reported large single centre study of both endoscopic and percutaneous extraction with a T tube in situ. Furthermore, there is no information about the medium to long term follow up of these patients. We now report a non-randomised retrospective review of 204 patients treated by percutaneous extraction and 68 patients treated by endoscopic sphincterotomy and duct clearance with a T tube in situ. We compare the efficacy of these methods with regard to stone extraction, complications, and long term follow up.

Patients and methods

During a 10 year period up to May 1988, 226 patients (88 men, 138 women) ranging in age from 25 to 101 years (mean 61 years) with a T tube or cholecystostomy tube in place were referred for extraction of retained common bile duct stones. Two hundred and fifteen patients had undergone cholecystectomy and T tube placement; 11 patients had had cholecystostomy with tube placement. The intraoperative cholangiogram was available for review in 57 patients (34 before, 18 after, and in five both before and after exploration). Intraoperative choledochoscopy was known to have been used in 27 and was reported to show a clear bile duct in 16 patients. The size of the T tube was known in 164 patients and ranged from 10–18 FG (141 patients had tubes 14 FG or larger). Unsuccessful flushing of the bile duct had been attempted intraoperatively in 20 and postoperatively via the T tube tract with saline in 19 and with solvents in seven patients. Two patients had had a second operation before referral.

CHOLANGIOGRAPHY

Cholangiography showed a single stone in 132 patients, two stones in 38 patients, three stones in 17 patients, and more than three stones in 39 patients. The location of stones within the biliary tree could be assessed in 190 patients. Stones were distributed in the biliary tree as follows: ampulla (1), common bile duct (157), junction of cystic and common duct (1), common hepatic duct (9), left intrahepatic duct (13), and right intrahepatic duct (9). An estimation of the stone size could be made in 62 patients and showed that stones were smaller than 1 cm in 27 (43.5%).

Percutaneous extraction was attempted in 204 and endoscopic extraction in 68 patients (46 patients had both procedures). Endoscopic

extraction was the preferred initial treatment in 29 patients for the following reasons: tortuous, anterior, or small T tube tract relative to the stone (12); multiple stones (5); postoperative cholangitis (1); sclerosing cholangitis (1), gall bladder cancer (1); and slipping of the T tube out of the bile duct (1). The reasons for an initial endoscopic approach in eight patients were not determined.

Percutaneous extraction was by choledochoscopy alone in 10 patients, by steerable catheters as described by Burhenne¹⁸ in 189 patients, and by both techniques in five patients. Extraction was attempted via a cholecystostomy tract in an additional 11 patients. General anaesthesia was required in 11 patients undergoing percutaneous extraction. Endoscopic sphincterotomy was done using an Olympus duodenoscope and Erlangen sphincterotome under intravenous sedation. Stones were extracted using balloons or baskets.

Percutaneous assistance for endoscopic access was given in three patients by the passage of a guidewire through the track or tube to the papilla to aid sphincterotomy.⁴² Percutaneous dilatation of the papilla was done in one patient and percutaneous choledochoscopy in another.

Medical notes were available for review in 175 (77.4%) patients. A questionnaire returned by the referring consultant or the family practitioner, or both, supplied follow up information in 132 (58.4%) patients.

Results

The time between surgery and attempted percutaneous extraction ranged from 4–30 weeks (mean 7) and from surgery to endoscopic extraction from 1.5–10 weeks (mean 4). Nineteen patients developed biliary related symptoms with the T tube in situ while awaiting percutaneous extraction: two patients at one week and the remainder two to 16 weeks after surgery. Six patients were jaundiced (three with pyrexia and pain), eight developed biliary colic, four patients had an intermittent fever, and one patient developed jaundice and reversible renal failure.

PERCUTANEOUS EXTRACTION

Percutaneous clearance of the bile duct was achieved in 158 of 204 (77.5%) patients. Percutaneous extraction was attempted once in 135 patients, twice in 49 patients, three times in 16 patients, and either four or five times in four patients. Thus, 33.8% of patients underwent more than one attempt at percutaneous extraction, giving an average of 1.5 attempts per patient. Failed clearance was caused by stone fragmentation (8), multiple or small stones (7), impacted stone (6), stone below a biliary stricture (3), large stone (1), intrahepatic stone (1), loss of the tract (5), tortuous tract (4), a narrow tract (3), anterior tract (2), tract perforation (2), and angulated bile duct (1) and was not determined in three patients.

In-hospital follow up was obtained in 153 of 204 (75%) patients undergoing percutaneous extraction. Complications occurred in six (3.9%) patients – cholangitis, in four and perforation of

the tract without peritonitis in two. There were no deaths.

Duct clearance was achieved in eight of 10 patients treated by percutaneous choledochoscopy alone and was without complication.

ENDOSCOPIC EXTRACTION

Endoscopic sphincterotomy was successful in 66 of 68 (97%) patients. Duct clearance was achieved in 52 of 68 (76.5%) patients. Endoscopic sphincterotomy with duct clearance was attempted once in 53 patients, twice in 12 patients, and three times in three patients. Thus, endoscopic duct clearance was attempted on more than one occasion in 22% of patients, averaging 1.3 attempts per patient. Failed duct clearance was the result of failure of endoscopic sphincterotomy in two patients (duodenal diverticulum (1) and papillary oedema (1)), impaction of a stone within the ampulla, intrahepatic biliary tree, common hepatic duct or cystic duct (6), stone above a bile duct stricture (3), and the T tube interfering with stone extraction (2). A stone was not found in the biliary tree in one patient and the reason for failed duct clearance was not determined in two.

Percutaneous assistance with a guide wire down the tract or tube was undertaken in three patients and achieved clearance in two. There were no complications. Failed clearance in one patient was caused by a stone lodging in the cystic duct remnant.

In-hospital follow up was available in 67 of 68 (98.5%) patients undergoing endoscopic treatment. Major complications occurred in three (4.4%) patients and included pancreatitis and cholangitis (1), pancreatitis (1), and bleeding requiring transfusion (1). There were no deaths.

PROGRESS AFTER FAILURE OF INITIAL TREATMENT

Failure of the initial method of duct clearance occurred in 48 patients. Thirty six patients underwent an attempt at endoscopic clearance after failed percutaneous clearance. Twelve patients in whom an initial attempt at endoscopic clearance failed underwent percutaneous clearance, and two of these subsequently underwent a second attempt at endoscopic clearance.

Progress after failed percutaneous extraction

Endoscopic clearance was achieved in 31 of 36 patients in whom percutaneous extraction had failed. A further attempt at percutaneous extraction was then successful in two of the five patients with failed endoscopic clearance.

Initial endoscopic approach

Percutaneous extraction was successful in 11 of 12 patients in whom endoscopic clearance had failed.

DUCT CLEARANCE – OVERALL RESULTS

The overall success of duct clearance in this series was 93% (210 of 226 patients). Follow up was not achieved in 11 of 16 patients with failed

duct clearance. Four patients were followed up after failed endoscopic clearance. One refused repeat endoscopy and remained well, one suffered recurrent cholangitis, one had a successful re-exploration, one underwent exploration but a large intrahepatic stone could not be removed. One patient with a retained cystic duct stone that could not be removed at a combined endoscopic procedure developed recurrent cholangitis and then underwent an uncomplicated further exploration and stone removal.

LONGTERM FOLLOW UP

Late biliary morbidity and mortality were assessed in 138 patients – 37 of 56 (66%) in whom endoscopy was the last procedure and 101 of 170 (59%) in whom the last procedure had been percutaneous clearance. Mean follow up was 40.7 months (range 1–130 months). There was no death within 30 days of the procedure. Two late biliary deaths occurred, both after percutaneous stone extraction. Cholangiocarcinoma was diagnosed three years after, and death six years after, stone extraction in one patient. In the second patient, death was the result of cholangitis two years after an apparently successful duct clearance. Late biliary morbidity occurred in two patients. Obstructive jaundice with pancreatitis three years after percutaneous extraction led to successful endoscopic sphincterotomy and stone removal in one patient. The second patient developed recurrent cholangitis five months after an apparently successful percutaneous clearance. Retrograde cholangiography showed a stone above a stricture and the patient underwent uncomplicated hepaticojejunostomy.

Discussion

Endoscopic sphincterotomy is considered a safe and effective procedure for bile duct stones. It carries a success rate of 95%, with clearance in around 85% of patients overall.^{43–46} Endoscopic sphincterotomy was achieved in 97% of patients, but bile duct clearance in only 76.4% in this series. There are several reports of endoscopic sphincterotomy and common bile duct extraction with a T tube in situ. In one series of 16 patients (18 calculi) complete clearance was achieved in all, but in these patients all calculi were situated in the common bile duct below the T tube and stones measured less than 1 cm in diameter.³⁹ In another series of 39 patients (76 calculi), successful endoscopic sphincterotomy was reported in all patients, with duct clearance in 95% and a major complication rate of 7.7%: one patient requiring laparotomy for basket impaction.⁴⁰ In the most recently reported series³⁸ of 16 patients (14 with T tube in situ and six with multiple stones), there was complete duct clearance in all but one patient (94%) with a complication in one patient (6%).

Our study is the largest reported series of patients undergoing endoscopic sphincterotomy with a T tube in situ. We have a lower success rate for endoscopic extraction than previous reports^{37–40} and there are several explanations for this. Firstly, the size and location of stones is important, and in this series we found intra-

hepatic stones or stones above the T tube in eight patients, six of whom had stones larger than 1 cm in diameter. Secondly, only one attempt at endoscopic clearance was made before proceeding to percutaneous extraction. We have previously shown that repeated attempts at endoscopic extraction are successful in at least 40% of patients after an initial failure,⁴⁷ hence we would now recommend a further attempt at endoscopic clearance for most patients.

In this series, we found similar success rates for percutaneous and endoscopic extraction (76% and 77.5% respectively) and similar complication rates (3.9% and 4.4% respectively). The following should be considered when deciding between percutaneous and endoscopic extraction as the initial treatment for retained stones with the T tube in situ. Firstly, general anaesthesia was required in 11 (5.4%) patients and secondly, biliary related symptoms with the T tube in situ while awaiting maturation of the T tube tract occurred in 19 (9.3%) patients undergoing percutaneous extraction. Medium term follow up was obtained in 37 (66%) patients undergoing endoscopic clearance and in 101 (59%) patients undergoing percutaneous extraction. This showed two biliary related deaths and two further biliary related complications (one requiring further exploration and another endoscopic sphincterotomy). These complications were confined to patients who had had an apparently successful percutaneous clearance.

In summary, we present 226 consecutive patients with retained biliary stones and the T tube in situ. We have found that the success and complications of endoscopic and percutaneous extraction are similar and believe that the choice of the initial procedure for stone extraction should depend upon several factors namely: patient tolerance of the T tube, the anatomy of the T tube tract or the ratio of the tract size to the size of the stone, and the age of the patient (endoscopic extraction is favoured in the older patient while the long term complications of sphincterotomy are undetermined). Finally, percutaneous and endoscopic procedures can be complementary with percutaneous guidance or dilatation of the biliary tree assisting endoscopic extraction.

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