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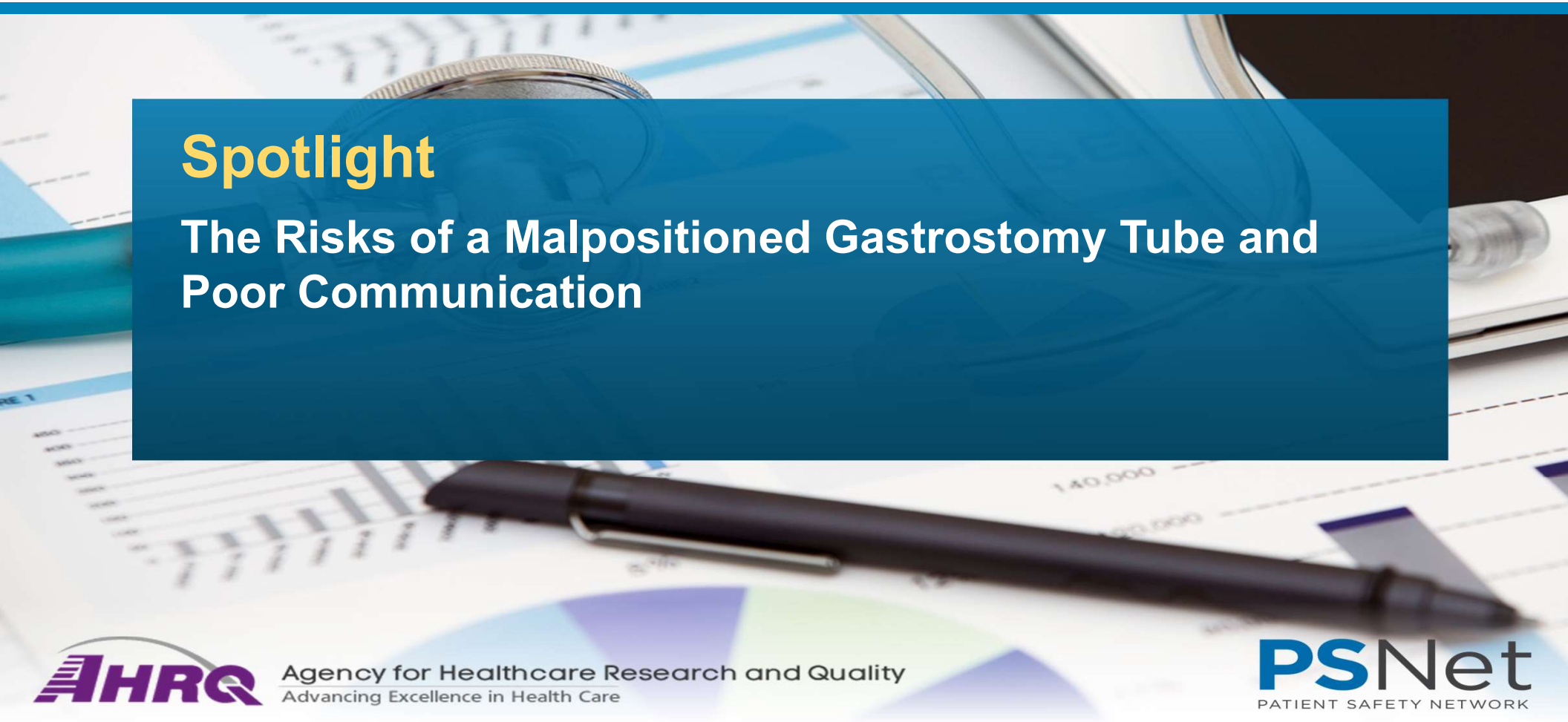
Morbidity and Mortality Rounds on the Web



Spotlight

The Risks of a Malpositioned Gastrostomy Tube and Poor Communication

AHRQ Agency for Healthcare Research and Quality

Advancing Excellence in Health Care

PSNet PATIENT SAFETY NETWORK

Source and Credits

- This presentation is based on the November 2023 AHRQ WebM&M Spotlight Case
  - See the full article at https://psnet.ahrq.gov/webmm
  - CME credit is available
- Commentary by: Rachel Ann Hight, MD
- AHRQ WebM&M Editors in Chief: Patrick Romano, MD, MPH and Deb Bakerjian, PhD, APRN, RN
  - Spotlight Editors: Amy Nichols, EdD, RN and Patrick Romano, MD, MPH
  - Managing Editor: Meghan Weyrich, MPH

Objectives

At the conclusion of this educational activity, participants should be able to:

- Describe various techniques available to place long-term gastric access devices.
- Recognize common and uncommon complications of PEG tube placement.
- Describe possible causes of diagnostic error in the interpretation of radiology studies.
- Describe vulnerabilities in communication across a spectrum of care environments.
- Suggest possible solutions to improve interprofessional and interfacility communication.

THE RISKS OF A MALPOSITIONED GASTRONOMY TUBE AND POOR COMMUNICATION

A case highlighting the importance of clear documentation of complications, mitigating risks during patient care transition, and using multiple communication approaches to ensure appropriate continuity of care

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Case Details (1)

- A 55-year-old woman was hospitalized after a motor vehicle crash with cardiac arrest in the field.
- She was found to have subarachnoid and intraventricular hemorrhages from multiple cerebral aneurysms, treated with endovascular coiling and complicated by refractory intracranial hypertension requiring decompressive hemicraniectomy on hospital day 12.
- She underwent percutaneous tracheostomy placement on day 24 and percutaneous endoscopic gastrostomy (PEG) tube placement on day 30.
- The surgeon placed the PEG tube in the ICU using the “pull technique” (i.e., via the mouth) because an operating room was not available, and her CT scan showed no bowel between the stomach and the abdominal wall.
- During the procedure, the abdominal wall transilluminated as expected, and 1-to-1 gastric motion occurred with external palpation.

Case Details (2)

- The postoperative plain film showed the gastrostomy tube bulb in an appropriate position, so the surgeon cleared the patient's team to advance tube feeds as tolerated.
- Six days after PEG placement, the patient developed "intractable emesis" of tube feeds and a gastroenterology consultant was unable to identify the etiology.
- Intermittent tube feed intolerance continued; a repeat CT scan on day 41, based on the gastroenterologist's request to evaluate for small bowel obstruction but without mention of the recent PEG placement, showed the gastrostomy tube in the stomach with no evidence of obstruction.
- On day 43, the patient underwent cranioplasty and ventriculoperitoneal (VP) shunt placement, followed on day 51 by repeat aneurysm coiling and right carotid artery stent placement.

Case Details (3)

- On day 64, the acute care surgery team was consulted to convert the PEG tube to a percutaneous gastrojejunostomy (GJ) tube due to the patient's intermittent emesis; however, they instead recommended interventional radiology (IR) to perform minimally invasive tube exchange.
- When the IR team evaluated the patient on day 65, they re-reviewed the CT scan from 24 days earlier and noted (for the first time) that the gastrostomy tube traversed the liver for 1.7 cm.
- They recommended surgical revision instead; the acute care surgical team agreed to perform open revision with possible GJ tube placement after coordinating with the neurosurgery team about VP shunt management.
- On day 67, a repeat CT scan with gastric contrast confirmed the transhepatic course of the tube, unchanged since the earlier CT scan.

Case Details (4)

- The neurosurgeon recommended continuing dual antiplatelet therapy for 2 months after carotid stent placement, so the two teams opted to keep the gastrostomy tube for gastric venting and to place a nasojejunal (NJ) tube.
- The NJ tube was placed successfully with confirmation of jejunal positioning on day 71. By the next day, the patient was tolerating goal tube feeds via the NJ tube and had weaned off parenteral nutrition.
- On day 73, the discharge planner left a note recommending surgery clinic follow-up in about 3 weeks to coordinate open gastrostomy tube revision after discontinuation of antiplatelet therapy.
- The patient was discharged to a rehabilitation facility on day 74 with orders that included a surgery follow-up appointment to “discuss GT revision to JT placement” but without clear documentation that the PEG tube was malpositioned through the liver.

Case Details (5)

- Around 10 days after hospital discharge, the patient was seen by the neurosurgeon, who now recommended a 3-month course of dual antiplatelet therapy with repeat cerebral angiography before stopping ticagrelor.
- The patient's spouse then called the surgery clinic to change the follow-up visit; he revealed that his wife was taking enough orally that enteral access was no longer required for nutrition.
- Unaware that the PEG tube was malpositioned through the liver, the surgeon attending clinic that day (who had not seen the patient previously) changed the plan to gastrostomy tube removal in clinic 3-4 weeks after discontinuation of antiplatelet therapy.

Case Details (6)

- Following this plan, the patient was seen in follow-up by a different surgeon (who had also not seen the patient previously) for outpatient gastrostomy tube removal.
- The patient had been eating full meals, but she had aphasia and her husband did not know that the PEG tube was malpositioned.
- The surgeon removed the tube uneventfully via the abdominal wall tract using the common traction technique.
- A few hours later, the clinic surgeon further reviewed the prior hospital record and noted the transhepatic course of the PEG tube.
- When he contacted the operating surgeon, he learned that the plan was to revise the PEG tube via laparoscopic or open technique due to concern for liver bleeding that might occur during removal.

Case Details (7)

- Surprised by this information, the clinic surgeon immediately contacted the patient's husband, who reported that his wife appeared well and that her vital signs were normal.
- An emergent abdominal CT showed no evidence of intra-abdominal hemorrhage.
- On further review, it became apparent that a third surgeon had assessed the patient near the end of her inpatient stay and recommended outpatient open gastrostomy tube revision, but neither the operating surgeon nor the clinic surgeon was aware of this plan.
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THE RISKS OF A MALPOSITIONED GASTRONOMY TUBE AND POOR COMMUNICATION

THE COMMENTARY

By Rachel Ann Hight, MD

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BACKGROUND

Background (1)

Although several opportunities for improvement were identified in the review of this complex case, the primary issues were:

1. The original complication of a malpositioned transhepatic PEG tube, which was a delayed diagnosis after tube feedings were poorly tolerated and the CT scan was misread, and
2. The subsequent lack of consistent communication identifying this complication and the associated plan for management of the malpositioned PEG tube.
   - The latter problem was compounded by the need for multidisciplinary care coordination with evolving care plans for management of dual antiplatelet therapy across transitions from the hospital through inpatient rehabilitation care into outpatient care.
   - Communication through these care hand-offs about the feeding tube reflected only “PEG tube” or “G tube” and did not specifically identify this tube being “malpositioned” and/or “transhepatic”; thus, subsequent members of the care team had no awareness that the PEG tube was transhepatic.

Background (2)

- Percutaneous endoscopic gastrostomy (PEG) tubes are commonly utilized for long-term enteral feeding access for many different reasons,[1] with about 200,000-250,000 procedures performed annually in the United States and a success rate of 95% or higher.[2-6]
- Decisions about the type of enteral access and the means to establish enteral access are driven by patient factors such as anatomy and specific pathology and comorbidities, in the context of available facility teams and resources for placement.[3,4,5]

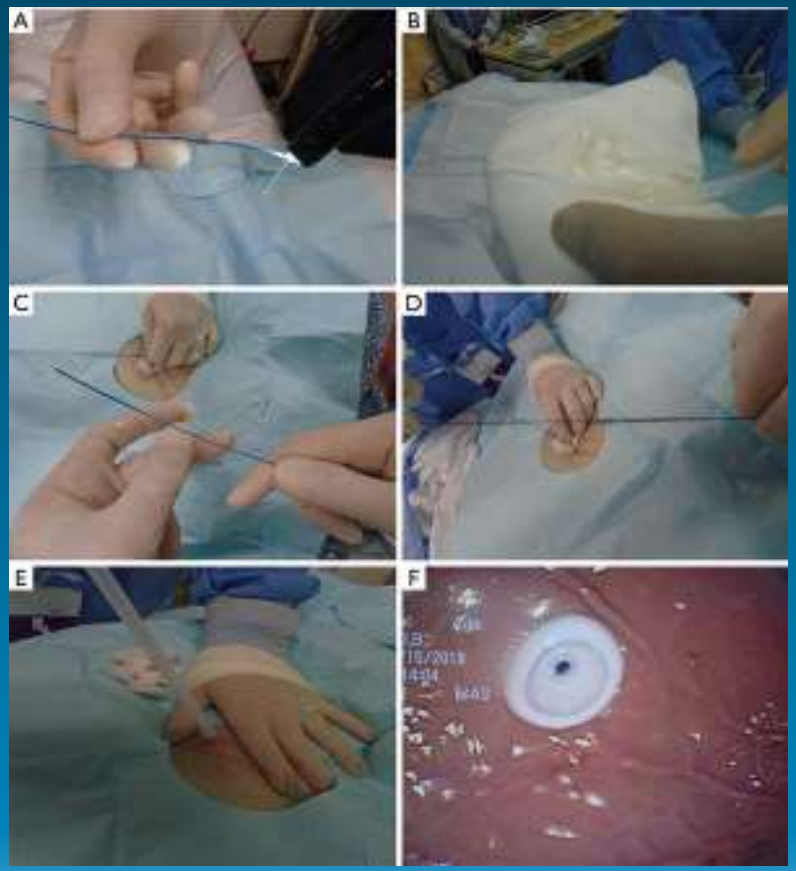
Background (3)

- Enteral feeding access options broadly include gastrostomy tubes and jejunostomy tubes.
  - These tubes can be placed nasally, orally, or directly through the abdominal wall.
  - Generally, gastrostomy tubes are preferred for long-term feeding access when it is clinically appropriate because there are usually less complications related to gastrostomy tube placement and long-term management compared with jejunostomy tube placement.[3,4,5,7,8]
- Feeding tubes placed nasally or orally can be optimized to terminate in the stomach, duodenum, or jejunum, with appropriate positioning confirmed radiographically using fluoroscopic guidance.
  - Although these tubes are easy to place at the bedside with minimal resources (i.e., without conscious sedation), their disadvantage is that they are usually intended for 6 weeks or less, and many long-term care facilities require patients to have more durable enteral access solutions.[7,8]

Background (4)

- The more durable gastrostomy tube options are those that go directly into the stomach via the abdominal wall.
- These tubes can be placed in a variety of ways.
  - Interventional radiologists use a “push technique” to position tubes percutaneously, using only fluoroscopic guidance, in a radiology suite or at bedside under conscious sedation,[6,8] although some practitioners offer CT-guided[8,9] or ultrasound-based[5,8,9] placement.
  - PEG tubes are placed via esophagogastroduodenoscopy (EGD), usually at the bedside under conscious sedation, by gastroenterologists, surgeons, or intensivists using either a “pull technique” or a “push technique,” depending on available supplies and proceduralist preference. [5,8,9]
  - Under general anesthesia, surgeons can place PEG tubes laparoscopically with or without EGD assistance (using either the pull or push technique), or by an open approach (i.e., in conjunction with another operation).[8]

Background (5)



Placement of the PEG tube via the pull method. (A) Guidewire with wire loop pulled out of the mouth; (B) lubricating gel applied to the PEG tube prior to insertion; (C) PEG tube looped through the guidewire; (D) PEG tube attached to the guidewire via a knot; (E) firm pressure applied while pulling the PEG tube through the abdominal wall; (F) direct visualization of the PEG tube bumper from inside the stomach. PEG, percutaneous endoscopic gastrostomy.

Image Source: Wei M, Ho E, Hegde P. An overview of percutaneous endoscopic gastrostomy tube placement in the intensive care unit. *J Thorac Dis.* 2021;13(8):5277-5296.

Background (6)

Completion of the PEG tube procedure. (A) External bolster placed onto the PEG tube; (B) skin marking on the external bolster kept at 2–5 cm depending on the patient's body habitus, making sure that the bolster is neither too tight nor too loose; (C) application of antibiotic ointment at the surgical site; (D) clamp positioned onto the PEG tube; (E) external port attached to the PEG tube; (F) successful placement of the PEG tube. PEG, percutaneous endoscopic gastrostomy.

Image Source: Wei M, Ho E, Hegde P. An overview of percutaneous endoscopic gastrostomy tube placement in the intensive care unit. *J Thorac Dis.* 2021;13(8):5277-5296.

RISK FACTORS AND ALTERNATIVE APPROACHES

Risk Factors and Alternative Approaches (1)

- In many locations, operating room access is limited, so bedside procedure options present a timely, cost-efficient alternative, avoiding the risk of general anesthesia.
- PEG tube candidates are typically screened for ability to tolerate an EGD and the safety of the percutaneous approach.
  - Many patients with proximal aerodigestive tract malignancies are not candidates because of the presence of obstructing tumor and/or esophageal stricture.
  - Obesity, adhesive disease from prior surgeries (especially of the foregut), and atypical location of the stomach relative to the small bowel or colon can increase the risk of complications associated with bedside PEG placement; these patients may instead be offered laparoscopic or open gastrostomy tube placement.[7,8,10,11]
- In this case, the patient had none of these risk factors, so there was no missed opportunity for prevention before placement.

Risk Factors and Alternative Approaches (2)

- For any patient undergoing PEG placement, the gastrostomy site is determined using indirect confirmatory adjuncts such as:
  1. External landmarks to the left of the patient's midline confirmed by:
     a) transillumination of the abdominal wall via the endoscope at the planned insertion site, and
     b) 1:1 indentation of the stomach seen with the endoscope at the externally palpated site of planned insertion[7,8]
  2. A "safe track" technique with endoscopic visualization of a fine 25-gauge "finder" needle puncturing the stomach at the expected location with bubbles noted in the syringe immediately as the needle enters the stomach. If bubbles are detected before the needle is visualized in the stomach, it may have traversed overlapping bowel.[12,13,14]
- If transillumination fails and a safe puncture site cannot be located using the above techniques, then a PEG tube can be inserted via surface ultrasound-guided landmarks,[15] percussion of the liver edge,[14] or using preoperative air insufflation to guide abdominal plain film marking of the puncture site.[16]
- In this patient's case, abdominal wall transillumination was documented, and one-to-one motion of the stomach occurred with external palpation.

PEG Tube Complications (1)

- PEG placement has an overall complication rate from 9% to 36%, depending on the classification of complications and the time period for ascertainment.[11,14,17,18]
  - The most common complications are wound problems such as infection (5-65%)[6] and leakage from the stoma (1-2%),[6] tube malfunction,[19] aspiration of tube feedings and/or pneumonia,[6,11] bleeding from the abdominal wall or gastric wall ulceration,[6,11,14] tube dislodgement with peritonitis or necrotizing soft tissue infection,[6,11,14] injury to adjacent organs such as the colon,[17] small bowel, liver, spleen,[20] or esophagus,[14] tumoral seeding of the PEG tract (<1%),[6] and gastrostomy site herniation.[6,9] “
  - Buried bumper” syndrome occurs in about 1-4% of cases[6,9,14] when the PEG tube’s internal bumper causes focal pressure necrosis on the gastric and/or abdominal wall, leading to erosion and “burial” under the skin, potentially outside the gastric lumen.
  - Liver[4,10,13-15,21-25] or spleen injury[20] are exceedingly rare complications of PEG placement, with one report citing only 16 cases of transhepatic placement in the literature, although these complications may be underreported due to the lack of specific symptoms and the need for imaging for diagnosis.[10]

PEG Tube Complications (2)

- In this case, failure to recognize the transhepatic PEG tube location on the initial postoperative CT scan contributed to the unintentional blind removal of the malpositioned tube.
- Diagnostic errors have received growing attention over the past 15 years as providers work to improve patient safety.
  - Delayed or missed diagnoses comprise the most common and costly reasons for malpractice claims,[27] with radiology being one of the specialties most susceptible to claims of medical negligence due to "failure to diagnose."[28]
  - In the radiology literature, these diagnostic errors have been categorized as pre-reporting, reporting, or post-reporting errors.[29]
  - In this case, the reporting error can be further classified as a "perceptual error," whereby the relevant finding was not noticed but is visible in retrospect.[30]

PEG Tube Complications (3)

- A widely accepted classification scheme developed by Kim and Mansfield assigns diagnostic errors into 12 groups based on the cause: 1) false-positive or over-reading, 2) faulty reasoning, 3) lack of knowledge, 4) under-reading, 5) poor communication, 6) technique-related, 7) prior examination-related, 8) history-related, 9) location-related, 10) satisfaction of search, 11) complication, and 12) satisfaction of report.[29]
- The missed finding of the transhepatic PEG tube in this case can be linked to several potential categories:
  - *under-reading error*, in which the abnormal finding was "undeniable and detectable"[29] yet completely missed;
  - *history-related error*, where the indications for the study only included the phrase "intractable emesis... evaluate for small bowel obstruction," without mention of recent PEG placement;
  - *location-related error*, where the abnormality was outside the anatomic area of focus (i.e., runoff of oral contrast through small bowel);
  - *satisfaction of search*, in which accompanying findings not specific to the primary question are under-read because the primary inquiry was satisfied.

PEG Tube Complications (4)

- Most hospitals utilize some form of peer review to identify care process and system solutions that can be implemented to enhance radiologists' performance.
  - An online survey of 339 institutions including 61 teaching hospitals confirmed that most facilities have a least one method of peer review; many sites use proactive review (double interpretation by separate radiologists) in addition to reactive methods (case review triggered when a discrepancy is noted).[26]
  - Some authors have reported on the challenges in developing software and technology to make peer review easier to accomplish and to reduce reviewer variability.[31]

PEG Tube Complications (5)

- Although it is impossible to prevent all trans-hepatic PEG tube placements, one article suggests real-time ultrasound visualization of the intended PEG tract[4] and another cautions against elevating the head of the patient's bed too steeply (more than 80°) to avoid excessive caudal displacement of the liver edge below the costal margin.[25]
- When a PEG tube complication has been identified, options for management include treating the complication while leaving the tube in place, removing the PEG tube without replacing it, or exchanging it or replacing it via the same or a different approach.[4,10,11,14]
- Management and timing of the intervention is dictated by the patient's clinical status and the specific complication.
  - If the patient no longer requires a PEG tube for nutritional support, it can be removed. This is usually done in a clinic setting without sedation or specialized equipment.
  - When the PEG tube has complications, such as a skin or soft tissue infection, but feeding access is still required, the tube can sometimes be used while managing the complication.
  - When the patient is not tolerating gastric feeding or is having aspiration events, the PEG tube can be exchanged or replaced or converted to a gastrojejunostomy tube under fluoroscopic or surgical guidance.
  - Generally, malpositioned tubes are managed by laparoscopic or open revision. With transhepatic positioning, removal or revision may be deferred if the tube is functioning and the risk of intervention exceeds the risk of utilizing the malpositioned tube. [4,10,11,14,25]

PEG Tube Complications (6)

There are several methods for removing PEG tubes. These include:

1. The somewhat controversial “cut & push” method,[32] whereby a PEG tube <18 French (Fr) in well-selected patients,[33,34] or 20-24 Fr[35] in other settings, is cut at the level of the skin and the internal gastric bumper is allowed to migrate downstream and pass through the colon, and passage of the bumper is confirmed either clinically[34,35] or with abdominal radiographs[33];
2. The traction technique where the PEG tube is pulled out of the stomach through the abdominal wall[36];
3. The endoscopic removal technique where the PEG tube is cut at the level of the skin but the internal gastric bumper is extracted endoscopically via EGD through the mouth;[19] and
4. Laparoscopic or open surgical approaches if the PEG tube needs to be removed or revised under direct visualization, allowing inspection of the involved and/or adjacent organs, potentially including infected tissue or other complications.[3,4,33]

PEG Tube Complications (7)

- It is widely accepted that removing a PEG tube less than one month after placement, regardless of technique, subjects the patient to an unacceptable risk of peritonitis and need for surgery.[21]
  - In this patient's case, the surgical team was not made aware of the patient's inability to tolerate tube feedings less than a week after the PEG was placed, which might have prompted an early postoperative CT scan to investigate the PEG site and pathway.
  - A CT scan was ordered by the primary service about 2 weeks postoperatively without surgeon input, but the malpositioned tube was not identified and the surgical team was not alerted.
- Since the patient was not tolerating gastric feeding, but still required access, the typical surgical approach would be an operative revision, especially in this case where the PEG was less than a month old.
  - Even without dual antiplatelet therapy, the risk of causing the liver to bleed with removal of the malpositioned PEG tube via the traction technique would be considered excessive.
  - In this case, the PEG was removed via traction technique about 4 months after placement. The risk of bleeding with transhepatic tubes varies according to the position of the PEG tube. A PEG tube traversing the periphery of the liver where there are smaller blood vessels and less parenchyma involved is associated with lower risk of significant bleeding than a centrally malpositioned PEG tube, where there are larger blood vessels and more parenchyma involved.[3,4,21,25]

APPROACH TO IMPROVING PATIENT SAFETY

Approach to Improving Patient Safety (1)

- Patients who require anticoagulant and/or antiplatelet therapy to minimize thrombotic risk are at increased risk for postoperative bleeding complications.
- Timing of discontinuation of anti-platelet therapy after invasive procedures is based on an individualized risk-benefit analysis, weighing the risk of thrombotic events against the risk of bleeding for the anticipated procedure.[37]
- In the case reviewed here, the neurosurgeon deemed the patient to be at prohibitively high risk of stroke if her anti-platelet therapy was interrupted before two months, which was later extended to three months. The extension of anti-platelet therapy delayed the anticipated surgical intervention for the malpositioned transhepatic PEG tube, which contributed to the change in the original management plan.

Approach to Improving Patient Safety (2)

- It has been well-established that care transitions across multiple providers and locations of care are associated with increased risk of patient harm, usually due to loss of information or other problems in communication.[38-42]
  - Contributing factors include challenges in transmitting consistent messages about patient status and care plans via verbal, written, and/or electronic health record (EHR) systems.
  - Additional complicating factors include various care locations, especially when multiple care teams are involved.
  - With transitions in environments of care, such as from inpatient to subacute rehabilitation care, interfacility data transmission remains highly susceptible to loss or degradation.[40-44]
- With the widespread recognition that care transitions are an extremely vulnerable time for patients, many clinicians have worked to develop mechanisms to mitigate this risk.[38,42]
  - Current best practices include using checklists at hand-offs, implementing standardized hand-off tools, and standardizing the content of discharge summaries regarding follow-up appointments and procedures.[40-45]
  - More than ever, clinical teams are working together to determine how to communicate clearly and directly with patients and their families and support networks.[38,40,42,46-48]

Approach to Improving Patient Safety (3)

- A Commonwealth Fund report noted, *"The need for coordination is in proportion to the degree of care fragmentation and the complexity of a patient's situation. Coordination of patient care is so important, and often must be achieved at so many points of potential breakdown, that multiple modes are needed. These might include the processes and outcomes of building pathways and protocols, oversight committees to achieve consistency and coordination of care, and clinical nurse specialists and other specialized integrative roles."*[49]
- In this case, the surgical division could consider both individual and system process improvement options, including:
  1. At the individual level, surgical team members can develop a process to regularly enter information into the EHR (or a team list) about patients with long inpatient courses and complex post-discharge planning needs. This information can be propagated through progress notes and included on discharge summaries, discharge orders, and discharge instructions that are provided to patients.
  2. At a systems level, a shared patient list in the EHR may bolster inter-service communication. This list should be accessible to faculty, residents, and advanced practice practitioners (APPs), in all locations where they provide care. With shared lists, it may be possible to auto-populate surgery-specific details into non-surgical team notes and documentation, such as discharge summaries, orders, and instructions.

Approach to Improving Patient Safety (4)

Process improvement options, continued:

3. A third systems solution might be to minimize the number of teams that offer percutaneous enteral tube placement in a facility, possibly through the creation of a single multidisciplinary "nutrition support team" which assesses patients for endoscopically placed feeding tubes and can standardize perioperative care delivery so that admitting/attending teams have a single entity to contact for any feeding access consults and/or complications and follow-up.[50]
4. A final comprehensive system option is the development of team-based patient navigation services, as previous authors have described for polytrauma[47] or traumatic brain injured patients. In this system, a navigator and the multidisciplinary team coordinate care between patient and family, care providers, and ancillary support agencies and resources.[48]

TAKE HOME POINTS

Take-Home Points

- PEG tubes are frequently placed and generally safely inserted in well-selected candidates. Health care providers and care teams should be aware of basic strategies to recognize and handle PEG complications.
- Any identified complications should be documented clearly for subsequent provider awareness. Because patient care handovers involving multiple specialists in multiple care environments have been shown to increase the risk of adverse events, care teams should implement tactics to minimize the risk of adverse events.
- Best practices to mitigate patient care transition risks are to minimize the number of provider transitions and the number of care teams performing gastrostomy procedures where possible, to standardize communication tools and strategies, and to optimize individualized post-discharge care instructions.
- Continuity of care guidance should be communicated clearly in face-to-face interactions supported by the EHR. Specific follow-up plan details should be included in the consultant sign-off note and also in the primary team's discharge summary.
- Teams practicing in a service model should consider creating and utilizing a clinic "follow-up" EHR list with the responsible provider and follow-up recommendations. This patient list should be readily available to faculty, resident, and APP providers in clinic as well as in the inpatient environment.

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