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The occlusion balloon reduction technique for de novo placement and salvage of malpositioned enteric tubes

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Abstract

Purpose Nasoenteric, gastrojejunostomy, and jejunostomy tubes are methods of enteral nutrition in patients with functioning gastrointestinal tracts who cannot maintain adequate oral intake. Current placements; however, may be complicated by redundant wire and catheter loops within the stomach preventing operators from optimal feeding tube placement and predisposing patients to feeding tube prolapse. This report describes the occlusion balloon reduction technique for salvage of malpositioned tubes and placement of new enteric tubes in the setting of redundant loops.

Materials and Methods Five patients underwent the occlusion balloon reduction technique for jejunostomy ($n=3$), gastrojejunostomy ($n=1$), or nasojejunal tube placement ($n=1$). All patients ($n=5$) had redundant wires coiled within the stomach. In all patients ($n=5$), a 9-French × 32 mm × 120 cm Coda balloon was inserted over the wire and passed into the small bowel. The balloon was inflated after which reduction of redundancy in the upper gastrointestinal tract was performed. Feeding tubes were then placed with tips in the distal jejunum. Technical success of the occlusion balloon reduction technique, successful placement of enteric tube, complications, and follow-up were recorded.

Results The occlusion balloon reduction was technically successful in all patients ($n=5$). Feeding tube placement was successful in all patients ($n=5$). No minor or major complication occurred. Mean follow-up was 56 days.

Conclusion The occlusion balloon reduction technique provides a method for reduction of redundant wire and catheter loops within the stomach during enteric tube placement or repositioning.

Keywords Occlusion balloon reduction · Redundant wire and catheter · Prolapse · Nasojejunal · Gastrojejunostomy · Jejunostomy · Enteric tube · Feeding tube

Introduction

Enteral feeding is a method of nutritional support in patients who have a functioning gastrointestinal tract, but who are unable to maintain adequate oral intake [1, 2]. Post-pyloric feeding, one method of enteral nutrition, reduces the likelihood of aspiration and vomiting caused by gastroesophageal reflux, especially when intrajejunal feeding, rather than intraduodenal, is performed [3].

Access routes for post-pyloric feeding include nasoenteric (nasoduodenal and nasojejunal) tubes, gastrojejunostomy, and jejunostomy [4]. Novel techniques for gastrojejunostomy and jejunostomy placement, such as the transnasal snare technique for retrograde percutaneous jejunostomy, have improved targeting of the jejunum, procedural outcomes, and patient safety [4].

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A major technical handicap associated with nasoenteric tube, gastrojejunostomy, and jejunostomy placement is formation of redundant wire and catheter loops within the stomach preventing operators from optimal feeding tube placement and predisposing patients to enteric tube prolapse [3, 5, 6]. Enteric tube prolapse may predispose patients to additional procedures and gastrointestinal perforation [7, 8].

The aim of this technical innovation is to describe the occlusion balloon reduction technique for salvage of malpositioned enteric tubes and placement of new enteric tubes. This technique allows for reduction of redundant wire and catheter loops within the stomach and small bowel allowing optimal intrajejunal feeding and reducing enteric tube prolapse.

Materials and methods

Patient selection

This study was conducted with Institutional Review Board approval and complied with the Health Insurance Portability and Accountability Act.

Patient demographics and procedures are shown in Table 1. Patients included three (60%) females and two (40%) males who underwent reduction of redundant wire or catheter loops within the stomach using the occlusion balloon reduction technique for jejunostomy ($n=3$), gastrojejunostomy ($n=1$), or nasojejunal tube placement ($n=1$). Technical success of the occlusion balloon reduction technique, successful placement of enteric tube, complications, and follow-up were recorded.

Occlusion balloon reduction technique (Figs. 1 and 2)

All procedures were performed under general anesthesia ($n=4$) or monitored anesthesia care ($n=1$) administered by an attending anesthesiologist. All procedures were performed by an attending interventional radiologist.

In all cases, patients were brought to the angiography suite and placed in supine position. After induction of general anesthesia or monitored anesthesia care, cannulation of an existing prolapsed feeding tube ($n=2$) or placement of a transnasal 5-French 100-cm Glidecath (Terumo Interventional Systems; Tokyo, Japan) and Glidewire (Terumo Interventional Systems) ($n=3$) was performed. All patients ($n=5$) had or developed redundant wire or catheter loops within the stomach.

In order to reduce redundant wire or catheter loops within the stomach, a 9-French × 32 mm × 120 cm Coda balloon catheter (Cook Medical; Bloomington, IN) was inserted over an Amplatz Super Stiff guidewire (Boston Scientific; Marlborough, MA) and passed into the small bowel. The balloon was inflated and gentle traction was provided to reduce wire redundancy throughout the stomach, allowing a direct pathway to the jejunum.

Over the Amplatz Super Stiff guidewire, the enteric tube was then placed with tip in the distal jejunum.

Variables and outcomes

Technical success of the occlusion balloon reduction technique was defined as successful reduction of redundant wire or catheter loops within the stomach. Successful placement of enteric tube was defined as placement of the enteric tube tip within the jejunum without redundant loops of wire or tube within the stomach. Complications were assessed according to the *Society of Interventional Radiology* Guidelines. Follow-up was recorded in days.

Results

The occlusion balloon reduction was technically successful in all patients ($n=5$). Feeding tube placement was successful in all patients ($n=5$). No minor or major complication occurred. Mean follow-up was 56 days (range 16–156 days).

Table 1 Patient and procedure characteristics

	Age (years)	Sex	Technically successful coda balloon reduction	Type of enteric tube placed	Complications	Follow-up (days)
	27	Male	Yes	Gastrojejunostomy	None	38
	18	Female	Yes	Nasojejunal	None	16
	87	Male	Yes	Jejunostomy	None	37
	75	Female	Yes	Jejunostomy	None	32
	73	Female	Yes	Jejunostomy	None	156
Mean (range)	56 (18–87)					56 (16–156)

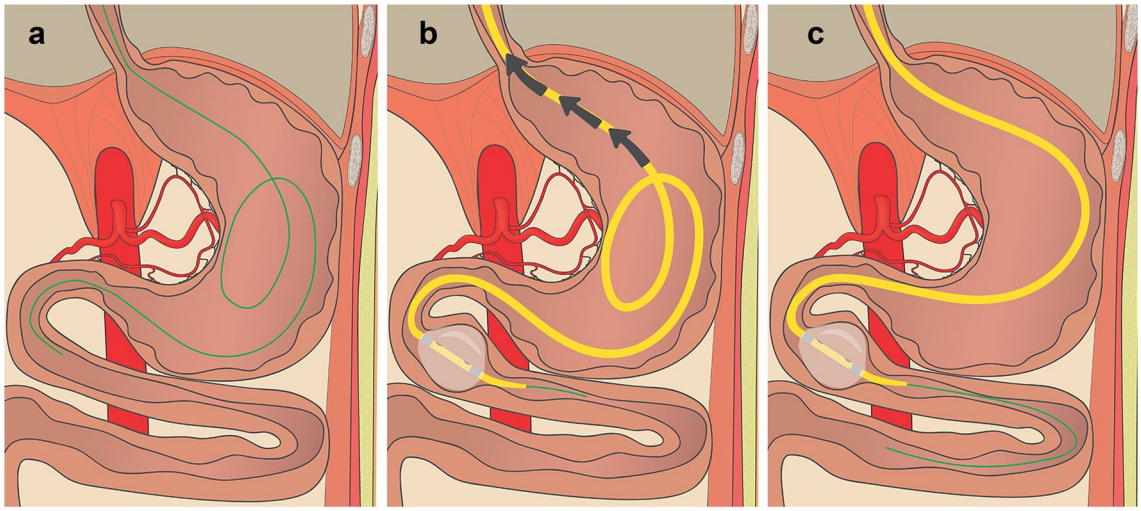

Fig. 1 *Schematic Diagram of Occlusion Balloon (Coda Balloon) Reduction Technique*. **a** Redundant wire loops are noted within the stomach. **b** A 9-French, 32 mm Coda balloon is advanced over an Amplatz Super Stiff wire into the small bowel and subsequently inflated. Gentle traction is placed on the inflated Coda balloon which is pinned in the small bowel to begin reduction of the loop. **c** Reduction of the previously redundant wire loops is noted

Patients 1, 2, and 3 (Fig. 1)

Three (60%) patients underwent retrograde jejunostomy placement. During these procedures, transnasal cannulation of the stomach and duodenum was performed using a 5-French 100-cm Glidecath and Glidewire (Terumo). All patients ($n = 3$), developed redundant wire or catheter loops within the stomach.

In order to reduce redundant wire or catheter loops within the stomach, a 9-French × 32 mm × 120 cm Coda balloon was inserted over an Amplatz Super Stiff guidewire and passed into the small bowel. The balloon was inflated and gentle traction reduced all wire and catheter redundancy. Following the occlusion balloon reduction technique, all three patients were able to have successful retrograde jejunostomy placements.

Patient 4 (Fig. 1)

One (20%) patient underwent nasojejunal tube replacement due to partial prolapse into the stomach. During the procedure, an Amplatz Super Stiff guidewire was introduced through the existing nasojejunal tube and advanced into the proximal duodenum.

In order to reduce redundant wire or catheter loops within the stomach, a 9-French × 32 mm × 120 cm Coda balloon was inserted over an Amplatz Super Stiff guidewire and passed into the small bowel. The balloon was inflated and gentle traction reduced all wire and catheter redundancy. Following the occlusion balloon reduction technique, the nasojejunal tube was successfully replaced.

Patient 5 (Fig. 2)

One (20%) patient underwent gastrojejunostomy replacement due to partial prolapse into the stomach with redundancy in the small bowel. During the procedure, an Amplatz Super Stiff guidewire was introduced through the existing gastrojejunostomy tube and advanced into the proximal duodenum.

In order to reduce redundant wire and catheter loops within the small bowel, a 9-French × 32 mm × 120 cm Coda balloon was inserted over an Amplatz Super Stiff guidewire and passed into the small bowel. The balloon was inflated and gentle traction reduced all wire and catheter redundancy. Following the occlusion balloon reduction technique, the gastrojejunostomy was successfully replaced.

Discussion

The Coda balloon catheter is traditionally used for the temporary occlusion of large blood vessels or expansion of vascular prostheses such as thoracic or abdominal aortic aneurysm endografts [9–11]. The Coda balloon catheter consists of a semi-compliant, polyurethane balloon whose flexibility and shape allow adaptation to anatomical regions of frequent diameter change [9–11]. Moreover, the Coda balloon catheter has been associated with a low risk of inflation-associated trauma.

This technical innovation describes the occlusion balloon reduction technique to facilitate placement and replacement of enteric tubes. A technical limitation associated with

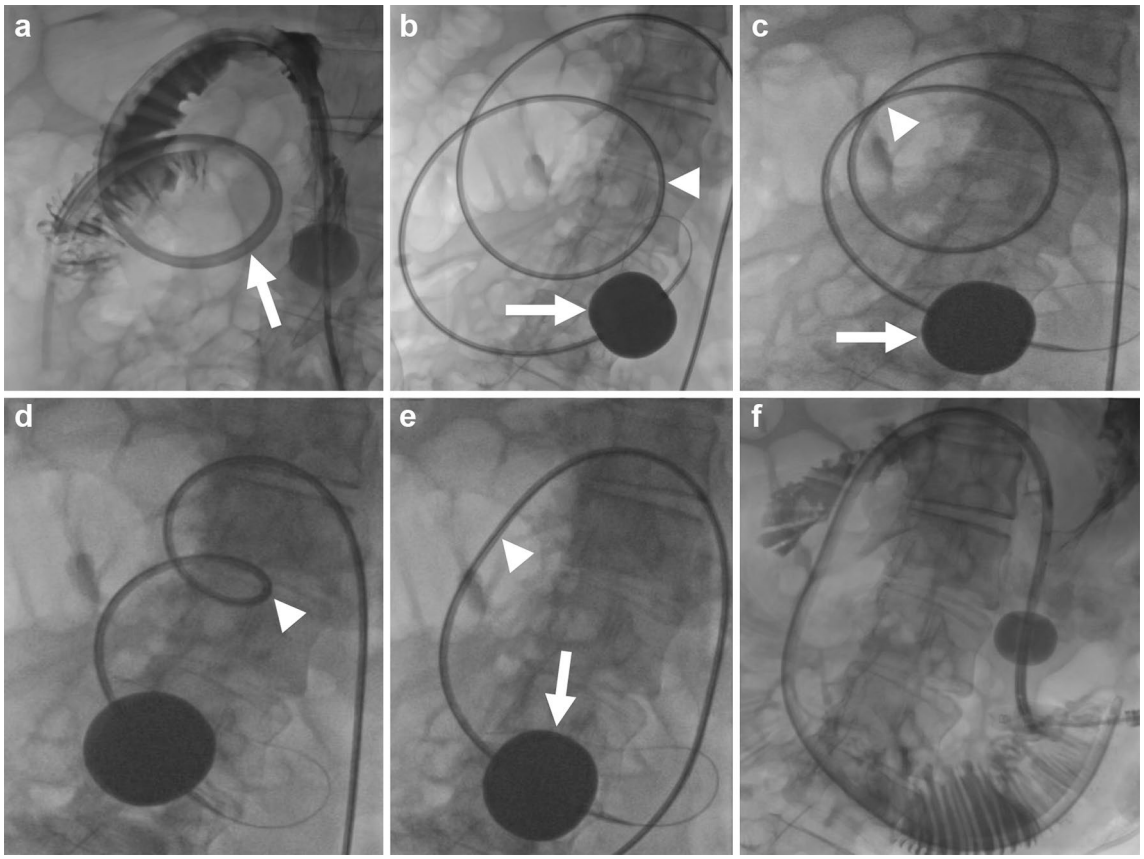

Fig. 2 *Occlusion Balloon (Coda Balloon) Reduction Technique.* **a** A gastrojejunostomy tube is visualized with a redundant loop noted within the small bowel (white arrow), which resulted in frequent tube dysfunction. **b** A 9-French, 32 mm Coda balloon (white arrow) was advanced over an Amplatz Super Stiff wire into the small bowel and subsequently inflated. The redundant loop is noted to be slightly larger (white arrowhead). **c** Gentle traction was placed on the inflated Coda balloon (white arrow), which was essentially pinned in the small bowel to begin reduction of the loop (white arrowhead). **d** Contraction of the size of the redundant loop is noted (white arrowhead) with only mild proximal slippage of the occlusion balloon. **e** Complete reduction of the redundancy was achieved (white arrowhead) with the inflated Coda balloon (white arrow). **f** Ultimately, a new gastrojejunostomy tube was placed with no unwanted looping

nasoenteric, gastrojejunostomy, and jejunostomy tubes is redundant wire and catheter loops within the stomach preventing operators from optimal enteric tube placement and predisposing patients to enteric tube prolapse [3, 5, 6]. Enteric tube prolapse may predispose patients to additional procedures and possible gastrointestinal perforation [7, 8].

The authors acknowledge that lower cost smaller occlusion or Fogarty balloons may also be used; however, this technique relies on the balloon getting caught distal to the area of loop redundancy. In the setting of gastrojejunostomy, where there is a redundant loop in the stomach, smaller occlusion balloons such as the 6-French × 8.5 mm-11.5 mm × 80 cm Berenstein Occlusion Balloon (Boston Scientific; Marlborough, MA) may be used as the balloon will get caught at the pylorus. If looping is distal to the pylorus, a larger occlusion balloon such as the Coda balloon, may prove necessary to achieve successful reduction. This innovation demonstrates that the occlusion balloon reduction technique is technically feasible, may reduce redundant catheter loops and wires, and facilitates successful enteric tube placement, including jejunostomy, gastrojejunostomy, and nasojejunal tube placements.

There are several limitations to this report. Procedures were performed at a single institution and the sample size consisted of only five patients undergoing occlusion balloon reduction. Moreover, all procedures were performed by two operators which may limit generalization to other operators familiar with these techniques.

Conclusion

The occlusion balloon reduction technique provides a method for reduction of redundant wire and catheter loops within the stomach during nasoenteric tube, gastrojejunostomy, and jejunostomy placements.

Authors contribution All authors have read and contributed to this manuscript.

Compliance with ethical standards

Conflict of interest Authors have no relevant disclosures.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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