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Helping to promote a culture of safety

Accreditation Information

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Learning Objectives

After reading these articles, the learner should be able to:

1. Describe the current methods to place small bore nasogastric feeding tubes.
2. List the types of complications associated with the placement of enteric feeding tubes
3. Discuss the methods or technologies that can be used to enhance patient safety during placement of enteric feeding tubes

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Life in the Balance: Blind Placement of Enteric Feeding Tubes

By Vicki Ross, RN, PhD, CNSC

Early and appropriate delivery of nutrition support is critical to achieving favorable outcomes for seriously ill patients. Evidence consistently supports delivering nutrition via the gut as the best option for patients. But when oral diets are not an option, as is often the case for many hospitalized patients,[1] enteral nutrition must be delivered via some type of enteral feeding device (EFD). EFDs are not risk free. Feeding tube misplacements in unexpected parts of the gastrointestinal (GI) tract, the lungs, or in the cranial vault have all been reported as complications of EFDs.[2-4] The need to balance early enteral nutrition with the risk of misplaced EFDs means the lives of critically ill patients hang in the balance. This article will provide an overview of the risks of EFD complications, regulatory reports and alerts about EFDs, methods to verify placement of EFDs, and actions that must be implemented to ensure enterally fed patients are both safe and well nourished.

> Based on conservative estimates, there are over 36,000 patients annually, who suffer from or succumb to EFD complications.

Epidemiology of Complications

An estimated 1.2 million small bore feeding tubes are purchased by US hospitals each year.[4] This is likely a conservative estimate given the wide variety of EFD sizes and types on the market today. Since EFD complications are not tracked, the data typically originate from case reports or single institutions willing to share their often tragic experiences. Reported complications include trauma to the nasal passageway such as epistaxis, naso-septal erosion or sinusitis that occur during tube placement or when tubes are left in place for extended periods of time. Complications can also arise due to malposition of a tube tip in unintended

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Supported by an educational grant from Covidien Sales LLC, a Medtronic company.

Panel Discussion: Blind Insertion of the small bore NG tube (sbNGT): *Looking Ahead to Prevent Misplacement*

Panelists: Mary S. McCarthy, PhD, RN, CNSC
Arlene A. Escuro, MS, RD, CNSC, LD
Susan L. Brantley, MS, RD, CNSC, LDN

What current methods are used to place small bore nasogastric feeding tubes (sbNGT)? Can you describe any challenges(s) or obstacles you are aware of (or have experience) with these blind placement techniques? In your opinion, what effect do these types of blind placements have on the patient and the nurse's time?

McCarthy For acutely ill patients who will remain NPO for a prolonged period of time due to surgery, procedures, or an inability to tolerate an oral diet, enteral nutrition (EN) should be considered based on a nutrition assessment and gastrointestinal (GI) function, but no longer than 7-10 days after admission in order to support positive clinical outcomes.[1] For EN support lasting ≥ 7 days, a small bore (5F to 12F), flexible, silicone or polyurethane NGT should be used to reduce the risk of complications, such as sinusitis, and improve patient comfort.[2] Clinicians insert small bore (sb) NGT using various methods including blind and magnet-guided bedside placement, endoscopy, and fluoroscopy. Before attempting blind placement of the sbNGT, the alert patient should receive an explanation of its purpose and the procedure for insertion. The clinician should ask the patient or review the medical record for any history of altered GI anatomy, either pre-existing or following surgery. EN therapy is not without risks, therefore the decision to initiate it should reflect the autonomy and wishes of the patient.[3] Patients that are awake and alert will typically experience some discomfort during passage of the tube through the nose and into the back of the throat.[4] The potential exists for adverse events during insertion including mucosal ulceration and bleeding, bronchopulmonary intubation, intracranial placement, and aspiration.[5] One safety precaution is for the nurse to measure the distance the tube will be inserted using recommended landmarks; most recent studies suggest nose-ear-xiphoid + 10 cm is more accurate than nose-ear-xiphoid (NEX).[6,7] After insertion, marking the tube with permanent ink or tape where it exits the nares provides a means of visually checking that the tube has remained in its gastric location, although it should never be the sole indicator of placement.[8,9] Experts recommend radiographic confirmation of tube placement before use;[9,10] this policy may vary by institution but can cause a delay in initiating nutrition therapy. All procedures involving bedside placement of a feeding tube will require a substantial amount of time and effort on the part of the nurse to ensure patient safety and a properly positioned tube for the delivery of nutrition therapy.

All procedures involving bedside placement of a feeding tube will require a substantial amount of time and effort on the part of the nurse to ensure patient safety

- McCarthy -

Brantley: There are a number of methods to place small bore nasogastric feeding tubes. Bedside placement by an individual can be as varied as those that practice these techniques. Many clinicians use the 10-10-10 protocol – the patient is given 10 mg metaclopromide 10 minutes prior to the initiation of the procedure; the small bore feeding tube is placed, leaving only 10 cm of the tube out-

side the nare. It is important to auscultate as you go, making certain that the patient's sats stay at a pre-insertion level and the patient isn't experiencing any distress during the placement. It always concerns me if the patient is coughing, if they cannot speak to me (if not intubated and they are alert), or if the tube becomes difficult to advance at about the 40-45 cm mark as these could all indicate placement into the lungs. As to your second question, my main issue is having adequate time to place the tube. Typically this isn't the process the nurses use for the placement of a nasogastric tube – those are usually accomplished quickly and effectively! This process takes more time to be successful. Placement into the lung is always a concern, particularly with an intubated, paralyzed patient as they will not have a cough or an indication that the tube has been misplaced. This doesn't happen often, in my experience, because I take my time and never force the feeding tube. As to your third question, although I have had very few complaints, it could be more uncomfortable for the patient just because it can take more time to place. The advancement of the tube usually must be slower to achieve good post-pyloric placement.

Escuro: Nutrition is an important aspect of patient care for those who are unable to meet their nutritional needs orally. Both enteral and parenteral nutrition are alternative methods of nutritional support and should be selected on an individual patient basis. When feasible, the gastrointestinal tract (GI) is the preferred route of delivery and superior to parenteral nutrition alone. The estimated duration of enteral therapy is the main factor in determining nasal tube placement versus tube enterostomy. Generally, tubes used for short-term therapy (< 4 weeks) are placed nasally (or in some cases orally) at the bedside blindly, endoscopically, or fluoroscopically in interventional radiology.[11] These tubes include nasogastric, nasoduodenal, nasojejunal, and nasogastric-jejunal tubes. Large bore nasogastric tubes used for gastric decompression should be converted to a smaller bore feeding tube within 5-7 days to decrease the risk of associated complications and improve patient discomfort.[2] Contraindications to nasogastric and nasoenteric feeding tube placement are obstructing head, neck, and esophageal pathology, or injury preventing safe insertion. Nasogastric or nasoenteric feeding tubes should not be used until confirmation of proper insertion is obtained. Nasogastric tubes are the least difficult feeding tubes to insert. Blind placement of nasogastric tube is a common nursing procedure. A nasoenteric feeding tube on the other hand, is more difficult to place than a nasogastric tube. Bedside placement usually requires experienced personnel with specialized training. Confirmation of the correct position of sbNGT is warranted to avoid serious complications such as misplacement in the lung. Complications of nasogastric and nasoenteric feeding tubes can be divided into those occurring during the insertion procedure or those occurring in the postprocedure period. The overall procedure related complication rate is ~10% and includes epistaxis, aspiration, and circulatory or respiratory compromise.[12] The most dreaded procedural complication is initial misplacement of the nasoenteric tube into the bronchopulmonary tree. Postprocedural complications include inadvertent tube dislodgement, tube occlusion, tube malfunction, tube feeding aspiration, and intestinal ischemia.[12] The length of the tube necessary for gastric placement can be estimated by measuring from the tip of the patient's nose to the earlobe and from the earlobe to about 3 to 5 cm below the xiphoid process. Placement of a nasogastric tube requires passage through a patient's nare and may be facilitated by concurrent patient swallowing. Aspiration of gastric contents, auscultation of insufflated air over the stomach, and absence of patient coughing or choking suggests, but cannot ensure, correct tube placement.[12] In a large, prospective observational study, the position of 331 feeding tubes was tested using the auscultatory method and pH measurement after tube insertion and compared with the "gold standard" (abdominal radiograph) to predict tube position in the stomach. The study showed that a pH of ≤ 5.5 from tube aspirate is adequate to check the position of the tube in the stomach and that the auscultatory

Placement into the lung is always a concern, particularly with an intubated, paralyzed patient as they will not have a cough or an indication that the tube has been misplaced.

- Escuro -

method was found to be an unreliable predictor of gastric tube placement.[13]

If the practitioner is unable to insert the sbNGT for any reason, or if the placement is in error, what are the steps taken to ensure the patient is fed? Can you describe these other methods & their effectiveness?

McCarthy: If a placement is in error (i.e. not in the GI tract) the tube should be removed immediately, a patient assessment performed, and the tube reinserted with the tip in the appropriate distal location. In situations where a patient is not a candidate for a sbNGT alternative strategies for safe nutrition support include postpyloric feeding, using a variety of blindly placed tubes, endoscopy/fluoroscopy, or "signaling" devices, such as the CorTrak® 2 Enteral Access System (EAS)™ (Viasys Medsystems, Wheeling, IL). Postpyloric placement of sb nasoenteric feeding tubes (FT) can be more challenging and time-consuming than gastric placements. While some FT have weighted tips to facilitate peristaltic migration through the pylorus, these tubes have not demonstrated any advantage with regard to successful placement in randomized controlled studies.[14] Methods used to enhance passage of FT include administration of promotility agents prior to and during insertion[15], positioning of patients[16] and a multi-step technique with radiographic confirmation at designated intervals, initially at 35 cm to ensure the tube is in the esophagus,[17] or 50 cm to ensure the tube is in the stomach,[18] and not in a bronchus. The highest success rates for blind insertion of nasoenteric FT are associated with the skill and experience level of the clinician; success rates of over 80% are reported with highly trained personnel.[17,19,20] A combination of a designated ICU RN/RD team and an electromagnetic guided placement system yielded 78% success, a significant decrease in time from MD order for tube placement to initiation of feeding (22.3 vs 7.8 hours; p=.003), and reduced costs for X-ray confirmation.[21] In our institution, nurses are inserting a relatively new nasoenteric tube, the 14 Fr Tiger 2™ (Cook® Inc, Bloomington, IN) self-advancing nasal jejunal FT with flaps that facilitate placement in the jejunum by allowing peristalsis to gently pull the tube into the small bowel. Successful placement of these FT by nurses has been superior to placement using the CorTrak EAS. The least costly and most successful postpyloric placements are achieved using fluoroscopy. Few complications and increased caloric delivery in the first 4 days following tube placement have made this technique highly desirable for ICU patients.[22] The gold standard for placement of jejunal FT is endoscopy; 90% success rates can be achieved with this technique.[23] New endoscopic advances reportedly overcome challenges related to anatomic alterations that previously required open procedures.[24]

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>
> - Brantley -

Brantley: A placement space line may be re-attempted and another KUB ordered, but if this method continues to fail, the patient is taken to Interventional Radiology (IR) for feeding tube placement under fluoroscopy. Sometimes, this fails also (possibly due to a hiatal hernia or obstruction that prevents FT passage). In this instance, a PEG/PEGJ may be planned as a surgical intervention if the patient is stable. Many times, when I fail at the bedside, IR will also fail! That can be a result of gastroparesis and, more often, a huge hiatal hernia. Occasionally, a patient is taken to the GI lab for a endoscopic placement of the feeding tube post-pylorically. This is sometimes a challenge as well, according to the GI physicians, since a tube that is placed with an endoscope, can sometimes be dislodged as the scope itself is being withdrawn.

Escuro: Several blind bedside methods of feeding tube placements have been reported using a special protocol or various equipment or devices for placement. The most common method uses the technique described by Zaloga.[25] This technique requires the patient to lie on the right side, the feeding tube is bent and advanced slowly with a combination of air insufflation, tube rotation, and auscultation. Promotility agents (erythromycin and metoclopramide) are often utilized to assist and improve the transpyloric passage of feeding tubes.

Can you tell us if you are aware of any new technologies that have been implemented to enhance these blind insertion procedures? If so, could you tell us the success you and others you are aware of have had with these? Have they been successful?

McCarthy: There are few bedside

technologies to enhance blind insertion of sbNGT, however, techniques such as pH testing and carbon dioxide monitoring[26] are still in use, although not based on high level evidence. The use of the CorTrak EAS described above has led to a significant improvement in successful placements on the initial attempt by nurses in the ICU setting. In our facility, RNs, RDs, and MDs use this device but only in the ICU environment. The upgraded CorTrak EAS incorporates a 3-D bedside visual display to observe the progress of the tube as it passes through the esophagus and into the GI tract. A receiver unit detects the signal from the stylet that has an electromagnetic transmitter in the tip and the monitor displays the exact position of the tube prior to removal of the guidewire. One study by Ackerman and colleagues[27] found that the CorTrak EAS had a 100% success rate in avoiding lung placement thus enhancing patient safety. The ability to monitor the location of the feeding tube tip in real time provides a safety feature for clinicians performing bedside insertions. The CorTrak EAS system was reported to be equivalent to direct visualization of postpyloric placement via upper endoscopy and other studies reported a reduction in mean time from physician order for tube placement to feeding initiation, and fewer X-rays for confirmation, thereby decreasing cost.[20,28,29]

Brantley: I have tested some of these new technologies but still do blind placement at the bedside. Having said that…probably the most effective and successful technique used is the CorTrak device. It gives a "real-time" picture and significantly can decrease the amount to time required to successfully place post-pyloric feeding tubes. I have also tried the magnet and find it difficult to use and cumbersome to manipulate; it is easier to use with two people but difficult to manage alone whereas the CorTrak can be used with only 1 person at the bedside. There is another technique that I am aware of but have not tried, and that is a device with a camera giving it more of a endoscopy-like procedure. That might be cost prohibitive!

The ability to monitor the location of the feeding tube tip in real time provides a safety feature for clinicians performing bedside insertions.

- McCarthy -

Escuro: Recently, devices have been developed to assist with timely placement of small bowel feeding tubes at bedside. An electromagnetic placement device (EMPD) uses a tube that contains an electromagnetic transmitter at the distal tip. The location of the distal tube tip is detected by using an external receiver and computer monitor. In one study, researchers found a 99% agreement between the EMPD and radiograph interpretation of the feeding tube location. Inadvertent airway placement occurred in 15 patients but was detected with the EMPD with subsequent tube withdrawal so that no patient experienced complications. Median tube placement time was 12 minutes.[29]

If EMPD is not available, fluoroscopic or endoscopic technique is often utilized. In difficult patients, more directed guidance can be accomplished with the assistance of either fluoroscopy or endoscopy. Fluoroscopy has been demonstrated to be more successful with regard to postpyloric placement and is similar in cost compared with blindly placed tubes.[2] Endoscopically guided tubes allow for immediate assurance that the tube is in the GI tract and allow for more distal guidance under direct visualization. Disadvantage of these techniques include delay in time until placement, and transporting critically ill patients to the radiology or endoscopy suite can be labor intensive and costly because it requires nursing, respiratory, and transport personnel.

In your opinion, given the challenges & obstacles of standard blind insertion of sbNGT, what, in your mind's eye would you say could improve this procedure, and benefit your patient by leading to safer, quicker nutrition from a technologic perspective?

McCarthy: We have used a portable "C arm" for small bowel placements in the past and this technology is superior to most other available resources. However, this equipment is primarily reserved for use in the operating suites so its availability to the ICU team is very limited. I have also used a prototype of a videoscopic tube placement technique[30] similar to bedside endoscopy but with a tiny mounted video camera in the stylet; I have never seen this reach full production and distribution by the manufacturer. I am not aware of any other technology currently available for feeding tube placement but

feel that this technique presents a safe and effective means of achieving postpyloric placement.

Brantley: A device such as CorTrak would be beneficial in that it could decrease the time needed to successfully place a feeding tube but it could also eliminate the need for further confirmation with a radiological exam. The CorTrak has been approved for placement that does not require a confirmation X-ray. This is also beneficial to the patient by avoiding additional radiation. In addition, feeds can be started more quickly if an X-ray doesn't have to be taken or read by a radiologist.

Escuro: Careful evaluation and consideration should be given to successfully use the appropriate placement method in a given patient. Clinicians across disciplines should have a working knowledge with regard to technique as well as the advantages and disadvantages of the various placement options to optimize patient outcomes and minimize unnecessary interventions. Because there is a training effect for timely accuracy, the better success rates of bedside tube placement are seen when a standardized protocol is used and trained, dedicated personnel place the tubes.

If given the opportunity to improve upon the current practice with innovative technology designed to visually guide sbNGT placement to allow guided, faster nutrition delivery to the patient population, would you say this would be beneficial to your practice? Please tell us why.

McCarthy: Absolutely. As mentioned previously there are published critical care guidelines addressing the importance of enteral feeding for the ICU

Clinicians across disciplines should have a working knowledge with regard to technique as well as the advantages and disadvantages of the various placement options to optimize patient outcomes and minimize unnecessary interventions

- Escuro -

patient beginning within 48 hours of admission in order to achieve maximal benefit from this therapy.[31] It can take 48 hours to secure postpyloric placement of FT using a blind bedside method, with or without a promotility agent. Acutely ill patients in environments outside the ICU as well as those in short and long-term skilled nursing facilities would all benefit from a portable, RN or RD-managed, visually guided feeding tube placement system that ensures safe and early delivery of individualized nutrition support. Further research and development is needed for the videoscopic application or perhaps an ultrasound technique.

Escuro: Definitely. Depriving a patient of nutrients for a prolonged period will likely worsen pre-existing nutrition deficits and allow malnutrition to develop as a comorbid condition. Because of issues and delays in gaining enteral access with endoscopic and fluoroscopic techniques, technological innovations for bedside placement of feeding tubes will allow for timely and consistent attainment of patient's energy and nutrient goals.

Brantley: Enteral feedings could be started sooner - no waiting for an X-ray to be completed and/or read by the radiologist or MD. Less distress for the patient, less radiation exposure, easier to replace if the tube becomes dislodged as the stylette is safe to re-insert into the SAME feeding tube and be replaced. In summary, this type of technology would eventually save professional time (RN, RD, X-ray tech, etc), patient discomfort, improve amount of enteral feeding delivered, decrease time needed to replace a dislodged or clogged tube, and, lastly, a cost savings could easily be realized.

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places such as the esophagus, brain or pulmonary system.[2-4] Reported rates of EFD complications range between 1 and 3%.[5,6] Based on reports conservative estimates are over 36,000 patients annually suffer from or succumb to EFD complications.

Do all patients have a similar risk for EFD complications? Probably not. Patients who are awake and able to swallow tubes seem to have less risk than patients who are sedated, critically ill, or with anomalies of the pulmonary or GI tract, such as tracheal/esophageal fistulas or tumors of the esophagus or upper pulmonary system.[5]

The experience of healthcare providers should be considered when evaluating the safest and most efficient method for placing EFDs. Nurses, physicians, or dietitians with little experience or training about EFD placement are more likely to misplace feeding tubes as are experienced professionals who must place a tube under emergency conditions or without sufficient time or assistance.

Tube type and composition also effect the risk of misplacing EFDs. Case and descriptive reports most often identify small bore tubes with guidewires that are misplaced. The frequency with which small bore feeding tubes are associated with risk for misplacement is probably the basis for one algorithm directing practitioners to avoid using the small bore feeding tubes for short term use and instead "use a salem sump whenever possible." However, using a larger bore tube without a guidewire may not be an option for delivering nutrition. According to one manufacturer, salem sump tubes are not to be used for administration of enteral feedings.[8] Providers are challenged to find the safest option for enterally feeding their patients.

> Radiological confirmation performed after tube placement does not prevent the inadvertent advancement of EFDs into the lung.

Even a change to what appears to be an equivalent type of EFD with the same composition can be associated with tragic results. After providers at one institution changed to an equivalent EFD and noticed a spike in the number of misplaced tubes, they asked for closer, independent review. The Pennsylvania Patient Safety Group concluded that although the new tubes appeared to be equivalent to those previously used, the difference in manufacturing was sufficient to require additional staff training about the product change.[7] Whether it is changing tube type or composition there are challenges in determining the safest EFD for feeding patients.

The possibility that the rate of misplaced EFDs could occur when changing tube type or composition should underscore the importance of planning, communicating and training when changing EFDs. This will be especially important with the implementation of ISO standards to meet international objectives for safe enteral connections[9] and the possibility that manufacturing changes may affect placement of EFDs. Planning, communicating and evaluating the transition to standardized enteral connections are paramount to meeting patient safety goals. For more information on safe enteral feeding connections, please go to www.stayconnected.org

The balance between patient comfort and the ease and accurate placement of EFDs can be a challenge. Large bore and/or stiffer tubes are thought to be more uncomfortable for patients. Smaller and more pliable tubes make it more comfortable for patients once the tube is placed. But the initial placement requires a guidewire to easily advance the tube and guidewires are associated with misplacement risks.[10] Again, providers are challenged by the balance of providing both comfortable and safe nutrition support.

The universal use of EFDs should not neglect the importance of eliminating complications related to these tubes. Despite the safety concerns and the lack of comprehensive data about the rates of EFDs, the need for delivering early enteral feeding remains.

Regulatory Reports and Professional Alerts

Evidence-based policies and procedures need to be put in place in healthcare settings and healthcare workers need to continuously evaluate processes and outcomes. Regulatory agencies do not tell providers which EFDs they can place. Like health care providers, regulatory agencies expect patients will receive safe, quality care without complications. To ensure patient safety verification of tube placement must be documented before and during administration of feedings or medications. Both regulatory agencies and professional organizations consistently and continuously issue alerts about and recommendations for the elimination of EFD risks. The Na-

tional Patient Safety Alert for safe placement of EFDs amended its 2005 alert demanding oversight to ensure safe placement and verification of feeding tubes prior to use. Their clarion call was that EFDs should not be used for the administration of any substance until the correct position has been verified by an experienced and knowledgeable professional.[10]

In 2009, the American Association of Critical Care Nurses issued a practice alert with the expectation that EFDs would be monitored after placement.[11] In a follow-up survey of over 300 critical care nurses, Bourgalt and associates[12] found that nurses who followed an institutional policy reflecting the AACN Practice Alert were more likely to have implemented all 4 components of the 2009 AACN Practice Alert for safe placement of EFDs. Evidence-based policies and procedures need to be put in place in healthcare settings and healthcare workers need to continuously evaluate processes and outcomes. It's critical that standardization and continuous evaluation of processes and outcomes for EFD placement occur if we are to eliminate EFD complications.

The Balance of Verification Techniques

The standard of care is to verify the location of EFDs prior to administering feedings or medications.[13] Direct visualization of tubes in operating rooms or endoscopy suites makes it relatively easy to confirm placement but these are unique situations. Most EFDs are placed blindly at the bedside, and because there are no confirmed methods or combination of methods performed at the bedside that verify placement with 100% accuracy,[14] providers must balance the need to feed their patients with the need to ensure EFDs are safely placed.[15]

> To fully understand and develop safe and effective methods for placing and using EFDs, there needs to be a standardization of EFD definitions and data collection methods for complications.

Because of the tragic events noted in case reports and reviews, and the lack of a bedside verification method that is 100% accurate, many institutions require X-ray confirmation of tube placement prior to use. Confirmatory X-rays require an image of high quality that shows the entire tube with a radiopaque line read by an experienced radiologist. Routine X-rays are not recommended for monitoring EFDs throughout the course of patients' therapy; however, in situations where there is concern or evidence that a tube has become dislodged, confirmatory X-rays should be performed.[16]

Radiological confirmation performed after tube placement does not prevent the inadvertent advancement of EFDs into the lung. Caution should be used when placing or advancing EFDs. If patients are able to swallow, tubes can be gently advanced as patients swallow. If patients are unable to swallow, it is more difficult to advance tubes with increased risk of a pulmonary intubation. Do not hesitate to retract EFDs during placement if patients begin to cough or show signs of dyspnea suggesting tubes are in airways.

Feeding into the stomach is both efficient and effective for most patients.[1] However, for patients requiring small bowel feedings, electromagnetic tracking devices may be used to drag tube tips into the desired GI tract location.[18,19] These, like all other forms of verification, are not 100% accurate or risk-free and when used should include radiological confirmation of placement.[19, 20]

A variety of methods have been used and described in the literature for confirming tube placement including auscultation, capnography, visual inspection, pH and bilirubin testing. The reliability and validity of bedside verification methods continues to be tested and as of this date, no single or combination of methods have been found to be 100% accurate. Providers must use the current available evidence to make decisions about safe placement, verification and maintenance of tubes. Current evidence supports abolishing the use of auscultation, visual inspection of aspirate or placing tubes under water for bubbling as methods for confirming EFD placement.[11,14,22]

Professional organizations recommend the use of multiple bedside verification methods. When accessible, a pH in the acidic range of less than 4 or 5 provides some indication the tube tip is in the stomach. Similarly, measuring aspirates for bilirubin or enzymes exclusively found in the GI tract might be beneficial. Capnography is another verification method that might be useful and could help to verify before the final confirmatory X-ray.

After placement and verification, EFDs must be stabilized and main-

tained for safe nutrition support. While there is some research focusing on the initial placement and verification, there is even less research about safe maintenance of EFDs. Professional organizations recommend recording and monitoring the external length of tubes at the time of X-ray confirmation and every 4 hours while EFDs are in place.[11,14] The expectation is to intervene immediately at the first indication a tube has been dislodged by patient movement, coughing, or vomiting. Interventions include replacing or repositioning and then reconfirming with X-ray that tubes are in the right place before restarting tube feedings or administering medications.

Professionals and industry continue to work together to identify a bedside verification method that is 100% accurate. Nowhere is this more important than in the pediatric population where the risk of X-ray radiation is of great concern. The objective of the NOVEL project is to identify and develop a safe and effective method for verifying EFD placement while minimizing or eliminating the risk of radiation to small children and neonates.[23] The work done by this group illustrates the importance of safe and effective nutrition support therapy using EFDs and the need for collaborative efforts if we are to reach the goal of finding an efficient and accurate method for tube verification.[24]

Conclusion

Recognition of EFD risk is not enough. To fully understand and develop safe and effective methods for placing and using EFDs, there needs to be a standardization of EFD definitions and data collection methods for complications. The numbers of patients that actually experience EFD complications are overshadowed by the ubiquitous use of feeding tubes. Standardizing definitions for what constitutes an EFD complication paves the way for professionals to collect, compile, analyze and define data driven interventions to eliminate those complications. Providers must decide if it is enough to record only those cases where a patient suffers a severe or lethal complication as a result of an EFD placement (e.g. pneumothorax, hemothorax, feeding into lungs, etc.) or to fully understand and evaluate the situations that most likely precede lethal events such as tube tips in the esophagus or the number of times medications or feeding are administered via EFDs before confirmatory X-rays are obtained. To accurately estimate the number of adverse events associated with EFDs will require combining data from many healthcare facilities. If EFD complications are to be eradicated, it will require consistent measures, continuous evaluation, and the concentrated and collaborative efforts of all involved with the use of EFDs.

The development and use of evidence-based protocols and policies are paramount to reaching the goal of safe, quality patient care.[25] Forming EFD teams to place and maintain feeding tubes in high risk patients would most likely improve outcomes by standardizing and tracking processes and outcomes. Of course, the costs of establishing EFD teams or interventions will be a major barrier, however, the costs of eliminating serious or lethal EFD complications must be factored into the equation. Balancing patients' need for early and appropriate nutrition without EFD injury requires attention to seeking safe, quality care.

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Upon completion of this offering, the learner will be able to:

Objectives

1. **Describe the current methods to place small bore nasogastric feeding tubes.**
2. **List the types of complications associated with the placement of enteric feeding tubes**
3. **Discuss the methods or technologies that can be used to enhance patient safety during placement of enteric feeding tubes**

To earn continuing education credit, do the following:

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6. **Test must be completed by Jan. 1, 2018. Faculty disclosure: No conflicts were disclosed. Nurse planner (Ms. Caffery) disclosed no conflicts of interest.**
8. **No off-label products were mentioned in this program.**

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1. **Which of the following patient characteristics are not associated with the placement of enteral feeding device complications?**
   A. Cuffed endotracheal tube
   B. Decreased level of consciousness
   C. Ability to swallow
   D. Critical illness

2. **Mr. Brookside arrived in the emergency room and immediately stopped breathing. An endotracheal tube was placed for mechanical ventilation and a feeding tube was placed at the same time. Tube feeding is ordered. Before starting the tube feeding;**
   A. There is no need to order another X-ray because Mr. Brookside's chest X-ray shows the NG tube "below the diaphragm and coursing off the screen."
   B. The pH of the aspirate is 5.0 indicating the feeding tube is in the stomach and there is no need for an X-ray.
   C. The tube should be located in the small bowel to prevent aspiration.
   D. An X-ray is obtained showing the entire course of the tube with the tip in the stomach.

3. **The goal of implementing ISO standards for enteral feeding devices;**
   A. Will improve bedside verification methods when blindly placing feeding tubes.
   B. Is to improve tube design for safe placement of enteral feeding devices.
   C. Is to address enteral feeding connection design and prevent misconnections.
   D. Is to improve feeding tube design allowing providers to auscultate and aspirate for tube placement.

4. **Which of the following enteral feeding device placement methods would be most likely to reduce the risk of a pneumothorax?**
   A. Obtaining an X-ray after every feeding tube placement and before feeding.
   B. Checking for bubbling as the feeding tube is advanced and withdrawing the feeding tube with the first sign of bubbling.
   C. Checking for carbon dioxide as the feeding tube is placed.
   D. Obtaining an X-ray after inserting the feeding tube and before advancing the tube below the level of the carina.

5. **Ms George is a patient in your small community hospital. A small bore feeding tube was placed at the bedside and a confirmatory X-ray shows the tip of the tube in the lung. You pull the tube back, advance the tube and obtain an X-ray confirming the tube is in the stomach. What information should be recorded?**
   A. Document the procedure in the patient's EHR and include the X-ray results.
   B. Document in the patient's EHR and the hospital patient safety network according to institutional policy.
   C. Document in the EHR and the state patient safety authority.
   D. Document in the patient's EHR and notify the hospital attorneys to protect against any liability.

6. **Which of the following is not part of the AACN Practice Alert?**
   A. Use multiple bedside verification methods when blindly placing tubes
   B. Use auscultation and water bubbling methods as verification methods.
   C. Use X-ray confirming entire course of tube within the GI tract.
   D. Check tube placement every four hours after confirming placement.

7. **When possible, the GI tract is the preferred route for of delivery and superior to parenteral feeding alone.**
   A. True
   B. False

8. **Methods used to enhance passage of FT include:**
   A. Administration of promotility agents prior to and during insertion
   B. Positioning of patients
   C. A multi-step technique with radiographic confirmation at designated intervals
   D. All of the above

9. **Newer techniques to assist in insertion include:**
   A. Endoscopically guided tubes
   B. Electromagnetic placement device
   C. pH testing
   D. A and B

10. **For enteral nutritional support lasting > 7 days, a small bore (5F to 12F), flexible, silicone or polyurethane NGT should be used to reduce the risk of complications.**
    A. True
    B. False

Participant's Evaluation

What is the highest degree you have earned? (circle one) 1. Certificate 2. Associate 3. Bachelor's 4. Master's 5. Doctorate

Indicate to what degree did this program meet the objectives: Using 1 = strongly disagree to 6 = strongly agree rating scale, please circle the number that best reflects the extent of your agreement with each statement.

At the end of the session the participant will be able to:	Strongly Disagree					Strongly Agree
1. Describe the current methods to place small bore nasogastric feeding tubes.	1	2	3	4	5	6
2. List the types of complications associated with the placement of enteric feeding tubes	1	2	3	4	5	6
3. Discuss the methods or technologies that can be used to enhance patient safety during placement of enteric feeding tubes	1	2	3	4	5	6

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Mark your answers with an X in the box identifying the correct answer(s).

	A	B	C	D
1	☐	☐	☐	☐
2	☐	☐	☐	☐
3	☐	☐	☐	☐
4	☐	☐	☐	☐
5	☐	☐	☐	☐
6	☐	☐	☐	☐
7	☐	☐		
8	☐	☐	☐	☐
9	☐	☐	☐	☐
10	☐	☐		

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