

# The Hidden Burden of Community Enteral Feeding on the Emergency Department

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## Abstract

**Background:** Enteral feeding tubes are associated with their most serious complications in the days and weeks after insertion, but there are limited published data in the literature on late complications and the implications for the healthcare service. **Methods:** This is a retrospective observational study of attendances to a UK hospital emergency department (ED), with enteral tube complications as the primary reason for attendance. **Results:** Over 24 months, 139 attendances were recorded. Dislodged tubes and blocked tubes accounted for the majority of complications and subsequent admissions, with a mixture of enteral tube types being associated with both. Thirty-five percent of patients were admitted, and the average healthcare cost per attendance was \$1071. **Conclusion:** Enteral tube complications can place a hidden burden on the patient, the ED, and healthcare costs. More work on education and supporting caregivers to resolve problems themselves could reduce the burden on busy EDs. (*JPEN J Parenter Enteral Nutr.* 2020;0:1–5)

## Keywords

blocked tube; costs; dislodge; enteral tube; gastrostomy; late complications

## Clinical Relevancy Statement

The clinical implications of our findings are that (1) complications from enteral tubes beyond the initial 30-day post-insertion period are common and can precipitate healthcare-seeking behaviors; (2) complication attendances place a morbidity, financial, and emergency department burden on patients, their families, and healthcare providers; and (3) strategies for prevention and the education of caregivers and healthcare providers could reduce this burden.

## Introduction

In 1979, the first percutaneous endoscopic gastrostomy (PEG) tube was placed,<sup>1</sup> sparking the beginning of a preference toward so-called minimally invasive enteral feeding tubes. G-tubes and jejunostomy tubes (J-tubes) have since become a reliable means of delivering clinically assisted nutrition and hydration (CANH) to patients. G-tubes and J-tubes describe the location of the tube tip, in the stomach or in the jejunum. They can be inserted in 1 of 3 ways: endoscopically, surgically, or radiologically. PEG tubes are the commonest type of G-tube. They enable the delivery of nutrients, minerals, and electrolytes required for daily energy needs, wound healing, growth, and tissue repair. Once inserted, some types of percutaneous enteral feeding tubes can last for years. A recent retrospective cohort of 277

patients found that at 5 years, 68.5% (n = 190) of PEG tubes remained intact.<sup>2</sup>

Before insertion of a gastrostomy tube, patients and their families would give informed consent for the procedure, including the risks of immediate or serious complications caused by insertion of the G-tubes themselves. These risks include migration of the tube, a misplaced tube, perforation,

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bleeding, peritonitis, infection, death, and future buried bumper syndrome. The most robust evidence of complications is centered around complications occurring in the first 30 days. A recent prospective, multicenter study of 950 patients, of whom 594 were having their first PEG, reported complications rates of 4.8% (n = 45) and mortality of 5.2% (n = 49). Of those complications identified, 50% (n = 22) were due to infection, 32.1% (n = 14) bleeding, 14.3% (n = 7) tube dislodgement, and 3.6% (n = 2) buried bumper.<sup>3</sup> Other large case series have found higher complication rates of 9.4% (n = 60). Serious complications that occur late, or are identified late, are represented in the literature in the form of case reports. This is due to their infrequency, often requiring a decade's worth of patients in order to study a cohort with a specific complication, such as buried bumper syndrome.<sup>5-7</sup>

Very little is documented in the literature about the nonendoscopic-related, and potentially less serious, complications that occur, particularly beyond the 30-day postinsertion period. Equally, there is little evidence on the impact of these late and less serious complications on the patient and healthcare system. This information is important, as it needs to form part of the risk-and-benefits discussion and frame the decision around placing a percutaneous tube. When complications do occur, enteral feeding, fluid, and medication cannot be administered until the issue is resolved. This may take many hours, or more, if an emergency department (ED) visit is needed. For those wholly dependent on a G-tube for all their CANH needs, this can lead to a presentation and potential admission to a secondary-care hospital setting. In addition, the much smaller number of studies on longer-term complications may focus on a specific tube type or a specific complication. They do not consider the broader impact on the patient and healthcare system, and thus they provide incomplete information. Indeed, a large prospective audit of 350 patients report high rates of longer-term complications and, at 1 year, noted that 38% (n = 133) of patients had experienced a site infection, with 70% (n = 245) of this group experiencing a subsequent infection, 5% (n = 18) having buried bumpers, and 7% (n = 25) with overgranulation,<sup>8</sup> but other complications are not considered.

The potential financial impact of PEG tube complications was highlighted in a retrospective analysis of 563 PEGs.<sup>9</sup> This study identified a 12.8% (n = 72) lifetime accidental dislodgement rate over 3 years, with most requiring ED visits totaling an average cost of \$1200.<sup>9</sup> Again, this focuses on 1 type of complication, and it is not known whether other complications trigger attendance and additional costs.

Here we investigate the hidden burden of community percutaneous enteral feeding tubes on a UK ED beyond the 30-day insertion time point. We focus on the less well-documented, late-presenting, and occurring complications and evaluating the impact on the patient and healthcare system.

## Method

### Setting

This retrospective observational study was undertaken in a single UK National Health Service (NHS) trust, an organizational unit within the NHS responsible for serving a geographical area and population of ~500,000. All invasive enteral feeding tube referrals are discussed in an enteral multidisciplinary team (MDT) setting, and the service is supported by 1.6 full-time-equivalent specialist nutrition nurses. Local G-tube policy dictates a first-choice brand (Freka<sup>®</sup> PEG are produced by Fresenius Kabi) and, in the cases of buried bumper, a switch to the second-choice brand (CORFLO<sup>®</sup> PEG tube is the registered trademark used by Avanos Medical Devices). Other types of tube are used on an individual basis with MDT input. All community patients are managed by a home service supplied by Nutricia<sup>™</sup>, with enteral tube troubleshooting advice available during standard working hours by Nutricia or the hospital enteral nutrition team.

All nonelective attendances pass through the ED as a single port of entry to the hospital from all referral sources. These referral sources include persons from outside the geographical area, as this particular NHS trust is a specialist center for ear, nose, and throat and maxillary facial surgery.

### Identification of Patients and Data Extraction

We undertook a retrospective review of attendances to the ED with G-tube and J-tube complications between June 2016 and May 2018. ED discharge coding was reviewed over a 24-month period to identify patients attending the ED with a G-tube or J-tube. Electronic medical records were then reviewed by an enteral nutrition nurse to determine if the primary reason for attendance was related to the enteral feeding tube. Data were subsequently extracted from the patient's electronic record. Results were reviewed and validated by another team member.

### Inclusion Criteria

Episodes of ED attendance of persons with a PEG tube, in which the primary reason for attendance was a problem with the enteral tube, were included in this study.

### Exclusion Criteria

Nasogastric tubes are excluded, as they pose a different nature of complication and risk compared with percutaneous feeding tubes. Patients attending who had a first enteral tube inserted within 30 days of the procedure were excluded, as this group has been well studied in large cohorts.

## Definitions

For the purposes of this study, standard working hours were defined according to enteral nutrition service availability as 8 am to 6 pm, Monday through Friday, and nonworking hours were defined as those between 6 pm and 8 am and all day on Saturday and Sunday.

## Tariffs

The UK clinical and procedural tariffs are used to calculate the healthcare costs. Total costs have been converted to US dollars for an international readership. The NHS in England introduced a payment-by-results system in 2004. In this system, a tariff is paid for each activity, for example, emergency admission, a procedure, or an operation. Standard diagnoses and clinical codes are used throughout England, using the World Health Organization International Classification of Diseases and OPCS-4 Classification of Interventions and Procedures codes, and linked to government set tariffs subject to regular review. Details of UK coding practices can be obtained through NHS Digital.<sup>10</sup>

## Results

A total 209 possible attendances for inclusion were identified from an initial search by discharge coding. Seventy patients were not analyzed because they did not meeting inclusion or meeting exclusion criteria. These 70 had enteral tubes in situ and were identified by NHS coding but were ineligible on review. Two patients had nasogastric tubes rather than percutaneous tubes, a small number were within 30 days of a tube insertion, and the remainder were not presenting with primary enteral tube complications.

In a 24-month period, 139 attendances were recorded. Demographic data are shown in Table 1.

The majority of enteral tubes prompting attendance were G-tubes, accounting for 69% of the 139 attendances. PEG tubes followed by surgical J-tubes and radiologically inserted G-tubes, were the most common method of insertion. As different tube types and different insertion methods may be linked to different complications, and necessitate different procedures to resolve them, they are presented by tube type and method of insertion prompting attendance in Table 2.

The main problem prompting ED attendance was a dislodged tube (42%), followed by a blocked tube (16%). The problems causing ED attendance are shown in Table 3. There were no cases of buried bumper syndrome in this case series.

Dislodged and blocked tubes represent the commonest causes for ED presentation, and the types of tubes associated with this are shown in Table 4.

Of those patients with dislodged tubes, 21 led to admission, and of those with blocked tubes, 13 led to admission,

**Table 1.** Demographic Characteristics of Patients Presenting to the ED Between June 2018 and May 2018.

Characteristic	Percentage
Gender	
Male	56
Female	44
Location	
Nursing home	36
Residential home	6
Another hospital	1
Own home	57
Presentation time	
Standard working hours	41
Nonstandard hours (evenings, overnight, and weekends)	59
Dependency of percutaneous tube for CANH	
Completely dependent	78
Fluids only	6
Nutrition only	1.5
Not dependent	14.5
Primary reason for percutaneous tube placement	
Head and neck cancer	36
Cerebral vascular accident	19
Neurological reasons	34
Other	11

CANH, clinically assisted nutrition and hydration.

**Table 2.** Location and Method of Insertion of Enteral Tubes Involved in Presentations to the ED.

Tube location	Method of insertion	Number of presentations to ED
Gastrostomy	PEG	46
	RIG	26
	Other BGT	24
	Low-profile device	8
Jejunostomy	PEG-J	8
	Radiological via BGT	7
	Surgical	28

BGT, balloon gastrostomy tube; J, jejunostomy; PEG, percutaneous endoscopic gastrostomy; RIG, radiologically inserted balloon gastrostomy.

accounting for 70% of the admissions. However, dislodged and blocked tubes account for 58% of complications.

Thirty-five percent of patients were admitted to the hospital for further management, all of whom were fully dependent on the G-tube for all medications and sustenance and two-thirds of whom presented outside routine working hours. Of these, 33% required radiological management and 8% required surgery, representing 14% of the total cohort

**Table 3.** Complication or Management Problem as the Cause of ED Presentation.

Problem	Percentage of presentations to ED (number)	Admitted (expressed as % admitted with individual complications) (total number)
Dislodged	42 (59)	35.6 (21)
Blocked	16 (22)	59.1 (13)
Infected	9 (12)	0 (0)
Leakage	10 (13)	38.5 (5)
Split tube	5 (7)	57.1 (4)
Pain	3 (4)	50 (2)
Bleed	3 (4)	50 (2)
Damaged tube	5 (7)	14.3 (1)
Other	7 (11)	9.1 (1)

**Table 4.** Blocked and Dislodged Tube Complications Categorized by Insertion Method.

Complication and tube-insertion method	Percentage
Blocked tube	
Gastrostomy	
PEG	16
RIG	24
Other BGT	24
Low-profile device	4
Jejunostomy	
PEG-J	6
Radiological via BGT	4
Surgical	26
Dislodged tube	
Gastrostomy	
PEG	22
RIG	17
Other BGT	9
Low-profile device	0
Jejunostomy	
PEG-J	26
Radiological via BGT	9
Surgical	17

BGT, balloon gastrostomy tube; J, jejunostomy; PEG, percutaneous endoscopic gastrostomy; RIG, radiologically inserted balloon gastrostomy.

requiring nonbedside management following admission. Forty percent of those attending who had come from their own home were admitted compared with 60% who had been in a professional nursing setting.

### Costs

The cost of 139 ED attendances with treatment, according to the NHS tariff, is \$37,097, and radiological procedures cost an additional \$26,435; inpatient surgical procedures,

\$10,691; and inpatient bed days, \$74,655. The total cost of this cohort to the healthcare system for managing these complications was \$148,876, the equivalent to \$74,438 per year and an average of \$1071 per attendance for a primary enteral tube complication.

### Discussion

Long-term percutaneous enteral tube complications are under reported in the literature, with an overrepresentation of PEG and radiologically inserted balloon gastrostomy insertion-related issues. This is demonstrated by a recently published systematic review and meta-analysis<sup>11</sup> identifying 344 studies in which the main conclusions drawn were around 30-day mortality, insertion-related complications, and skin infections.<sup>11</sup> Other studies have identified that so-called minor complications can occur, with lifetime risks of dislodgement<sup>9</sup> or a 1-year risk of infection,<sup>8</sup> but there is little information about what this means for the patient and the associated healthcare costs. This is the first study from the UK looking at the secondary care-level costs of these complications when they cannot be managed in the community. It is of interest that there is little cost difference per ED attendance and the similarly reporting US study ~10 years ago,<sup>9</sup> suggesting that this problem is persistent and potentially transcends healthcare systems, and simple solutions are not easily at hand. The European PEG guidelines<sup>12</sup> describe late complications as being potentially avoidable and exclusively dependent on the quality of tube management and aftercare. This is almost certainly too simplistic, and qualitative studies show that patients and families face a range of challenges and emotions adapting to and living with a feeding tube and with the associated condition necessitating its insertion.<sup>13–15</sup>

The cost of failing to prevent or deal with these complications in the community can be financial, as demonstrated here, but is manifested in bed days, procedural costs, and patient morbidity. In a resource-restricted environment, these hidden costs represent an unmeasured impact. Clearly, this study is limited by being a single-site study, but there are 152 NHS trusts in England alone, meaning the failure to address these apparently preventable issues could be costing the NHS >\$10 million a year.

The challenge for the healthcare profession and the patients, their families, and caregivers is how we improve the situation. Education and follow-up support programs, beyond what is currently available, are clearly required, as 65% of attendances did not require admission and were reassured or treated and directly discharged. Admissions were more likely to occur when specialist nutrition team support was not available outside of standard working hours.

We would propose these interventions could have 3 foci, firstly on preventing the issues from occurring in the first

place. This can be achieved by appropriately preparing and training patients and caregivers, thus optimizing care and tube management in the community setting. This needs to be done sensitively and with appreciation for the different patient and family narratives and lived experiences as they go through their journey.

Secondly, the focus would be on equipping our ED staff with the skills needed to manage complications without the need to resort to hospital admission if patients present outside of routine working hours. An alternative option would be to have personnel with experience in clinical nutrition and feeding tubes available to manage problems during nonstandard-hours shifts and weekends.

We need to test and demonstrate the efficacy of an education program and invest in appropriately supporting nutrition teams, patients, and caregivers.

The third area that requires attention is the requirement for more evidence on the prevalence and long-term rates of these types of complications to guide the setting of standards. This would help target reductions in community enteral tube complications and drive the improvement and standardization of care. Many of these patients will have complex medical and nursing needs, and it may be an unrealistic expectation and burden to suggest that all complications can be prevented. However, quality assurance and improvement has been highly effective in other areas of gastroenterology, such as endoscopy,<sup>16</sup> and enteral nutrition would be amenable to the same process of standard-driven care.

## Conclusions

Dislodged and blocked tubes were the 2 main complications identified in this study that precipitated ED attendance and accounted for the majority of the subsequent admissions. Patients are more likely to be admitted to the hospital from the ED outside of standard working hours. This study has shown percutaneous enteral tube complications that occur after 30 days, and lead to a presentation at the ED, place a significant financial burden on the healthcare system. Furthermore, over half of admissions were subsequently resolved at the bedside. Therefore, improved aftercare for patients and training for ED staff are targets for intervention to reduce patient morbidity and healthcare costs.

## Statement of Authorship

D. Barrett and H. Steed equally contributed to the conception and design of the research and analysis of the data; D. Barrett, H. Steed, V. Li, and S. Merrick contributed to the acquisition and interpretation of the data; A. Muruganathan

contributed to the interpretation of the data; and H. Steed drafted the manuscript and revisions. All authors critically revised the manuscript, agree to be fully accountable for ensuring the integrity and accuracy of the work, and read and approved the final manuscript.

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