

# Long term follow-up of patients with side to side choledochoduodenostomy and transduodenal sphincteroplasty

ANTONY R BAKER MA FRCS

Lecturer in Surgery

JOHN P NEOPTOLEMOS MA MD FRCS

Senior Surgical Registrar

TREVOR LEESE MA FRCS

Lecturer in Surgery

DEREK C JAMES FRCR

Consultant Radiologist

DAVID P FOSSARD MD FRCS

Consultant Surgeon

Leicester Royal Infirmary

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## Summary

From a consecutive series of 190 patients with choledochoduodenostomy (CDD) and 56 patients with transduodenal sphincteroplasty (TDS), there were 10 and 3 hospital deaths respectively. A long term follow-up study was performed on the remainder. Late deaths occurred in 35 CDD and 5 TDS patients. Serious long term complications occurred in 3.3% of CDD cases, comprising 5 cases of 'sump syndrome' and a further case of cholangitis in the presence of a clear biliary tree. Cholangitis occurred in 2 of the TDS patients (3.8%). Recurrent common duct stones were found in 3 of the 'sump syndrome' cases (1.6%) and one of the TDS patients with cholangitis (1.9%). Eighty-eight per cent of the CDD patients and 90.2% of the TDS patients, who were reviewed, were subjectively well. Serum alkaline phosphatase was raised in 21.6% of the CDD patients and only 3.4% of the TDS group ( $P < 0.05$ ). Radiological studies showed that the CDD stoma admitted air and barium more often than the TDS stoma ( $P < 0.001$ ). Neither the biochemical nor the radiological findings correlated with the long term symptomatic results of the two procedures. Dynamic HIDA scans showed a shorter time to peak activity in the common hepatic duct for both CDD ( $P < 0.01$ ) and TDS ( $P < 0.05$ ) as compared with endoscopic sphincterotomy (ES). These long-term clinical, biochemical and radiological results are similar to those reported following ES.

## Introduction

Permanent drainage of the biliary tree may be indicated in some circumstances, such as multiple common bile duct calculi where the surgeon cannot be certain of duct clearance, cholangitis and papillary stenosis. The options available include side to side choledochoduoden-

ostomy (1-3) and transduodenal sphincteroplasty (4-5) or sphincterotomy (6). Although side to side choledochoduodenostomy is the simplest procedure it has the potential disadvantage of leaving a 'sump' of distal common bile duct which may not drain freely into the duodenum. Transduodenal procedures avoid leaving a sump but risk injury to the pancreatic duct. The increasing availability of endoscopic retrograde cholangiopancreatography (ERCP) has resulted in another approach to management, namely endoscopic sphincterotomy (ES) followed by cholecystectomy (7).

In considering the options, it is important to take into account not only the procedural morbidity and mortality but also the long term results and complications of these methods of treatment. The purpose of this study was to document the late complications of side to side choledochoduodenostomy and transduodenal procedures.

## Patients and methods

### PATIENTS

In the 10 years from 1972 to 1981, 190 patients underwent side to side choledochoduodenostomy (CDD), 36 were treated by transduodenal sphincteroplasty and 20 by transduodenal sphincterotomy, all for presumed benign disease. The age range of these patients was 17-92 years with a median of 69 years for CDD and 58 years for the transduodenal procedures (TDS). There were significantly more elderly patients (>65 years) in the CDD group (60.5%) than in the TDS group (21.4%) ( $P < 0.001$ ). Fifty nine per cent of the CDD patients and 68% of the transduodenal patients were female. The hospital records of all these patients were reviewed.

### FOLLOW-UP METHODS

In patients who had not survived to follow-up, the case records of those who had died in hospital were used to

find the cause of death. For those who had died at home, questionnaires were sent to the general practitioners to establish the cause of death and any possible relationship to the previous biliary surgery. In the remaining cases the cause of death was obtained from the death certificates. Long term survivors were invited to attend a special biliary follow-up clinic where subjective well being was assessed, by one of the authors (either JPN or ARB), using a simple system of clinical grading and blood was taken for estimation of serum bilirubin and hepatic enzymes. Those who were unable to attend the clinic were sent questionnaires by post or visited at their homes. Follow-up was achieved in 89% overall.

#### BARIUM EXAMINATIONS

Barium meal examinations were performed, using a technique designed to demonstrate filling and emptying of the biliary tree through the stoma. A control film was taken to show the presence of air in the biliary tree. Following the ingestion of barium, the patient was placed on the right side to fill the duodenum and biliary tree and a second film was exposed. The patient then sat erect for 15 minutes to allow the biliary tree to drain back into the duodenum and a final film was taken in the erect position. For comparison 18 patients, treated by endoscopic sphincterotomy (ES), were also examined with barium meals. All these examinations were performed by a single radiologist (DCJ).

#### DYNAMIC HIDA SCANS

Dynamic HIDA scans (60 × 1 min images) were performed in 12 CDD, 14 TDS and 18 ES patients. Activity/time curves were derived from the computer images for the common hepatic duct at the porta hepatis and the time to peak activity (Tp) was calculated.

#### STATISTICAL ANALYSIS

Differences between the groups were analysed using the  $\chi^2$  test with Yates' correction or the Mann-Whitney U-test.

### Results

#### CLINICAL OUTCOME

The presence of common bile duct calculi was the most common indication for both supraduodenal and transduodenal procedures (Table 1). Ten patients died following CDD and 3 following transduodenal procedures giving an overall one month, or in hospital mortality of 5.3% for CDD and 5.4% for transduodenal procedures. Details of postoperative mortality and morbidity in relationship to presenting clinical features, indications for surgery and age have been reported elsewhere (8). There were 35 late deaths in the CDD group (18% of hospital survivors) and 5 in the transduodenal group (9%—not significant). Seven of the CDD late deaths, resulted from carcinoma of the pancreas (Table 2). All but one of these 7 had common bile duct calculi found at operation. The time interval between operation and death ranged from 9 months to 4 years and was less than a year in 3 cases. The ages of these patients at the time of death ranged from 54 to 77 years (median 70 years).

One hundred and forty five patients with CDD and 48 patients with TDS had survived and were invited to attend the follow-up clinic. One hundred and fourteen CDD patients (78%) and 35 TDS patients (74%) respectively attended. Forty seven patients were sent questionnaires or visited at home. All except 27 of the survivors were contacted. Assessment of long term subjective well being showed that 88% of patients with CDD and 90.2% of patients with transduodenal procedures were either 'very well' or 'well' (Table 3). The remainder were not improved by their operation.

TABLE 1 Indications for operation

	CDD (n=190)	TDS (n=56)
Cholelithiasis	127 (66.8%)	38 (67.9%)
Papillary stenosis	33 (17.4%)	15 (26.8%)
Common duct stricture	4 (2.1%)	0
Complete CBD clearance uncertain	18 (9.5%)	2 (3.5%)
Cholangitis	8 (4.2%)	1 (1.8%)

TABLE II Late deaths

CDD n=35 (18% of hospital survivors)	
Myocardial infarction	2
Stroke	6
Bronchopneumonia	3
Carcinoma pancreas	7
Carcinoma gallbladder	1
Carcinoma stomach	1
Carcinoma unrelated organs	9
Gastrointestinal bleed	1
Unknown cause	5
TDS n=5 (9% of hospital survivors)	
Myocardial infarction	1
Heart failure	1
Stroke	1
Fractured femur	1
Carcinoma prostate	1

TABLE III Subjective well-being

	CDD n=125	TDS n=41
Very well	63 (50.4%)	21 (51.2%)
Well	47 (37.6%)	16 (39%)
Same	3 (2.4%)	2 (4.9%)
Worse	6 (4.8%)	0
Sump/cholangitis	6 (3 with calculi)	2 (1 with calculi)

Long term complications requiring further intervention occurred in five (2.8%) of the 180 survivors of CDD and three (5.7%) of the 53 patients surviving transduodenal operations. The 5 CDD patients presented with various combinations of upper abdominal discomfort or pain, pyrexia, rigors and jaundice associated with raised hepatic enzymes. They were all shown to have debris and/or stones in the distal common bile duct and were all diagnosed as having the 'sump syndrome' (9). One was treated by refashioning the CDD, another by transduodenal sphincteroplasty and the remaining 3 by endoscopic sphincterotomy. In addition to these 5, one patient, a 78 year old woman, who underwent CDD for an impacted ampullary stone which could not be dislodged, presented with clinical features suggestive of cholangitis 10 months postoperatively. Endoscopic retrograde cholangiopancreatography (ERCP) showed a normal biliary tree with a 6 mm CDD but no evidence of debris or retained calculus. She responded to antibiotic treatment. One further patient developed acute pancreatitis 7 years following CDD. This resolved with conservative management and barium meal, performed 7 days after the onset of symptoms, showed a widely patent stoma. Recurrent common bile duct stones were found in 3 of the patients with 'sump syndrome', giving an incidence of 1.6% of the survivors following CDD.

TABLE IV Results of serum bilirubin and hepatic enzyme levels

	CDD n=102		TDS n=29	
	Normal	Raised	Normal	Raised
Alkaline phosphatase n median (range) IU/l	80 —	22 153 (134–657)	28 —	1 143
$\gamma$ GT n median (range) IU/l	77 —	25 79 (52–185)	25 —	4 50 (43–69)
ALT n median (range) IU/l	99 —	3 60 (55–96)	29 —	0 —
Bilirubin n median (range) $\mu$ mol/l	95 —	7 19.5 (18–32)	29 —	0 —

Normal ranges—Alkaline Phosphatase = 40–130 IU/l

$\gamma$ GT Male = 0–50 IU/l

$\gamma$ GT Female = 0–35 IU/l

ALT = 2–53 IU/l

Bilirubin = 3–17  $\mu$ mol/l

The patients who underwent subsequent biliary procedures following transduodenal operations include one patient who had further surgery for sclerosing cholangitis. She is not regarded as having had a complication of the transduodenal technique. The other 2 both developed cholangitis at 2 years and 11 years postoperatively (3.8%). The first patient had initially had a transduodenal sphincterotomy and was treated by fashioning a CDD; the second had undergone a sphincteroplasty and subsequent treatment was by ES. One of these 2 patients had recurrent common bile duct calculi (1.9% of the survivors). In addition, in the TDS group, retained stones were identified in 3 patients (5.4%) in the early postoperative period.

#### BIOCHEMICAL RESULTS

One hundred and two patients with CDD and 29 patients with transduodenal procedures had their serum bilirubin and hepatic enzyme levels measured (Table 4). In 65 patients with CDD (63.7%) and 24 of the transduodenal cases (82.7%), these were entirely normal. The presence of abnormal results did not correlate with poor symptomatic results in either the CDD or TDS groups. Serum alkaline phosphatase level was raised significantly more often after CDD than TDS ( $P<0.05$ ). There were 37 CDD patients with abnormal results; only one result was abnormal in 21 patients, 2 results were abnormal in 14 and 3 in 2 patients. In contrast there were 5 TDS patients with abnormal results and in all 5 cases only one result was abnormal. In general the abnormalities found in the CDD patients were less severe than may be encountered in the sump syndrome (9).

#### BARIUM FINDINGS

Both air ( $P<0.001$ ) and barium ( $P<0.001$ ) penetrated the biliary tree more often following CDD than TDS (Table 5). Of the 25 transduodenal patients studied, 21 had had a sphincteroplasty and 4 had undergone sphincterotomy. Of the 4, in whom barium entered the bile ducts, 3 had had sphincteroplasty and one had undergone a sphincterotomy. Failure of penetration of the biliary tree by air and/or barium did not correlate with symptoms in either CDD or TDS groups. In 3 of the 84 CDD patients, in whom barium outlined the biliary tree (3.6%), debris was also shown to be present in the duct. Two of these patients said they felt 'very well' and the third felt 'well'. In 61 of the 84 (72.6%) CDD patients,

TABLE V Barium studies

	CDD n=94 (%)	TDS n=25 (%)	ES n=18 (%)
Air into biliary tree	94 (100)	12 (48) ( $P<0.001$ )	8 (44.4)
Barium into biliary tree	84 (89.4)	4 (16) ( $P<0.001$ )	1 (5.6)
Barium in intrahepatic ducts at 15 min	61 (64.9)	2 (8) ( $P<0.001$ )	1 (5.6)
CBD pool at 15 min	64 (68.1)	3 (12) ( $P<0.001$ )	1 (5.6)

where barium penetrated the biliary tree, it remained in the small intrahepatic ducts for the full 15 minutes of the examination even though the larger ducts had drained back into the duodenum. This only occurred in 2 of the 4 transduodenal patients. The barium meal findings in a group of 18 patients who had undergone endoscopic sphincterotomy (ES) for common bile duct calculi were similar to those of the TDS patients (Table V).

#### DYNAMIC HIDA SCAN RESULTS

HIDA scanning for the 3 groups (including ES) showed that both CDD patients ( $24.3\pm 8.3$  min—mean  $\pm$  standard deviation) and TDS patients ( $27.6\pm 9.4$  min) had a shorter time to peak activity in the common hepatic duct than ES patients ( $37.2\pm 14.6$  min). ES was significantly different from CDD ( $P<0.01$ ) and TDS ( $P<0.05$ ) using the Mann-Whitney U-test.

#### Discussion

The long term symptomatic results were good for both types of surgical procedure. This is in agreement with other series of patients with CDD (3,10) and also transduodenal procedures (4,5). In this series 88% of the CDD patients and 90.2% of the TDS patients were either completely relieved of symptoms or showed great improvement. This compares with rates of 87.1% to 93.5% reported for endoscopic sphincterotomy (11,12).

Sump syndrome has been reported occasionally by other authors (13) but several reviews of large numbers of patients with CDD have shown no cases of this syndrome (2,10). Five cases occurred in this series (2.8%). The syndrome may be effectively dealt with by

surgery though endoscopic sphincterotomy is preferred (9). Cholangitis following biliary drainage is believed to be due to some degree of biliary obstruction with a rise in pressure in the biliary tree (14) in association with bacterobilia, which is common after both CDD (15) and TDS (16). One patient in this series developed cholangitis without any evidence of obstruction; such cases have been reported previously (17). An incidence of 3.3% of sump syndrome or cholangitis following CDD and 3.8% of cholangitis following TDS is comparable to the reported rate of cholangitis following ES of 4.2% in patients without gallbladders (18). An incidence of recurrent stones of 1.6% following CDD and none following TDS also compares favourably with that following ES of 2.8–20.5% (12,19,20).

Scrum bilirubin and hepatic enzyme levels were frequently abnormal in this series, occurring in 36% of patients with CDD and 17% of patients with TDS. Most other series have reported only occasional instances of such abnormality following CDD (3). High alkaline phosphatase levels have been reported following sphincteroplasty (4) and abnormal serum gamma glutamyl transpeptidase levels have been found in 20% of patients at long term follow-up after ES (21). Aspiration liver biopsy of ES patients has shown mild portal fibrosis and inflammation in those with gas in the biliary tree (21). A study of liver biopsies in CDD patients, however, showed no significant inflammation, cholangitis or biliary cirrhosis (22). It is conceivable that the wider stoma of CDD, allowing free drainage of the biliary tree, may prevent inflammation although some effect on hepatocytes must take place since 36% have deranged hepatic function tests.

The radiological studies showed air in the biliary tree in all cases studied with CDD and barium penetrated the biliary tree in the vast majority of cases. This finding is in agreement with other radiological studies of patients with CDD (23). In contrast, air was only present in less than half of the TDS patients and barium penetrated in less than a quarter of those studied. Such findings would be easier to explain if all our patients had been treated by sphincterotomy, since in 70% of these patients barium does not penetrate the biliary tree (6). In this group, however, all but 4 of the transduodenal patients had undergone sphincteroplasty.

The barium studies showed that, compared with transduodenal procedures, CDD provides a wider stoma in the long term allowing easier flow of barium into and out of the bile duct. The long term characteristics of the transduodenal procedures are similar to those of endoscopic sphincterotomy and may imply either a sphincteric action of the duodenal wall or that postoperative scarring reduces the size of the transduodenal stoma so that ready penetration of barium is not possible in the long term. Such late narrowing has been reported in up to 74% of surgical sphincterotomy patients (24). Dynamic HIDA scanning confirmed that the isotope reached peak activity in the common hepatic duct significantly faster in both operative groups than following ES. This suggests that there may be even more scarring after ES than TDS. A permanent wide stoma may be more important following CDD than TDS (or ES) since with CDD the presence of the distal sump makes free drainage more necessary.

Barium studies also showed debris in the common bile duct in 3 patients with CDD, all of whom felt well. This may represent food material which must pass freely in and out of the biliary tree as does the barium. Capper (1) found debris in 3 out of 72 cases of CDD and endoscopic studies have shown debris in 4 out of 7 cases with widely patent CDD's (25). It is likely that symptoms only result if this debris remains in the duct for a long period, as

may occur in the presence of stomal stenosis. The presence of a pool of barium in the distal common bile duct after sitting erect for 15 minutes may imply some papillary dysfunction since those in whom a pool is not present at this time must have cleared the distal bile duct through the papilla. It may, however, take up to 6 hours to completely clear the biliary tree of barium (23).

The high incidence of carcinoma of the pancreas among the late deaths following CDD gives some cause for concern. Since 3 of these deaths occurred within a year of operation, it is possible these were missed at the time of operation. Clearly if there is any doubt about the presence of pancreatic malignancy at operation then transduodenal biopsy is mandatory. The higher proportion of elderly patients in the CDD group makes the occurrence of carcinoma more likely in this group. Six of these 7 patients were 65 or more years old at the time of death. An association has been suggested between carcinoma of the pancreas and a history of previous cholecystectomy (26) but only one of these patients (the youngest) had had a cholecystectomy in the past. Permanent biliary drainage procedures might predispose to pancreatic cancer but previous studies of long term follow-up in patients with CDD, TDS or ES have not reported such a relationship and it therefore seems unlikely.

### Conclusions

Both side to side choledochoduodenostomy and transduodenal drainage of the common bile duct give good long term results in terms of subjective wellbeing. Objective studies, however, show that serum alkaline phosphatase levels are more commonly raised in CDD patients and the CDD stoma more readily allows penetration of the biliary tree by air and barium. Ready reflux from the duodenum into the biliary tree may lead to some derangement of hepatic function tests but this is not clinically important. These long term results are similar to those obtained with ES (7-10 years). Thus, in choosing between the different options, the main factors to consider should relate to the early mortality and morbidity rather than later complications.

A recent prospective randomised study, comparing preoperative endoscopic sphincterotomy versus surgery alone for common bile duct stones in patients with gallbladder *in situ*, indicated that ES need not be routinely used prior to surgery (27). Choledochoduodenostomy and transduodenal sphincteroplasty will continue to enjoy an important role in the management of choledocholithiasis.

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## Assessor's Comments

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This week an elderly woman was admitted to my ward, just recovering from an attack of severe abdominal pain and markedly jaundiced. Within days a gallstone at the lower end of her common bile duct had been precisely delineated by ERCP and removed. The procedure was carried out under light sedation and topical anaesthesia and with minimal disturbance to the patient. Clearly, this is excellent practice and points the way ahead. Yet it is precisely for this reason that we should have on record a meticulous and balanced account of other methods of dealing with similar problems. This is just what Mr Baker and his colleagues provide, for they have reviewed the results of choledochoduodenostomy and transduodenal sphincteroplasty in a considerable number of patients (246), both with regard to the immediate situation and in the longer term (up to five years). The study is not prospective and the ratio of 190 CDD to 56 TDS procedures no doubt reflects the fact that CDD is usually

simpler to perform. It must be a cause for concern that seven late deaths in this latter group were due to pancreatic carcinoma; yet, no carcinoma cases at all are mentioned in the TDS group so we cannot point to this as a means toward earlier diagnosis. This anxiety aside, it is clear that, from a functional standpoint, there is, in the main, relatively little difference between CDD and TDS in the quality of long term results. Further, we are told (although the evidence is not in this account) that TDS and endoscopic sphincterotomy results are also comparable in the long term—all extremely useful information to the surgeon who has to operate in such a situation, either because he is without the support of a highly skilled endoscopist or because endoscopy has failed.

JOHN MCFARLAND MD ChM FRCS  
 Consultant Surgeon, Royal Liverpool Hospital  
 Clinical Lecturer in Surgery, University of Liverpool