

INTRODUCTION

Perforation is a life-threatening complication of peptic ulcer disease. Intestinal perforation can present acutely or in an indolent manner like abscess or intestinal fistula formation. A confirmatory diagnosis is made primarily using abdominal imaging studies. Duodenal perforation is a common complication of duodenal ulcer. The first clinical description of perforated duodenal ulcer was made by Crisp in 1843. Laparoscopic treatment of perforated duodenum was first reported by Mouret in 1989.

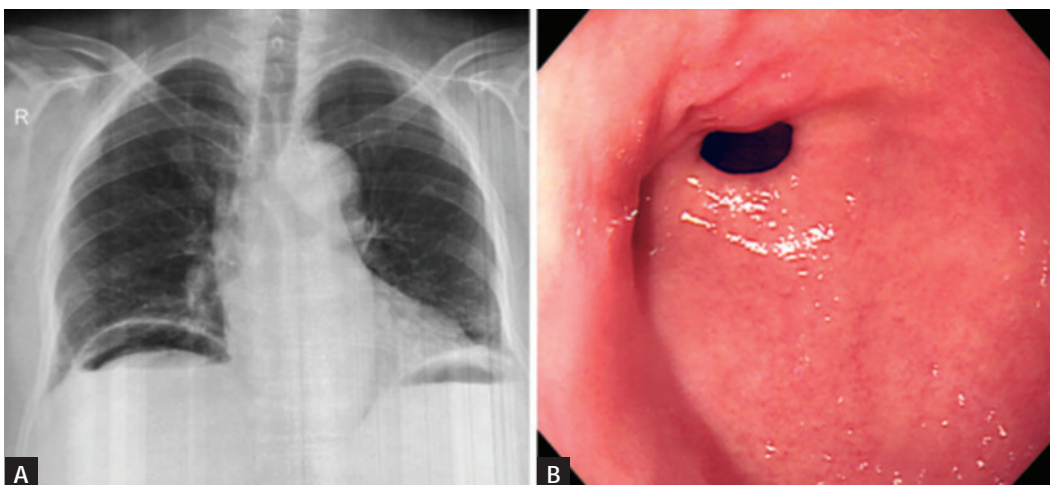
Perforated duodenal ulcer is mainly a disease of young men but because of increasing smoking in women and use of nonsteroidal anti-inflammatory drug (NSAID) in all the age group, nowadays, it is common in all adult population. In Western society, it is a problem seen mainly in elderly women due to smoking, alcohol, and use of NSAID. Majority of patients of perforated duodenal ulcers are *Helicobacter pylori* (*H. pylori*) positive.

Diagnosis is made clinically and confirmed by the presence of pneumoperitoneum on radiographs (Figs. 1A and B). Additional studies may be indicated as a means to further investigate a suspected perforation in a specific organ. Other imaging studies include endoscopy (upper, lower), esophagography, upper gastrointestinal series, ultrasound, contrast enema, and dye studies. Nonoperative

management is successful in patients identified to have a spontaneously sealed perforation proven by water-soluble contrast gastroduodenogram. For most of the patient of perforation of duodenal ulcer, the preferred treatment is its immediate surgical repair. The traditional management of perforated duodenal ulcer was Graham patch plication described in 1937. Laparoscopic repair of duodenal perforation by Graham patch plication is an excellent alternative approach.

Operative management consists of the time-honored practice of omental patch closure, but now same can be done by laparoscopic methods. The practice of addition of acid-reducing procedures is currently being debated, though it continues to be recommended in high-risk patients. Laparoscopic approaches to closure of duodenal perforation are now being applied widely and may become the gold standard in the future, especially in patients with <10 mm perforation size presenting within the first 24 hours of onset of pain. The role of *H. pylori* in duodenal ulcer perforation is controversial and more studies are needed to answer this question, though recent indirect evidence suggests that eradicating *H. pylori* may reduce the necessity for adding acid-reducing procedures and the associated morbidity.

Perforated duodenal ulcer is a surgical emergency. Laparoscopic repair of duodenal perforation is a useful



Figs. 1A and B: (A) Gas under diaphragm revealing perforation; (B) Endoscopic finding of duodenal perforation.

method for reducing hospital stay, complications, and return to normal activity. In many elegantly designed and meticulously executed prospective randomized trial, the laparoscopic approach in the management of perforated peptic ulcer disease has been compared to the open approach. Studies validate that laparoscopic approach is safe, feasible, and with morbidity and mortality comparable to that of the open approach. With better training in minimal access surgery now available, the time has arrived for it to take its place in the surgeon's repertoire.

ADVANTAGES OF LAPAROSCOPIC APPROACH

- Cosmetically better outcome
- Less tissue dissection and disruption of tissue planes
- Less pain postoperatively
- Low intraoperative and postoperative complications
- Early return to work.

The main tasks of this operation consist of:

- Preparation of the patient
- Creation of pneumoperitoneum
- Insertion of ports
- Diagnostic laparoscopy and locating the perforation
- Cleaning the abdomen
- Closure of the perforation with an omental patch
- Irrigation and suction of operating field
- Final diagnostic laparoscopy for any bowel injury or hemorrhage
- Removal of the instrument with complete exit of carbon dioxide (CO₂)
- Closure of wound.

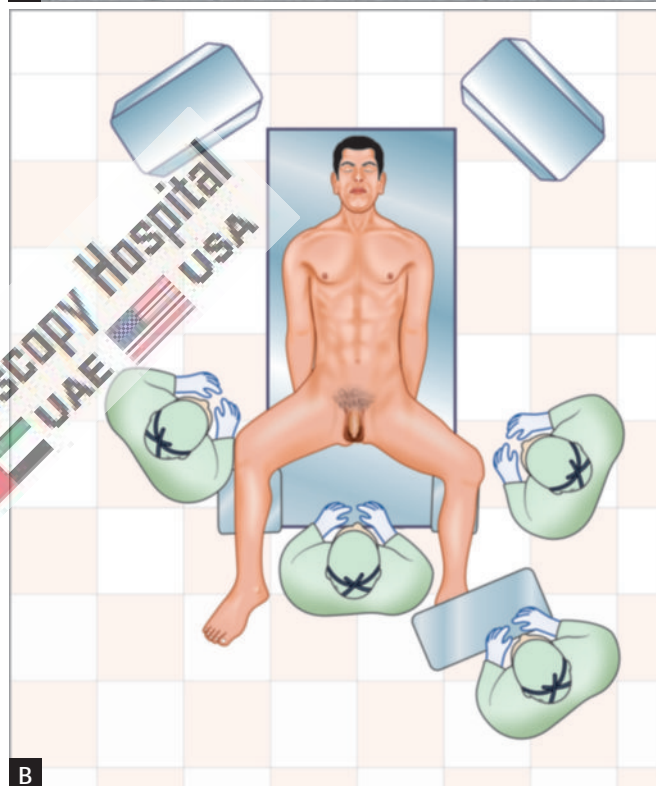
Patient Selection

Duodenal perforation is a surgical emergency. If the patient condition is otherwise stable and peritonitis is diagnosed within 12 hours of onset, it is possible to repair the perforation by laparoscopic method. After 12 hours, chemical peritonitis will give way to bacterial peritonitis, with severe sepsis and then the laparoscopic repair is not advisable.

OPERATIVE TECHNIQUE

Patient Position

The patient is placed on the operating table with the legs in stirrups, the knees slightly bent, and the hips flexed approximately 10°. The operating table is tilted head up by approximately 15° (**Figs. 2A and B**). Compression bandage is used on leg during the operation to prevent thromboembolism. The surgeon stands between the patient's legs. The first assistant, whose main task is to position the video camera, sits on the patient's left side. The instrument trolley is placed on the patient's left allowing the scrub nurse to assist with placing the appropriate instruments in the



Figs. 2A and B: Position of patient for laparoscopic repair of duodenal perforation.

operating ports. Television monitors are positioned on either side of the top end of the operating table at a suitable height for surgeon, anesthetist, and assistant to see the procedure.

Anesthesia

General endotracheal anesthesia is used. Each patient is injected in the preinduction phase with 60 mg intramuscular (IM) contramal, intravenous (IV) metronidazole or tinidazole, and with 2 g of cefizox IV. The H₂-receptor antagonist like ranitidine injection is also advisable.

Creation of Pneumoperitoneum

- Check Veress needle before insertion
- Check Veress needle tip spring
- Confirm that gas connection is functioning

- Ensure flushing with saline (does not block that needle)
- Make a small incision just above the umbilicus
- Lift up abdominal wall and gently insert Veress needle till a feeling of giving way and two click sound
- Confirm position of needle by saline drop tests
- Connect CO₂ tube to needle and confirm quadromanometric indicators
- Switch off gas when desired pneumoperitoneum is created and remove the Veress needle.

Port Location

Four ports are then inserted, using the triangulation concept, to form a diamond shape. The surgeon usually stands between the legs of patient. A 10 mm camera port is placed in the umbilicus; this position will vary according to the build of the patient. A 5 mm port is inserted in the right upper quadrant 8–10 cm from the midline. A 5 mm port is placed in the left upper quadrant and another 5 mm port is placed in the right subxiphoid region (**Fig. 3**).

The patient is placed in reverse Trendelenburg's position, with the first assistant to the right and a second assistant to the left. The surgeon thus works comfortably with two hands, triangulated with the cameras.

Locating the Perforation

The gallbladder, which usually adheres to the perforation, is retracted by the surgeon's left hand and moved upward. The gallbladder is passed to the assistant using the subxiphoid port which is placed to the right of the falciform ligament. The exposed area is checked and the perforation is usually clearly identified as a pinpoint hole on the anterior aspect of the duodenum.

Cleaning the Abdomen

Whole abdomen should be irrigated and aspirated with about 10 L of saline mixed with antibiotics. Each quadrant

is cleaned methodically, starting at the right upper quadrant, going to the left, moving down to the left lower quadrant, and then finally over to the right. Special attention should be given to the vesicorectal pouch. Fibrous membranes are removed as much as possible, since they might contain bacteria.

Closure of the Perforation with an Omental Patch

A flappy piece of omental flap should be taken and the assistant holds the omentum patch just over the perforation using both the hands (**Figs. 4A to C**). Intracorporeal knot together with omental patch should be applied to seal the perforation. The perforation is closed by intracorporeal stitches (simple closure by 3/0 Vicryl on Ski needle) and re-enforced by a pedicle omental graft (**Figs. 5A to F**). This should be followed by a complete lavage of the peritoneal cavity with an ample amount of warm physiological saline. Always insert the omental patch in the knot rather than tail of the knot to hold the omentum because with the latter, a small space remains between the knots. Do not use extracorporeal knotting because this exerts tension on the friable tissue.

Ending of the Operation

At the end of the procedure, the abdomen should be examined for any possible bowel injury or hemorrhage. The instruments and then the ports should be removed. Telescope should be removed leaving gas valve of umbilical port open to let out all the gas. Closure of the wound is done with suture, Vicryl for rectus, and unabsorbable intradermal or stapler for skin. Adhesive sterile dressing over the wound should be applied. Patient may be discharged after 3 days.

Oral intake can be started after 48 hours, starting with clear fluids. They all are prescribed the triple therapy regimen, which consisted of clarithromycin and amoxicillin for 10 days, in addition to omeprazole for 14 days. This

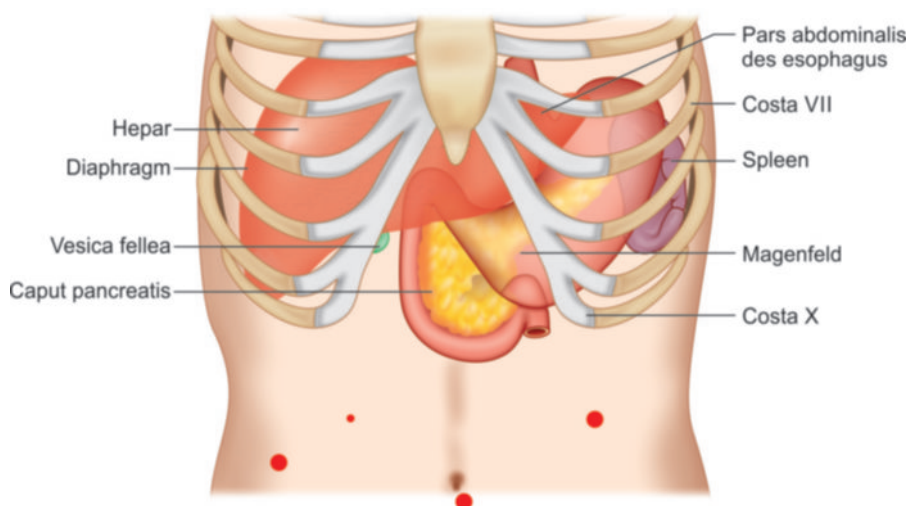
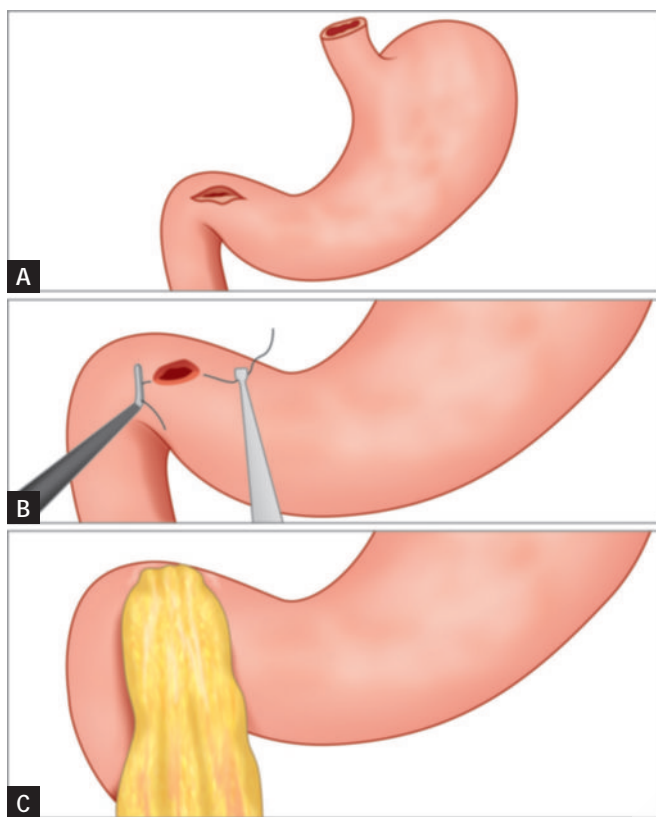


Fig. 3: Port position for laparoscopic repair of duodenal perforation.



Figs. 4A to C: Closure of perforation with omental patch.

should be followed by gastroduodenoscopy after 2 months. All patients should be followed on an outpatient basis for at least 6 months and most (66%) of them for up to 2 years.

DISCUSSION

The incidence of perforated duodenal perforation remains the same. Operative treatment of perforated duodenal ulcer consists of time-honored practice of omental patch closure, but now this can be done by laparoscopic method. Laparoscopic approaches to closure of duodenal perforation are now being applied widely and may become the gold standard in the future, especially in patient with <10 mm perforation size presented within the first 24 hours of onset of pain. Perforated duodenal ulcer is a surgical emergency. Urgent simple closure of the perforation with omental patching is widely applied for the vast number of these patients; the consensus is to perform simple closure alone without any definite procedures, especially in patients with poor surgical risks and severe peritonitis. Various laparoscopic techniques have been advocated for closing the perforation by intra- and extracorporeal knots, sutureless techniques, holding the omental patch by fibrin glue or sealing with a gelatin sponge, stapled patch closure, or gastroscopically aided management in the perforation. Many surgeons have reported patient with sealed perforation and have been managed by peritoneal lavage and drainage only.

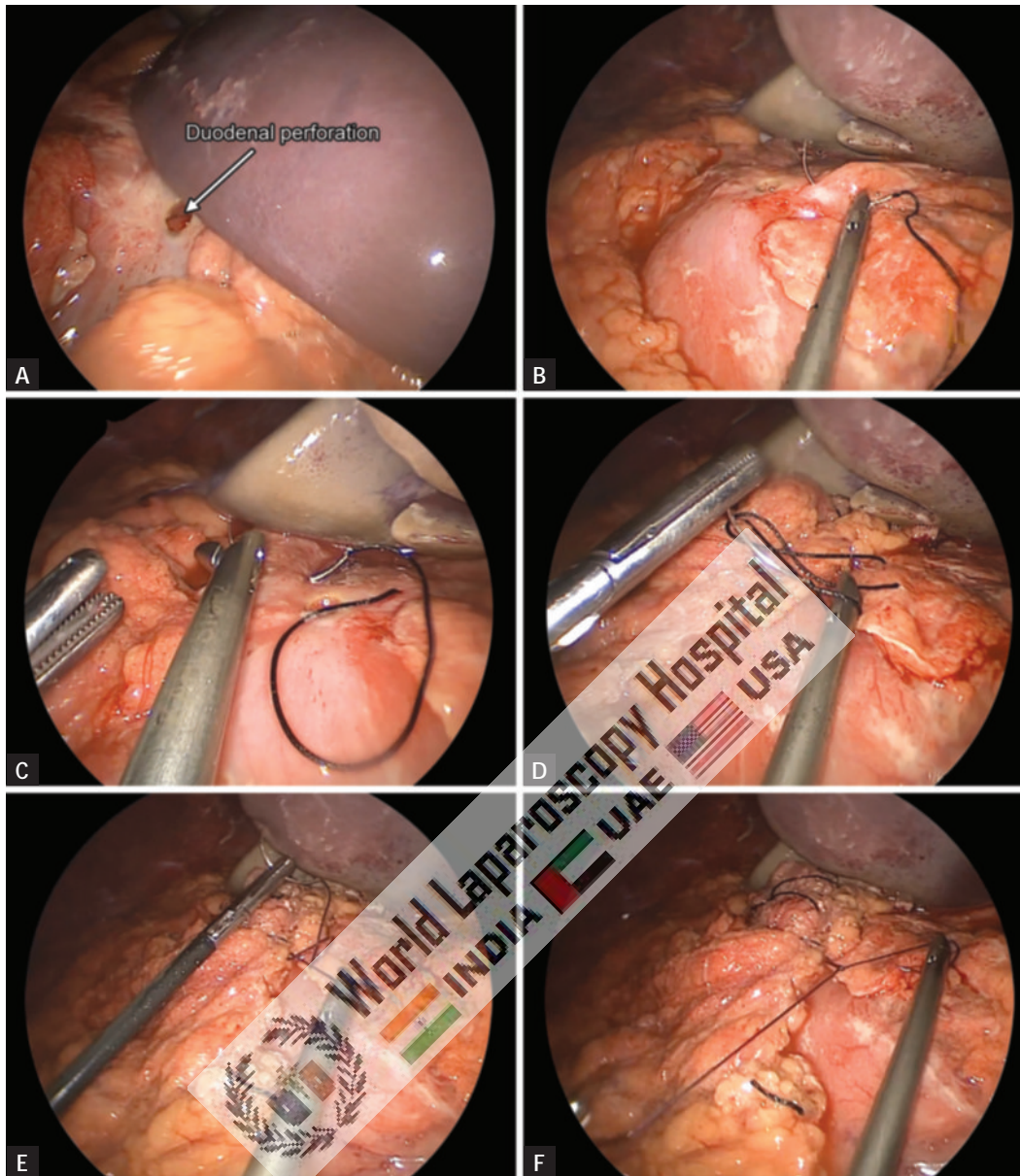
LAPAROSCOPIC CLOSURE OF PERFORATION OFFERS IMPORTANT ADVANTAGES

- Decreased postoperative pain
- Less abdominal wall complication
- Better visualization and ability to carry out a thorough peritoneal lavage
- Cosmetically better outcome
- Lower intraoperative and postoperative complications
- Early return to work
- Early mobilization
- Lower mortality
- It is as safe and effective as open surgery
- Patients subjective well-being was better after laparoscopic repair of perforated duodenal ulcer.

Laparoscopic duodenal ulcer perforation closure was performed in 30 patients. The interval before surgical intervention from the onset of perforation ranged between 20 and 36 hours. Perforation closure with Graham's patch omentoplasty was performed in all cases. In three patients, posterior truncal vagotomy and anterior highly selective vagotomy were combined with perforation closure. Oral fluid was permitted in second postoperative day (POD) in 21 patients and others on third and fourth POD. Postoperative morbidity was very minimal. Two patients had trocar site infection. All the patients were discharged between 5th and 7th POD.

Though the management of peptic ulceration has reduced the incidence of perforated peptic ulcer, it remains a challenging disease for the surgeons since it is an emergency procedure. The proper management of this complication of peptic ulcer disease has generated a lot of discussion; laparoscopic surgical treatment of perforated peptic ulcer is an attractive alternative for conventional treatment because of the absence of complications as compared to conventional surgery for patients who develop perforation in the setting of *H. pylori* infection. Eradication of infection may prevent ulcer recurrence.

Those patients who tolerate insult and whose ulcer was sealed may be adopted for nonoperative therapy. However, decision of nonoperative therapy is difficult and can be done only after evaluation by and close consultation with an experienced surgeon. If nonoperative treatment is chosen, then the patient requires frequent clinical examinations so the operative therapy can be done at the first sign of clinical deterioration. A variety of laparoscopic techniques have been described. A combined laparoscopic-endoscopic method was described, also mini-laparoscopy was described. Intracorporeal suturing was better than extracorporeal knotting because the latter one is liable to cut through tissues. The choice between combining definitive treatment and simple closure is still a matter of controversy. The choice depends on certain factors including age, fitness, and status of peritoneal cavity. The definitive surgical procedure of



Figs. 5A to F: Closure of perforation with omental patch.

choice in perforated duodenal ulcer is patch closure and highly selective vagotomy. Although this procedure has low mortality and morbidity, it is technically demanding and requires experienced surgeon to ensure adequate vagotomy.

In this series, 30 cases of perforated duodenal perforation, three were treated with combined definitive treatment. Older patients with septic shock and generalized peritonitis should better be served by conventional surgery. Open conversion may be required, especially in the presence of certain high-risk factors as:

- Inadequate ulcer localization
- Posterior location of gastric ulcer
- Pancreatic infiltration (penetrating ulcer)
- Localized abscess formation.

It been shown that the age, presence of concomitant disease and length of free air, or fluid collection in abdominal

CT scan correlate with conversion in meta-analysis of 13 publication comprising 658 patients comparing open versus laparoscopic closure of perforated duodenal perforation, it was found that postoperative pain was lower after laparoscopic repair than open repair supported by significant reduction in postoperative analgesic requirement after laparoscopy repair, meta-analysis demonstrated a significant reduction in wound infection after laparoscopic repair as compared with open. But, a significant higher reoperation rate was observed after laparoscopic perforated duodenal repair. Laparoscopic perforated duodenal repair is a safe and reliable procedure associated with short operating time, less postoperative pain, reduced chest complication, shorter postoperative hospital stay, and earlier returns to normal daily activity than conventional open repair. Operative time is also shorter and morbidity also lowers in

laparoscopic repair of perforated duodenal ulcer. Also, low mortality, better cosmetic outcome with laparoscopic repair, and postoperative adhesions and incision hernia were lower in comparing with open method. Laparoscopic repair is as safe and effective as open repair. The patient's subjective well-being was better after laparoscopic repair. Laparoscopy provides better vision of peritoneal cavity and allows early mobilization.



The incidence of perforated peptic ulcer disease has decreased nowadays with vast improvement in medical therapy. However, minimal invasive surgery still has a significant role to play in treatment of complicated disease. It decreases hospital stay and overall recovery period as compared to open surgery, regardless of the preference of the individual surgeon. Our result has shown that the laparoscopic surgery may become the gold standard for surgical treatment of complicated peptic ulcer disease.




Laparoscopic closure of duodenal ulcer perforation is an attractive alternative to conventional surgery with the benefits of minimally invasive surgery such as parietal wall integrity, cosmetic benefits, and early subjective postoperative comfort and rehabilitation.




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