

Periampullary diverticula: consequences of failed ERCP

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Periampullary diverticula (PAD) are associated with biliary disease and contribute to failure of endoscopic retrograde cholangiopancreatography (ERCP), especially in elderly patients. The presence of PAD and causes of failure to cannulate the ampulla were noted in 1211 consecutive patients undergoing ERCP. Case notes of 100 consecutive patients with PAD were reviewed retrospectively.

Overall prevalence of PAD was 9%. Prevalence was higher in patients ≥ 75 years when compared with those < 75 years (19.2% vs 4.8%, $P < 0.0001$). Ampullary cannulation was successful in 62.4% of patients with PAD and 92.7% without PAD ($P < 0.0001$). Success rates were lower in patients with intradiverticular papillae than in those with juxtapapillary diverticula (38.1% vs 77.6%; $P < 0.0001$). Of 19 patients with PAD who did not have any imaging other than ultrasound, 16 were asymptomatic over a median follow-up of 20 months. Biliary surgery was performed on 35 patients, with no major complication.

PAD are a major cause of failed ERCP. Failure rates are higher in patients with intradiverticular papillae than juxtapapillary diverticula. Though a large proportion of patients not imaged remain asymptomatic on follow-up, it is difficult to predict which patients may form this group. Surgery, when indicated, is safe and effective in elderly patients in whom ERCP has failed.

Periampullary diverticula (PAD) are found in up to 23% of patients undergoing endoscopic retrograde cholangiopancreatography (ERCP) (1) and their prevalence increases with age (2,3). There is evidence that the incidence of pigment common bile duct (CBD) stones is increased in patients with PAD (4-8). The success rate of ERCP is uniformly lower in patients with PAD when compared with those without PAD (3,6,9-11). Moreover, as the majority of these patients are elderly, failure of ERCP poses a management dilemma. This study was undertaken to ascertain the prevalence of PAD, to record the cholangiographic abnormalities in patients with PAD and to determine the consequences of failed ERCP in these patients.

Patients and methods

The records of all patients undergoing ERCP over an 8-year period at Nottingham City Hospital, Nottingham, were studied from a prospectively recorded database. ERCP was offered primarily for biliary indications, which included a strong history of biliary symptoms, abnormal biliary ultrasound scan (USS) and/or altered liver function tests (LFTs). Patients undergoing more than one ERCP were included only once. ERCPs were performed by two consultants (one medical and one surgical) and by senior medical and surgical gastroenterology trainees under supervision.

PAD were defined as extraluminal outpouchings of the duodenum adjacent to or containing the ampulla of Vater or intraluminal component of the CBD. If the major papilla was contained within a diverticulum, it was termed an intradiverticular papilla (IDP). A diverticulum within a 2 cm radius of the major papilla but not containing it was called a juxtapapillary diverticulum (JPD). Patients

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were divided into two groups: those < 75 years and those \geq 75 years. Presence of PAD, success at cannulation and causes of failure to cannulate the ampulla were noted. Cannulation was deemed to be successful if images of the biliary tree were obtained.

The case notes of 100 consecutive patients found to have PAD at ERCP were reviewed retrospectively. ERCP findings and outcome of patients having successful and unsuccessful ERCP were recorded, along with procedure-related morbidity and mortality. Follow-up consisted of 3-monthly liver function tests by the patients' general practitioners and 6-monthly outpatient clinic visits for at least 1 year after the procedure. The data collected were analysed using the χ^2 test. Differences were considered significant at $P=0.05$.

Results

The study was carried out on 1211 patients who underwent ERCP for biliary indications. The overall median age was 65 years (range 2–104 years) and 29% of patients were \geq 75 years. Patients with PAD had a median age of 76 years (range 37–93 years) while the median age of those without PAD was 65 years. The male:female ratio was 2:3. The overall prevalence of PAD was 9% (109/1211). The prevalence in patients < 75 years was 4.8% (41/856) while that in patients \geq 75 years was 19.2% (68/355). This difference was statistically highly significant ($P < 0.0001$).

Success at cannulation of the ampulla was significantly higher in patients without PAD than in those with PAD, and in patients < 75 years compared with those \geq 75 years (Table I). The presence of PAD was the single most common cause of failure to cannulate the ampulla in both age groups (Table II).

Of the 100 patients with PAD reviewed, 61 were female and 59 were \geq 75 years of age. Indications for ERCP included deranged LFTs in 91 patients and biliary pain after cholecystectomy in nine. Fifteen patients had undergone previous cholecystectomy. All patients underwent USS, and though dilatation of the CBD was observed in 54, a diagnosis of choledocholithiasis was suggested in only 21. The success rate of cannulation at ERCP was 92.7% in 1102 patients without PAD and 61%

Table I. Successful cannulation rate

	All patients	< 75 years	\geq 75 years
No diverticula	1022/1102 ^a 92.74%	763/815 ^b 93.62%	259/287 ^c 90.24%
Diverticula present	68/109 ^d 62.38%	24/41 ^e 58.53%	44/68 ^f 64.70%
Overall	1090/1211 90.01%	787/856 ^g 91.93%	303/355 ^h 83.35%

a vs d, b vs e, and c vs f: $P < 0.0001$

b vs c: $P = 0.065$ (NS)

e vs f: $P = 0.514$ (NS)

g vs h: $P = 0.0005$

All significance values calculated by χ^2 test

Table II. Causes of failure to cannulate the ampulla

Cause	< 75 years n (%)	\geq 75 years n (%)	Overall n (%)
Periampullary diverticulum	17 (24.6)	24 (46.1)	41 (33.9)
Ampullary carcinoma*	10 (14.5)	4 (7.7)	14 (11.6)
Duodenal/pancreatic carcinoma*	9 (13.0)	7 (13.4)	16 (13.2)
Deformed duodenum	7 (10.1)	8 (15.4)	15 (12.4)
Gastric antrum carcinoma*	5 (7.3)	2 (3.9)	7 (5.8)
After gastrectomy	5 (7.3)	2 (3.9)	7 (5.8)
Ampulla not located	6 (8.7)	0 (0)	6 (4.9)
Incarcerated hiatus hernia*	0 (0)	1 (1.9)	1 (0.8)
Unable to cannulate	10 (14.5)	4 (7.7)	14 (11.6)
Total	69	52	121

*The endoscopy component of the ERCP provided a diagnosis in 24 (34.8%) patients < 75 years and in 14 (26.9%) patients \geq 75 years of age, in whom cannulation was unsuccessful

Table III. Type of periampullary diverticulum and cannulation success rates

Type of diverticulum	Number of patients (n)	Successful cannulation n (%)
Juxtapapillary diverticulum (JPD)	58	45 (77.6)*
Intradiverticular papilla (IDP)	42	16 (38.1)*

15 patients had more than one diverticulum

* $P < 0.0001$ (χ^2 test)

in 100 patients with PAD ($P < 0.0001$). The success rate was significantly higher in patients who had JPD when compared with those who had IDP (Table III).

The outcome of the 61 patients with PAD who had a successful ERCP is outlined in Fig. 1 and that of the 39 patients in whom ERCP was unsuccessful is shown in Fig. 2. The bile ducts were normal in 33 of the 81 patients (40.7%) who had their ducts imaged by ERCP, percutaneous transhepatic cholangiography (PTC) or on-table cholangiography (OTC). Nineteen patients (median age 80.2 years, range 68–94 years) had no imaging other than USS. Three died of unrelated causes during the course of the study and 16 were asymptomatic and had normal LFTs over a median follow-up period of 20.2 months. Choledocholithiasis was diagnosed in 49.4% of patients in whom cholangiography was performed (Table IV).

Thirty-five patients (median age 75 years, range 58–91

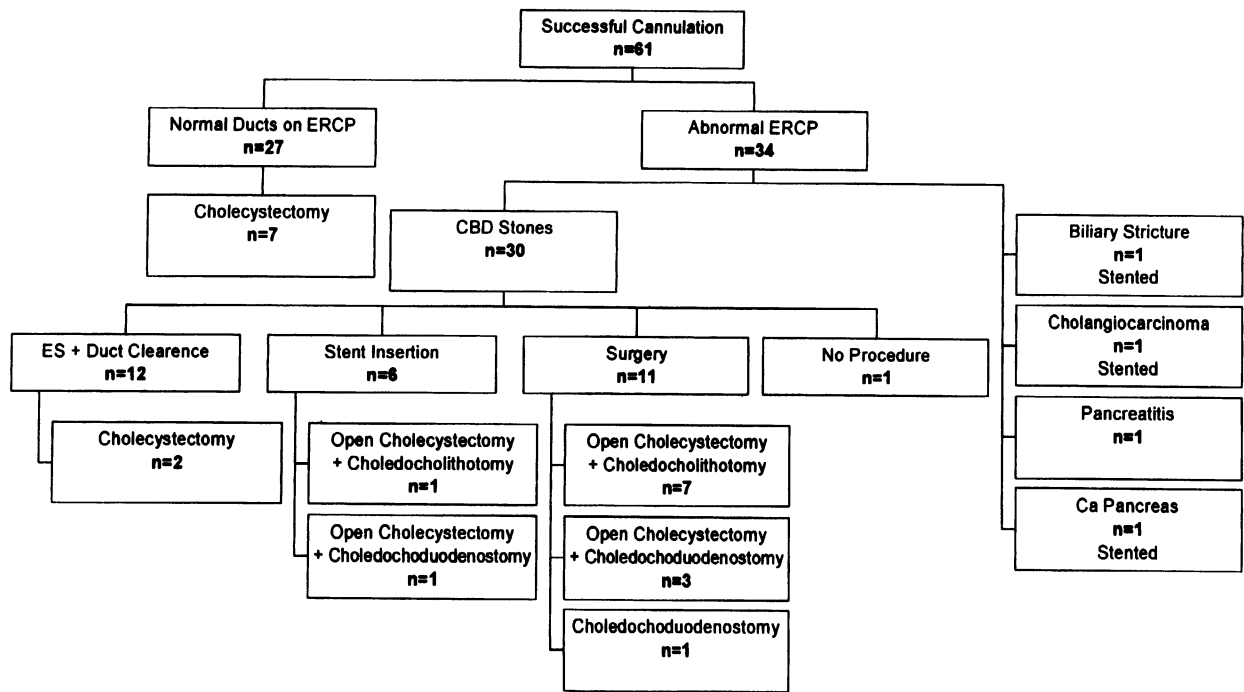


Figure 1. Outcome of patients with periampullary diverticula in whom ERCP was successful. (CBD = common bile duct, ES = endoscopic sphincterotomy).

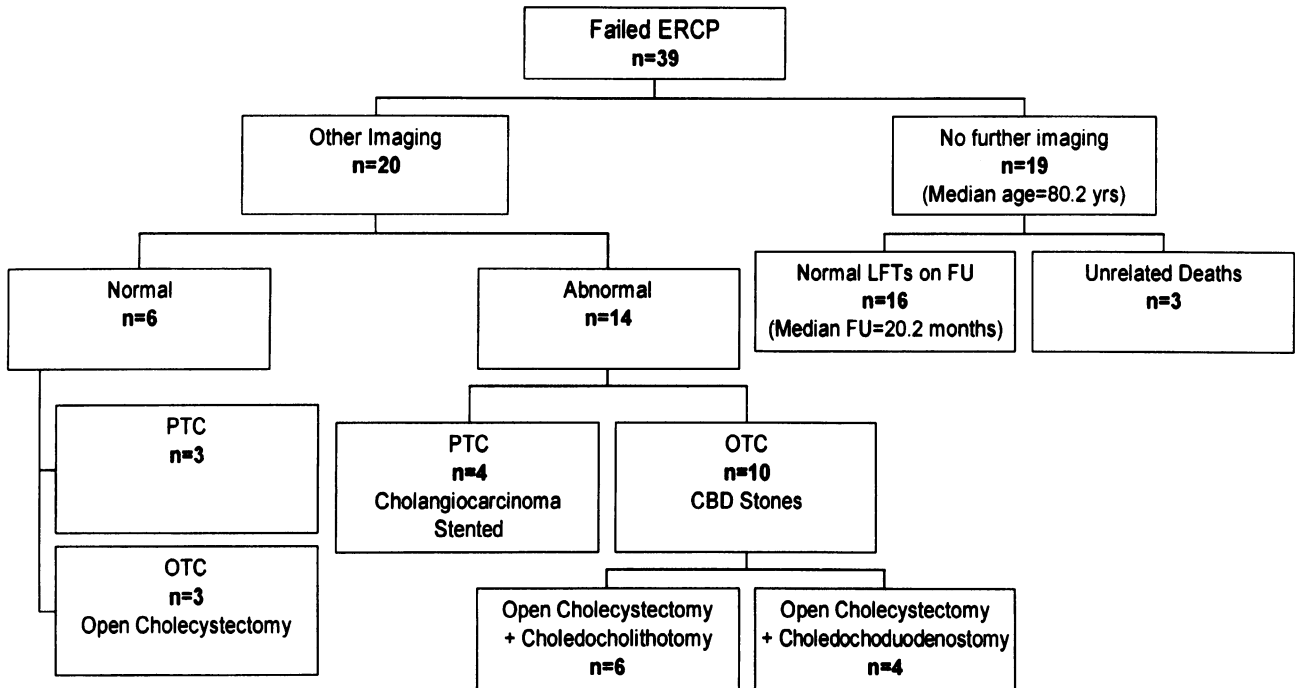


Figure 2. Outcome of patients with periampullary diverticula in whom ERCP failed. (LFTs = liver function tests, FU = follow-up, PTC = percutaneous transhepatic cholangiography, OTC = on-table cholangiography).

years) underwent biliary surgery, one of whom had a choledochoduodenostomy subsequent to a previous cholecystectomy. The remaining 34 had a cholecystectomy. This was combined with an OTC alone in three, a choledocholithotomy in 14, and a choledochoduodenostomy in eight. One patient had a minor wound infection, three had urinary tract infections and one had a respiratory infection. The others made uncomplicated recoveries. One patient developed cholangitis after ERCP

that responded to antibiotic therapy and another had mild pancreatitis. There were no other procedure-related complications.

The overall median follow-up of patients with PAD was 30.3 months. Two patients with cholangiocarcinoma, who underwent insertion of a biliary endoprosthesis at ERCP/PTC, died within 30 days of the procedure. There were 15 late deaths during the period of the study. Pancreaticobiliary malignancy was the cause of death in four patients

Table IV. Diagnoses after imaging

Diagnosis	Total
Normal ducts on ERCP/PTC/OTC	33
Abnormal ducts on ERCP/PTC/OTC	
Cholelithiasis	40
Cholangiocarcinoma	5
Carcinoma pancreas	1
Chronic pancreatitis	1
Benign biliary stricture	1
No imaging other than ultrasound	19
Total	100

and the others died of unrelated conditions. The median duration between ERCP/attempted ERCP and death was 8.9 months (range 19 days to 54.5 months).

Discussion

Interest in the relationship between PAD and pancreaticobiliary disease was evoked in 1934 when Lemmel described the 'papilla syndrome' (12). He attributed liver and bile duct disease with damage to the pancreas and pancreaticogenic diarrhoea to the presence of PAD. Subsequently, it has been shown that sphincter of Oddi resting pressures are reduced in patients with PAD (13–15) and that bile duct colonisation with β -glucuronidase-producing organisms is frequent in these patients (16–18). A combination of these factors accounts for the increased incidence of pigment CBD stones (4–8). There is no conclusive evidence associating PAD with pancreatic disease, but recently it has been suggested that PAD should be excluded before making a diagnosis of idiopathic acute pancreatitis (19).

The wide range of prevalence of PAD emphasises the difficulty of ascertaining the true prevalence rate in the general population. Prevalence rates on barium meal examinations range from 0.16% to 5.76% (20,21), while those at autopsy are as high as 23% (22). Prevalence rates of 5% to 23% have been reported on ERCP (1–3,9,23), the average being 10% to 15%.

Our overall success at ampullary cannulation was 90%. This is lower than the success rate quoted by specialist centres and can be explained by the fact that only the first attempt at ERCP in each patient was recorded in this study and cumulative success rates were not considered. Moreover, the endoscopy component of the examination was able to provide a diagnosis in a substantial number of patients (Table II), thereby precluding the necessity for cannulation. Some authors who quote high success rates do not include such cases as failures (2).

The presence of PAD was the single most common cause of failure to cannulate the ampulla in both age groups (Table II) and was responsible for 24% of the unsuccessful ERCPs in patients <75 years and 46% of the failures in patients \geq 75 years.

Our cannulation success rate of 61% in patients with PAD is modest, but this correlates with other studies

which quote success rates of 55.3% (10) and 60% (9). The success rate in patients without PAD was significantly higher at 92.7%. In one of the largest studies from a specialist centre, a cannulation success rate of 76.9% was achieved at first attempt and this rose to 94.2% at the third attempt (3). IDP accounted for only 6.8% of PAD in that study (3) compared with 42% in the present study. The consensus is that ERCP is much more difficult to perform in patients with IDP than JPD (3,24), and the present study has addressed this statistically. High success rates of 91.5% (2) and 94.7% (6) have been reported in studies in which all examinations were carried out exclusively by one (2) or two (6) experienced endoscopists. The relatively low complication rate of ERCP in the present study reflects the fact that routine precuts and persistent attempts at cannulation were not made in patients with PAD in whom initial cannulation was unsuccessful.

We were able to demonstrate an association between the presence of PAD and cholelithiasis (Table IV). This finding is supported by earlier work (4–8). However, features of pancreatitis were seen in only one patient, and we are in agreement with other authors who have shown that PAD are not associated with an increased incidence of pancreatitis (9,23). More interestingly, 40.7% of patients in whom the biliary tree was imaged had no abnormality within the ducts. Normal ducts have been demonstrated in 17% of patients with PAD in another recent study (11). Patients in both the studies were symptomatic, and these findings suggest that PAD may be responsible for transient biliary symptoms, elevation of alkaline phosphatase and even jaundice. This may be especially true in the elderly as the prevalence of PAD is four times higher in patients \geq 75 years than in patients <75 years. Intermittent extrinsic compression of the lower end of the CBD brought on by entry of food into the diverticulum, sphincter of Oddi dysfunction, or a low-grade cholangitis may explain this phenomenon. Spontaneous passage of a CBD stone before ERCP may also account for the normal ducts.

Nineteen elderly patients with PAD were followed up closely after unsuccessful ERCP. Three of them died of unrelated causes, but the remaining 16 had normal LFTs and were symptom free during a median follow-up period of nearly 2 years. The clinical course of these patients suggests that though the ducts were never imaged, the probability of finding an abnormality is low. There is definitely a case for a wait and watch policy in some patients in whom ERCP has been unsuccessful, but it is difficult to predict which patients may form this group. Spiral CT, magnetic resonance cholangiopancreatography and endoscopic ultrasound are proving to be useful tools in the evaluation of patients with pancreaticobiliary disease and may help resolve this dilemma. PTC may be used for both diagnostic and therapeutic purposes, but the procedure is more invasive than ERCP and carries a higher morbidity. The presence of PAD may make the interpretation of PTC difficult, as filling defects produced by a diverticulum may mimic a CBD stone or even a periampullary neoplasm (25,26).

ERCP with endoscopic sphincterotomy (ES) is considered the treatment of choice for CBD stones, as traditionally the morbidity and mortality of ERCP and ES are lower than that of surgery (27), especially in elderly patients. Patients with PAD form a unique group because of the relatively high failure rate. Combined ERCP/PTC techniques (28) have proved successful in managing such patients, but they are not without complications. New approaches and 'tricks' have been described to facilitate cannulation (29,30) and stent-guided sphincterotomy has been recommended to minimise the possibility of perforating the diverticulum (31).

Surgical intervention remains an effective means of dealing with such patients. We tend to offer surgery readily, when indicated, to patients who have had unsuccessful ERCP and the results of surgery have been rewarding in this study. The 35 patients operated on made excellent recoveries and there were no major complications. A recent randomised, controlled study has shown that the results of surgery are superior to those of ES in achieving duct clearance in elderly patients with choledocholithiasis and that there is no significant difference in immediate morbidity and mortality between the two groups (32).

The consequences of failed ERCP in patients with PAD are unpredictable. High risk elderly patients in whom ERCP has failed could be kept on careful review before subjecting them to other invasive investigations, because a significant proportion do not have any ductal abnormalities and are asymptomatic on follow-up. However, surgery should be offered to those with appropriate indications because results are good, even in the elderly.

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