ADVANCES IN ENDOSCOPY

Current Developments in Diagnostic and Therapeutic Endoscopy

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Optimizing Endoscopic Bypass Procedures

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G&H What has been a major development in endoscopic bypass procedures?

CT Malignant gastric outlet obstruction has been a condition endoscopists have been trying to treat or palliate for decades. Originally, percutaneous endoscopic gastrostomy (PEG) tubes were used for venting purposes that could help alleviate some symptoms (eg, nausea, vomiting), although they were not optimal for delivering nutrition. In some patients, placement of a jejunal tube through a PEG tube would help. Total parenteral nutrition was always an option for palliative purposes and nutrition, although not ideal. In enteral stent placement, the stent can span the length of the malignant obstruction and hold it open, which has been helpful; however, this results in a long segment of bowel with minimal motility to push food through. The recently developed lumen-apposing metal stents (LAMS) are a major advance because instead of going through the tumor, the endoscopist can bypass the tumor, and they have the promise of delivering more effective palliation. They can potentially allow patients to eat a wider range of foods, which can broaden their diet and provide more of a normal quality of life. Now the goal is to try to figure out how to use these stents safely and how to train people to perform the procedures.

G&H How is endoscopic ultrasound–guided gastrojejunostomy performed?

CT The procedure has been described in different ways, and some countries have access to other supporting technologies. My colleagues and I published a Standardized Clinical Assessment and Management Plan (SCAMP) for the procedure in 2022. This was a multidisciplinary review of the procedures we had performed to optimize a systematic approach. Preoperatively, we admit patients in advance and place a nasogastric (NG) tube to minimize the amount of food residue in the stomach. In the event of a misplaced stent, food must be prevented from entering the peritoneal cavity. It is important to make sure the stomach is clean (admit the patient, insert an NG tube, and clean out the stomach) among other preparations and provide antibiotic coverage. During the procedure, we always move the patient into a modified prone, or swimmer, position in an effort to pin the bowel and prevent it from moving during the procedure. It helps to use 700 mL of contrast agent to try to fill the bowel and distend it up to create a target, and to use glucagon to paralyze the bowel and prevent contrast from going down to the colon. These steps help to create a stable target. We also recommend adding a little methylene blue to the contrast. After stent placement, we expect to see that blue contrast reflux back into the stomach, and we are then confident we are in the right place.

Fluoroscopy and an endoscopic ultrasound (EUS) probe are used to identify the contrast-filled loops of bowel that are closest to the stomach. A loop of bowel that will be a good target is not tacked down (eg, with peritoneal carcinomatosis), is adequately distended, and is in a favorable position near the stomach. Using ultrasound guidance, the endoscopist drives the delivery catheter, which is electrocautery-enhanced, through the stomach into the small bowel. We prefer to do this with a freehand technique, as wire placement is likely to push the bowel

away from the stomach. Different techniques may be used to accomplish the next step, which is to open the distal flange of the LAMS to catch the small bowel and pull it back up to the stomach. This must be done quickly and with precision. Again, having the patient in a prone position helps trap the small bowel and enhances the ability to capture it without a complication. The endoscopist then pulls the catheter back into the stomach and releases the more proximal flange, and the small bowel is now connected to the stomach. EUS has made this possible and has been instrumental in helping develop this procedure.

There are many subtleties in how we perform the procedure that have led to a high success rate. For instance, the electrosurgical generator settings can be adjusted to provide a pure cutting current and allow the endoscopist to go from the stomach into the small bowel without pushing the small bowel away. The endoscopist using a generator with blended currents is less likely to be able to cut cleanly into the small bowel. Not incorporating such subtleties will potentially lead to higher failure rates and poor results.

Systems are being used to help improve the safety of the procedure, although none are widely available in the United States at this time. One example is use of a balloon catheter that can be advanced through the area of obstruction. The endoscopist inserts 2 balloons into a segment of bowel that are blown up, the distal balloon followed by the more proximal balloon, and then fills the intermediate segment of bowel with fluid. This creates a more stable target. Another idea is to use EUS needles to place tissue anchors into the bowel to help secure the connection between bowel and stomach. The anchors hold the bowel up against the stomach during EUS placement of the stent. Different methods may make the procedure easier to perform in the future; however, the steps delineated in the SCAMP publication show that it is a reproducible and relatively safe procedure in its current form.

G&H How do the outcomes of the procedure compare with those of other bypass techniques?

CT The two major techniques to compare with EUS-guided stent placement are enteral stent placement and surgical bypass. In a study published in 2019, my colleagues and I retrospectively analyzed a database of 100 consecutive patients of whom 22 had EUS-guided gastroenterostomy (EUS-GE) and 78 had traditional enteral stent placement. There was 100% technical success with both groups. The rate of initial clinical success was higher in the EUS-guided group (95.8%) than in the enteral stent group (76.3%), and the rate of repeat intervention was lower in the EUS-guided group (8.3%) than in the enteral stent group (32.0%). The rate of adverse events was also lower in the EUS-guided group.

Regarding outcomes with bypass surgery, my colleagues and I published a retrospective cohort study in 2022 that included 25 EUS-GE and 27 surgical gastrojejunostomy consecutive patients. The clinical success was similar between both groups, 88% vs 85%, respectively; however, the rate of recurrent obstruction was lower in the endoscopic group at 28% vs 41% in the surgical group. The adverse event rate was also much lower in the endoscopic group than in the surgery group (8% vs 41%). At Brigham and Women's Hospital, EUS-GE is considered the standard of care. The Dana-Farber Cancer Institute in Boston preferentially sends us patients for EUS-GE with LAMS placement, and EUS-GE is typically preferred over either enteral stent placement or surgical gastrojejunostomy, when it is possible.

G&H What are the major risks associated with these procedures and possible solutions?

CT Misdeployment of the stent is, in my opinion, one of the major issues. The more comfortable one is with LAMS and with performing these procedures, the less likely misdeployment is. Therefore, it is essential to have adequate training. Nevertheless, misdeployment can still happen in the most experienced of hands. Other potential problems can occur when placing LAMS. The bowel can start moving during the procedure. Patient factors can cause problems. A big window cannot be found, or the bowel is not well distended or too far away. Knowing when to not attempt the procedure is also important to minimize potential complications.

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If misdeployment of the stent has resulted in the catheter bouncing off the small bowel and creating an opening between the stomach and the peritoneal cavity, then assuming everything is done correctly and the stomach has no debris that could lead to peritoneal soiling with contaminants, the stent can be pulled out and the opening clipped closed. This should not lead to any problems. However, it can be difficult to find the hole once the

stent is pulled out. I recommend placing clips on either side of the stent or using a wire before removal to not lose sight of the defect.

A mechanical difficulty with the stent, where it opens partially instead of fully, could result in the LAMS sliding out and leaving a hole in the small bowel. Many times, if another stent can be placed distal to the hole, food will not pass by it. It would be helpful to place the stent close enough to where the hole can be closed, potentially. The key is to place another stent distal not proximal to the hole to avoid food entering that area. This will allow the hole to heal. However, placing the stent nearby and closing the hole is still probably preferable. The hole could also be closed using a wire through the delivery catheter to mark the site and use a natural orifice transluminal endoscopic surgery–style procedure.

One other potential serious, although very unlikely, complication is to go out of the stomach all the way through the small bowel and deploy the distal flange on the other side of the small bowel, completely compressing the small bowel. This could result in 2 large holes in the small bowel, especially if the flange fully opened, and would likely require surgery to fix.

It is important to watch patients carefully after misdeployed stents and to have them on antibiotics. This complication should be treated like a perforation. For example, the patient should not be fed right away, and an upper gastrointestinal series or computed tomography scan with oral contrast should be performed to make sure there is no contrast extravasation.

Another legitimate concern is not being able to find bowel that is free-floating and close to the stomach. Bowel that is tacked down with carcinomatosis may be pulled up to the stomach but then could dehisce and fall apart a few days later. It is very important to pick the loop of bowel carefully and select one that is very close or overlying the stomach. On fluoroscopy, the target bowel will be above the bow in the endoscope shaft along the greater curvature when advancing the endoscope.

G&H What training should be acquired before performing these complex procedures?

CT These procedures are taught in our fellowship program at Brigham and Women's Hospital. Learning a new device is not done at the same time as learning a new procedure. Our fellows work with the device, usually on a simulator, until it becomes second nature, or until they achieve a level of unconscious competence, as if they could use the device in their sleep. Once the technical aspect is covered, then the procedural elements are worked on over time (eg, by watching procedures, talking through each procedure, and performing similar procedures to build the fellow's skill set). There are also cognitive aspects of the procedure (eg, knowing how the device works and what problems may arise) that are broken into part tasks. After learning the device, watching multiple procedures, and using the device in easier procedures, the fellow performs the procedure while being supervised. EUS-GE is, absolutely, not one of the first therapeutic EUS procedures the endoscopist should perform. Endoscopists need to be comfortable with other therapeutic EUS procedures first, as well as other LAMS procedures. Once endoscopists have done that, they need to observe EUS-GE at a center that performs many of these procedures to be able to do it safely.

G&H What are some of the needed improvements in devices?

CT I think having tissue anchors would enhance the safety of this procedure. A small tissue anchor could be fed through a needle with a hypodermic bevel design that slips through the tissue without taking a piece of it, providing atraumatic access to the small bowel. The small bowel could then be pulled up against and secured to the stomach to prevent it from moving during LAMS placement. I think the anchors are better than other devices that require going through an area of tumor to set up a safe zone. Sometimes, the tumor area is too tight to get through and entering the tumor may be traumatic. Tissue anchors may also potentially provide a better window for filling the bowel with fluid, which is critical for creating targets for stent placement. It would be great to understand where exactly anastomoses are being placed. We do not want to place them too low, where the patient has dumping syndrome or diarrhea, for example. Being able to assess what part of the small bowel one is in and how much bowel is above and below that point would be fantastic. Finally, I think modifications could be made to the stent, perhaps having a better coating so that the stents can be permanent. Currently, stents are replaced after about 9 months because of concerns that the

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coating could break down, which can lead to tissue ingrowth, occlusion, and pain.

G&H What persistent challenges need to be addressed?

CT I think training is the greatest challenge and then obtaining proper reimbursement. I mentioned some technological advances that could make EUS-GE easier to do. However, the procedure can be performed safely by a well-trained endoscopist with the existing technology. The challenge is how to train endoscopists efficiently. Currently, the LAMS being used are approved for the treatment of walled-off necrosis, and their use in EUS-GE is off label. Also, most training occurs only in fellowship programs or through society courses. Once the stents are approved, the manufacturer can provide formal training and help ensure that it is disseminated safely.

G&H How can endoscopic bypass procedures be optimized?

CT I think having a good team approach and maybe doing some simulated team exercises could help, but the team is what is critical here. Everyone needs to be competent and know what they are responsible for, and they must be fully engaged in the procedure. They must also understand the subtleties of managing the device. Performing these procedures is a team effort. EUS-GE is a high-risk procedure. Even though it is very doable and generally safe, and one can become very good at it and realize great results, if it goes wrong, it could go very wrong, very quickly. In endoscopy, there are many different roles that team members take seriously and fulfill; however, at times, there can be a miscommunication or misunderstanding about team roles that results in cross-covering of tasks. For this high-stakes procedure, it is important to keep team dynamics straight.

Disclosures

Dr Thompson has consulted for Boston Scientific, Endoquest Robotics, Fractyl, Fujifilm, Medtronic, Lumendi, USGI Medical, Softac, Olympus, Xenter, Apollo Endosurgery, and GI Dynamics; he has received research support from Olympus, Erbe, Endoquest Robotics, Boston Scientific, Apollo Endosurgery, Fractyl, Fujifilm, GI Dynamics, Lumendi, and USGI Medical; has served as an advisory board member for Fractyl, Xenter, Endoquest Robotics, and USGI Medical; and has ownership interest in GI Windows, Xenter, Softac, EnteraSense, Bariendo, and EnVision Endoscopy.

Suggested Reading

Abbas A, Dolan RD, Bazarbashi AN, Thompson CC. Endoscopic ultrasound-guided gastroenterostomy versus surgical gastrojejunostomy for the palliation of gastric outlet obstruction in patients with peritoneal carcinomatosis. *Endoscopy.* 2022;54(7):671-679.

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