SHORT REPORT

The utility of upfront double wire guided biliary cannulation following early unintentional pancreatic cannulation in patients undergoing ERCP

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Short Title: Early Double Wire Biliary Cannulation

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Abstract

Background and Study Aims To assess the impact of upfront double-guide wire technique (DGT) following inadvertent early pancreatic duct (PD) cannulation on biliary cannulation and post endoscopic retrograde cholangiopancreatography (ERCP) complications.

Methods A pilot non-randomized cohort study was performed in patients undergoing ERCP from 2010-2011. DGT was utilized in the first 25 patients followed by standard cannulation technique (SCT) in the subsequent 25.

Results A significantly lower PD cannulation rate (median (range)) was noted in the DGT group (1 (0-5) versus 3 (0-6); $p=0.013$), however the pancreatitis rate was similar (2 (9 %) DGT, 1 (4 %) SCT; $p=0.601$). In the SCT group 15/25 (60 %) required a DGT to achieve biliary cannulation.

Conclusion The majority of our cohort proceeding to an SCT following early PD cannulation required a DGT to achieve biliary cannulation. Early DGT resulted in a significant reduction in unintentional pancreatic cannulation but did not translate into a reduction in pancreatitis in our cohort.

Keywords Biliary Duct; Pancreatic duct; Pancreatitis

Introduction

Endoscopic retrograde cholangiopancreatography (ERCP) is a key treatment modality in biliary diseases [1]. However, even in experienced hands biliary cannulation remains challenging [2, 3]. Dumonceau et al. first described the double-guide wire technique (DGT) in difficult biliary cannulation [4]. DGT involves the insertion of a pancreatic guide wire, which occupies the duct and straightens out the biliary and pancreatic ducts [5, 6]. A cannulation device is placed in the papilla above the pancreatic wire, assisting biliary cannulation [1, 6]. Maeda et al. showed that DGT was superior to standard cannulation technique (SCT) in difficult biliary cannulation [7], however a subsequent randomised controlled trial rejected these findings [1]. No data exists on upfront DGT following early inadvertent pancreatic duct (PD) cannulation, its impact on biliary cannulation rates and post procedure complications compared to SCT.

Materials and Methods

A pilot non-randomized cohort study was conducted from May 2010 - August 2011 at Austin Health in Victoria, Australia. Consecutive patients with native papillae undergoing ERCP were eligible for recruitment. Inclusion criteria were age ≥ 18 yrs, inadvertent PD cannulation within the first 5 attempts at biliary cannulation and procedure performed by the study endoscopist. Exclusion criteria were previous sphincterotomy or balloon dilatation, and previous biliary or pancreatic stent insertion.

A single consultant endoscopist (M.N) was involved in this study. With institutional review board approval, data was collected prospectively. .

Design and Definitions

Common bile duct (CBD) cannulation was attempted in all cases by a guide-wire technique. The start of the cannulation attempt was defined when the cannulatome was inserted into the ampullary orifice and ceased when disengagement from the ampulla occurred.

Enrolment of patients occurred if the pancreas was inadvertently cannulated with the wire during the first 5 attempts of biliary cannulation. The first 25 patients in our study proceeded to upfront DGT with the subsequent 25 patients continuing with SCT after pancreatic wire removal.

In the upfront DGT group the PD wire was left in place and no contrast was injected (step 1). A cannulatome exchange was performed (step 2). The second wire-loaded cannulatome was positioned at the ampullary orifice above the pancreatic wire in the direction of the CBD and 10 attempts at cannulation were undertaken (step 3). If CBD cannulation was not successful a pancreatic stent was inserted (step 4). A further 10 attempts were then made at cannulation (step 5). If failure of CBD access occurred the endoscopist proceeded to precut sphincterotomy (PS), (step 6).

In the SCT group after initial inadvertent pancreatic wire cannulation the wire was removed and 10 attempts at CBD cannulation performed. If unsuccessful, the endoscopist would proceed to intentional pancreatic cannulation and the DGT route as previously described in steps 1 to 6. Flow chart of the study design is illustrated in Fig. 1.

Outcome measures

The primary endpoint was successful cannulation of the CBD. Secondary endpoints included procedural times, additional procedures required to gain CBD cannulation and post ERCP complications.

Statistical analysis

Descriptive statistics were utilized to describe patient characteristics, which were presented as means and standard deviations. Continuous variables were compared with the Mann-Whitney test, whereas categorical variables were analysed with the chi-square and Fisher's exact test.

Statistical analysis was performed by using SPSS software (version 19.0; SPS Inc, Chicago IL).

Sample size calculations were not performed as this was an observational pilot study and from our calculations, in order to detect a 50 percent decrease in pancreatitis rates (8 % to 4 %) alone between DGT and SCT we would require 500 patients in each study arm which was not feasible at our institution.

Results

In total, 300 patients underwent ERCP during the study period. Fifty (17 %) patients fulfilled inclusion criteria and were enrolled. Two patients were excluded from DGT group due to equipment failure.

The SCT and DGT groups were comparable across demographics, co-morbidities and ERCP indications (Table 1). The only significant difference was a higher proportion of patients with a lower ASA class in the DGT group (1 (0-5) vs 3 (0-6); $p=0.013$).

All patients achieved CBD cannulation. However 15 (60 %) patients in the SCT group failed initially to gain biliary access and proceeded to DGT to gain CBD cannulation (Table 2). Of these patients 9 (36 %) gained CBD cannulation by a DGT alone and 6 (24 %) combined with PD stenting.

The mean time to successful CBD cannulation was 12 minutes in DGT and 20 minutes in the SCT group, however this difference was not statistically significant ($p=0.433$). There were similar rates of pancreatic stenting across both groups [6 (24 %) SCT vs 8 (35 %) DGT

$p=0.412$). The requirement to proceed to PS was similar between the two groups [4 (16 %) SCT vs 4 (17 %) DGT; $p=0.897$] as seen in Table 2. A significant difference in the number of repeated pancreatic cannulation was observed between the two groups in our study. The mean number of pancreatic cannulation was 1 in DGT versus 3 in the SCT group, $p=0.013$. Pancreatitis post ERCP were similar across the groups [1 (4 %) SCT vs 2 (9 %) DGT; $p=0.601$] despite the significant reduction in PD cannulation in the DGT group. All cases were mild in nature. There were no significant differences in post procedure bleeding (8 % SCT and 0 %), cholangitis (4 % SCT and 9 % DGT), cholecystitis (4 % SCT and 0 % DGT) and 30 day mortality rate (4 % SCT and 4 % DGT). In both groups one death occurred following discharge from hospital, which was related to cholangitis secondary to presumed biliary stent occlusion initially inserted for the indication of malignant biliary obstruction.

Discussion

Our pilot study was performed to assess biliary cannulation rates and post ERCP complications with upfront DGT in comparison to SCT when early unintentional PD cannulation occurs. We found no significant difference in biliary cannulation rates between the two techniques. However despite the global 100 % biliary cannulation rate in our cohort, the majority of the SCT group required subsequent reversion to DGT to achieve biliary cannulation. If we had not reverted to a DGT following failed standard cannulation attempts and utilized other biliary cannulation techniques, it is possible that our findings may have been different.

The DGT group had a substantially lower rate of PD cannulation in comparison to the SCT group. This difference was firstly due to ongoing inadvertent PD cannulation during attempts at CBD cannulation in the SCT group and secondly a large proportion (60 %) in the SCT group required a subsequent DGT procedure. This did not translate into a difference in post

procedural pancreatitis. However to detect a 50 percent decrease in pancreatitis rates (8 % to 4 %) between DGT and SCT we would require 500 patients in each study arm which was not feasible at our institution. The complication rates observed in our cohort reflected those published in the literature [1, 2, 8].

The time period to successful biliary cannulation was higher in the SCT group compared to the DGT group, however this did not achieve statistical significance (20 minutes and 12 minutes respectively; $p=0.433$). An 8 minute time differential is substantial if we consider that 10 minutes has been used previously to classify difficult biliary cannulation [7]. The significance of prolonged ampullary orifice manipulation has been assessed as a risk factor for post-procedure pancreatitis [9].

There were several limitations in our study, the main one being the small cohort size, which may have prevented detection of significant differences between the two groups. Secondly a significant number of patients from the SCT group required the use of DGT to gain biliary access. Our protocol however allowed a direct comparison between the two techniques in early inadvertent PD cannulation. It has been increasingly advocated that endoscopists should proceed straight to a PS following failure of SCT [10] in order to avoid trauma to the papillae [8], which was not examined in our study. In a recent RCT, DGT was comparable to PS for overall biliary cannulation, with DGT requiring a significantly shorter time to achieve biliary access [2]. The other point highlighted in their study was the rapid up-skilling in DGT whereas PS requires a substantial case volume to achieve an acceptable cannulation success rate [2, 8]. Reports suggest that PS has an increased complication rate over SCT even in the hands of experienced endoscopists [8, 11, 12]. DGT may therefore have a role in achieving biliary cannulation prior to PS.

The strength of our study was the involvement of a single endoscopist with experience in the use of SCT, DGT and PS, unlike other studies which included fellows with varying levels of expertise [1, 7]. We were therefore able to maintain a strict protocol for all patients involved.

In conclusion for early unintentional PD cannulation there was no clear advantage of DGT over SCT in biliary cannulation or post procedure complications for our cohort. The lack of superiority of DGT over SCT may have been due to the crossover of patients from the SCT group to subsequent DGT to gain biliary access. Our pilot study is the first of its kind to review DGT against SCT in early unintentional PD cannulation. Further prospective RCTs are therefore required to investigate the utility of upfront DGT and its impact on biliary cannulation and post ERCP complications.

Acknowledgments and potential conflicts of interest

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FIGURE/TABLE LEGENDS

Fig. 1

CBD common bile duct

PD pancreatic duct

SCT standard cannulation technique

DGT double guide wire technique

PS precut sphincterotomy

Fig. 2 Fluoroscopic image of the double wire guided biliary cannulation technique

Table 1 Characteristics of patients undergoing endoscopic retrograde cholangiopancreatography with early pancreatic wire cannulation				
	Overall (n=18)	Standard cannulation technique (SCT) group (n=25)	Double guide wire technique (DGT) group (n=23)	Difference (p value)
Patient Characteristics				
Male	24 (50 %)	14 (56 %)	10 (44 %)	0.386
Age	62 (32.89)	65 (37-89)	59 (32-86)	0.403
Part Cholecystectomy	23 (48 %)	9 (36 %)	14 (61 %)	0.085
Diabetes	7 (15 %)	6 (24 %)	1 (4 %)	0.099
History of pancreatitis	8 (17 %)	4 (16 %)	4 (17 %)	0.897
ASA Class I	2 (4 %)	0 (0 %)	2 (9 %)	0.001*
II	21 (44 %)	7 (28 %)	14 (61 %)	
III	22 (45 %)	16 (64 %)	6 (26 %)	
IV	3 (6 %)	2 (8 %)	1 (4 %)	
Pre-procedure ICU admission	1 (2 %)	0 (%)	1 (4 %)	0.479
Preoperative laboratory tests				
Hemoglobin (g L)	131 (86-173)	132 (87-173)	126 (86-166)	0.759
WCC (x10 ⁹ /L)	7.4 (3.2-26.4)	7.4 (4.7-26.4)	7.9 (3.2-17.7)	0.617
Platelet (x10 ⁹ /L)	297 (31-701)	292 (86-701)	301 (31-679)	0.683
Bilirubin (μmol/L)	46 (6-554)	69 (6-554)	37 (7-381)	0.397
Albumin (g/L)	34 (22-48)	32 (22-46)	38 (27-48)	0.054

Urea (mmol/L)	4.3 (1.3-13.8)	4.2 (1.3-10.0)	4.3 (2.0-13.8)	0.461
Creatinine (μmol/L)	73 (35-173)	74 (35-133)	73 (43-173)	0.783
INR	1.1 (0.8-1.7)	1.1 (0.9-1.7)	1.1 (0.8-1.3)	
Indications				
Cholelithiasis	15 (31 %)	6 (24 %)	9 (39 %)	0.259
Malignant stricture	11 (23 %)	8 (32 %)	3 (13 %)	0.122
Benign stricture	1 (2 %)	0 (0 %)	1 (4 %)	0.479
Acute cholangitis	9 (19 %)	6 (24 %)	3 (13 %)	0.466

Table 2 Outcomes of endoscopic retrograde cholangiopancreatography in patients with early pancreatic

wire cannulation				
	Overall (n=48)	Standard cannulation technique (SCT) group (n=25)	Double guide wire technique (DGT) group (n=23)	Difference (p value)
Procedures				
Biliary sphincterotomy	48 (100 %)	25 (100 %)	23 (100 %)	1.0
Pancreatic sphincterotomy	3 (6 %)	2 (9 %)	1 (4 %)	0.601
Pre-cut sphincterotomy (PS)	8 (17 %)	4 (16 %)	4 (17 %)	0.897
Attempted stone extraction	27 (56 %)	13 (52 %)	14 (61 %)	0.536
Pneumatic dilatation	8 (17 %)	2 (8 %)	6 (26 %)	0.130
Plastic biliary stent insertion	23 (48 %)	12 (52 %)	11 (44 %)	0.571
Pancreatic stent insertion	14 (29 %)	6 (24 %)	8 (35 %)	0.412
Biliary Metal stent	8 (17 %)	6 (24 %)	2 (9 %)	0.249
Biliary sphincterotomy	48 (100 %)	25 (100 %)	23 (100 %)	1.0
Procedural outcomes				
Need for double wire technique	38 (79 %)	15 (60%)	23(100%)	N/A
Successful biliary cannulation	48 (100 %)	25 (100 %)	23 (100 %)	1.0
Pancreatic cannulation number	3 (1-5)	3 (1-5)	3 (1-5)	0.849
Number of repeat pancreatic cannulation	2 (0-6)	3 (0-6)	1 (0-5)	0.013*
Successful Biliary cannulation attempt	9 (2-40)	13 (2-33)	8 (2-40)	0.206

Biliary cannulation time after	20 (2-58)	20 (2-48)	12 (2-58)	0.433
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Figure 2

Figure 1. Study design flow chart.