Endoscopic nasogastric-jejunal feeding tube placement in critically ill patients

Paula G. Patrick, BSN, RN, CGRN, Shivaprasad Marulendra, MD, Donald F. Kirby, MD
Mark H. DeLegge, MD*

Richmond, Virginia

Background: Historically, placement of small bowel nasoenteric feeding tubes in the critically ill patient has been difficult because of lack of bedside fluoroscopy, inadequately designed endoscopic tubes, or failure of the tube to spontaneously pass into the duodenum following placement.

Methods: We followed-up 54 consecutive critically ill patients who had a combined nasogastric-jejunal feeding tube placed at the bedside using a new endoscopic, nonfluoroscopic method of placement. Data were obtained on the placement procedure, outcomes, and complications that followed.

Results: Tubes were successfully placed in 94% of the patients in an average time of 12 minutes. Negative outcomes included the following: inadvertent removal by patient or staff (21%), intolerance to tube feeding (14%), clogging (9%), kinking (6%), and cracking at the tube adapter (11%). The duration of the tube following placement ranged from 1 to 42 days, with an average of 9 days.

Conclusion: The combined tubes were easy to place endoscopically. The endoscopic, nonfluoroscopic method of placing feeding tubes can be performed at the bedside and allows for gastric decompression and enteral feeding to be rapidly and efficiently achieved, which is particularly useful for intubated patients in an intensive care setting. Negative outcomes should decrease by avoidance of inadvertent tube removal and by improved tube maintenance and materials. (Gastrointest Endosc 1997;45:72-6.)

Providing early enteral nutrition to the critically ill patient has recently emerged as an important treatment modality. This may be due to bacterial translocation, which is thought to occur when the gastrointestinal tract is deprived of intraluminal fuels, causing an interruption in the normal gut defense barrier and thus allowing for bacteria to invade the body systematically.1 This concept has been substantiated in several studies that involved high-risk surgery patients and showed that septic morbidity rates were lower in patients who were fed enterally as compared to patients who received total parenteral nutrition (TPN).2

Although there are some who maintain that the concept of bacterial translocation has not been adequately proved in humans,3 the practice of providing early enteral nutrition to the critically ill patient is now considered by many to be an important entity. A nasoenteric tube (NET) is generally the preferred method used to deliver feedings to critically ill patients who are expected to require tube feedings for less than 30 days. Of the various types of NETs commercially available, a combined nasogastric-jejunal (NG-J) tube offers an advantage in that it provides the ability of maintaining gastric access while simultaneously feeding into the small bowel. The gastric port can also be used to deliver medications and to decompress the stomach, which is especially helpful in ven-
tilated patients. Placement of this type of tube past the third portion of the duodenum, and preferably past the ligament of Treitz, may help to decrease the risk of aspiration by detecting any tube feeding in the stomach, serving as an early warning that the tube is mal-positioned, and allows for changes to be made before problems occur. A study conducted by Ho et al.\(^4\) reported an 8% aspiration rate with gastric feedings (surgically placed gastrostomy) as compared to 0% with jejunal feedings (radiologically placed jejunostomy). Unfortunately, the placement of a NET to deliver jejunal feedings is often technically challenging for the physician. Several factors have contributed to this problem, including inappropriately designed feeding tubes (which make post-pyloric intubation difficult) and, in many institutions, a lack of bedside fluoroscopy. Without bedside fluoroscopy, the patient must be transported to a fluoroscopy unit, which is often difficult with critically ill, ventilated patients. In our study, we wanted to evaluate the placement of NG-J feeding tubes at the bedside using endoscopy alone without fluoroscopic guidance. We believed this would be beneficial in that it would eliminate the necessity of transporting critically ill patients to other areas of the hospital and offer an effective method of providing early enteral nutrition to this patient population.

**METHODS**

**Patients**

Fifty-four consecutive patients referred for NG-J tube placement were included in the study. Prior to inclusion, a gastroenterology-nutrition service consult was obtained to validate both the indication for nasojejunal feedings and combined gastric suction, and to determine the patient’s ability to tolerate the procedure in terms of respiratory, hemodynamic, and coagulation status. Subjects were determined to be at high risk for gastric aspiration if they had an altered mental status, were mechanically ventilated, or had gastroparesis as determined by high gastric residuals with intragastric feeding.

**Materials and methods**

All patients had a Stayput (Sandoz Nutrition, Minneapolis, Minn.) combined 18F nasogastric-9F jejunal feeding tube placed by the same method. A screening endoscopy was performed to rule out abnormalities and to define the patient’s anatomy. The endoscope was then withdrawn to the mid-esophagus and the NG-J tube, with a preloaded stylet and .035 guide wire, was inserted through the patient’s nares and into the esophagus. The endoscope and the NG-J tube were advanced into the stomach. Simple advancement of the NG-J tube, under direct visualization, often allowed this tube to pass through the pylorus and into the appropriate position in the small bowel. Occasionally, it was necessary to advance the .035 guide wire 1 to 2 cm beyond the distal tip of the feeding tube. When this was required, a grasping forceps or snare was used to grasp the guide wire and advance it into the third portion of the duodenum. At that point, tension was applied to the proximal end of the guide wire while the NG-J tube was advanced distally over the guide wire and into position. Once the tube was in position, the tension on the guide wire was released and, with suction, the endoscope was gently rolled from side to side and withdrawn back into the stomach until the junction of the gastric and jejunal tube could be verified in the antrum. Also, at this time the position of the feeding tube was assessed to ensure that there was not a loop of tube coiled in the stomach. The endoscope was then removed from the patient, and the stylet and .035 guide wire were removed from the NG-J tube. To ensure that the tip had not kinked during the withdrawal of the guide wires, a catheter-tip syringe was used to flush the jejunal port. The attending physician who performed the procedure was then asked to rate the degree of difficulty of the procedure using a visual analog scale.\(^5\) The time required to complete the procedure was measured: this began with the insertion of the endoscope and included the screening endoscopy, placement of the tube, and removal of the endoscope.

Following the procedure and prior to initiating feedings, an x-ray was obtained of each patient to confirm placement (Fig. 1). Patient follow-up was subsequently performed on day 1 (defined as the day after the placement procedure), day 3, day 7, and then weekly thereafter until the tube was removed or needed to be replaced. Data collected immediately
following the placement of the tube included the ease with which the tube was placed, total length of time for the procedure, and complications of placement. Data collected during the follow-up phase included the type and rate of tube feeding and any medications that were administered through the tube. In addition, problems associated with the function of the tube were identified and categorized into outcomes, which either did or did not lead to removal of the tube.

**RESULTS**

Placement was successful in 94% (n = 51 of 54) of the tubes, which was defined as radiologically verified placement of the tube in the distal duodenum or proximal jejunum. Of the remaining tubes (6%), 2% were kinked and 4% were coiled in the stomach. The average length of time required to complete the entire procedure was 12 minutes. The average degree of difficulty of the procedure was 2.73 (0 = not at all difficult, 10 = extremely difficult). The longevity of the tube following the verification of successful placement ranged from 1 to 42 days, with an average of 9 days. There were a total of 61 tube placement procedures that were required to maintain tube feedings for the 54 patients included in the study.

Table 1 summarizes all of the negative outcomes, which were identified following the placement of the tube. Outcomes that led to removal of the tube included inadvertent removal of the tube by the patient or by the staff during routine care (21%), patient expiration (13%), tube conversion to a percutaneous endoscopic gastrojejunostomy or surgical jejunostomy (8%), cracking at the tube adapter (4%), kinking of the tube (6%), clogging of the tube (3%), and development of a concurrent medical condition unrelated to the tube but requiring removal (UGI bleed, ileus, or enterocutaneous fistula, 5%). Negative outcomes identified that did not lead to removal of the tube included tube feeding intolerance (abdominal distention or nausea, 14%), clogging of the tube (6%) and cracking at the tube adapter (4%). There was one episode of aspiration; however, this was attributed to the aspiration of gastric contents due to a large hiatal hernia and was not tube-feeding related. Epistaxis occurred in one patient following the insertion of the tube through the nares. Forty-two percent of the patients experienced no problems and progressed to an oral diet after having the tube in place for a range of 2 to 42 days, with an average of 11 days.

**DISCUSSION**

Providing early enteral nutrition to the critically ill has been associated with an improved outcome. For those patients who have a functioning gut, enteral nutrition is preferred over TPN for several reasons. Enteral nutrition is thought to be a key factor in maintaining the normal mucosal barrier of the gut, which prevents the systemic invasion of bacterial flora. The complications that are associated with enteral feeding are generally less severe than those associated with TPN. In addition, a comparison of the costs between these two methods of feeding at our institution reveal that although endoscopic placement of a feeding tube is more expensive ($927) than central line placement ($263), enteral nutrition is significantly less expensive to provide and maintain than parenteral nutrition. More specifically, the cost of providing the endoscopic placement procedures, x-rays, and 9 days of standard enteral nutrition (the average longevity of the NG-J tubes placed in this study) is calculated to be approximately $84,000; this includes the repeat x-rays and endoscopic placement procedures required to maintain tube feeding to the 54 patients in our study. In comparison, the cost of providing central line placement, x-ray, and 9 days of TPN (using 2 L of standard solution) for 54 patients is calculated to be $235,000.

Although the benefits of enteral nutrition appear to outweigh those of TPN, the options for placing postpyloric, nasoenteric tubes can be technically challenging. Of the available methods, blind bedside placement is perhaps the simplest and the most common; however, in one large series in which 242 bedside placements were retrospectively reviewed, the success rate was reported to be relatively low (17%). With the bedside technique, correct placement is determined by an abdominal radiograph, which verifies the position of the tube prior to initiating feedings. The first attempt at placement is often unsuccessful and requires repositioning of the tube followed by repeat radiographs and leads to delays in the initiation of feedings. The reported complications of bedside place-
Blind placement. Verification of the tube’s position is been attributed to patients who have had a large hiatal hernia, and the tube can then be passed into the small bowel. Although the success rate of this procedure is favorable, the study demonstrated that the number of repeated attempts required to correctly maneuver the tube into the small bowel ranged from 5 to 20 times, making the average placement time 40 ± 14 minutes (mean ± SD). 10

A study conducted by Heiselman et al. 11 describes a method of placing NETs using a tube with a special pH sensor, which confirms the placement of the tube in the small bowel by detecting changes in the pH from the stomach to the small bowel. Although this method may be of benefit in that the number of repeat radiographs is reduced, the success rate of the initial placement of the tubes in this study was only 79%, as 5 of the 24 placements (21%) resulted in gastric intubation. 11

Fluoroscopic placement is another method used to place these tubes and offers several advantages over blind placement. Verification of the tube’s position is confirmed during the fluoroscopic procedure; therefore, tube feedings can be initiated soon after placement. Fluoroscopically guided nasoenteric tube placement has a reported success rate ranging from 86.6% to 91%. 8, 12, 13 Failures associated with this method of placement (inability to intubate the pylorus) have been attributed to patients who have had a large hiatal hernia, prior gastric or duodenal surgery, or a neoplasm. 8 A study conducted by Gutierrez and Balfe 12 showed that major complications associated with fluoroscopic placement were infrequent (0.4%); however, those reported included one episode of tracheobronchial misplacement and three patients who experienced a cardiac arrhythmia that led to cardiac arrest. 12 Even though the reported success rate of fluoroscopic tube placement is high and the major complication rate is low, there are several disadvantages associated with this method. If the patient cannot be moved to the radiology department, then portable C-arm fluoroscopy is required, which may not be readily available or, when it is, risks the exposure of patients and staff to the harmful effects of radiation. In addition, the alternative of transporting to the radiology department a typical ICU patient, on a ventilator with multiple intravenous drips or other cumbersome mechanical equipment, is both time consuming and labor intensive. The risks of spreading resistant organisms to other areas in the hospital during transport of the patient must also be considered.

In our study, endoscopic placement of postpyloric feeding tubes was found to offer several advantages over the previously mentioned placement techniques. The ability to directly visualize the placement of the tube negates the complications that are associated with blind placement and reduces the need for repeat radiographs. Another advantage is that the endoscopic procedure for placing the tube can be performed in the ICU, at the bedside, which both eliminates the need to transport the patient to another area of the hospital and prevents the patients and staff from being exposed to the harmful effects of radiation. Furthermore, we report a 94% success rate for endoscopically placed NETs, which compares favorably with the success rate of both bedside method (17%). 8 Fluoroscopically guided tube placement (86.6% to 91%). 8, 12, 13 pH detection methods (79%). 11 and the corkscrew method (92%). 10 In addition, the average procedure time of 12 minutes is significantly less than those procedure times in the aforementioned fluoroscopic study by Ott et al., 13 in which the average time for fluoroscopic placement including fluoroscopy room times was 30.3 ± 14 minutes (mean ± SD), and the study conducted by Zaloga, 10 which was 40 ± 14 minutes (mean ± SD).

Our study offers several advantages for placing NETs endoscopically (delineated above). Although some of the outcomes in the follow-up phase were identified as leading to premature tube removal, we found that there are steps that can be taken to help prevent this. The high rate of patient self-removal of the tube (18%) was most likely due to the patient’s nasopharyngeal discomfort, altered mental status, and lack of awareness of the importance of the tube, all of which may have contributed to its inadvertent removal. Given this fact, when appropriate, steps may be taken to reduce the incidence of self-removal by restraining sedated and confused patients.

Clogging of the jejunostomy tube, which occurred in 9% (n = 5) of the patients, was a frustrating problem and most often occurred because of inappropriate administration of medications through the jejunal port or lack of flushing of the tube. This problem was corrected in 67% of the patients by flushing the tube with carbonated soda or using a guide wire to unclog the tube. In 33% of the patients, the tube needed to be replaced because of the inability to unclog the tube by
the aforementioned methods. Educating the staff as to the proper care and flushing of the tube may be helpful in preventing this problem in future cases.

Cracking at the external Y-adapter was noted in 11% of the patients. Since it was impossible to replace only the adapter due to the design of the tube, 7% required endoscopic replacement of the tube, 2% had a smaller adapter inserted inside the cracked adapter (which prevented leakage), and 2% successfully progressed to an oral diet. The cracking was subsequently traced to an improper batch of plastic material used in the construction of the adapter and, according to the manufacturer, has since been corrected. Tube kinking was noted in 6% of patients, which required replacement of the tube in each case. Intolerance to the tube feeding included abdominal distention (12%) and nausea (2%). Although this intolerance did not lead to removal of the tube, alterations in the feeding protocol did occur, since tube feedings often needed to be interrupted or delayed until the intolerance resolved. Nasopharyngeal trauma, which occurred in one patient in our study, should be recognized as a potential complication associated with this method of placement.

In conclusion, endoscopically-placed NG-J tubes can be easily placed with a high rate of success and are associated with a low incidence of complications. Early enteral feeding in critically ill patients can be readily achieved by this nonfluoroscopic method with good outcome. Advancements in tube technology to decrease tube kinking and adapter breakage, education of staff members about the proper flushing of the tube to prevent clogging, and restraint of sedated patients to avoid inadvertent tube removal will most likely further improve the outcomes associated with this useful method of NET placement.

ACKNOWLEDGMENT

The authors would like to thank Mrs. Sheryl Miller Hosey.

REFERENCES
