Management of sigmoid volvulus using percutaneous endoscopic colostomy

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ABSTRACT

INTRODUCTION The aim of this systematic review was to appraise the current literature on the use of percutaneous endoscopic colostomy (PEC) as an alternative to major surgery and endoscopic decompression alone for treating sigmoid volvulus in frail, comorbid patients.

METHODS A systematic literature search of literature published between April 2000 and January 2017 was carried out using the MEDLINE®, Embase™ and CINAHL® (Cumulative Index to Nursing and Allied Health Literature) databases. The search terms were “percutaneous endoscopic colostomy”, “PEC”, “sigmoidopexy”, “sigmoidostomy” and “sigmoid volvulus”. The studies identified were screened and those that did not fulfil the inclusion criteria were excluded.

FINDINGS Seven observational studies and seven case reports (comprising eighty-one patients) were found to match our inclusion criteria. All patients had recurrent sigmoid volvulus and were treated with PEC either with a single PEC tube or with two PEC tubes inserted. Sigmoid volvulus recurred in 10 of the 81 patients; 3 of these individuals developed recurrence with PEC tubes in situ and 7 following tube removal. There were seven deaths after the procedure. The most frequent morbidity associated with PEC tube insertion was site infection ($n=6$).

CONCLUSIONS Our systematic review highlights the use of PEC as an alternative in managing recurrent sigmoid volvulus in frail, comorbid patients unfit for or refusing surgery, with the best outcomes seen in those patients where two PEC tubes were inserted and remained in situ indefinitely. Further studies are needed to improve the safety and efficacy of the procedure as well as post-procedure care.

KEYWORDS

Percutaneous endoscopic colostomy – Sigmoid volvulus

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Introduction

Volvulus is the third most common cause of acute large bowel obstruction.¹ In the Western world, it accounts for 3–5% of all bowel obstructions,² with sigmoid volvulus making up a large proportion (around 50–90%) of all colonic volvulus presentations. If untreated, it can result in ischaemia and perforation.^{3,4}

Worldwide, demographics vary, but in North America, Australia and Western Europe, patients present on average at the end of the sixth decade. These individuals frequently have multiple comorbidities, including cardiac, psychiatric and neurological disease.^{3,4} Predisposing factors include a long redundant loop of sigmoid colon with narrow mesentery,¹ chronic constipation^{2,5} and adhesions.⁴

Clinical presentation depends on how quickly torsion occurs, and typically consists of abdominal pain, distension and absolute constipation.⁵ Vomiting may also be present. Diagnosis is made following abdominal radiography showing large bowel dilation, often with an air–fluid level

and deflated colon distal to the point of volvulus. The characteristic ‘coffee bean’ sign is present in less than 60% of cases. If diagnosis remains uncertain, computed tomography (CT) would provide definitive evidence. CT has the added benefit of identifying incidental pathology and complications such as bowel ischaemia.^{4,6}

Management is targeted at the resolution of the volvulus and prevention of future recurrence. Initial treatment focuses on endoscopic decompression,¹ reducing the risk of acute perforation until large bowel resection can be performed electively if appropriate. It also allows time for patient comorbidities to be optimised, giving surgery the greatest chance of success. Recurrence rates vary from 40% to 90% with endoscopic decompression alone and the gold standard is therefore operative management (sigmoid resection with anastomoses),^{7–10} ideally within 48 hours of decompression.⁴

Emergency surgery is required in those presenting with complications of volvulus, including ischaemia, perforation,

peritonitis and shock.⁵ In these cases, Hartmann's procedure is most commonly performed, carrying morbidity and mortality rates of 42% and 20% respectively.⁶

One of the dilemmas surrounding sigmoid volvulus treatment is in managing the older, frail subset of patients. In this group, mortality from sigmoid volvulus increases above the age of 70 years largely owing to comorbidities.^{4,5} In the older cohort, elective resection has a mortality rate of 16–42%.^{3,4} This is less favourable than the 9% mortality rate for the same group with recurrent volvulus (without surgical resection). With 40–70% of older patients developing recurrence within two years and 60% of these recurrences being associated with tissue necrosis, it is vital that we develop more effective means of managing this condition in the geriatric population.⁴

Guidance published by the National Institute for Health and Clinical Excellence in 2006 suggests that PEC is an alternative to both major surgery, with its associated risks, and endoscopic decompression alone, where recurrence of sigmoid volvulus is high. The guidance states that 'the safety and efficacy of [PEC] appear adequate to support the use of this procedure in elderly and frail patients with recurrent sigmoid volvulus and colonic motility problems provided that the normal arrangements are in place for audit and clinical governance'.¹¹ Other indications for PEC include colonic pseudo-obstruction,¹² incontinence and refractory constipation.¹⁵ The advantage of PEC over conventional management is that it offers definitive treatment in the same way as resection without the inherent risk; it can be used in frail patients who are unfit for surgery or where there has been recurrence.¹¹

Currently, there is a limited body of published evidence looking at the efficacy of PEC for the management of sigmoid volvulus. This evidence mainly consists of case reports/series, which do not provide the strength of validity or the high quality methodology needed to practise evidence-based medicine.⁷ With this systematic review, we aim to build on the work carried out by Frank *et al*,¹⁰ by appraising the current literature on the use of PEC for treating sigmoid volvulus, particularly in those unfit for surgical intervention.

Methods

A systematic review of the literature published between April 2000 and January 2017 was carried out using the MEDLINE®, Embase™ and CINAHL® (Cumulative Index to Nursing and Allied Health Literature) databases. Search terms comprised "percutaneous endoscopic colostomy", "PEC", "sigmoidopexy" and "sigmoidostomy" in conjunction with "sigmoid volvulus". There were no limits with regard to language but all included studies were carried out between 2000 and 2017.

The initial search identified 50 potential studies. Each of these abstracts were examined and the search was further refined according to our inclusion/exclusion criteria. Four additional papers were identified using backwards chaining

although only two of these met our inclusion criteria (Fig 1).

Inclusion criteria:

- > Studies that used PEC as a treatment for sigmoid volvulus either once or on more than one occasion
- > Description of PEC as a single intervention or compared against the results of another intervention such as surgery
- > Abstracts in English (or translated)
- > Description of patient demographics including comorbidities and post-procedure complications.

Exclusion criteria:

- > If PEC was combined with other interventions such as colopexy, sigmoidostomy or sigmoidopexy
- > If PEC was used to treat any other form of bowel obstruction (eg pseudo-obstruction)
- > If it was impossible to differentiate the results of PEC in managing sigmoid volvulus from other conditions (eg refractory constipation)
- > Letters and abstracts were excluded if they had insufficient data for comparison.

Findings

Fourteen studies fulfilling our inclusion criteria were selected from the literature search. These comprised six retrospective studies^{1–5,9,15,14} and one prospective study (observational)⁷ as well as seven case reports,^{8,12,15–19} giving a total of eighty-one patients. All patients had been treated for sigmoid volvulus, either on their first presentation or following recurrence. They were managed conservatively owing to frailty/multiple comorbidities and/or patient preference with insertion of either one or two PEC tubes.

Patients had multiple comorbidities ranging from neurological to cardiac conditions, therefore making them unfit for major surgery. In some studies, frailty and anaesthetic risk were quantified using the American Society of Anesthesiologists (ASA) grade or World Health Organization (WHO) performance status score.^{1,5,7,15} In these studies, patients included had ASA grades/WHO scores of ≥ 3 .

Procedure: preparation and post-procedure care

The majority of the 14 included studies specified administration of intravenous antibiotics either prior to or during the procedure for their patients. Procedures were performed under conscious sedation and mainly used transillumination with indention^{1,7,9,12,15,15,17,19} to ensure correct placement of PEC tubes. Only Khan *et al* used fluoroscopy.⁵

Either one ($n=18$) or two ($n=61$) PEC tubes were inserted (Table 1). The decision to insert one tube rather than two was influenced by patient frailty and toleration of the procedure as well as technical difficulties. The type of device used varied from 14F to 22F percutaneous endoscopic gastrostomy tubes; only Cowlam *et al* used designated PEC tubes (12F) in some of their patients.¹⁵ In one study,

there were no data with regard to technique or device used.² The authors of all studies but one¹⁵ reported completion of a short course of antibiotics as part of post-procedure care and facilitation of prompt discharge once medically fit was included in three studies.^{9,12,15} One study performed post-procedure CT to check the position of the PEC tubes and 'ensure the absence of free gas beyond the tube insertion'.¹² The mean follow-up period varied from 7 weeks¹⁵ to 35 months.⁷

Post-procedure complications

Complication details were specified by the authors of all 14 studies apart from Tun *et al.*,¹⁹ where there were no details given. Although Cowlam *et al* listed their complications, they were expressed as a figure per 100 patient-months and it was therefore not possible to compare their data with the other studies.¹⁵ They described an incidence of faecal peritonitis in one of their patients with a history of

dementia after she pulled out the PEC tube as well as cases of granulation, buried bumper syndrome and infection. Daniels *et al* also reported one of their patients (who had learning difficulties) pulling out the PEC tube; that patient underwent sigmoid resection within 24 hours.⁹

Mortalities

Seven deaths (9.7%) were reported following the procedure (Table 2).^{2,7,14,15} One of these was secondary to peritonitis caused by faecal contamination after PEC tube migration; this was managed palliatively owing to patient frailty.⁷ Another death arose following perforation after colonoscopic detorsion of a recurrent volvulus that occurred with the PEC tube in situ.¹⁵ Ifverson and Kjaer felt that one of their patient's deaths could be attributed to not achieving colonoscopic derotation prior to PEC tube insertion.² For the remaining four deaths, the exact cause was not specified.

Table 1 Details of studies using PEC to treat recurrent sigmoid volvulus										
Author	Type of paper	Number of patients	Patient demographics	PEC method	Type of device used	PEC tube removal	Recurrence of volvulus	Follow-up duration	Morbidity	Mortality
Bruzzi, 2015 ¹	Retrospective study	6	Mean age: 90 years; median ASA grade: 4	2 tubes in 5 patients; single tube in 1 patient (owing to technical difficulties)	Not specified	Not specified	1 recurrence at 1 month following PEC removal (patient request)	Median 2 years	2 episodes of local infection at PEC site; 1 episode of abdominal wall bleeding; 1 episode of postoperative pain	Nil
Ifverson, 2014 ²	Retrospective study	2	Unfit for surgery	Not specified	Not specified	Remained in situ indefinitely	Not specified	Not specified	Nil	Both patients died (at 36 days and at 9 months). In the 1st patient, colonoscopic derotation was not achieved.
Khan, 2013 ³	Retrospective study	8	Median age: 88 years (5 male, 3 female); frail with multiple comorbidities; 6 patients had ASA grade 4; 2 patients had ASA grade 3	2 tubes	15F PEG tubes (Freka)	6/8 remained in situ, 2/8 removed	2 recurrences following removal of PEC tubes. In one patient, reinsertion attempt failed, sigmoid colectomy carried out – died 5 days later. The other patient required repeat PEC procedure.	Median 12 months	1 episode of localised peritonitis/leakage at PEC site; 1 episode of postoperative pain at PEC site	Nil
Baraza, 2007 ⁷	Prospective study	19	Mean age 79 years; ASA grade ≥3	2 tubes in 14 patients; single tube in 5 patients owing to frailty / technical difficulties	20F PEG tubes (Corflo)	6/19 removed between 5 and 26 months (patient request)	1 recurrence (the 2nd tube was resited – no issues)	Mean 35 months	1 buried bumper syndrome; 2 abdominal wall bleeds; 4 PEC site infections; 1 recurrence	1 episode of peritonitis (secondary to tube migration), managed conservatively

Chase, 2017 ⁸	Case report	1	68-year-old man; nursing home resident; unfit for surgery	Single tube	Not specified	Original tube migrated	Nil	9 months	Tube migration following accidental skin clip removal (passed spontaneously); colocutaneous fistula at PEC site	Nil
Daniels, 2000 ⁹	Retrospective study	14	Mean age: 78 years; unfit for surgery	2 tubes	14F PEG tubes (Freka)	8/14 removed at 6 weeks	3/8 recurrences (in patients where tubes removed early); no recurrences in patients where tubes remained in situ	Mean 12.6 months	1 tube pulled out within 24h (underwent sigmoid resection)	Nil
Al-Alawi, 2010 ¹²	Case report	1	93-year-old man; multiple comorbidities (incl atrial fibrillation, ischaemic heart disease, asthma); unfit for surgery	2 tubes	20F PEG tubes	Proximal tube removed at 20 months (owing to erosion from the skin), then replaced following recurrence	Yes – 6 months following removal of proximal PEC tube	24 months	Erosion of proximal tube from skin	Nil
Cowlam, 2007 ¹³	Retrospective study	8	Mean age: 80.4 years; mean WHO performance status: 3; median number of coexisting comorbidities: 2	Single tube	14F or 20F PEG tubes (Corflo), or 12F PEC tubes (Corflo)	3 tubes removed ;/ dislodged	Nil	Mean 8.8 months	1 episode of granulation, 1 episode of buried bumper syndrome and 7 infections per 100 patient-months	1 episode of faecal peritonitis (secondary to tube being pulled out) per 100 patient-months
Johns, 2009, abstract ¹⁴	Retrospective study	17	Median age: 82 years	2 tubes	Not specified	Not specified	Not specified	Not specified	Nil	3 deaths as a direct consequence of sigmoid volvulus and attempted treatment with PEC

Hammad, 2012, abstract ¹⁵	Case report	1	82-year-old man; multiple comorbidities including severe COPD (on home oxygen), hypertension; previous biliary pancreatitis – unfit for surgery	Single tube	Not specified	Removed after 8 months (patient request)	Nil	18 months	Nil	Nil
Molina- Infante, 2012 ¹⁶	Case report	1	83-year-old woman; dilated cardiomyopathy, nursing home resident, refused surgery	Single tube	22F PEG tube	Remained in situ indefinitely	Recurrence at 7 weeks	7 weeks	Nil	Recurrence – detorsion, then perforation; emergency laparotomy performed but patient died 24h later
Mullen, 2009 ¹⁷	Case report	1	87-year-old woman; bed bound and PEG fed with significant motor deficit following subarachnoid and intracerebral haemorrhage	2 tubes	16F PEG tubes (Corflo)	Remained in situ indefinitely	Nil	3 months	Nil	Nil
Toebosch, 2012 ¹⁸	Case report	1	73-year-old woman; previous breast cancer requiring resection for local recurrence; severe Parkinson's disease; refused surgery	Single tube	PEC tube (no specific details)	Remained in situ indefinitely	Yes – 2 years after PEC procedure (with PEC tube in situ)	2 years	Nil	Nil
Tun, 2016 ¹⁹	Case series	1	91-year-old man; unfit for surgery	2 tubes	20F PEG tubes	Not specified	Not specified	Not specified	Not specified	Not specified
ASA = American Society of Anesthesiologists; COPD = chronic obstructive pulmonary disease; PEC = percutaneous endoscopic colostomy; PEG = percutaneous endoscopic gastrostomy; WHO = World Health Organization										

Morbidities

Complications occurred in 18 patients (25.0%) (Table 2). The most common of these was an infection at the PEC site, arising in six cases (8.3%), in the studies by Bruzzi *et al* and Baraza *et al*.^{1,7} Baraza *et al* managed the infections successfully with antibiotics in almost all patients; only one required PEC tube removal and reinsertion.⁷ In addition, they reported one case of buried bumper syndrome and two patients with abdominal wall bleeding. Bruzzi *et al* also described one case of abdominal wall bleeding.¹ Localised peritonitis/leakage at the PEC site was another complication observed in one patient, by Khan *et al*, along with post-procedure pain in a second patient.⁵ A further case of post-procedure pain was noted in the study by Bruzzi *et al*.¹

Al-Alawi reported a case of a PEC tube eroding through the skin.¹² This occurred with the most proximal of the two PEC tubes inserted at 20 months after the PEC procedure. The tube was removed in clinic but required reinsertion after volvulus recurrence six months later. There was one other incident of PEC tube migration, reported by Chase *et al*, when the external skin clip was removed accidentally.⁸ Unlike the case reported by Baraza *et al*,⁷ however, the tube passed spontaneously with no complications.⁸ A new PEC tube was inserted adjacent to the site of the original colostomy during the same hospital admission.

Recurrence rates and removal

Ten of the eighty-one patients developed recurrent sigmoid volvulus following PEC tube insertion; this number includes cases where PEC tubes remained in situ and those in which they had been removed. Predictably, a larger number of patients experienced recurrence when one or both of the tube(s) had been removed ($n=7$)^{1,5,7,9} than when the tube(s) remained in situ ($n=3$).^{7,15,18} There were no data available on recurrence in 3 of the 14 studies, accounting for 20 patients.^{2,14,19}

In cases of PEC tube removal, either both^{5,15} or just one of the two tubes originally inserted were taken out.^{7,9} In these patients, one underwent sigmoid resection after the

tube was pulled out inadvertently by the patient within the first 24 hours.⁹ In another, the attempt at reinsertion failed, resulting in sigmoid colostomy; this patient died postoperatively.³ In some cases, another PEC tube was inserted successfully after removal of the first.¹ In the 20 cases where PEC tubes were removed, sigmoid volvulus recurred in 7 patients.^{1,5,7,9} In one case, the proximal of the two PEC tubes inserted was removed and this resulted in recurrence at six months.¹²

Discussion

The aim of this systematic review was to evaluate the use of PEC in treating recurrent sigmoid volvulus. Our findings, comprising 14 studies, highlight the potential use of PEC, as an alternative to major surgery or endoscopic decompression alone, for managing recurrent sigmoid volvulus in patients who are either unfit for or have refused surgical intervention. If PEC insertion is to be considered, the best outcomes are seen in patients where two PEC tubes remained in situ indefinitely.

Unsurprisingly, recurrence of sigmoid volvulus following PEC was found to be more common in patients who either had their PEC tube(s) removed or who had a single tube rather than two. This supports the theory that two-point fixation of the sigmoid to the anterior abdominal wall is more effective in preventing renewed twisting of the sigmoid on its mesentery than single point fixation, which can still allow axial rotation.³ Nevertheless, in some cases, it was impossible to insert two PEC tubes owing to technical difficulties or patient frailty.^{1,7} Three studies reported recurrences with a single PEC tube in situ.^{12,15,18}

Conversely, there were no recurrences in the majority of patients in whom PEC tubes had been removed either electively (by patient request) or because they had inadvertently been pulled out.^{7,15,16} The length of time that the tubes remained in situ prior to removal varied from 8 months¹⁶ to between 5 and 26 months in Baraza *et al*'s study.⁷

Table 2 Mortalities and morbidities (excluding the studies where mortality and morbidity was either not reported or comparable)

Mortalities		Morbidities	
Cause of death	Frequency (n=72)	Complication	Frequency (n=72)
Faecal peritonitis	1 (1.4%)	PEC site infection	6 (8.3%)
Perforation following detorsion after recurrence	1 (1.4%)	Abdominal wall bleeding	3 (4.2%)
Colonoscopic derotation of sigmoid colon not achieved prior to PEC tube insertion	1 (1.4%)	Postoperative pain	2 (2.8%)
Unspecified	4 (5.6%)	PEC tube migration	2 (2.8%)
		PEC tube pulled out	2 (2.8%)
		Localised peritonitis/leakage at PEC site	1 (1.4%)
		Buried bumper syndrome	1 (1.4%)
		Erosion of PEC tube through skin	1 (1.4%)
Total deaths	7 (9.7%)	Total morbidities	18 (25.0%)
PEC = percutaneous endoscopic colostomy			

At least 8 of the 20 PEC tubes were removed at the patients' request^{1,7,16} and we need to look at ways to reduce this. A simple measure would be to improve patient counselling prior to the procedure so that patients are more prepared for and better able to tolerate their PEC tube after insertion.

In some instances, PEC tubes were pulled out inadvertently; in one case, this was by a patient with learning difficulties⁹ and in another, by a patient with dementia.¹⁵ Chase *et al* reported one incident of the skin clip of the PEC tube in one of their patients being accidentally removed by a healthcare worker, resulting in dislodgement and migration of the tube.⁸ This suggests we need to improve patient/carer education in terms of managing the PEC in situ. Additionally, in patients with cognitive impairment, the PEC tube could be switched to a percutaneous endoscopic gastrostomy button or to a flat MIC-KEY tube, as in the case of five of Daniels *et al*'s patients,⁹ which would less easily be pulled out.

One of the most common morbidities associated with the procedure was PEC site infection despite the majority of studies administering intravenous antibiotics either prior to or during the procedure. Cowlam *et al* hypothesised that high infection rates in their patient cohort may have been a result of inadequate epithelialisation of the PEC tract.¹⁵ Simple site infections may be avoided with prolonged antibiotic courses following the procedure (ie 5 days rather than 24 hours). However, Baraza *et al* described one incidence of unresolving site infection necessitating removal and resiting of the PEC tube.⁷

Mortalities were largely secondary to peritonitis.^{7,13,15} One death followed after the PEC tube was pulled out,¹⁵ and two others followed detorsion and perforation after recurrence,¹⁵ and PEC tube migration.⁷ Two of these cases were managed conservatively.^{7,15} Sigmoid resection was carried out in the third but the patient died of cardiopulmonary failure postoperatively.¹⁵

Cowlam *et al* argued that the use of PEC long term 'was limited by the unacceptable morbidity caused by recurrent complications'.¹⁵ Nevertheless, this view should be considered in the context of other available options. These are constrained to either major surgery or conservative treatment with endoscopic decompression, which has recurrence rates of up to 90%.¹⁰ Surgical resection is often contraindicated owing to the nature of the patient demographics (ie individuals who are frail, often with multiple comorbidities). PEC offers a possible definitive and viable option for patients unfit for or refusing surgical intervention with lower recurrence rates than for decompression alone.

Two of the fourteen included studies compared surgical outcomes, morbidity and mortality with PEC data. Bruzzi *et al* compared surgery with PEC tube insertion.¹ Patients were selected for surgery if they had an ASA grade of <3. The overall morbidity rate (including major and minor complications) was 9%. There were no deaths among the surgical cases. This compared with three deaths (50%) among the PEC patients although these were all secondary to medical causes, reflecting the frailty of the cohort.

There were no major complications but 67% of PEC patients experienced minor complications.

Ifversen and Kjaer compared elective and semielective surgery with PEC insertion.² In their study, the two patients who underwent PEC died, one at 36 days and the other at 9 months. Both had been deemed unfit for surgery. Elective surgery had better outcomes than semielective surgery, with morbidity rates of 3% and 36% respectively. There were no deaths following elective surgery. This was in contrast to a 30-day mortality rate of 33% for the semielective cohort, with the majority of these having undergone Hartmann's procedure rather than primary anastomosis.

Limitations of this systematic review centre around the heterogeneous nature of the included studies. Two of the studies included both patients who had a single PEC tube inserted and those in whom two tubes were inserted.^{1,7} Furthermore, PEC was used not only to treat sigmoid volvulus but also conditions such as chronic pseudo-obstruction and refractory constipation. In addition, there was no consistency with regard to the length of time that the PEC tubes were in situ, both between studies and within the same study. This makes it difficult to correlate findings, particularly in determining a minimum time the PEC tubes need to remain in place for recurrence risk to be reduced. In some studies, details such as the follow-up period, exact cause of death and even length of time the PEC tube was in situ were not specified.

There are several potential areas of bias in the included studies, mainly centred around their variability. There is a wide variation in publication dates, from 2000 to 2017. During this period, there have been undeniable advances in surgical/interventional technique as well as diagnosis and post-procedure care, and this would have an impact on complication rates and patient outcomes. Another important point to note is that centres with greater experience in PEC are likely to have better outcomes. Finally, the review is limited by the small number of patients in the included studies. Much of the data remain unpublished and one hopes that the procedure will become more widespread with time, leading to a greater pool of data available for future studies.

Conclusions

Our systematic review, consisting of eight observational studies and six case reports, highlights the use of PEC as a potential option in managing recurrent sigmoid volvulus in frail, comorbid patients unfit for or refusing surgery. Best outcomes were seen in those patients where two PEC tubes were inserted and remained in situ indefinitely. However, concerns remain over the rate of serious complications reported, such as faecal peritonitis. The National Institute for Health and Clinical Excellence guidance published in 2006 clearly states that there need to be processes in place to continue auditing and evaluating the use/effectiveness of PEC in treating recurrent sigmoid volvulus. Further studies involving greater patient numbers will help improve the safety/efficacy of the procedure as well as refining the PEC technique and post-procedure care.

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