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Review article

Endoclips for fixation of nasoenteral feeding tubes: A review

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ABSTRACT

Background: Maintaining the position of an endoscopically placed nasoenteral feeding tube beyond the pylorus is often problematic because of retrograde migration. Fixation of a feeding tube to the small intestinal wall with an endoclip may prevent this. This article reviews available literature on the feasibility, efficacy and safety of endoclips for fixation of nasoenteral feeding tubes.
Methods: A systematic search of the English literature was performed using MEDLINE, EMBASE and Cochrane databases to identify articles assessing the use of endoclips for fixation of feeding tubes, as well as articles assessing duration of attachment of endoclips.
Results: Five cohort series were identified that evaluated the applicability of endoclips for fixation of feeding tubes to the small intestinal wall. In all patients, except one, a nasoenteral feeding tube could be successfully fixated to the small intestinal wall. During follow-up, no spontaneous migrations of feeding tubes were observed. No complications related to placement or removal of endoclips were observed. Three comparative studies evaluated duration of attachment of different types of endoclips to the gastrointestinal wall. Duration of attachment ranged from less than 1 week to more than 18 weeks, depending on the type of endoclip.
Conclusions: Based on available literature the use of endoclips for fixation of nasoenteral feeding tubes is feasible, effective and safe. Data from randomized controlled trials are needed.

1. Introduction

Adequate nutritional support plays an important role in the treatment of hospitalized patients. It has been well established that enteral nutrition has beneficial effects over parenteral nutrition in patients with a functioning gastrointestinal tract [1,2]. However, a number of medical conditions, such as gastroparesis, gastric outlet obstruction and proximal enteral fistula are associated with intolerance to gastric feeding [3]. In these cases, postpyloric enteral feeding can be considered. When the anticipated length of assisted feeding is ≤6 weeks, placement of a nasoenteral feeding tube is often the choice [4,5]. Nasoenteral feeding tubes can be placed using bedside, fluoroscopic or endoscopic techniques. Bedside techniques for placing standard nasoenteral feeding tubes are unreliable (success rate of 7%), but success rates have been reported to improve when using Bengmark tubes (69%) [6]. Fluoroscopic placement of nasoenteral feeding tubes has a higher success rate (95%) but transportation of ICU (intensive care unit) patients to the radiology department for tube placement is a major limitation [7]. Endoscopic placement ensures placement of a feeding tube under direct vision and can be performed at the bedside [8,9]. In comparison to the traditional transoral endoscopic method, the transnasal technique is equally effective, but less time consuming [10]. The procedure time of transnasal endoscopy, which has now almost completely replaced the transoral method, is also significantly shorter than fluoroscopic feeding tube placement [11].

Maintaining the position of an endoscopically placed feeding tube may be problematic due to retrograde migration of the tube during withdrawal of the endoscope. Moreover, spontaneous migration of the distal tip of an initially correctly placed feeding tube into the stomach or into the oesophagus frequently occurs. Only a few studies have evaluated the incidence of nasoenteral feeding tube migrations. In a recent study in 201 critically ill adult patients, the incidence of migration of feeding tubes was evaluated. The position of the feeding tube was confirmed by radiologic imaging. Of the 116 feeding tubes that were initially placed in the duodenum or jejunum, a total of 24 (21%) had migrated proximally into the stomach or oesophagus within 3 days after placement [12]. In another study, 42 patients underwent endoscopic placement of a nasojejunal feeding tube. It was found that feeding tube migration occurred in 10% of patients [13]. Others reported feeding tube migration or dislodgement rates ranging from 16% to 36% [14–16].

Fixation of a feeding tube to the mucosa of the small intestine with an endoclip may prevent migration into the stomach or into the oesophagus. An endoclip is a metallic mechanical device for approximation of tissues during gastrointestinal endoscopy [17].

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Endoclips were originally developed for achieving hemostasis in focal gastrointestinal bleeding [18]. Over the last few years, the therapeutic use of endoclips has however expanded. Currently, endoclips are also used for closure of fistulas, anastomotic leaks and perforations [19–23], as identification of anatomic landmarks for radiologic imaging, radiotherapy or surgery [24,25] and for fixation of stents and catheters to the gastrointestinal wall [26,27].

This article reviews available data on the feasability, efficacy and safety of the use of endoclips for fixation of nasoenteral feeding tubes.

2. Methods

A systematic search of the English literature was performed using MEDLINE (1950 to July 2009) and EMBASE (1980 to July 2009) databases and the Cochrane Central Register of Controlled Trials (The Cochrane Library, until issue 2, 2009). Databases were searched using the search terms "endoscopic" and ("clip" or "hemoclip" or "endoclip"). The search was limited to original articles and full-text available articles. Titles and abstracts of retrieved articles were assessed for relevance. Articles that evaluated the use of endoclips for fixation of nasoenteral feeding tubes were selected for inclusion. Additionally, articles evaluating duration of attachment of endoclips were included. References of selected articles were reviewed manually for relevant articles that were not covered by the electronical search.

3. Results

Several types of clip-application devices are commercially available, both non-disposable (HX-3L and HX-5L (Olympus, Tokyo, Japan)) and disposable. Current disposable types of clip-application devices have different features; some have the ability to rotate (QuickClip (Olympus, Tokyo, Japan)), others are 3-pronged (Tri-Clip (Cook Endoscopy, Winston-Salem, NC)) or are 2-pronged and have the ability to be re-opened several times prior to deployment, enabling repositioning of the endoclip (Resolution Clip (Boston Scientific, Natick, MA)). One device has the ability to apply multiple clips sequentially without reloading the clip-application device (Multi Clip (InScope Inc., Cincinnati, OH)).

4. Techniques for fixation of nasoenteral feeding tubes

Review of the literature revealed 5 cohort series evaluating the applicability of endoclips for fixation of the tip of nasoenteral feeding tubes to the small intestinal wall. No comparative studies were found. In addition, three studies were found that evaluated duration of attachment of different types of endoclips to the small intestinal wall.

In 1994, Ginsberg et al. [28] reported an endoscopic technique by which the tip of a nasoenteral feeding tube could be endoscopically placed beyond the ligament of Treitz and secured to the small intestinal wall with a HX-3L clip-application device. Consecutive steps are illustrated by Fig. 1a–d. A nasojejunal feeding tube was inserted via a transnasal route and brought back out through the oropharynx. A 3-0 silk suture was sewn through the distal end of the feeding tube to tether the endoclip to the feeding tube. A clip-application device was passed through the working channel of a paediatric colonoscope. The endoclip was loaded onto the clip-application device and used to grasp the suture on the feeding tube (Fig. 1a). The endoclip was withdrawn into the colonoscope (Fig. 1b). The colonoscope was then inserted into the oropharynx and advanced through the oesophagus into the stomach (Fig. 1c). After passing the pylorus, the colonoscope was advanced as far as possible. The clip-application device was re-exposed and the endoclip was attached to the intestinal wall by grasping a mucosal fold (Fig. 1d). Five out of 6 patients with recurrent pulmonary aspiration of gastric contents were successfully treated with this technique. Clip attachment was confirmed radiographically directly after placement and weekly during follow-up. Follow-up was discontinued after intentional removal of the endoclip or discharge from the hospital. No complications related to placement or intentional removal of endoclips were observed. The mean duration of observed attachment of the endoclips was 18 days (range 7–29).

Faigel et al. [29] treated 3 patients with intolerance to a gastric feeding due to an abnormal gastrointestinal anatomy: one patient with duodenal obstruction, a second with an esophageal stricture and a third with an obstructed jejunal pouch after gastrectomy. A similar technique and the same clip-application device as described above were used to place the tip of a feeding tube beyond the ligament of Treitz. On follow-up radiologic imaging, no feeding tube migration or dislodgement was observed. Nasoenteral feeding could be discontinued after 2–4 weeks. The endoclips were blindly removed by gentle traction of the feeding tube, without any complications.

Shie et al. [30] used a different clip-assisted endoscopic technique as compared to the technique described above, illustrated by Fig. 2a–d. A 3-0 silk suture was sewn through the distal tip of a nasoenteral feeding tube, which was then blindly inserted into the stomach via a transnasal route (Fig. 2a). A gastroscope was advanced into the stomach through the oropharynx (Fig. 2b) and a clip-application device (HX-5L) was used to grasp the suture on the tip of the feeding tube (Fig. 2c). The gastroscope was advanced into the distal duodenum and the endoclip was deployed by grasping a mucosal fold. Fig. 2d shows the nasoenteral feeding tube after release of the clip. Retrograde migration on withdrawal of the endoscope occurred in none of the patients. A total of 9 patients with intolerance to gastric feeding was treated using this technique. The mean duration of nasoenteral feeding was 15 days (range 7–27) in these patients. During follow-up no spontaneous migration of feeding tubes was observed. No complications due to placement or removal of endoclips were observed.

Wu et al. [31] used the same technique, as well as the same clip-application device as described by Shie et al. [30] for placement of a nasojejunal feeding tube. A total of 21 patients that required postpyloric feeding was included; 13 patients with gastroparesis and 8 patients with a gastroesophageal ulcer. The mean duration of nasojejunal feeding was 15 days (range 4–26) in the patients with gastroparesis and 22 days (range 8–36) in the patients with ulcers. No retrograde migration on withdrawal of the endoscope or spontaneous migration of feeding tubes were observed during follow-up. Additionally, no complications due to placement or removal of endoclips were observed.

Most recently, Frizzel et al. [32] reported 2 cases of clip-assisted endoscopic placement of a nasojejunal feeding tube and a percutaneous endoscopic gastrostomy catheter with a jejunal extension (PEG-J), respectively. In these two patients, the technique reported by Shie et al. [30] was used, although a different type of endoscope (paediatric colonoscope) and a different type of clip-application device (Resolution Clip) were used. In both cases placement of the endoclip was successful. No migration of the feeding tubes was observed before intentional removal after 46 days.

5. Duration of clip attachment

Three studies have evaluated the duration of attachment of different types of endoclips to the gastrointestinal wall: one clinical study [33] and two experimental animal studies [34,35]. Duration of attachment of endoclips ranged from less than 1 week to

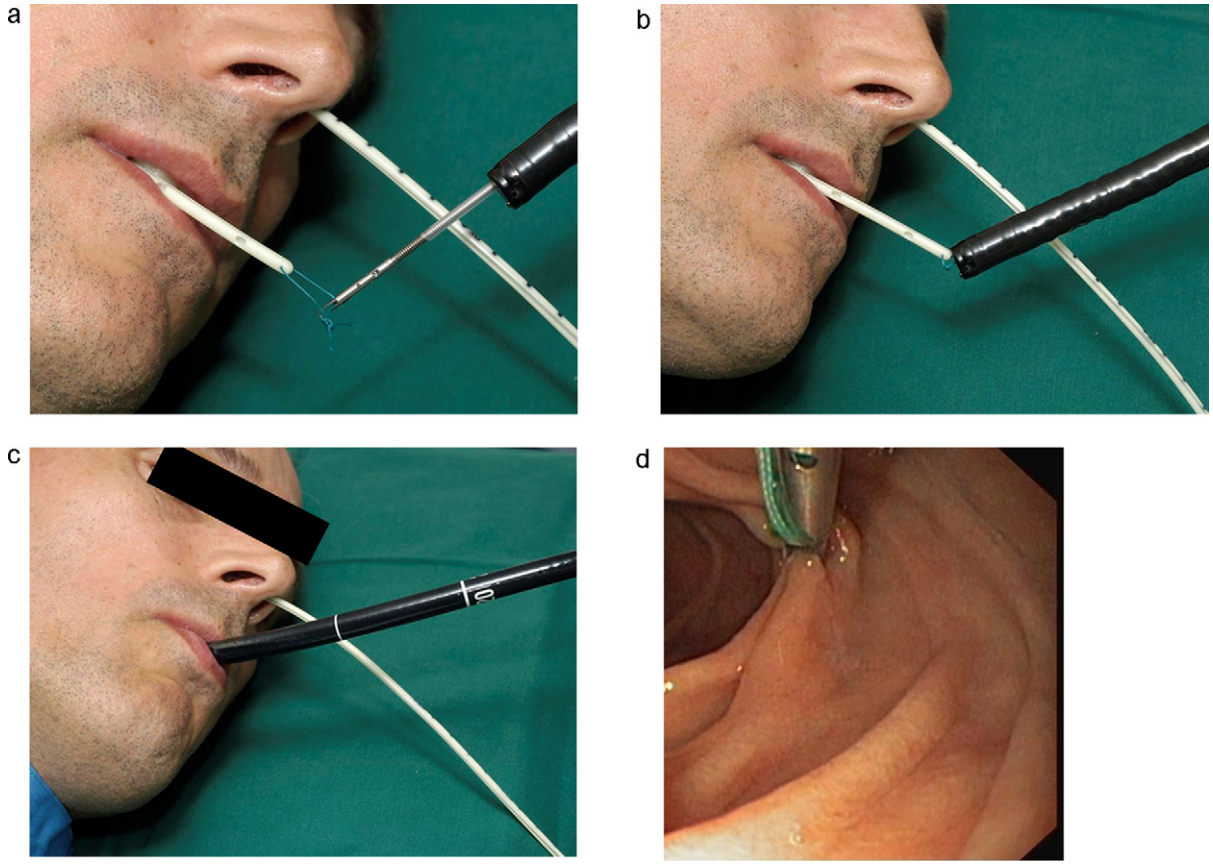

Fig. 1. (a) The suture, attached to the nasoenteral inserted tube (which is brought back out through the oropharynx) is grasped with the endoclip. (b) The endoclip is withdrawn into the working channel of the endoscope. (c) The endoscope (with the nasoenteral tube attached) is inserted into the oropharynx. (d) The endoscope (with the nasoenteral tube attached) is advanced into the duodenum and a mucosal fold is grasped by the endoclip.

Table 1
Duration of clip-attachment.

Study	Study design	Application site	Type of clip-application device	Number of clips	Duration of clip-attachment (weeks)
Binmoeller et al. 1993 [29]	Prospective, clinical	Upper- and lower gastrointestinal tract	HX-3L (Olympus, Tokyo, Japan)	255	NA (1–3)[a]
Jensen et al. 2006 [30]	Prospective, experimental	Stomach	TriClip (Cook Endoscopy, Winston-Salem, NC)	27	1 (1–2)[b]
			QuickClip (Olympus, Tokyo, Japan)	27	2 (2–3)[b]
			Resolution Clip (Boston Scientific, Natick, MA)	31	4 (1–18)[b]
Shin et al. 2007 [31]	Prospective, experimental	Stomach	TriClip	5	<1 (NA)[a]
			HX-5L (Olympus, Tokyo, Japan)	5	1–2 (NA)[a]
			Resolution Clip	5	>4 (NA)[a]

NA, not available.
[a] Mean (range).
[b] Median (interquartile range).

more than 18 weeks, depending on the type of endoclip (Table 1). Compared to other types of endoclips, the Resolution Clip had the longest duration of attachment [34,35].

6. Discussion

This review shows that the use of endoclips for fixation of nasoenteral feeding tubes to the small intestinal wall is feasible, effective and safe. In this review 5 cohort series were included. A nasoenteral feeding tube could be successfully fixated to the small intestinal wall in all patients, except one. In that case, inadequate use of the clip-application device by resulted in failure of deployment of the endoclip [28]. Of note, the number of patients that have been included in the available studies is only limited and, to date, no comparative studies have been performed.

Two different techniques for fixation of a nasoenteral feeding tube with an endoclip have been reported. Ginsberg et al. [28] used

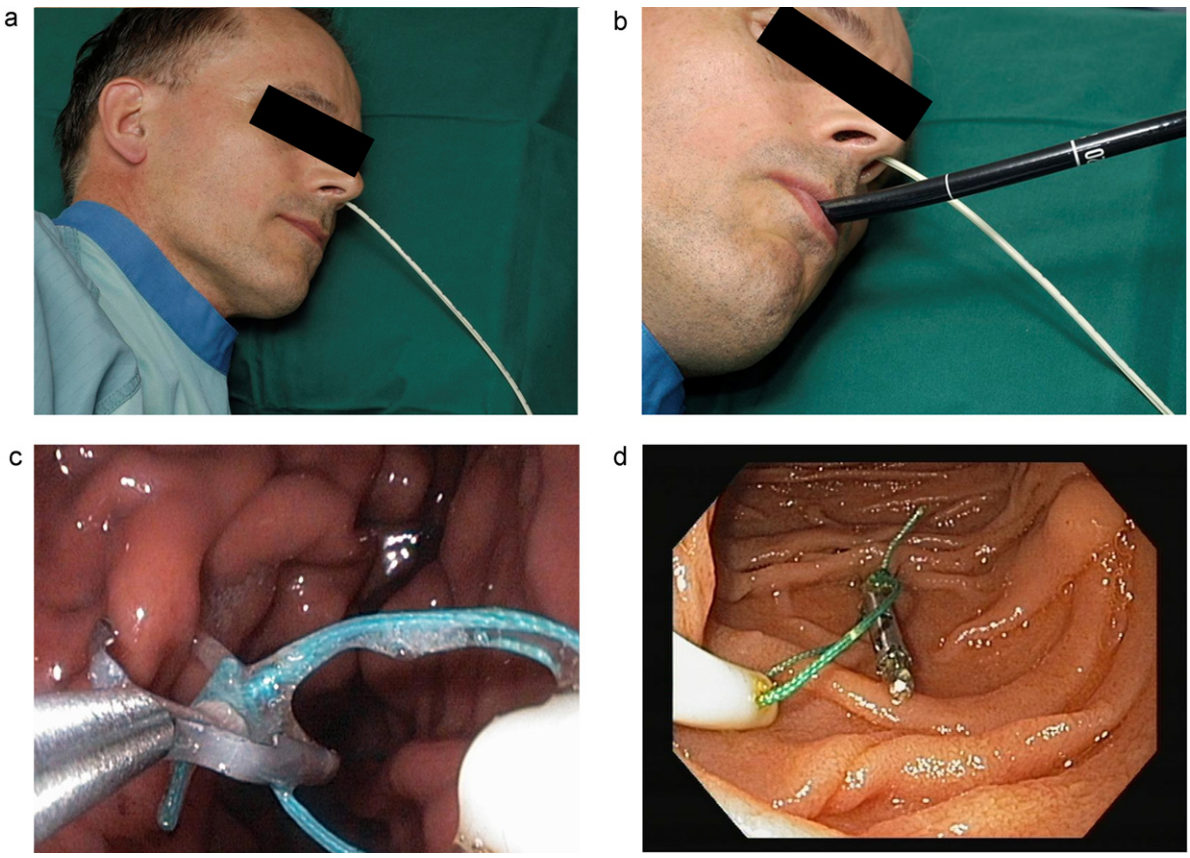

Fig. 2. (a) The nasoenteral feeding tube is blindly inserted into the stomach via the nasopharynx. (b) The scope is introduced through the oropharynx into the stomach. (c) The clip-application device is introduced through working channel to grasp the suture attached to the enteral feeding tube, located in the stomach. (d) Release of the endoclip device: the nasoenteral feeding tube is attached to the duodenal wall.

a suture that was fixed to the tip of the feeding tube. This suture was grasped by the clip-application device prior to advancement into the oropharynx (Fig. 1a–d). In more recent studies [30–32] the feeding tube with the suture attached was blindly inserted via the transnasal route and the suture was then grasped by the clip-application device after advancement into the stomach (Fig. 2a–d). The latter technique may be preferable, as it is more comfortable to the patient.

Long-term attachment of endoclips to the small intestinal wall is necessary to prevent migration of feeding tubes. However, the number of studies investigating duration of attachment of endoclips is limited. Moreover, the results of these studies are often biased by intentional removal of endoclips prior to spontaneous dislodgement and/or incomplete follow-up. Based on the available literature, the duration of endoclip attachment varies from less than a week to more than 18 weeks [28–35]. Of the clips currently available, the Resolution Clip has been reported to have the longest duration of attachment to the intestinal wall [34,35]. Potential other factors affecting duration of attachment include the type of tissue and the grasping depth of the endoclip [36].

No complications, such as perforation or bleeding, related to the placement and removal of an endoclip for fixation of feeding tubes have been reported [30–32]. One case of duodenal perforation after endoscopic placement of an endoclip for bleeding from a Dieulafoy's lesion in a duodenal diverticulum has been reported [37]. Histologic examination showed that the depth of tissue involvement of the endoclip was the level of the muscularis mucosa or, at most, the muscularis propria. Moreover, the tissue damage of an endoclip has been reported to be comparable with that caused by a biopsy forceps. Endoclips can be blindly removed by gentle traction [28,29]. Dislodged clips pass the digestive tract safely and are excreted with the faeces [33].

In our opinion, fixation of a feeding tube with an endoclip can be considered in case of recurrent tube migration, difficult to perform tube placement procedures and when a longer period (more than 2 weeks) of assisted feeding with an enteral feeding tube is considered.

It is however important to keep in mind that placement of a feeding tube with an endoclip will result in additional costs. Although prevention of spontaneous tube migration may avoid repeat endoscopies for tube repositioning, it is currently unknown whether this is will compensate for the costs of endoclips. In order to evaluate effectiveness, safety and costs of the clip-assisted method in comparison to conventional endoscopic placement of nasoenteral feeding tubes, we are currently performing a randomized controlled clinical trial. Results from this trial will hopefully provide new insights into the long-standing problem of stabilization of feeding tubes in the upper digestive tract.

Conflict of interest statement

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