Graham Patch Closure of Duodenal Ulcer

Erin Burton and Ariel Santos

Introduction:

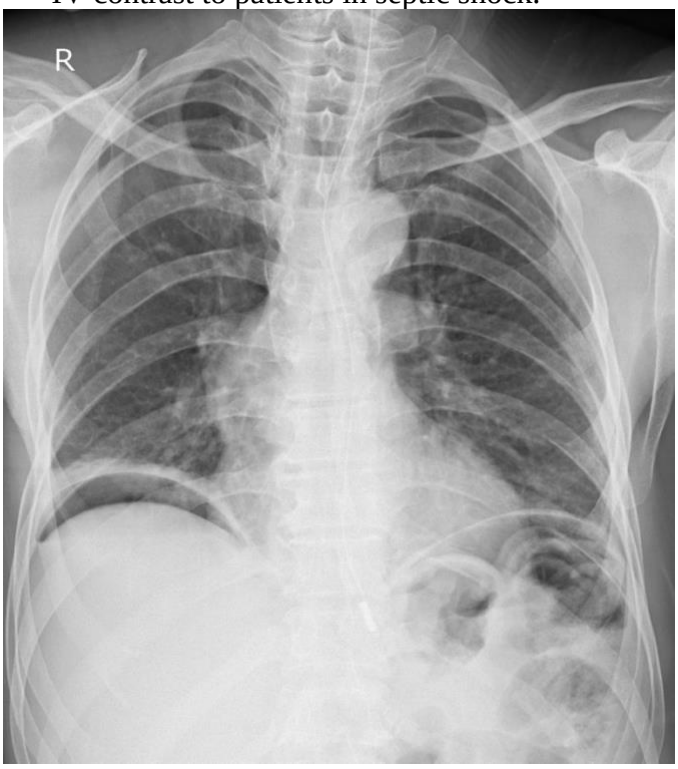
Duodenal ulcers are in large part attributed to the presence of Helicobacter pylori infection (>90%). Additional contributors to the development of duodenal ulcer disease include Non-Steroidal Anti-Inflammatory Drugs, gastrinoma, and smoking. Due in large part to the medical advancements in treating H. pylori, the number of patients presenting with ulcer perforations has greatly declined. However, when a patient presents with a perforated ulcer, prompt surgical consultation and operative intervention is indicated. Due to the morbidity and mortality that can result from this condition if not treated expeditiously, the general surgeon must be comfortable and confident managing peptic and duodenal ulcer disease. One indication for operative repair is a perforated duodenal ulcer in a patient that may have a classic history of sudden onset of epigastric abdominal pain radiating to the back associated with signs and symptoms of pneumoperitoneum and peritonitis. Duodenal perforations are usually small (less than 1 cm in diameter) and can be treated by primary repair with omental reinforcement or omental or Graham's patch if tissue quality will not allow primary repair. Large perforation may require pyloroplasty closure, resection, duodenostomy or pyloric exclusion in some cases.

A brief overview of the essential steps of repair is listed below:

- Upper midline incision and culture any peritoneal fluid
- Explore the abdomen and identify the duodenal perforation
- Mobilization of the duodenum (Kocherization) and evaluation of the lesser sac for any posterior perforation
- Place interrupted sutures across the margins of the perforation
- Place a pedicle of healthy omentum over the defect
- Tie previously placed sutures
- Intra-operative leak test
- Placement of drain and abdominal closure

Steps:

1. Workup for the patient includes CBC, comprehensive metabolic panel, Coagulation studies, Type and Screen, and upright chest x ray or abdominal CT scan. The patient will likely have CXR showing pneumoperitoneum or abdominal CT scan showing pneumoperitoneum, intra-abdominal fluid, and thickened gastric/duodenal wall. Be cautious administering IV contrast to patients in septic shock.



Subdiaphragmatic free air, seen on both the left and the right sides. On the patient's left, the air can be seen outlining the adjacent small bowel, which helps distinguish it from the gastric bubble in this location. Case courtesy of Kewal Arunkumar Mistry, from the case *https://radiopaedia.org/cases/35318?lang=us*

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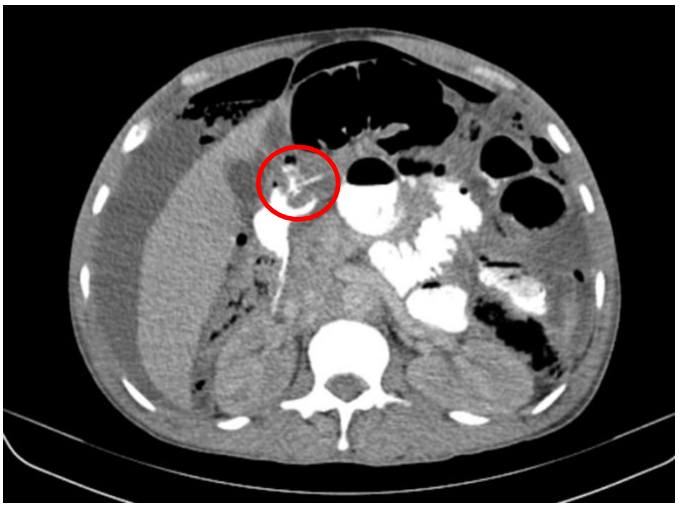
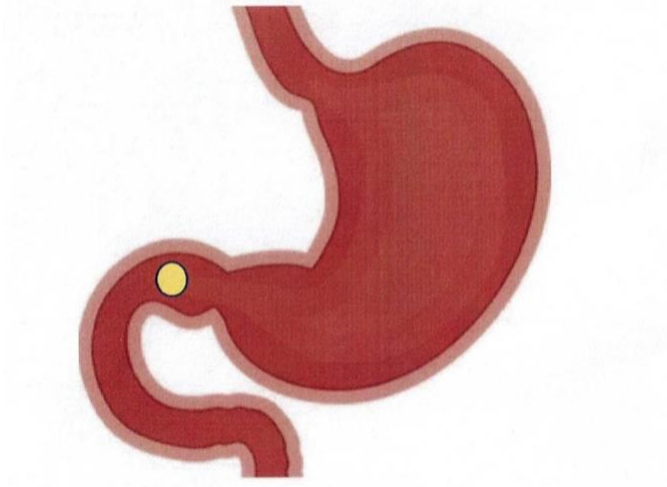


CT scan with oral contrast only shows extravasation of contrast from a hole in the duodenum (Red circle). For most presentations of duodenal ulcer, a careful history and an upright chest x-ray showing free air are enough to make the diagnosis.

Typical appearance after entry into the abdomen with perforated duodenal ulcer. Cloudy fluid and exudate cover most surfaces, and some of the fluid collections are already "walled off" from the rest of the abdomen, typically in the subphrenic spaces, the paracolic gutters, and the pelvis. The fluid or a piece of the inflammatory exudate can be sent for culture.

2. Fluid resuscitation and correction of electrolyte abnormality should be performed as soon as possible. Also, start the patient on broad spectrum antibiotics and administer an IV proton pump inhibitor. There is no current evidence showing that antifungal therapy improves outcome on patients with perforated peptic ulcer disease.
3. The operative procedure should be conducted under general anesthesia.
4. The patient should be placed in supine position on the operating table and consider tucking the right arm. Nasogastric tube and foley catheter should be placed before the initiation of the procedure.
5. An upper midline incision is made using a scalpel. Mobilization and adequate exposure are paramount as well as determining whether the perforation can be primarily repaired or will require resection and reconstruction.
6. Use a culture swab to take a sample of any intraperitoneal fluid that is present upon abdominal entry and send for gram stain and culture if possible. Next, use a Poole suction to evacuate the intraperitoneal fluid to allow for adequate visualization.
7. Inspect the stomach and duodenum to identify the perforation. Debride to healthy tissue. Unlike gastric ulcers, **duodenal ulcers do not traditionally have to be biopsied** unless suspicious findings are present.



Typical location of a perforated duodenal ulcer, in the first portion of the duodenum just distal to the pylorus (which can often be palpated.)

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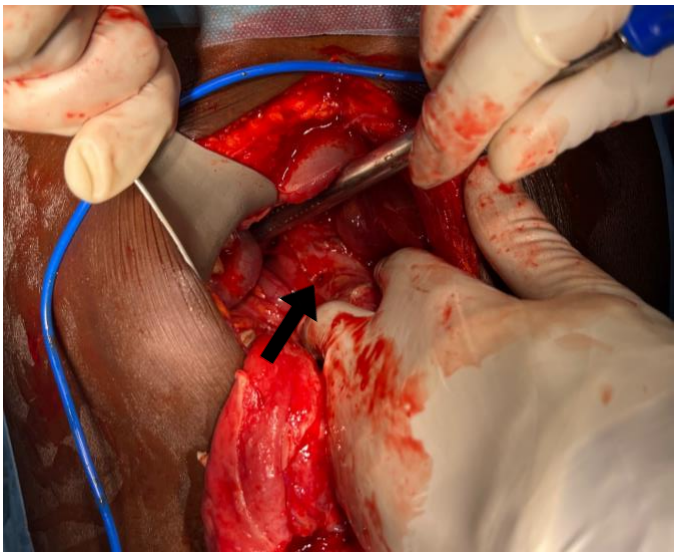
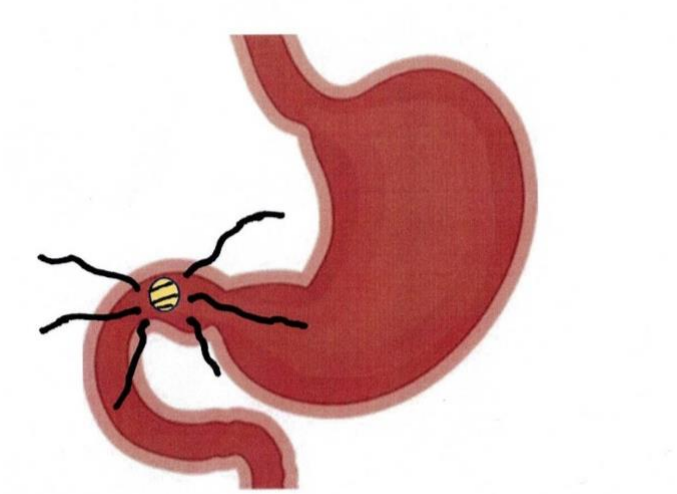
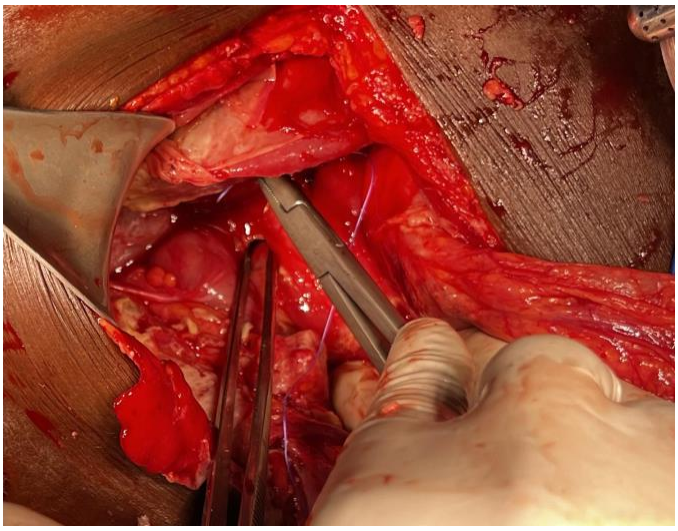


Careful exploration reveals the perforated ulcer (Black arrow)

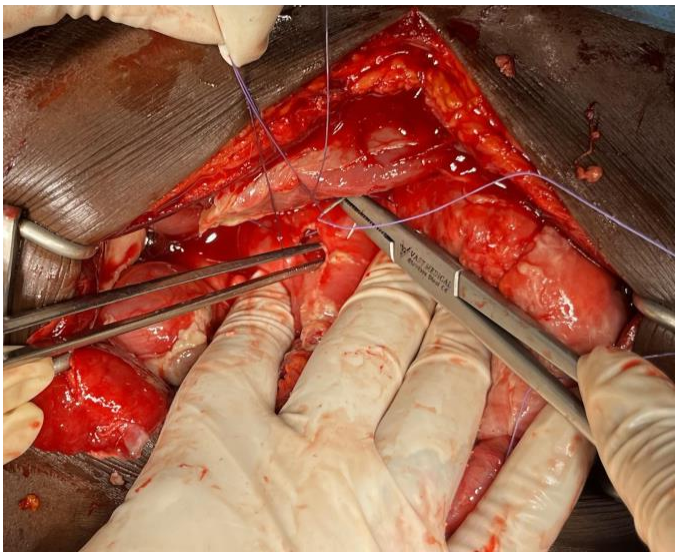
8. Once the perforation has been identified, use interrupted 3-0 suture (generally silk, Vicryl or PDS) across the margins of the perforation beginning about 5 mm superior to the perforation but do not tie the sutures, instead place a hemostat or other clamp on each end of each sutures.



The sutures are each placed separately, oriented longitudinally as shown, rather than transversely to avoid narrowing the duodenum.



When placing the sutures, it is important not to pass the needle through the posterior wall of the duodenum. Here, the surgeon has inserted the forceps into the ulcer to hold the anterior wall of the duodenum up away from the posterior wall.



After you pass each suture, leave it long enough to tie and hold it with a hemostat. Continue until you have enough sutures placed to hold a tongue of omentum over the entire hole, each one held by its own hemostat: usually 3 to 5 sutures are enough.

9. Position and confirm placement of the nasogastric tube.
10. Mobilize a healthy tongue of omentum using either a combination of clamps and ties or by using a bipolar or ultrasonic ligation device.

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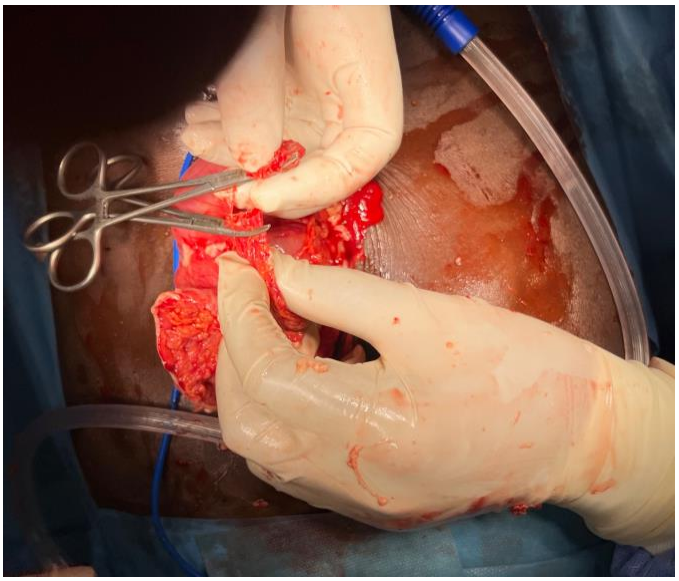
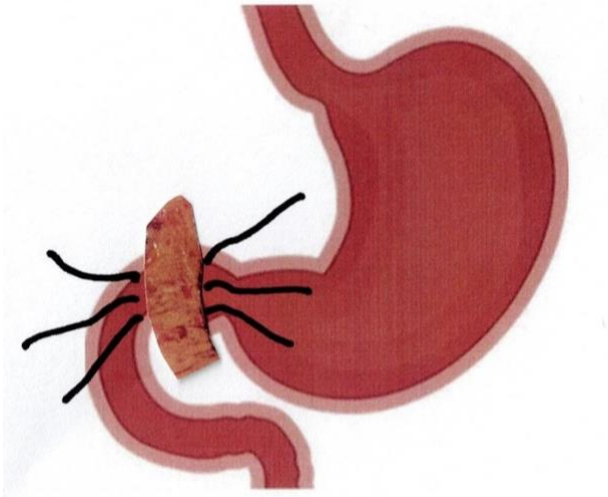


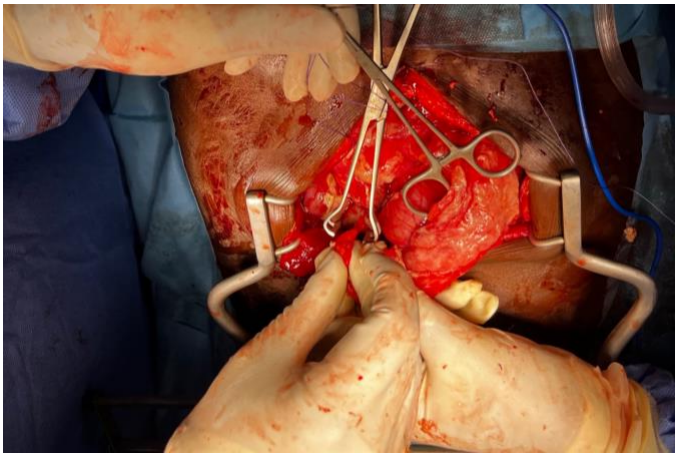
Bear in mind that the blood supply to the omentum comes from the gastroepiploic arcade, along the greater curvature of the stomach. Divide a pedicle of omentum to create a flap that is proximally based, arising from the stomach.

As shown here, the plane between the omentum and the transverse colon is avascular: gain extra length to your omental flap by dissecting it off this structure.

11. Place the omentum over the ulcer defect, ensuring that it is placed overlying the previously placed sutures.



In this illustration, the sutures have simply been left free after being placed and the flap of omentum is laid between them.



Here, the sutures are held by hemostats which are held up by the hand at the top of the photo. The Babcock clamp is shown passing underneath the clamps, in between the sutures, and used to grasp the omental flap.

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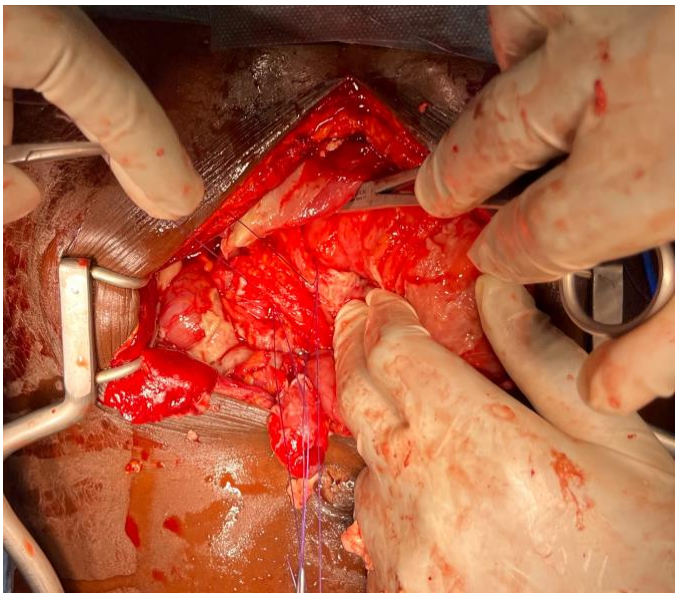
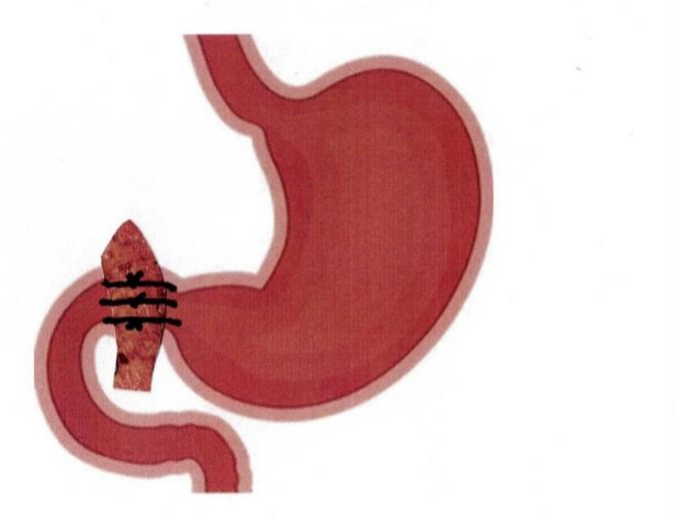
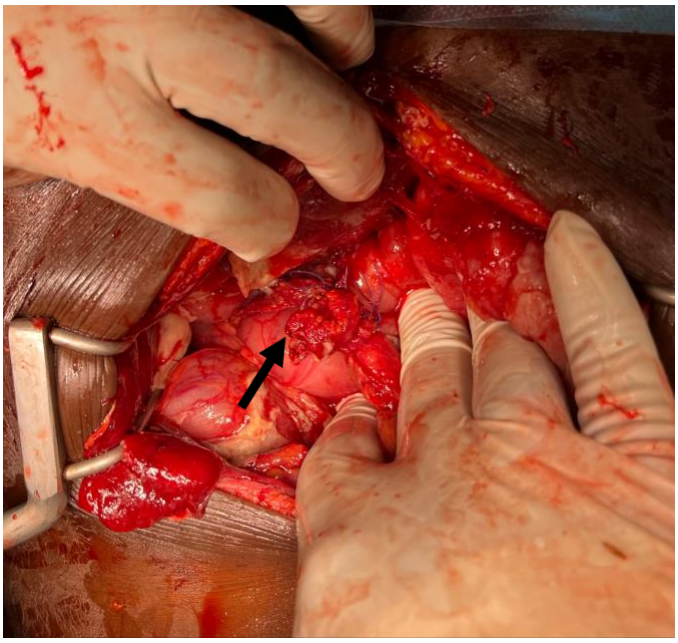


Then pull the omental flap into place under the sutures, as shown here. The Babcock's tip has passed from caudal to cranial (from the bottom towards the top of the photo,) taking the omentum with it and pulling it under the sutures to cover the ulcer.

12. Tie the sutures down over the omentum. Do not over-tighten these and strangulate the omental patch.



By tying the sutures, secure the omental flap in place and cover the ulcer.



The omental patch is secured in place with sutures. The omentum distal to the tied sutures (Black arrow) is clearly viable and not dusky.

13. Irrigate the abdomen with warm saline until all signs of contamination are gone (return of clear irrigation). Pay close attention to the right and left subphrenic spaces, the right and left paracolic gutters, and the pelvis.
14. Perform Leak Test: Fill the abdomen with warm saline until the repair is submerged. Request the anesthetist to gently insufflate air via the NG tube and look for air bubbles. If present, further repair or revision is indicated, if absent, repair is deemed adequate. Evacuate the irrigation.

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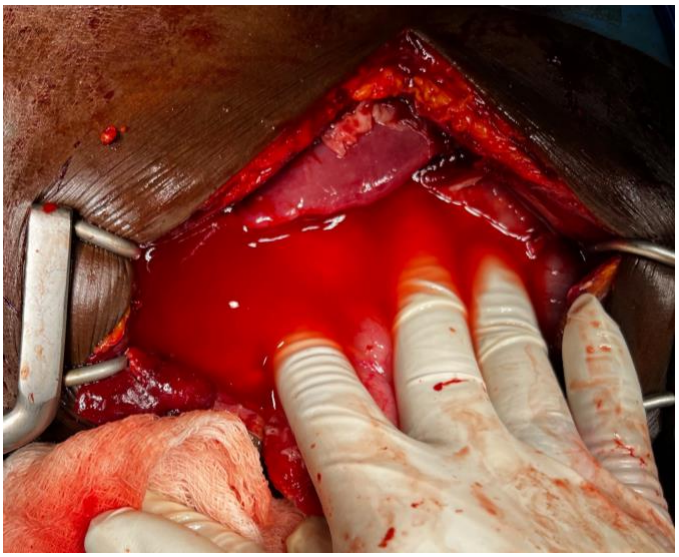

Gently hold the stomach and duodenum away from the inferior edge of the liver and fill this space with water. Ask the anesthetist to inflate the stomach with air through the nasogastric tube. No bubbles should appear.

15. Place a closed suction drain next to the repair, and secure the drain to the skin using 2-0 nylon suture.
16. Close the abdomen
17. Leave the skin open if patient has advanced peritonitis with severe contamination, otherwise close the skin in routine fashion.
18. Postoperatively keep the patient strict NPO with intravenous fluids and nasogastric drainage for 4 days.
19. On postoperative day 4, perform a contrast study. This can be conducted by administration of water-soluble contrast through the nasogastric tube and obtaining a plain abdominal x-ray.
    Another option is to administer colored liquid orally or by nasogastric tube and monitor to see any color change in the drain (example: have patient drink blue juice or dye and monitor drain for blue output). If leak test negative, the patient can be started on oral diet.

Editor's note: some surgeons do not consider this step mandatory, instead advancing the diet cautiously and watching for signs of toxicity that might indicate a postoperative leak.

20. Monitor drain output throughout post-operative course; if character changes to bilious or enteric contents, this represents a leak. Additionally, monitor for signs of abscess via purulent drain output. The drain can be removed when serous in character, minimal output, and patient is tolerating oral diet.
21. Treat the patient for *Helicobacter pylori* infection after they have recovered (amoxicillin, clarithromycin, and a proton pump inhibitor with or without Metronidazole depending on local resistance patterns.)

Pitfalls:

- Inadequate resuscitation prior to anesthesia induction
- Inadequate mobilization and exposure
- Failure of adequate debridement: Incorporating dead tissue in the repair and closure increases the chance of leakage.
- Closure of perforation under tension: complete mobilization of the duodenum helps prevent this problem.
- Inadequate patch coverage resulting in leak. The omental patch should not be under tension and should lie easily in place even before it is secured.
- Ensure the vascular supply to the omental patch is intact to prevent patch failure. The sutures that hold the patch in place should be snug, but not over-tight.
- When conducting a primary repair, prior to placing the patch ensure that the bowel lumen is adequately patent, to help prevent duodenal stenosis. Longitudinal (parallel to the duodenum) rather than transverse orientation of the sutures helps prevent this.
- Ensure adequate hemostasis of the bowel edges to prevent bleeding requiring reoperation.
- Post-operative intra-abdominal abscess development: watch the patient's vital signs closely during the postoperative period. (The differential diagnosis of postoperative sepsis always includes leakage of the repair.) See Recognizing Post-Operative Intra-Abdominal Sepsis.

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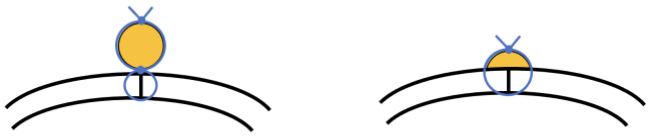
Variations:

- The Graham patch as originally described is shown in this chapter. The modified Graham patch involves closure of the ulcer first, then tying the patch into the tails of the suture from the ulcer closure. No difference between the two techniques has ever been shown.



In the modified Graham patch (Left) the ulcer is closed first and then the tails of the sutures are used to secure the omental patch. The classic Graham Patch (Right) incorporates the omentum in the same suture that closes the ulcer.

- Use upper intraoperative endoscopy to inspect the repair site, confirm the duodenum is not narrowed by the repair, and insufflate during the leak test
- Perform the repair laparoscopically: This is an advanced skill and requires specialized equipment, including a suction/irrigation device that will allow you to thoroughly irrigate and aspirate all four quadrants of the abdomen. The modified Graham patch technique may be more easily adapted to a laparoscopic approach.

Editor's note: we have not seen a laparoscopic Graham Patch repair performed in resource-limited settings, but it is certainly possible. Proper mobilization of an omental patch that would lie over the ulcer without tension is probably the most difficult part.

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