AACN Practice Alert

Initial and Ongoing Verification of Feeding Tube Placement in Adults

(applies to blind insertions and placements with an electromagnetic device)

Scope and Impact of the Problem

Although often considered an innocuous procedure, bedside placement of a feeding tube can cause serious and even fatal complications.[1-3] Although styleted small-bore tubes are most often associated with complications, large-bore tubes without stylets are not without risk.[1,4-6] In a study[7] of 9931 blindly inserted narrow-bore nasoenteric tubes, 1.9% were placed in the tracheobronchial tree; of the 187 tube misplacements, 35 cases of pneumothoraces (at least 5 of which resulted in a patient's death) occurred. In rare situations, feeding tubes may also be inadvertently positioned in the brain, especially in patients with a traumatic defect.[4,8-10] Risk for aspiration is greatly increased when a feeding tube's ports end in the esophagus.[1,11]

AACN Levels of Evidence

Level A Meta-analysis of quantitative studies or metasynthesis of qualitative studies with results that consistently support a specific action, intervention, or treatment (including systematic review of randomized controlled trials)

Level B Well-designed, controlled studies with results that consistently support a specific action, intervention, or treatment

Level C Qualitative studies, descriptive or correlational studies, integrative reviews, systematic reviews, or randomized controlled trials with inconsistent results

Level D Peer-reviewed professional and organizational standards with the support of clinical study recommendations

Level E Multiple case reports, theory-based evidence from expert opinions, or peer-reviewed professional organizational standards without clinical studies to support recommendations

Level M Manufacturer's recommendations only

Expected Practice

1. Use 2 or more of the following bedside methods to predict tube location during the insertion procedure. [level B]
   a. Observe for signs of respiratory distress.
   b. Use capnography if available.
   c. Measure pH of aspirate from tube if pH strips are available.
   d. Observe visual characteristics of aspirate from the tube.
2. Do not use the auscultatory (air bolus) method to determine tube location. [level B]
3. Do not use the water bubbling method (holding tube under water) to determine tube location. [level B]
4. Recommend radiographic confirmation of correct placement of a blindly inserted small-bore or large-bore tube before its initial use for feedings or medication administration; this recommendation also applies to a tube inserted with assistance from an electromagnetic tube placement (ETP) device and gastric decompression tubes that are later used for other purposes. [level A]

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a. The radiograph should visualize the entire course of the feeding tube in the gastrointestinal tract and should be interpreted by a radiologist to avoid errors. Mark and document the tube's exit site from the patient's nose or mouth immediately after radiographic confirmation of correct tube placement.

5. Check tube location at 4-hour intervals after feedings are started. [level B]
   a. Observe for a change in length of the external portion of the feeding tube as determined by movement of the marked portion of the tube.
   b. Recommend radiographic confirmation of tube position if there is doubt about the tube's location, and mark exit site after radiographic confirmation is obtained.
   c. Review routine chest and abdominal radio- graphy reports to look for notations about tube location.
   d. Observe changes in volume of aspirate from feeding tube.
   e. If pH strips are available, measure pH of feeding tube aspirates if feedings are interrupted for an hour or more.
   f. Observe the appearance of feeding tube aspirates if feedings are interrupted for an hour or more.

Supporting Evidence

Bedside Methods to Determine Placement During Blind Tube Insertion

Noting signs of respiratory distress:

1. Signs of respiratory distress (eg, coughing, choking, dyspnea) may occur when a feeding tube is inadvertently positioned in the airway. When these signs occur, the tube should be removed and a new insertion attempted.[12] However, it is important to recognize that signs of respiratory distress are sometimes absent when feeding tubes are inadvertently positioned in the airway, especially in patients with an impaired level of consciousness.[13-15]

Capnography:

1. A carbon dioxide detector is helpful in detecting when a feeding tube is in the tracheobronchial tree; however, capnography is not sufficiently sensitive and specific to preclude the need for a confirming radiograph before initial use of a feeding tube.[16-21] For example, carbon dioxide may be detected when the tube is not in the airway (eg, when the tube is in the mouth) and may not be detected when the tube is in the airway if the ports are occluded.[18]

Measuring pH and assessing appearance of the aspirate:

1. Fasting gastric pH is usually 5 or less, even in patients receiving gastric-acid inhibitors.[12,22-24] Respiratory secretions typically have a pH of 6 or greater.[14,24,25] However, because gastric fluid occasionally has a high pH, the pH method is not sufficiently reliable to rule out the need for radiography to distinguish between gastric and respiratory tube placement.[25]
2. Small-bowel secretions typically have higher pH values (≥6) than gastric fluid; thus, observing for pH changes is useful in determining when a feeding tube has advanced from the stomach into the small bowel.[22,23,26-28] With this method, it is often possible to limit the number of confirming radiographs needed to one.
3. The pH method is not useful for detecting placement of a feeding tube in the esophagus. Fluid withdrawn from the esophagus could be swallowed alkaline saliva or refluxed acidic gastric fluid.[27]
4. In summary, although the pH method is helpful, it is not sufficiently accurate to eliminate the need for a confirming radiograph before first-time use of a feeding tube.
5. The pH of feeding tube aspirates is likely to approach fasting levels 1 hour or more after feedings are interrupted.[25] Thus, testing the aspirate's pH can serve as an indicator of tube location.
6. Aspirate appearance is not sufficient to eliminate the need for a confirming radiograph before first-time use of a feeding tube; trying to differentiate between gastric and respiratory secretions

visually is confusing.[29] However, aspirate appearance can be useful in determining when a tube has moved from the stomach to the small bowel; gastric fluid is typically clear and colorless or grassy green; in contrast, small-bowel secretions are typically bile-stained.[29]

Listening over the epigastrium for air insufflated through the feeding tube:

1. Although widely used in practice, no evidence indicates that the auscultatory method is useful for determining tube location.
2. Some evidence does indicate that the auscultatory method is not useful for distinguishing between respiratory and gastrointestinal placement of a feeding tube or for distinguishing between placement in various sites within the gastrointestinal tract (esophagus, stomach and small bowel).[30-34]
3. Numerous anecdotal reports[5,6,14,35-43] of blindly inserted tubes entering the respiratory tract undetected by the auscultatory method, causing clinicians to assume that the tubes were correctly positioned in the stomach, have been published. In a number of these cases,[6,15,35,37,39,40,44,45] feedings or medications were administered and led to poor outcomes for patients.
4. The auscultatory method should not be used.[28,46-48]

Observing for bubbling when the proximal end of the feeding tube is held under water:

1. The bubbling method (holding the proximal end of a feeding tube under water and observing for bubbles upon exhalation) does not enable users to distinguish between gastric and respiratory placement of a feeding tube.[14] A false-negative result can occur when the tube's ports are occluded by the airway mucosa, and a false-positive result can occur because the stomach often contains air.[49]

Electromagnetic guidance:

1. Some evidence indicates that well-trained and experienced clinicians can achieve a high level of success in placing postpyloric feeding tubes when an ETP device is used.[50,51] Successful use of an ETP device is dependent on the user's familiarity and dexterity with the device.[52]
2. Multiple cases have been reported in which clinicians failed to recognize placement of feeding tubes in the respiratory tract while using an ETP device; some of these were associated with fatal outcomes.[53,54] Reports of clinicians failing to recognize tube perforations through the nasopharynx or esophagus while using an ETP device have also been published.[55,56]

Radiographic Confirmation

1. A properly obtained and interpreted radiograph is recommended to confirm correct placement of any blindly inserted tube (small bore or large bore) before its initial use for feedings or medication administration[1,11,57-63]; the same recommendation applies to a tube inserted with assistance from ETP device.[52,53] Because radiographs may be misinterpreted,[39,45,58,64] it is best to have a radiologist interpret the film to approve use of the tube for feedings.[1]
2. Marking and documenting the tube's exit site at the time of radiographic confirmation of correct placement will be helpful in subsequent monitoring of the tube's location during its use for feedings.[28,65]

Checking Tube Location at Regular Intervals After Feedings Are Started

Unfortunately, feeding tubes can become dislocated during use.[66,67] For this reason, it is necessary to monitor tube location at regular intervals while the tube is being used for feedings or medication administration.

Observing for change in external tube length:

1. Observing for a change in length of the external portion of the feeding tube (as determined by movement of the marked portion of the tube) may be helpful in detecting tube dislocation.[65,66]

Reviewing routine chest and abdominal radiography reports:

1. Reviewing routine chest and abdominal radiography reports to determine if the radiologist has referred to feeding tube location can be quite helpful.[65]

Observing for changes in volume of feeding tube aspirates:

1. Observing for a change in the volume of fluid withdrawn from a tube at 4-hour intervals during continuous feedings or before each intermittent feeding may be helpful.[65] Although results of a recent study[68] suggest that a 6-hour interval (as opposed to a 4-hour interval) is sufficient for monitoring gastric aspirate volume, the longer interval was associated with a significantly higher incidence of vomiting or regurgitation.
2. A sharp increase in the volume of fluid withdrawn from the feeding tube may indicate displacement of the tube from the small bowel into the stomach.
3. Consistent inability to withdraw fluid (or ability to withdraw no more than a few drops) from the feeding tube may signal upward displacement of the tube from the stomach into the esophagus.[27,69]
4. It is sometimes difficult to withdraw fluid from small-bore feeding tubes.[70] To avoid this problem, it is helpful to inject air boluses into the tube with a large syringe and then slowly apply negative pressure to the plunger to withdraw fluid.[71] This method was effective in obtaining fluid from more than 90% of nasogastric and nasointestinal tubes in a large study of acutely ill adults.[72] A similar technique has proved successful in obtaining fluid from the feeding tubes of acutely ill children.[73]

Testing pH and observing the appearance of feeding tube aspirate if feedings have been off for at least 1 hour:

1. Feedings should never be interrupted solely for the purpose of pH testing; however, feedings are sometime interrupted in preparation for tests and procedures. If such an interruption occurs, testing the pH of a feeding tube aspirate may be useful in distinguishing between gastric and small-bowel placement of a feeding tube.[25]
2. The pH method is less helpful during continuous feedings because enteral formula buffers the pH of gastric secretions.[25]
3. Observing the appearance of feeding tube aspirates may be useful in distinguishing between gastric and small-bowel positions of feeding tubes.[29] During fasting, gastric fluid is usually grassy green or clear and colorless, whereas small-bowel fluid is often bile stained.[29]

Listening over the epigastrium for air insufflated through the tube:

1. As indicated earlier, the auscultatory method is not useful for distinguishing between respiratory and gastrointestinal placement of a feeding tube or for distinguishing between sites within the gastrointestinal tract (esophagus, stomach, and small bowel). For this reason, auscultation should not be used to determine feeding tube placement.

Recommending a radiograph be obtained to determine tube location if in doubt:

1. When bedside methods suggest that tube displacement has occurred, it is prudent to request a radiograph to determine the tube's location.

Actions for Nursing Practice

Use a minimum of 2 bedside techniques to assess tube placement during the insertion procedure; these results can be used to determine when it is time to use radiography to confirm tube location. The number of confirming radiographs needed can most likely be reduced to one.

Recommend obtaining a radiograph that visualizes the entire course of a blindly inserted small-bore or large-bore tube to ensure that the tube is in the desired position (either the stomach or the small bowel) before its initial use. (This recommendation also applies to tubes inserted with assistance from an ETP device). Work with an interdisciplinary team to establish a protocol whereby a radiologist will interpret the film and give written permission for first-time use of the tube for feedings or medication administration.

Ensure that your critical care unit has written practice documents such as a policy, procedure, or standard of care that specify when the initial radiograph should be obtained, a method of marking the tube, where to document the exit site, and the frequency of the documentation.

Form a collaborative team including a radiologist, pulmonologist, staff nurse, and risk manager to develop strategies for implementing documentation of tube placement if this practice is not currently a

part of the routine interpretation of chest and/or abdominal radiographs.

Monitor tube position at 4-hour intervals by using a variety of bedside techniques after initial radiographic confirmation of tube location; consider the need for a radiograph if bedside techniques raise doubt about a tube's location.

Need More Information or Help?

1. Contact a clinical practice specialist for additional information: go to www.aacn.org /practice-resource-network.
2. AACN Practice Alert: Prevention of Aspiration in Adults. *Crit Care Nurse.* 2016;36(1):e20-e24.
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None reported.

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