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Retrograde Device Assisted Enteroscopy as a Salvage Procedure for Failed Colonoscopy: The Experience of a large Australian Centre

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Abstract

Aim: Failed caecal intubation occurs in 4-25% of colonoscopies. The primary objective was to assess the technical success of retrograde Device Assisted Enteroscopy (rDAE) after failed colonoscopy. Secondary aims were to describe the diagnoses and interventions, and to identify factors affecting technical success.

Methods: Retrospective review of consecutive patients undergoing retrograde DAE at our institution between November 2004 and May 2016. Data were collected on: demographics, technical success, bowel preparation, diagnoses, interventions and adverse events.

Results: In total, 277 patients underwent retrograde DAE. Of these, 86 procedures were performed on 82 patients for incomplete colonoscopy, primarily in redundant colons. Cecal intubation was achieved in 80 procedures (93%). Incomplete procedures were caused by unsatisfactory preparation in 5 cases (6%) and by colonic herniation in 1 case (1%). Of the 80 completed procedures, 2 were non-diagnostic due to poor bowel preparation and 20 showed no abnormalities. In the remaining 58 procedures, 66 diagnoses were made: adenomatous polyps (n=25), inflammatory bowel disease (n=14), angioectasias (n=7), colonic diverticulosis (n=6), strictures (n=5), laterally spreading tumours (n=3), adenocarcinomas (n=3), and ileal ulcers (n=2). Interventions performed were: snare polypectomy (n=29), biopsy (n=17), argon plasma coagulation (n=8), endoscopic mucosal resections (n=3), dilatation (n=3) and endoscopic clipping (n=4). No reported adverse events.

Conclusion: Salvage retrograde DAE has a high technical success in redundant colons and important diagnostic findings. DAE should be recommended in preference to repeat standard colonoscopy or CT colonography. There should be a strong focus on optimising bowel preparation, as it was the major factor influencing technical success and diagnostic yield.

Keywords: Colorectal disease; Colonoscopy; Pelvic surgery; Mucosal lesions

Introduction

Colonoscopy is the primary diagnostic modality for colorectal disease, allowing tissue acquisition as well as therapeutic interventions [1,2]. A key component of technical success of colonoscopy is caecal intubation; however this is not achieved in 4% to 25% of cases [2]. The importance of complete colonoscopy was demonstrated by Ridolfi et al, who showed that 12% of clinically significant lesions are missed by an incomplete index colonoscopy (21/179) [2]. Moreover, incomplete screening colonoscopy has been associated with a twofold increase in interval cancer of the proximal colon [3]. Colonic factors contributing to incomplete colonoscopy comprise redundant colon, loop formation, angulated or fixed segments, and stenosis [4]. Extra-colonic factors include female gender, advanced age, prior abdominal or pelvic surgery, and low BMI [5,6].

Computed Tomography Colonography (CTC) has become the default option after failed colonoscopy, despite multiple studies demonstrating that CTC's sensitivity for detecting polypoid lesions <10 mm and flat sessile lesions of any size is significantly smaller than that of colonoscopy [7,8]. Moreover, repeat colonoscopy offers the advantage of being able to perform biopsy and therapeutic interventions [9]. However, even in expert hands colonoscopy is unsuccessful in up to 28% of cases. Therefore, Device Assisted Enteroscopy (DAE) has emerged as a salvage technique [10].

The primary aim of this study was to assess the technical success of retrograde DAE (rDAE) after incomplete colonoscopy, using either Single Balloon Enteroscopy (SBE) or Double Balloon Enteroscopy (DBE). Secondary aims were to describe the diagnoses, interventions, and adverse events, and to identify factors affecting technical success.

Methods

Patients

All patients with a prior incomplete colonoscopy who were therefore referred to our center for a retrograde DAE between November 2004 and May 2016 were included. Incomplete index colonoscopy was defined by failure to intubate the caecum. Other endoscopists, both from within and outside our institution, referred patients for this procedure.

Endoscopic procedures

After informed consent was obtained, DAE procedures were performed or supervised by two experienced gastroenterologists. The senior enteroscopist had performed more than 1,000 DAE procedures, of which more than 500 were done by the retrograde approach. The bowel preparation regimen varied over the studied period, but universally consisted of a split dose preparation. Carbon dioxide insufflation was used for all procedures.

DBEs were performed using the Fujinon EN-450T5 enteroscope (length 2,300 mm, outer diameter 9.4 mm) with a pump allowing for selective inflation of latex balloons on the enteroscope and overtube (length 1,450 mm, outer diameter 13.2 mm). SBEs were performed using the Olympus ST-SB1 enteroscope (length 2,345 mm, outer diameter 9.2 mm) with a silicone overtube (length 1,400 mm, outer diameter 13.2 mm) with attached balloon.

Procedures were performed under physician-administered conscious sedation, using intravenous midazolam and fentanyl, or anaesthetist-administered propofol sedation.

Technique

DAE consists of a 200 cm endoscope with an overtube. There are one (SBE) or two (DBE) inflatable balloons attached to the scope and/or overtube. With this technique the scope is advanced through the small bowel with alternately inflating and deflating the balloon(s). The balloons grip the walls of the small intestine and this brings the small bowel towards the endoscopist by pleating the small bowel over the overtube.

Data collection and statistics

Patient medical records, electronically searchable endoscopic records, and an established database of patients undergoing DAE procedures were reviewed. Data was collected retrospectively on patient characteristics, procedure characteristics, bowel preparation and safety. The primary outcome was technical success, defined as cecal intubation. Secondary outcomes were: proximal extent of examination, bowel preparation quality, endoscopic findings, interventions performed and adverse events. Descriptive statistics were calculated using Microsoft Excel 2016 (Microsoft, Redmond, Wash).

This study was performed in accordance with the Declaration of Helsinki and was approved by our local ethics committee (Sydney Local Health District, Research Ethics and Governance Office).

Results

Baseline characteristics

In total, 277 patients underwent retrograde DAE between November 2004 and May 2016. Of these, 86 procedures were performed on 82 patients (mean age 63.5 ± 13.9 years, 55% male) for the indication of prior incomplete colonoscopy. Patient characteristics are listed in Table 1. Procedure characteristics and results are listed in Table 2. The reasons for incomplete index colonoscopy were: redundant colon in 87% (n=71), angulation in 5% (n=4), adhesions in 5% (n=4) and stricture or obstructing mass in 4% (n=3). Five patients had undergone CTC prior to DAE. In two patients, CTC results (polyps) were confirmed at DAE. In another two cases, CTC findings were inaccurate: one had false positive findings (proximal colonic changes) and one had false negative findings (missed Crohn's colitis). In the fifth case, CTC was technically unsuccessful due to a large abdominal wall hernia impeding appropriate distension.

Characteristics	N (%)
Patients	82
Procedures performed	86
Repeat procedures	4
Mean age (SD)	63.5 years (+/- 13.9)
Gender Male Female	 45 (55) 37 (45)

Table 1: Patient characteristics.

Technical success and proximal extent of examination

The caecum was intubated in 80 out of 86 procedures (93%), and in 77 out of 82 patients (94%). Failed caecal intubation occurred in 6 procedures (7%), performed on 5 patients. The reasons for incomplete procedure were abandonment due to unsatisfactory preparation in 5 cases (6%) and difficult passage of the enteroscope due to herniation of the colon into a post-laparotomy incisional defect in 1 case (1%). The terminal ileum was intubated in 70 cases (81%), and more proximal small bowel was reached in 10 cases (12%). Four patients had repeat procedures; 3 due to inadequate bowel preparation and 1 for sequential stricture dilatation.

Bowel preparation

Information on bowel preparation was available for 41 cases. The bowel preparation was adequate in 29 (71%) patients and inadequate in 12 (29%) patients. Of the 6 cases in which technical success was not achieved and no diagnosis was made, 5 patients had inadequate bowel preparation (Table 2).

Characteristics	N (%)
Reason for incomplete colonoscopy	
Redundant colon	71 (86.6)
Tortuosity/sharp angulations	4 (4.9)
Adhesions	4 (4.9)
Stricture or obstructing mass	3 (3.7)
Bowel preparation	
Adequate	29 (34)
Inadequate	12 (14)
Unknown	45 (52)
No diagnosis made	8 (9.3)
Diagnosis made	65
Normal	20 (23.3)
Adenomateous polyps	25 (38.5)

Angioectasia	7 (10.8)
Diverticulosis	6 (9.2)
Crohn's disease	13 (20)
Eosinophilic enteritis	1 (1.5)
Strictures / IBD-related stricture	5 (7.7)/1 (1.5)
Adenocarcinoma	3 (4.6)
Laterally spreading tumour	3 (4.6)
Ileal ulcer	2 (3.1)
Interventions performed	64
Snare polypectomy	29
Endoscopic mucosal resection	3
Biopsy	17
Argon plasma coagulation	8
Dilatation	3
Hemoclip	4

Table 2: Procedure characteristics.

Diagnoses

In 8 out of 86 procedures (9%) no diagnosis could be made: 6 because of inability to intubate the caecum (80% due to inadequate bowel preparation) and 2 due to inadequate bowel preparation in a completed procedure. Twenty out of the remaining 78 procedures showed no abnormalities. In the remaining 58 procedures, 65 diagnoses were made, including: ≥ 1 adenomatous polyps (n=25), angioectasia (n=7), colonic diverticulosis (n=6), inflammatory bowel disease (n=14), strictures (n=5; 1 case related to IBD), latteraly spreading tumour (n=3), adenocarcinoma (n=3), and ileal ulcers (n=2).

Interventions

In total, 64 interventions were performed in 53 out of 86 procedures (62%). These included: snare polypectomy (n=26), endoscopic mucosal resection (n=3), biopsy (n=17), argon plasma coagulation (n=8), endoscopic clipping (n=4), and balloon dilatation (n=3). No significant adverse events were reported.

Discussion and conclusion

This study demonstrates a very high technical success rate of 93% for DAE in patients who had a failed conventional colonoscopy. Previous data showed that the success rate of repeat standard colonoscopy in expert's hands was only 72% [10]. This may suggest that the characteristics of the balloon overtube are well suited as a salvage method after previous failed colonoscopy for redundant colons [11]. As explained in the method section DAE uses a different technique compared to regular colonoscopy. DAE uses balloon(s) which are alternately inflated and deflated to pleat the bowel towards the endoscopist. Our study is the third largest published series to date on this subject, and the largest in the southern hemisphere. Our findings are comparable to previous studies, which report success rates for DBE between 87% and 100%, and SBE between 93% and 100% [12-31]. In Table 3 we summarize the available literature. This study was not designed to assess the different success rates between DBE and SBE, as all procedures were reported as DAE in our database.

Author	Modality	Type of study	Patients	Caecal intubation rate
Kaltenbach et al. [12]	DBE	Prospective	20	19 (95%)
Das et al. [13]	DBE	Small case series)	16	14 (87.5%)
Gay et al. [14]	DBE	Retrospective	29	28 (96.6%)
Monkemuller et al. [15]	DBE	Retrospective	7	7 (100%)
Pasha et al. [16]	DBE	Retrospective	16	14 (87.5%)
Moreels et al. [17]	DBE	Retrospective	26	23 (88.5%)
Moreels et al. [18]	DBE	Prospective	45	42 (93.3%)
Matsushita et al. [19]	DBE	Retrospective	24	24 (100%)
Dzeletovic et al. [20]	DBE	Retrospective	27	25 (92.6%)
Gomez et al. [21]	DBE	Retrospective	51	46 (90.2%)
Hotta et al. [22]	DBE	Prospective	110	110 (100%)
Suzuki et al. [23]	DBE	Prospective	47	47 (100%)
Yamada et al. [24]	DBE	Prospective	10	10 (100%)
Becx et al. [25]	DBE	Retrospective	114	101 (88.6%)
Nemoto et al. [26]	DBE	Prospective	28	28 (100%)

Yung et al. [27]	DBE	Retrospective	57	55 (96.5%)
Teshima et al. [28]	SBE	Prospective	23	22/23 (96%)
Keswani et al. [29]	SBE	Prospective	30	28/30 (93%)
Coppola et al. [30]	SBE	Prospective	79	74/79 (94%)
Yamada et al. [31]	SBE	Prospective	11	10/11 (91%)

Table 3: Summary of studies to date reporting caecal intubation rates using enteroscopy after failed colonoscopy.

In our study we showed a high rate of clinically significant diagnoses that were made after previous failed colonoscopy (73% of successful procedures). This highlights the importance of a complete colonoscopy. Despite its wide use, CTC fails to detect lesions with a diameter greater than 10 mm in 10-15% of patients [7]. Flat mucosal lesions, including sessile serrated polyps, are also frequently missed [8,32]. In a large Dutch cohort of 8,884 patients comparing colonoscopy with CTC it was demonstrated that colonoscopy detects a higher rate of high-risk sessile serrated polyps than CTC (3.1 *vs.* 0.4%) [8]. Given the importance of sessile serrated polyps as precursor lesions to colorectal adenocarcinoma alternatives for CTC should be considered [32].

Moreover, CTC cannot be used to perform intervention. In our cohort, almost two third of patients (62%) needed an intervention. Polypectomy was performed in 34% of cases, and beyond mitigating the risk of future colorectal adenocarcinoma, this enabled correct risk stratification and appropriate surveillance intervals. Radiological studies do not allow such interventions and 63% of patients undergoing CTC for failed colonoscopies require repeat colonoscopy [33].

Our data highlights the importance of optimal bowel preparation to gain a high technical and diagnostic success rate. Inadequate bowel preparation was the reason for failure to intubate the caecum in 5 out 6 cases. In addition, in the 2 patients in whom a diagnosis was not made despite cecal intubation the bowel preparation was inadequate. This shows the need for adequate bowel preparation.

Although our study is limited by a retrospective study design, no periprocedural adverse events were reported in our cohort. Furthermore, most procedures were performed under conscious sedation, highlighting the safety and tolerability of DAE for this indication. This is consistent with the literature. In 2014 Becx & Al-Toma reported only 2 minor adverse events (self-resolving, postprocedural bleeding) out of 114 DBE procedures [25]. Similarly, Hotta et al. reported only 1 case of asymptomatic mild mucosal tears, not requiring intervention, out of 110 DBE procedures [22].

A limitation of our study is the lack of an active comparison between DAE and other salvage option, such as CT colonography or repeat colonoscopy. Ultimately, to accurately compare these modalities a prospective trial would be required. Moreover, we present the data from experienced enteroscopists in a large-volume, academic center. Caution is therefore needed in extrapolating these success rates to daily practice as not all endoscopists are experienced in using DAE.

In conclusion, this study shows that retrograde DAE is a safe and effective salvage procedure after incomplete colonoscopy in redundant colons, with a high technical success rate in an expert center. It yields important findings, which may be expected to alter clinical management, and offers therapeutic potential. The main reason for failure of DAE in this setting seems to be inadequate bowel preparation. As such, we strongly feel DAE should be recommended after incomplete colonoscopy, rather than repeat standard colonoscopy or CT colonography.

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