

Primary placement of low-profile or 'button' versus traditional balloon-retention radiologically inserted gastrostomy catheters in adults: a retrospective review

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ABSTRACT

Objective De novo percutaneous placement of radiologically inserted low-profile or 'button-type' gastrostomy catheters (LPG) is infrequently reported in adults. This study compares the safety and clinical outcomes of primary percutaneous placement of LPG catheters and traditional balloon-retention gastrostomy catheters (TG) using image guidance at a single institution.

Design This was a retrospective, single-institution review comparing initial LPG and TG radiologically inserted catheter placements in a 36-month time period. The age, gender, indication, catheter type and method of anaesthesia of 139 consecutive initial gastrostomy placement procedures were recorded. Total catheter days without intervention, major and minor complications, reasons for reintervention, and procedure fluoroscopy times were compared.

Results During the 36-month study period, 61 LPG and 78 TG catheters were placed. Mean total catheter days prior to intervention was 137 days in the LPG group and 128 days in the TG group ($p=0.70$). Minor complications including cellulitis, pericatheter leakage and early catheter occlusion occurred in 4.9% (3/61) in the LPG group and 9% (7/78) in the TG group ($p=0.5$). Major complications including early catheter dislodgement and bleeding requiring transfusion (in one patient) occurred in 4.9% (3/61) in the LPG group and 7.7% (6/78) in the TG group ($p=0.4$). Procedure fluoroscopy time was lower in the LPG group (2.56 min) compared with the TG group (4.21 min) ($p<0.005$).

Conclusion Primary placement of low-profile or 'button-type' gastrostomy catheters is technically feasible with a low complication rate similar to that of traditional radiologically inserted gastrostomy catheters.

INTRODUCTION

Gastrostomy catheter placement is a commonly performed procedure, which provides an alternate access point for nutrition in patients at risk for or suffering from malnourishment.¹ First reported in the late 1800s, gastrostomy placement techniques and catheters have evolved over time.²

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Radiologically inserted low-profile or 'button-type' gastrostomy catheters, traditionally placed weeks after initial gastrostomy catheter placement to allow for tract maturation, are more convenient for some patients with an active lifestyle.

WHAT THIS STUDY ADDS

⇒ De novo placement of radiologically inserted low-profile gastrostomy catheters is feasible with comparable success rate and safety profile to traditional radiologically inserted balloon retention gastrostomy catheters.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ With an acceptably low complication rate, radiologically inserted low profile or 'button-type' gastrostomy catheters can be placed de novo and offered to patients referred for image-guided gastrostomy insertion.

Percutaneous endoscopic gastrostomy placement was first described in 1979, while percutaneously placed gastrostomy using radiologic guidance was described in 1981.³ Patients with percutaneous gastrostomy catheters frequently experience tube dislodgement, occlusion and leakage around the insertion site.^{2 4 5}

Low-profile gastrostomy (LPG) or button-type gastrostomy catheters are shorter in tube length, providing a less obtrusive alternative to traditional pigtail or balloon retention catheters.^{4 6 7} LPG placement was first described in patients with established gastrocutaneous tracts and is commonly performed in the paediatric population.^{4 6 8 9} LPG catheters are typically placed in patients with an active lifestyle, those at risk for frequent gastrostomy dislodgement or in patients dissatisfied with

**Table 1** Study population demographics and indication for gastrostomy insertion

	Traditional	Low profile
Total	78	61
Indication		
Malignancy	54	55
Neurological disorder	18	3
Dysphagia	3	0
Chronic respiratory failure	3	3
Age	66.8	68.0
Gender		
Male	73	59
Female	5	2
Anaesthesia		
Local w/ morphine	18	6
Moderate sedation	57	55
General anaesthesia	3	0

the traditional catheter's appearance.^{4,8,9} A waiting time of approximately 3 months for tract maturation prior to exchange of a traditional gastrostomy catheter for an LPG has been suggested.^{4,6,8}

A technique for de novo placement of radiologically inserted LPG catheter placement has been previously described.¹⁰ However, the safety and technical feasibility of LPG primary placement has not been compared with traditional balloon-retention catheters. The purpose of this study is to compare the technical feasibility and safety of primary placement of LPG catheters and traditional balloon retention gastrostomy catheters using radiologic guidance.

METHODS

Patient population

Internal review board approval was obtained to perform this retrospective review. During the 36-month study period, 139 patients (132 males, 7 females; mean age of 67.3) had successful percutaneous gastrostomy catheter placement in a tertiary Veterans Affairs hospital and were included in the study. Table 1 summarises the demographics of the study population and gastrostomy indications. An additional three pigtail gastrostomy catheters were placed, which were excluded from the analysis. Low profile or standard balloon retention gastrostomy catheters were placed at the discretion of the operator.

Patient characteristics including age, gender and procedure indication were recorded. Indication for gastrostomy placement was categorised as follows: malignancy (oesophageal carcinoma or carcinoma of the head or neck), neurological disorder (including stroke, dementia, Parkinson disease, amyotrophic lateral sclerosis or multiple sclerosis), respiratory failure or dysphagia (secondary to oesophageal stricture or other

benign structural abnormality of the oropharynx). Procedure details including type of catheter, tube size, catheter tract length, fluoroscopy time, use of gastropexy anchors and type of anaesthesia were also recorded.

Date and reason for reintervention were also recorded. Total catheter days prior to intervention or catheter removal were calculated if available. Finally, minor and major complications were recorded. Cellulitis, skin ulceration, leakage around the gastrostomy tube and tube clogging were considered minor complications. Major complications including hospital readmission for pain management, tube dislodgement within 30 days of placement, peritonitis, bowel perforation, gastric ulceration and bleeding requiring transfusion were considered major complications. Data were analysed using SPSS Statistics for Windows, V.27.0 (SPSS). T-test was used to evaluate for significant difference of the number of days without intervention and fluoroscopy time and χ^2 for evaluation for significant difference in major and minor complications.

Technique

All procedures were performed by four interventional radiologists with 2–12 years' experience placing gastrostomy tubes. Rotating radiology residents often participated in gastrostomy placement procedures. However, an attending interventional radiologist supervised all procedures. The type of tube placed was at the discretion of the performing physician. The gastrostomy placement technique used was as follows:

- ▶ Procedures were most often performed using conscious sedation with intravenous fentanyl and midazolam. However, some procedures were performed using a local anaesthetic with or without intravenous morphine. Few patients required general anaesthesia.
- ▶ If the patient did not have a nasogastric feeding tube in place, a 5-French angled catheter was advanced using fluoroscopic guidance via the left or right nares into the stomach. The nasogastric catheter was used to insufflate the stomach with room air.
- ▶ Two to four T-Fasteners (Halyard Health, Alpharetta, Georgia) were then placed to form a gastropexy. After accessing the stomach with an 18-gauge needle, a stiff guidewire is advanced into the stomach.
- ▶ A telescoping serial dilator (Halyard Health, Alpharetta, Georgia) is then advanced over the wire into the stomach in low-profile cases and serial dilators in balloon retention gastrostomy catheter cases.
- ▶ If an LPG is placed, an over-the-wire stoma-measuring device (Halyard Health, Alpharetta, Georgia) is advanced into the stomach through the dilated tract and used to measure the tract length.
- ▶ A peel-away sheath is then inserted over the wire to allow for insertion of the appropriate tract length LPG through the peel-away sheath. If a balloon retention gastrostomy catheter is placed, this tube is also

Table 2 Summarize complication rates and reason for re-intervention

	Traditional	Low profile	P value
Total catheter days before intervention	128	137	0.7
Minor complication rate	7	3	0.5
Cellulitis	1	2	
Clogged gastrostomy	4	1	
Leaking around gastrostomy	2	0	
Major complication rate	6	3	0.4
Dislodged within 30 days	5	3	
Bleeding requiring transfusion	1		
Reason for reintervention	4	1	
Clogged catheter	3	2	
Damaged or leaking catheter	10	12	
Dislodged catheter	16	20	
No longer required	3	2	
Convert to other type of tube			
Still in place at end of study period	12	10	
Fluoroscopy time	4.21 min	2.56 min	0.005
Death prior to any intervention	19	9	
Lost to follow-up	6	5	

advanced through the peel-away sheath into the stomach and retention balloon inflated.

- ▶ Gastric feeding (or oral feeding if possible) is resumed 6 hours after catheter placement. Patients are then contacted 3 weeks after gastrostomy placement. Any remaining T-tacks are then removed 3–4 weeks after catheter placement.

RESULTS

An LPG was inserted in 61 of the 139 patients, whereas traditional gastrostomy (retention balloon type or pigtail catheter) was placed in the remainder of the patients. Technical success rate for both methods was 100%. At the end of the study period (36 months), 10 LPG tubes and 12 traditional gastrostomy tubes were still in place. Nine patients in the low-profile group and 19 patients in the traditional group had died prior to any intervention. Five patients in the low-profile group and six in the traditional gastrostomy group were lost to follow-up.

The most common reason for reintervention across both groups was to remove the catheter, as it was no longer required: 20 in the low-profile group and 16 in the traditional gastrostomy group. Table 2 summarises procedure-related complications. Dislodgement of the catheter was the second most common indication for reintervention and occurred more frequently in the low-profile group (12) than the traditional gastrostomy group (10). Catheter occlusion was a more frequent complication in the traditional gastrostomy group than in the LPG group (8 vs 1). Reintervention due to catheter damage, leakage or conversion occurred more frequently within the traditional gastrostomy group. Overall, total catheter days before intervention averaged 137 days in the low-profile group and 128 days in the traditional gastrostomy

group. Prior studies report an average duration prior to reintervention of 96–105 days.^{6 10}

Complications were characterised as major or minor using the Society of Interventional Radiology recommendations but were not statistically significant in any group. Dislodgement of the catheter within 30 days of instalment was the most frequent complication across the two groups and occurred in three instances with the low-profile group and in five instances in the traditional gastrostomy group. In one instance, a traditional gastrostomy was placed and resulted in bleeding necessitating blood transfusion. Occlusion of the gastrostomy tube was the most common minor complication and occurred in four instances in the traditional gastrostomy group and in one instance in the low-profile group. Catheter leakage occurred in two instances in the traditional gastrostomy group. Soft tissue cellulitis occurred in two instances with the low-profile group and once in the traditional gastrostomy group.

DISCUSSION

Percutaneous radiologic gastrostomy tube placement has evolved over time. Balloon retention catheters have largely supplanted Foley catheters and pigtail catheters as they are less predisposed to peritubal leakage and dislodgement.^{4 7 11} Low profile balloon gastrostomy catheters, though initially intended for mature tracts, have been safely inserted de novo in the adult population.^{4 8} LPG catheters are shorter in length and thus less prone to clogging.^{4 12} Patients and their caregivers also find them more cosmetically appealing and less prone to dislodgement.⁷



In our institution, we employ the push method of gastrostomy placement with the use of gastropexy anchors. The alternative pull method has been reported to be superior in outcome and complication rate but has not been used with low-profile catheters.¹³ There are several established advantages to the use of gastropexy anchors including facilitation of rapid maturation of the gastrostomy tract, which can be dilated to accommodate a larger-sized catheter. A mature tract also simplifies gastrostomy catheter replacement if the catheter is inadvertently removed. An additional advantage is the decreased risk of intraperitoneal placement of the gastrostomy catheter and procedure-related peritonitis.^{5 10}

Gastrostomy placement at our institution is a shared service line—the Interventional Radiology Department performs the majority of procedures in patients who suffer from head and neck malignancies whereas the Gastroenterology Department performs the majority of procedures in patients with neurological conditions requiring supplemental feeding. Patients who suffer from head, neck or oesophageal cancer may have obstructive lesions or may have radiation mucositis related to treatment making advancement of an endoscope technically challenging.¹⁴ Additionally, there is a theoretical risk of implant metastasis with use of a pull or endoscopic methods in this patient population.^{15 16} The next most commonly encountered group of patients who require gastrostomy catheter includes those who suffer from neurological conditions such as amyotrophic lateral sclerosis, Parkinson disease, advanced dementia and patients who have impaired swallow function due to stroke. Less common indications include dysphagia not associated with radiation therapy and those patients on chronic ventilator support, both of which place patients at risk for malnutrition. Other indications, such as for decompression for patients with gastric outlet or small bowel obstruction, are less frequently encountered. Overall, the variety of indications are similar to that documented in other studies.

We found the low-profile group to have a similar safety profile when compared with the traditional group, as has been reported previously.⁴ No fatalities were recorded during our study period. The most common major complication across both groups was tube dislodgement within 30 days. Within the traditional gastrostomy group, this was most commonly attributed to inadvertent traction and removal whereas with low profile catheters, it has been previously reported and attributed to rupture of the retention balloon due to overdistention or from erosion of the balloon by gastric enzymes.¹⁰ Tube leaking and clogging occurred more frequently within the traditional gastrostomy group. Tube dislodgement, clogging and pericatheter leakage were the most frequently reported complications with traditional gastrostomy catheters within our study as has been reported in other studies.^{4 7 13} One episode of major bleeding within the traditional gastrostomy group resulted in escalation of medical care and the need for blood transfusion. This likely resulted

from vascular injury by needle puncture(s), in a patient who may or may not have suffered from gastropathy, a relative contraindication. Bleeding ceased without additional intervention such as angiography or embolisation. We do routinely and safely perform many gastrostomy catheter placements in patients with impaired swallowing due to cerebrovascular accident and are on dual antiplatelet therapy.

Furthermore, the LPG catheter shared a similar sustainability profile when compared with the traditional catheters: 137 days vs 128 days. Many patients continued to use the gastrostomy catheters without need for reintervention at the end of the study period. The most common reason for reintervention across both groups was removal of the catheter as it was no longer required. Catheter removal was considered in patients with improved swallowing function who were able to maintain weight with oral feeding without need for supplemental feeding via the gastrostomy catheter. The second most common indication for reintervention was catheter dislodgement necessitating catheter replacement, the most common major complication in our study.

Interestingly, our results found that the LPG catheter placement was associated with a statistically lower ($p \leq 0.005$) fluoroscopy time (2.56 vs 4.21) despite the added step of stoma measurement. This is not to say that one method is superior to another but most likely reflects practice variations among our IR providers as two of them predominantly place the low-profile catheters while the other two predominantly place the traditional gastrostomy catheters. In addition, the LPG kit includes a telescoping dilator as opposed to serial dilators typically used in traditional gastrostomy placement. This may have impacted the procedure fluoroscopy time.

The patient population at our institution instils an inherent selection bias within our study thus this data may be less generalisable to patient populations at other institutions. The majority of our patients are male, have a medical history of tobacco abuse and suffer from malignancy of the head and neck. In addition, radiologically inserted gastrostomy catheter placement is preferred over endoscopically placed gastrostomies in certain scenarios frequently encountered at our institution, such as head and neck malignancy. For example, this differs from the patient population at a county trauma centre where the majority of patients requiring a gastrostomy centre may suffer from post-traumatic neurological conditions. Additionally, ambulatory patients, some of whom may suffer from head and neck malignancies, may be less prone to inadvertently removing their gastrostomy catheters when compared with delirious patients. A small number of patients were lost to follow-up as well.

It should be mentioned that longer sustainability of the low-profile catheters is beneficial to the patient as it results in fewer trips to the hospital for gastrostomy-related catheters and overall results in decreased cost to the healthcare system. The appearance of the low-profile catheters is often preferred over the traditional type by

patients and caretakers.^{6 8} Additionally, LPG catheters can easily be exchanged at the bedside or in the office without the use of angiography suite thus avoiding additional healthcare costs.^{3 8 10}

Transabdominal primary placement of LPG catheters with the aid of gastropexy is technically feasible with comparable clinical outcomes and safety profile when compared with the placement of traditional balloon retention gastrostomy catheters. As such, it can be offered to patients in need of enteric access, particularly those who are ambulatory, some of whom may suffer from head and neck malignancies.

Contributors ZM was involved in study design. IB was involved in data collection. IB and HA-B were involved in data analysis. IB, DS and HA-B were involved in manuscript draft. HA-B and ZM were involved in the final draft. HA-B is the guarantor and responsible for overall content.

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Patient consent for publication Not applicable.

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Data availability statement No data are available.

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