Early Percutaneous Endoscopic Gastrostomy Tube Dislodgment

A case of PEG tube dislodgment and replacement leads to sepsis and death.

OVERVIEW: The authors present a case of early percutaneous endoscopic gastrostomy tube dislodgment, attempted replacement, and subsequent sepsis that resulted in the patient's death. Gastrostomy techniques, complications, preventive strategies, and proper tube management are addressed.

Keywords: gastrostomy tube dislodgment, gastrostomy tube replacement, percutaneous endoscopic gastrostomy, peritonitis

THE CASE

J. B., a man in his mid-50s, was involved in a motor vehicle accident and was brought to the ED at a large urban hospital. (This is a real case; the patient's initials and other nonessential details have been changed to deidentify him.) On initial evaluation, it was discovered that he had a minor subdural hematoma, for which he was monitored in the ICU for two days. The lesion appeared to be stable, and he was discharged to home. Eight days after his discharge, he was found unresponsive in his home and was rushed back to the hospital. An emergency craniotomy with drain placement was performed to evacuate an extending, chronic subdural hematoma. After this procedure, the patient suffered neurologic deterioration and respiratory failure. A percutaneous endoscopic gastrostomy (PEG) tube and a tracheostomy tube were placed for nutritional and respiratory support, respectively. Three days after placement of the PEG tube, Mr. B. was discharged to a rehabilitation facility in stable condition.

On the third morning after his arrival at the rehabilitation facility, the patient became confused and agitated after a bath, and forcibly dislodged his PEG tube. The nurse inserted a Foley catheter to replace the PEG tube, drew an air bubble out of the catheter to confirm gastric placement, noted this, and then reported the event to the facility's attending physician, who acknowledged and approved the action. This procedure was performed at the bedside with no further confirmatory testing reported. One minute after the procedure, the patient became even more agitated, with a respiratory rate greater than 60 breaths per minute. He was given lorazepam, and the pulmonologist was notified. The patient's arms were

restrained to prevent further tampering with lines or tubes, and feedings were resumed at 70 mL per hour. He remained anxious all day and became tachypneic every time he was repositioned in bed. Later that evening, he developed a fever of 105.8° F, and had an episode suspected to be a seizure. He was taken to the ED and was admitted to the hospital for sepsis. Pneumonia was suspected as the underlying source of infection. The admitting physician noted that the patient seemed to have abdominal pain, but providers at the hospital were not made aware of the PEG tube dislodgment and replacement that had occurred at the rehabilitation facility.

Thirty-six hours after Mr. B.'s admission to the hospital, the position of the replacement tube (the Foley catheter) was evaluated by interventional radiology, at which point it was discovered that the tube emptied into the peritoneum rather than the stomach. During the procedure, 1,400 mL of tube feedings were removed from the peritoneal cavity. The Foley catheter was left in place, but was set to suction, and a nasogastric tube was placed.

Supportive measures to address septic shock were performed until the seventh day of hospitalization, including inotropic support, intravenous fluid administration, sedation, and intravenous antibiotics. A computed tomography (CT) scan of the abdomen was performed; the results indicated peritonitis. The family was counseled regarding treatment options, which included an aggressive surgical debridement, abdominal drainage performed by interventional radiology, and comfort measures. They elected to proceed with comfort measures only, and the patient died on the ninth day after hospital admission. A coroner's autopsy was ordered.

Autopsy findings. The external exam revealed a Foley catheter tube in the left upper quadrant. On internal exam, it was found that large amounts of purulent exudate filled the peritoneal cavity. The free tip of the Foley catheter ended in the peritoneal cavity anterior to the stomach, with the balloon fully inflated (see Figure 1). The insertion site in the stomach from the original PEG tube had adhered to the overlying omentum with associated purulent exudate. Microscopic examination revealed foreign material in the exudate covering the gastrointestinal (GI) lining. Additionally, evidence of subacute blunt force injuries to the head, subdural hemorrhage, and previous craniotomy were noted. The cause of death was determined to be peritonitis related to the misplacement of a Foley catheter into the peritoneal cavity following dislodgment of a PEG tube, with a contributing underlying factor of blunt force head trauma with subdural hemorrhage. The manner of death was ruled accidental by the coroner.

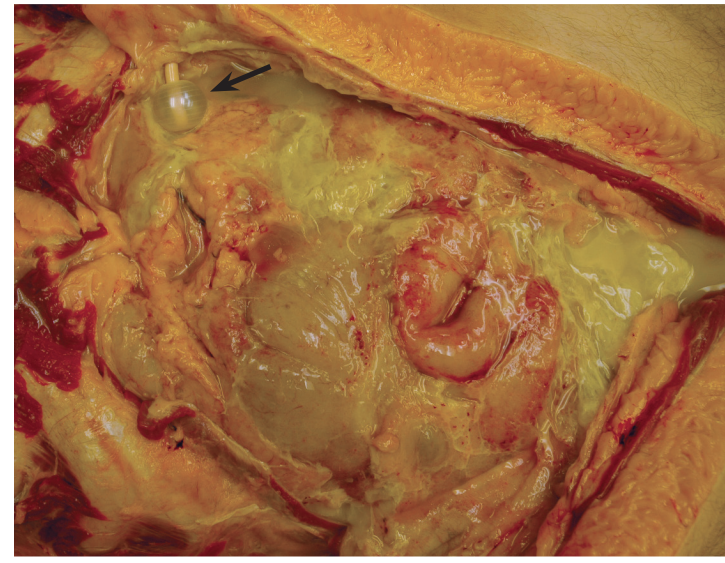

Figure 1. Purulent exudate fills the abdomen and covers the intraperitoneal fascia. The arrow shows the position of the Foley catheter in the peritoneal cavity.

DISCUSSION

Enteral nutrition. Several options exist when patients are unable to support their caloric needs through diet alone. Parenteral nutrition delivers nutrients directly into the bloodstream through an IV line, whereas enteral nutrition delivers nutrients to either the stomach or the small intestine through a feeding tube, bypassing most of the upper GI tract. When feasible, enteral nutrition is preferable because it is safer, less costly, and offers several physiologic benefits: it maintains gut flora, helps to preserve the enteral immune system, decreases mucosal atrophy, and avoids the risk of introducing bacteria into the bloodstream.[1] Indications for enteral nutrition range from neurologic damage to tumors that obstruct the upper GI tract.

This article focuses on intragastric feeding, with particular attention to PEG tubes. PEG is widely regarded as "one of the most useful" means of delivering enteral nutrition.[2] The procedure typically lasts just 15 to 20 minutes and can be performed under sedation rather than general anesthesia, making it ideal for critically ill patients.[3] In Mr. B.'s case, PEG was performed because he had suffered neurologic damage that interfered with his swallowing ability, and because it was anticipated that he would need enteral support for more than four weeks.

Gastrostomy techniques. Various methods have been used to perform gastrostomy. *Surgical gastrostomy* can be done laparoscopically or through an open laparotomy.[1] A percutaneous method, *PEG*,

Table 1. Options for Confirming Gastrostomy Tube Position Following Tube Replacement[7,8]

Method	Finding	Strength of Finding
Gastrografin radiocontrast study or gastroscopy	Radiocontrast agent administered through tube permits visualization of tube position in stomach or gastroscopy performed permits visualization of internal bolster in gastric lumen	Gold standard to confirm placement
Air insufflation followed by radiographic imaging	Abdominal radiograph demonstrates insufflated stomach and permits visualization of tube position in stomach	Literature supports this; radiographic imaging may be equal in efficacy to gastrografin radiocontrast study.
Aspiration of gastric or bilious contents	pH < 5.5 indicates intragastric placement	Highly specific for confirming tip position, but aspirate frequently isn't obtained despite proper insertion
Saline flush through replaced tube	Resistance or pain indicates intraabdominal placement	Poor sign. Patients with cognitive impairment may fail to demonstrate pain.

was developed in 1979 by Gauderer and Ponsky, who were also the first to perform it successfully.[1] PEG rapidly became the preferred method for accessing the stomach: it was relatively simple, time- and cost-effective, and generally safer for patients. Also known as the pull method, PEG is still the most widely used gastrostomy technique.

To perform it, a fiberoptic gastroscope is passed through the oropharynx and esophagus and into the stomach.[1] The stomach is insufflated to bring the anterior gastric wall in contact with the abdominal wall and to shift the position of the colon, spleen, and liver away from the intended fistula tract. A light at the end of the gastroscope transilluminates the abdominal wall, highlighting the puncture site. A small incision is made, and a needle and cannula are advanced through the abdominal wall into the stomach under direct visualization. A guidewire is passed through the cannula, snared by the gastroscope, and drawn through the stomach, esophagus, oropharynx, and mouth. The gastrostomy tube is attached to the end of the guidewire extending from the mouth, and the other end of the wire is then pulled, drawing the gastrostomy tube with it. When the gastrostomy tube reaches the stomach, the tip continues to be drawn through the abdominal wall until resistance is felt (caused by the tube's internal bolster pulling the gastric wall against the abdominal wall). An external bolster (also called a bumper) is then placed to secure the tube. It's important to note that the stomach is not anchored to the abdominal wall, but is simply held in place against it by the tube (see Figure 2). This produces a more friable gastrocutaneous tract than that achieved with surgical gastrostomy. The tract begins to mature one to two weeks after the procedure, but complete maturation may take four to six weeks.[4] Tract maturation involves the formation of granulation tissue around the stoma, resulting in adherence of the stomach to the internal abdominal wall and creating a tract between the stomach and the external abdominal wall through which tubes can be reinserted.[5]

Inadvertent tube dislodgment before mature tract formation has been shown to have the greatest impact on morbidity and mortality.

Variations to this technique include the push method, which differs from the pull method only in that the gastrostomy tube is pushed over the guidewire from the mouth to the abdominal wall, rather than pulled; and the introducer method.[1] The introducer method involves advancing an introducer over the guidewire through the external abdominal wall, dilating the abdominal incision, and then inserting the gastrostomy tube through the abdominal wall into the stomach. The internal bolster for this method is usually a balloon rather than a solid structure.

Percutaneous radiologic gastrostomy (PRG) is similar to PEG but is performed using fluoroscopic or CT guidance. A nasogastric tube is passed to insufflate the stomach. A needle and cannula are inserted into the stomach under fluoroscopic guidance, and the tube is placed using a guidewire.[1] In both the endoscopic introducer method and PRG, the anterior gastric wall is anchored to the abdominal wall before tube insertion by placing T-fasteners around the tube insertion site. (A T-fastener is a nylon suture attached to a T-shaped metal bar.) In the push and pull endoscopic methods, internal and external bolsters at the end of the tube are the only elements holding the stomach in position against the abdominal wall, with no permanent attachment occurring until the tract matures.[6]

Options for confirming gastrostomy tube position following tube replacement are given in Table 1.[7,8]

Complications. Insertion of a PEG tube carries immediate intraoperative risks related to sedation, endoscopy, and tube advancement. These risks include aspiration; oversedation; hemorrhage; pneumoperitoneum; and injury to the liver, colon, or spleen.[2,3] Later complications involve problems with the tube or infection. The tube may leak or become dislodged, malpositioned, or obstructed. Infection may arise in the form of peristomal infection, peritonitis, sepsis, or necrotizing fasciitis.[3,9,10] Of these complications, inadvertent tube dislodgment before mature tract formation has been shown to have the greatest impact on morbidity and mortality.[6] Spillage into the intraperitoneal cavity increases the risk of peritonitis and sepsis, leading to a rapid decline in patient status.[6,11] Unfortunately, tube dislodgment is a common complication. Various studies have cited rates of early tube dislodgment ranging from 1% to 7%[6]; but the true incidence may be underestimated, since complications often go unreported when patients are discharged to rehabilitation facilities and lost to follow-up.[6,12] Because of the potential severity of the consequences, this issue warrants serious attention from nurses, physicians, and other providers.

Preventing tube dislodgment. Steps should be taken to prevent tube dislodgment before, during, and after the procedure. Patients at high risk for tube removal should be identified preoperatively. Such patients include those who are combative or disoriented and those with a history of removing their central lines, urinary catheters, or nasogastric tubes.[11] For these high-risk patients, there is evidence supporting the use of T-fasteners during tube placement; this ensures that the stomach remains fixed to the abdominal wall even if the tube becomes dislodged, and decreases the risk of complications related to intraabdominal spillage.[6] After the procedure, soft wrist restraints, mittens, or abdominal binders can be used to prevent the patients from dislodging the tube.[11]

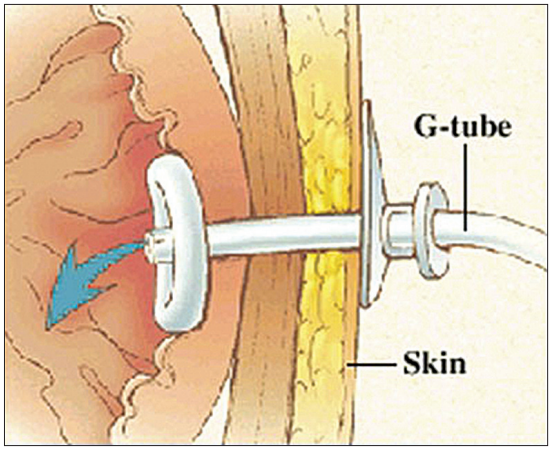

Figure 2. A PEG tube (or G-tube) is inserted through the skin, subcutaneous tissue, and abdominal wall into the stomach. Illustration courtesy of the StayWell Company, Yardley, PA.

Managing tube dislodgment. When preventive strategies fail, early PEG tube dislodgment can be managed in several ways, depending on patient presentation and available resources. The first consideration should be the length of time between tube placement and dislodgment. If the dislodgment occurs within seven days of initial placement, as in Mr. B.'s case, the patient will need surgical or percutaneous gastrostomy to replace the tube. Replacement can sometimes be delayed in stable patients, who can be treated with nasogastric decompression for 48 hours along with IV antibiotics; the PEG procedure is then repeated in seven to 10 days.[11] If tube dislodgment occurs seven or more days after initial placement, bedside tube replacement may be considered, but proper position must be confirmed through radiologic contrast studies, air insufflation with radiographic imaging, aspiration of gastric contents, or gastroscopy before the tube is used for feedings.[6] Because tract maturation can take as long as six weeks, extreme caution must be used when inserting replacement tubes at the bedside for patients with a new

gastrostomy. Indications that the tube has not been properly reinserted into the stomach include difficulty with insertion, encountering resistance or eliciting pain during a saline irrigation test, and failure to aspirate gastric contents.[4] If sepsis is present, regardless of how much time passed between initial placement and dislodgment, laparotomy with irrigation of the abdominal cavity and conversion to a sutured gastrostomy is necessary.[6]

COULD J. B.'S DEATH HAVE BEEN PREVENTED?

Mr. B. dislodged his PEG tube six days after initial placement, and several subsequent mistakes played a role in his death. First, immediately after the dislodgment, a Foley catheter was passed through the abdominal incision. Reinsertion should not have been attempted at the bedside because the tract was immature; moreover, T-fasteners had not been used in his procedure, so aside from the original tube, nothing connected the stomach wall to the abdominal wall. The nurse and the attending physician at the rehabilitation facility should have considered the date of tube placement and the type of tube placed, then realized bedside replacement was not an option. The appropriate course of action would have been immediate notification of the gastroenterologist who had placed the tube. Depending on Mr. B.'s status, Mr. B. would have been either admitted to the hospital for immediate surgical or percutaneous endoscopic replacement or treated through nasogastric decompression and IV antibiotics, with a PEG replacement procedure seven to 10 days later.

Second, the rehabilitation facility failed to notify the hospital of the tube dislodgment and replacement when the patient was transferred following the dislodgment. Such failure is unacceptable; the use of inaccurate or incomplete medical records can have deadly consequences. Accuracy becomes even more critical when patients are unable to articulate their medical history or participate in a review of systems. Mr. B. had a tracheostomy tube and was unable to speak. Because the hospital was unaware of the patient's history of tube dislodgment and replacement and of his new-onset abdominal pain, the proper workup for his septic presentation was delayed.

Third, the hospital staff failed to immediately consider an abdominal source of sepsis in a patient with a PEG tube. While it's true that they didn't have the complete medical history, they should have known that it's common for tubes to leak or become dislodged. The initial evaluation considered pneumonia, meningitis, and urinary tract infection as possible sources of sepsis, but an abdominal evaluation was delayed until the second day of hospitalization.

This death was a tragic accident that likely could have been prevented through the prompt transfer of the patient's complete medical record, attention to the dates of his procedures, adherence to guidelines regarding PEG tube replacement, and awareness of the complications associated with PEG tubes.

Three major complications that nurses should watch for in all patients with PEG tubes—regardless of how long a tube has been in place—are aspiration, peritonitis, and tube migration.

NURSING IMPLICATIONS

PEG tube management, like other medical concerns, requires the involvement of a multidisciplinary health care team. Nurses have the critical roles of administering feedings, performing skin care, and identifying complications at an early stage in order to reduce morbidity and mortality. Here are a few basic points regarding PEG tube management.

- Be aware of the type of tube placed, the date and indications for placement, and any previous complications related to the tube.
- Practice proper skin care to keep the insertion site clean and dry. Check the site daily for erythema, edema, pain, exudate, or leakage. After 24 hours postprocedure, no dressing should be required. For the first 10 days, clean the site daily using saline and sterile gauze; after 10 days, clean daily with soap and water.[2, 13]
- Be aware of the tube position and the tension of the bolsters. If the tube position changes by more than 6 mm, this is abnormal; the physician should be notified to evaluate for tube displacement.[2] Excess tension on the bolsters can cause tissue ischemia, necrosis, ulcer formation, and "buried bumper syndrome" (in which the gastric lining reepithelializes over the internal bolster).[1] Push the tube forward toward the abdomen and rotate daily to prevent adherence to the tract.[13]
- Adhere to the feeding regimen in order to maintain tube patency. Flush the feeding tube with 30 mL of sterile water or saline after feedings and administration of medication. Regular flushes should be scheduled if the tube is not in use.[2, 14]

- Keep the feeding preparation environment clean using aseptic technique to reduce the risk of contamination.[14] Depending on the patient's condition and type of formula, shorter-than-usual hang times may be warranted.
- Ensure that the external portion of the tube is secure and not irritating to the patient; this reduces the likelihood that the patient will tamper with or dislodge the tube.
- Consider the use of soft wrist restraints, mittens, or abdominal binders in patients suffering from dementia or delirium or who are otherwise at high risk for inadvertent tube dislodgment.[11]
- In the event of tube dislodgment, identify the tube type and date of placement to help determine whether bedside reinsertion is appropriate. If dislodgment occurs within one week of placement, the physician who originally placed the tube should be consulted immediately. If the tract is mature and bedside replacement is performed, intragastric placement must be confirmed with radiologic contrast studies, air insufflation with radiographic imaging, aspiration of gastric contents, or gastroscopy.
- Avoid placing catheters or tubes not intended for use as enteral feeding devices (such as urinary or GI drainage tubes), which usually lack an external bolster.[14] Use of such tubes can lead to enteral misconnection and tube migration.
- All issues related to tube management and complications must be clearly documented and communicated to all providers and caregivers.

Signs of complications may be subtle, and early identification requires astute observation and a high index of suspicion. Three major complications that nurses should watch for in all patients with PEG tubes—regardless of how long a tube has been in place—are aspiration, peritonitis, and tube migration. Typically, aspiration will manifest as respiratory distress in a neurologically compromised or sedated patient who has been "placed in a supine position with the stomach intentionally overinflated."[1] Peritonitis should be suspected in patients with abdominal pain, fever, leukocytosis, and abdominal tenderness.[1] Tube migration should be evaluated when the patient has pain during feeding, when there is resistance to flow related to peritubal leakage, and when it's difficult to advance, pull, or rotate the tube.[1]

CONCLUSION

PEG tubes are useful, cost-effective tools that can be easily managed in an outpatient setting. But as Mr. B.'s case illustrates, the failure to recognize and address complications expediently can have devastating consequences. To prevent such outcomes, providers must receive appropriate training in managing gastrostomy tubes and their potential complications. It's also imperative that patient care decisions be made with full knowledge of the patient's medical and surgical history, and are communicated effectively to everyone on the health care team. ▼

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