TECHNICAL REPORT

Endoscopic ultrasound-guided choledoco-duodenostomy as an alternative to percutaneous trans-hepatic cholangiography

James A. Nicholson1, Marianne Johnstone1, Michael G. T. Raraty2 & Jonathan C. Evans3

1NIHR Pancreas Biomedical Research Unit, 2Department of Surgery, and 3Department of Radiology, Ground Floor, Royal Liverpool University Hospital, Liverpool, UK

Abstract

Background: Endoscopic ultrasonography (EUS)-guided choledochoduodenostomy (CDS) is an alternative to percutaneous transhepatic cholangiography (PTC) drainage in patients with an obstructed biliary system where conventional endoscopic retrograde biliary drainage (ERBD) has been unsuccessful.

Methods: Five EUS-CDS procedures were reviewed to assess whether successful decompression was achieved and maintained.

Results: There was technical success in each instance with no immediate complications. There was a significant fall in the median bilirubin of 164 mmol/l. The median follow-up was 44 days. In one patient the stent migrated with no adverse outcome.

Conclusion: EUS-CDS is a viable alternative to PTC with fewer complications and comparable success rates. EUS-CDS may offer a future route for novel therapeutic advances.

Keywords
endooscopic palliation < pancreatic neoplasia, radiological imaging/intervention < pancreatic neoplasia, interventional endoscopy < chronic pancreatitis, interventional radiology < chronic pancreatitis, outcomes < pancreatic neoplasia

Received 29 February 2012; accepted 12 April 2012

Correspondence
James A. Nicholson, 5th Floor UCD, The Duncan Building, Daulby Street, Liverpool, L69 3GA, UK.
Tel: +44 151 706 4168. Fax: +44 151 706 5826. E-mail: europac@liv.ac.uk

Introduction

First described by Giovannini and colleagues in 2001, endoscopic ultrasound-guided choledoco-duodenostomy (EUS-CDS) is increasingly being used globally as an alternative to percutaneous trans-hepatic cholangiography (PTC) in patients where anatomical abnormality has rendered endoscopic transpapillary insertion of a biliary stent impossible.1 Peri-hepatic ascites is the only relative contraindication to PTC,2 but PTC does carry a significant associated morbidity and mortality.3 In addition, PTC normally requires a separate procedure after failed ERCP biliary drainage, thereby increasing the morbidity associated with biliary stasis. In spite of interest internationally there are few published examples of EUS-CDS.

Endoscopic retrograde biliary drainage (ERBD) remains the most popular choice of biliary decompression in those patients with obstruction of the distal main bile duct. The success of this technique ranges from 90% to 95% in the USA.2 Failure may be as a consequence of: variations in anatomy; the presenting pathology (impacted stones, tumour infiltration and duodenal compression by pancreatic pseudocyst); previous surgery; or may be a variant of normal anatomy (periampullary diverticula and tortuous ducts).

The authors’ institution performs over 500 upper gastrointestinal endoluminal interventional procedures annually. Previously a failed ERBD would lead to repeated attempts, PTC or operative intervention. The aim of the present study was to describe the technical factors and outcome associated with an alternative method of obtaining biliary drainage after failed ERBD.

Methods

Five consecutive patients who had undergone EUS-CDS, performed by one of the authors (J.C.E.) over a 6-month period, were reviewed.

Patients within this cohort were deemed suitable for an attempted EUS-CDS as a one-stage procedure after a further ERBD attempt, rather than being recalled for PTC. All patients had undergone at least one unsuccessful ERBD attempt. Patients were consented for EUS-CDS before a repeat ERCP. Once
cannulation of the papilla had proven to be unsuccessful, a routine EUS examination of the biliary tree was performed as follows.

A linear echoendoscope (Olympus© GFUE260; Olympus Life Science, Hamburg, Germany) is placed within the first part of the duodenum using a ‘long scope’ position. The optimal position has the tip of the endoscope in a vertical orientation when seen on fluoroscopy. This results in a longitudinal view of the lower common bile duct (Fig. 1), and optimizes a vertical approach into the bile duct. The duct is assessed for accessibility (distance from the duodenal wall and evidence of intervening vessels) before puncturing the duct directly above the common bile duct (CBD) stricture. A 19-gauge fine-needle aspiration needle (Cook© EchoTip Ultra™; Cook Medical, Bloomington, IN, USA) is used to puncture the duct using ultrasound guidance. The puncture needs to be as closely aligned to the duct as possible to allow easy passage of the wire and stent.

Once the tip of the 19-G needle is within the duct, bile is aspirated for confirmation of position, followed by contrast injection (Fig. 2a). An insulated wire (Boston Scientific© Jagwire™0.035 450 cm; Boston Scientific, Natick, MA, USA) is then passed through the 19-G needle using fluoroscopy to monitor placement of the wire tip into an intra-hepatic duct. After removal of the 19-G needle, a wire-guided cystotome (Cook Medical© Cystotome 10 Fr 165 cm with inner catheter removed) is passed over the wire and using pulsed diathermy (ERBE™ APC2; ERBE Medical UK, Leeds, UK) a choledocho-duodenostomy is performed (Fig. 2b). Ultrasound imaging is usually sub-optimal at

![Figure 1](image1.png) Dilated common bile duct (CBD) on endoscopic ultrasoundography (EUS)

![Figure 2](image2.png) (a) Contrast injection. (b) Cystotome over guidewire (c). Stent in situ
this stage, and therefore fluoroscopy is used to observe the progress of the cystotome. As soon as the cystotome has clearly entered the duct it can be removed leaving the wire in place. A stent is then passed over the wire and positioned across the CDS (Fig. 2c).

The patient received 200 mg of ciprofloxacin given orally pre- and post-procedure as for a standard ERBD.

In all patients so far the procedure has been performed in continuity with the previously attempted ERBD. It is usually necessary to give additional sedation and analgesia as the procedure time can be anywhere between 30 and 45 min beyond the attempted ERBD duration.

All patients were followed up post-procedure with regular serum bilirubin measurements for a minimum of 10 days post-procedure.

**Results**

The patient demographics, indications for EUS-CDS and diagnoses for each patient are given in Table 1.

The serum levels of bilirubin pre- and post-procedure are represented graphically in Fig. 3. The procedure was completed successfully in all patients with decompression of the biliary tree confirmed by a median drop in bilirubin of 164 (range 73–281) mmol/l by 10 days.

The serum levels returned to normal (<17 mmol/l) in three patients and there were no immediate complications. None of our patients developed cholangitis or symptoms of sepsis. Neutrophil count at day 10 was within the normal range for all five patients.

The median follow-up was 184 days with four choledocho-duodenostomies remaining in situ. One patient (C), who had the plastic stent placed, suffered from a migrated stent and represented with jaundice at 571 days post-EUS-CDS (discussed below). Three patients succumbed to their pancreatic cancer.

**Discussion**

Evidence is growing that EUS-CDS is a safe alternative to surgery in those patients with an obstructed biliary tree in whom ERBD is

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age (years)</th>
<th>Gender</th>
<th>Diagnosis</th>
<th>Stent inserted</th>
<th>Operation</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>52</td>
<td>Female</td>
<td>Cancer</td>
<td>Metal</td>
<td>No</td>
<td>Relief of jaundice</td>
</tr>
<tr>
<td>B</td>
<td>66</td>
<td>Female</td>
<td>Cancer</td>
<td>Metal</td>
<td>Resection</td>
<td>Relief of jaundice</td>
</tr>
<tr>
<td>C</td>
<td>52</td>
<td>Male</td>
<td>Chronic pancreatitis</td>
<td>Plastic</td>
<td>Beger’s</td>
<td>Relief of jaundice, distal migration – jaundice at 571 days</td>
</tr>
<tr>
<td>D</td>
<td>55</td>
<td>Female</td>
<td>Cancer</td>
<td>Metal</td>
<td>Palliative bypass</td>
<td>Relief of jaundice</td>
</tr>
<tr>
<td>E</td>
<td>68</td>
<td>Male</td>
<td>Cancer</td>
<td>Metal</td>
<td>Palliative bypass</td>
<td>Relief of jaundice</td>
</tr>
</tbody>
</table>

**Figure 3** Serum bilirubin for each patient pre- and post-endoscopic ultrasound-guided choledoco-duodenostomy (EUS-CDS)
impossible. This case series adds further weight to support the consideration of EUS-CDS as a feasible option, certainly within specialist units.

Technically the procedure is similar to EUS-guided drainage of a pseudocyst and, as the same equipment is involved, there should be no added financial burden to those units wishing to offer this service.

The major advantages of EUS-CDS over PTC include: the reduced risk of complications associated with PTC (hemorrhage, cutaneous fistula formation, cholangitis, peritonitis and empyema) which have been estimated to be 21–32%. An additional benefit of EUS-CDS is the relative ease of performing the procedure immediately after a failed attempt at ERBD, thus reducing the delay in decompression of the biliary tree.

In this cohort of patients both a 10F straight plastic stent and self-expanding covered metal stent were successfully placed; however, the sole plastic stent migrated leading to the patient (C) re-presenting with jaundice where successful ERBD was achieved. A repeat computed tomography at the time of re-presentation revealed that the stent had migrated (presumably expelled via the anus) and that the CBD was obstructed by distal calculi which had not been evident previously. As stated, an ERCP and sphincterotomy initially relieved the jaundice and a subsequent cholecystectomy was performed. The histology was consistent with chronic cholecystitis.

In all, EUS-CDS was performed after at least one failed ERBD thus a single attempt at a further ERCP was made before the procedure and when this failed EUS-CDS was performed. The time taken for EUS-CDS was between 30–45 min which is less than the time taken for a standard percutaneous transhepatic cholangiography (30–120 min).

Compared with surgical intervention, EUS-CDS has far lower rates of mortality and morbidity, albeit without offering a curative intervention. Therefore the authors have started using EUS-CDS as a bridge to surgery, as can be seen in three of the five patients in the current cohort.

A case series in the USA has explored the possibility of dilating the choledocho-duodenal fistula created at EUS to apply local endoluminal therapies (e.g. phototherapy) to tumours within both the pancreas and the main bile duct. It might be that such trans-fistula endoscopic therapies become an alternative method of delivering cytotoxic agents topically.

A detailed review of the literature has been conducted previously by Komaki in 2011 identifying 11 case series. Since that time two further studies have been published. Combined with the current cohort there are now reports of 56 individual patients who have undergone EUS-CDS across the world with 98.2% (n = 55) achieving successful decompression of the biliary tree. Complications have been low with a combined complication rate of 21.4% (n = 12) with patients developing cholangitis (n = 4), biliary peritonitis (n = 4), perforation (n = 3) and 1 patient with distal stent migration. This combined complication rate compares favourably with PTC.

The present study is limited by the small size of the cohort. Recent small-scale prospective studies have confirmed the safety and efficacy of EUS-CDS and it would now be appropriate to consider a randomized trial comparing PTC with EUS-CDS in patients with repeated failed ERBD.

Conflicts of interest
None declared.

References