**Peptic Ulcer Surgery:**

"A Shift in the Paradigm" Indications, Operations of Choice and Operative Technique

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1. Introduction

With the success of medical therapy, surgery has a very limited role in the management of peptic ulcer disease (PUD). Helicobacter Pylori eradication has become the medical equivalent of vagotomy, relegating definitive operations to the history chapters of surgical textbooks. (1) Combinations of multiple antibiotics and acid reducing agents, usually PPIs, have been the mainstay of these regimes. Cure rates of greater than 80% (intent to treat) are possible. (2) Eradication of H. pylori infection can give long-term remission of ulcer disease; reduce recurrence; prevent recurrent ulcer bleeding and resolve pyloro-duodenal stenosis in some cases. (3) In light of this evidence general surgeons need to revise their indications for peptic ulcer surgery and critically re-appraise the procedures performed for peptic ulcer disease. Elective peptic ulcer surgery has been virtually abandoned. In the 1980s, the number of elective operations for peptic ulcer disease dropped more than 70%, and emergent operations accounted for more than 80% of these. (4) Currently, surgery for peptic ulcer disease is largely restricted to the treatment of complications, particularly bleeding, perforation, and obstruction, while relying on H. pylori eradication to prevent ulcer recurrence, and these will be the focus of this review. The focus of surgical therapy is to manage the complication effectively and not necessarily to cure the ulcer.

2. Bleeding Peptic Ulcer

Bleeding is the commonest complication of peptic ulceration. Endoscopic hemostasis is now accepted as the first-line treatment in patients with non-variceal upper gastro-intestinal bleeding. Endoscopy is an effective tool in the diagnosis, prognostication, and therapy of bleeding PUD and has been
shown in randomized studies to lead to a reduction in blood transfusion requirements, to shortened intensive care unit and hospital stays, to a decreased need for surgery, and a lower mortality rate. Early endoscopy (within 24 hours of admission) has been shown to reduce blood transfusion requirements and length of hospital stay. Patients who are hemodynamically stable with endoscopy revealing ulcers without high-risk stigmata may be safely discharged home after endoscopy. Patients with endoscopic stigmata indicating a high risk of rebleeding, including adherent clots, visible vessels, and active arterial bleeding should all undergo endoscopic therapy to achieve hemostasis and reduce the risk of rebleeding. Recurrent bleeding may occur in as many as 10% of patients despite endotherapy and the use of high-dose proton pump inhibitors. In patients who rebled after initial endoscopic therapy, repeat endoscopic therapy is suggested before considering surgical or radiologic intervention.

Several controlled trials have shown that endoscopic therapy using a variety of combined techniques significantly reduces the need for blood transfusion and emergency surgical intervention. Similar results are reported with acid suppression, especially when gastric pH is kept above 6 by using high dose proton pump inhibitor (PPI) therapy.

Further benefits have been shown when endoscopic therapy is combined with intravenous PPI therapy. The combined therapy has now been endorsed by the British Society of Gastroenterology, who have recommended intravenous PPI therapy with an initial dose of 80mg, followed by a maintenance dose of 8mg per hour over 72 hour period. The blanket use of expensive PPI therapy has been challenged by a recent randomized study showing that smaller intravenous doses (20mg) of omeprazole administered after endoscopic therapy gave results comparable to the recommended high dose PPI regimen when rebleeding, surgery and mortality were analyzed. However the cost and availability of intravenous PPI therapy remain a major consideration and should be restricted to high risk patients.

The independent pre-endoscopic predictors of rebleeding that are significant in at least two separate studies are hemodynamic instability and comorbid illness. The independent endoscopic predictors of rebleeding that are significant in at least two separate studies are active bleeding at endoscopy, large ulcer size, posterior duodenal location, and lesser gastric curve location.

The benefit of early “second look” endoscopy and further injection if required has been debated for some time. There is now an increasing body of evidence that this approach does not confer benefit further reducing the incidence of re-bleeding. However the benefit of early “second look” endoscopy is still valuable in selected cases where the initial endoscopy was inadequate or demonstrated a Forrest I or IIA ulcer. Rebleeding can be handled effectively by repeat endoscopic therapy or surgery: which to use should be based on the pre-existing comorbidities of the patient. Pre-operative on table endoscopy is first done for an acute upper GI bleed to exclude varices.

The role of surgery during acute bleeding is now restricted to patients with an exsanguinating bleed or those in whom endoscopic therapy fails for technical reasons, or in patients who rebled after a second endoscopic attempt to control the bleeding. The preferred operation today for a bleeding duodenal ulcer is to under-run the bleeder with or without a pyloroplasty.

For bleeding gastric ulcers, a gastrotomy with under-running of the bleeder with biopsy, or depending on the site, local excision is recommended. If the source of bleeding cannot be identified on gastroscopy, a gastrotomy commencing from the pre-pyloric region through the pylorus to the first part of the duodenum should be done, and the incision extended in the direction where the bleeding seems to be coming from. Gastrectomy is reserved for large penetrating ulcers or when there is suspicion of a malignant ulcer. The move away from definitive surgery has been vindicated by ulcer cure rates in excess of 90% in patients who have had successful H.Pylori eradication therapy.

Patients who require long-term non-steroidal anti-inflammatory drug (NSAIDs) therapy are advised to take PPI medication, or alternatively use the safest NSAID available.

### 3. Perforated Peptic Ulcer

Perforation occurs in approximately 7% of patients hospitalized for peptic ulcer disease. Duodenal perforation tends to occur in the anterior wall while gastric ulcers may perforate anteriorly or posteriorly. Concomitant haemorrhage should suggest the presence of a ‘kissing’ ulcer (ulcers involving anterior and posterior duodenal walls simultaneously).

#### 3.1. Epidemiology

**Risk factors**

NSAIDs, immunosuppression (esp. transplant patients on steroids), increasing patient age, chronic obstructive lung disease, major burns, multi-organ failure and smoking

**Gender and age of patients with perforated PUD**

The percentage of women with duodenal ulcer perforations has increased almost threefold over the last 45 years. The male to female ratio is now 2:1 (initially was 7:1). The mean age of women with perforated duodenal ulcers is 10 years higher than for their male counterparts.

**Localization**

Perforations of duodenal ulcers are 7 times more common than perforated gastric ulcers in both sexes in Western literature. However, in developing countries 74% of the perforations may be in the pre-pyloric area.

**Predicting morbidity and mortality**

It is important to stratify patients into different categories based on the likelihood of morbidity and mortality, so that high-risk patients can receive more appropriate treatment and greater intensive care. Several risk scores exist for the prediction of outcomes in PUD example, Boey, ASA, APACHE II and the Mannheim Peritonitis index.

The Boey scoring system is among the common risk stratifications used because of its simplicity and high predictive value for mortality in perforated peptic ulcers. Boey risk factors include: pre-op shock (<100mmHg), perforation present for >24 hours, associated medical co-morbidities. Each of these risk factors score 1 point to a maximum of 3 points with corresponding mortality rates.
**Classification of gastroduodenal ulcer perforation:**

**Type A:** solitary prepyloric ulcer located anteriorly. Treatment of choice should be an open/ laparoscopic closure by suture with omentopexy and post-op endoscopic biopsy to identify H. Pylori and to exclude malignancy.

**Type B:** perforated ulcer with a large defect. Excision and suture is necessary by open surgery.

**Type C:** complicated perforated ulcer with proximal duodenal destruction and penetration into adjacent organs, often pancreas, for which resectional surgery may be indicated like Billroth I, II, with Roux-en-Y or an atypical resection.

Regardless of the ulcer types, those patients that are critically ill and high risk can be offered minimal surgical intervention by percutaneous peritoneal drainage which may significantly lower the mortality in this selected patient group. (27)

**Presentation**

Classically: acute onset of severe epigastric pain with / without radiation to the shoulders. Anxiety, fever, tachypnoea and tachycardia, generalized peritonitis, loss of liver dullness are also present. These classic features may be absent in the very young/old, immunosuppressed, quadriplegic and comatose patient.

Radiology: Free air on erect chest or left decubitus x-ray. This may not be visible in 30% cases and a water-soluble contrast may facilitate the diagnosis.

**Management**

Resuscitation – with view to stabilization for anaesthesia and surgery:

- Nasogastric tube, intravenous fluids, catheterize and monitor urine output
- Analgesia, intravenous antibiotics, acid suppression, eradication therapy.

### 3.2. Surgical management

#### 3.2.1 Perforated Duodenal Ulcer

The primary aim is to close the perforation, and decontaminate the peritoneal cavity.

##### 3.2.1.1. Simple patch closure

The long debate, about the choice between simple patch closure and definitive surgery, has now been settled in favour of patch closure combined with H.Pylori eradication. (27, 28) There is conclusive evidence that the risk of recurrent ulceration is below 10% with this combination therapy. Simple patch closure is also the treatment of choice for NSAID induced perforations since PPI therapy provides effective ulcer protection in these patients.

##### 3.2.1.2. Laparoscopic repair of perforated peptic ulcer: first choice?

The controversy about the surgical management of perforated peptic ulcers has now shifted to the choice between open or laparoscopic closure. Several laparoscopic techniques have been described, ranging from a simple stitch to the use of fibrin glue. Controlled studies have shown that laparoscopic closure is associated with less postoperative analgesic requirements, a lower incidence of respiratory infection, a lower median hospital stay and earlier return to normal activity. (27-30)

A recent literature review has concluded that laparoscopic ulcer repair is safe even in patients with prolonged peritonitis. (29) It is however technically demanding and requires a surgeon experienced in laparoscopy. A remarkable difference in morbidity (14.35 in laparoscopic group vs. 26.9% in open group) and mortality (3.6% vs. 6.4%) should advocate laparoscopy as a diagnostic and therapeutic tool. The overall conversion rate is around 12.4% (range 0-28.5%). The most common reason for conversion was the size of the perforation, but by using a pedicled omentoplasty, size might not necessarily be a reason to convert anymore. Other common reasons for conversion include failure to locate the perforation, shock on admission (conversion rate 50% vs. 8%) and time elapsed since perforation and presentation (33% vs. 0%). The reported series on laparoscopic repair of perforated peptic ulcers comes from specialized centres and cannot be recommended for general community practice where most of these patients are treated.

The new “stamp” method which consists of closure of the perforation by gluing a biodegradable patch onto the outside of the stomach could, in the future, further improve the ease of laparoscopic management.

Open simple patch closure remains the gold standard in the management of perforated peptic ulcers and, when performed through a small midline incision, the outcome should be similar to the laparoscopic approach.

##### 3.2.1.3. Conservative approach to duodenal ulcer perforations

The feasibility of non-operative management for perforated peptic ulcers was first reported by Taylor in 1951. Croft from Hong Kong in 1989 reported

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**Risk factors**

0 0%

1 10%

2 45.5%

3 100%

The incidence of mortality of perforated PU is 5-10%. Mortality increases up to 50% if the perforation has been present > 24 hours.
the first prospective randomized trial comparing the outcome of non-operative treatment with that of emergency surgery in patients with a clinical diagnosis of perforated peptic ulcer. (31)

Approximately half of the duodenal ulcers will have self-sealed by the time of admission. The presence of self-sealing can be reliably established by a water-soluble contrast meal and follow-through. The spontaneous seal for a perforated duodenal ulcer is remarkably secure (only 2 out of 152 re-leaked) and non surgical treatment should include nasogastric drainage, antibiotics, IV PPIs and serial abdominal examinations.

If the signs of peritonitis are not beginning to resolve within 12 hours, the diagnosis of a self-sealed ulcer should be questioned. In patients with severe co-morbid disease preventing surgical intervention, sump suction drains can be placed under local anaesthesia to the site of perforation with an aim of creating an external fistula.

3.2.1.4. Management of large perforated peptic ulcers

Large perforations are between 1 and 3 cm in size; with giant perforations exceeding 3cm in size occurring in only 2.5% of peptic ulcers. It should be stressed that large perforations may not be suitable for simple patch closure. The leak rates with its attendant morbidity and mortality is high in these patients. Different authors have recommended various surgical options as these large perforations are particularly hazardous because of the extensive duodenal tissue loss and surrounding tissue inflammation. (32)

These options include resection of the perforation bearing duodenum and the antrum in the form of a partial gastrectomy with either a BI or BII anastomosis, or the more morbid procedure of gastric disconnection in which an antrectomy, gastrostomy, lateral duodenostomy and feeding jejunostomy are performed, with restoration of gastrointestinal continuity electively at 4 weeks.

Others have recommended conversion of the perforation into a pyloroplasty, or closure of the perforation using a serosal jejunal patch or a pedicled jejunal graft. It is probably advisable where possible to attempt the simplest closure technique. Omentopexy is still safe to perform in perforations of up to 3cm. it is simple and avoids a major resection in an already compromised patient. (33,34)

Omental plugging can be safely performed with giant perforated duodenal ulcers with indurated, fibrotic, friable margins and seems to have a better long term outcome with regards to gastric outlet obstruction when compared to omentoplasty.

The technique of omental plugging is as follows:
The tip of the NG tube is guided through the perforation. The free edge of the omentum is then sutured to the tip of the tube, which is then carefully withdrawn, pulling the plug of omentum into the stomach. 5-6cm of omental plug is usually enough to occlude the perforation. The omentum is then fixed with interrupted sutures taken between the omentum and the healthy duodenum, approximately 3-4mm from the margins of the perforation.

An alternative approach described in critically ill patients with giant perforations, where a resection would increase the patients’ morbidity, is to perform a gastric partition, gastrojejunostomy and simple closure of the perforated peptic ulcer. The gastric body partition above the angular incisura is expected to avoid or minimize hypergastrinemia, as well as avoid uncontrollable leakage from the site of ulcer repair. A tube duodenostomy is added for bile drainage.

3.2.1.5. Failure of primary omental patching

Failure is defined as an early post-operative re-perforation, obstruction and or hemorrhage. A more aggressive surgical procedure is then recommended, such as pyloroplasty or an antral resection.

3.2.1.6. Duodenal perforations associated with a bleeding (“kissing”) ulcer

In this situation a pyloroplasty should be performed to allow undersewing of the posterior bleeder. The pyloroplasty will then include closure of the perforation. Pyloroplasty options include Jabulay, Finney or Heinecke-Mikulicz techniques. Alternatively, partial gastrectomy may be considered as a definitive procedure.

3.2.1.7. Perforations associated with Gastric Outlet Obstruction (GOO)

If an element of GOO is suspected in a duodenal perforation it is safest to perform a pyloroplasty, or consider simple omentopexy with a diverting gastrojejunostomy, before a partial gastrectomy is considered. If post-operatively the patient develops GOO treatment options include: pyloroplasty or antral resection; balloon dilatation; removable stent.
3.2.1.8. Perforations with duodenal destruction and local organ penetration

In situations with significant duodenal obstruction and local organ penetration any repair will be difficult due to much inflammation and friable, fibrotic tissue edges. A higher than normal duodenal leak rate must be anticipated. Various authors will advocate different techniques of management from partial gastrectomy to gastric disconnection. **Again, the simplest technique possible should be advised:** pyloroplasty or omentopexy or plugging with diverting gastrojejunostomy. A Billroth I may provide a safe option than a Billroth II using a **Horsley slit technique**. If a formal resection is unavoidable, be aware of the high risk of duodenal stump blow-out and always leave a drain. In this situation some recommend a tube duodenostomy.

3.2.1.9. Tube duodenostomy

Duodenal stump leakage remains one of the most feared complications of gastric resection. Despite good results reported with this technique it has not gained wide acceptance and is rarely used. It may be considered when surgical closure of the inflamed or scarred duodenum is not safe after resection for chronic peptic ulcer disease, or when a duodenal stump leakage has occurred following previous duodenal stump closure.

The technique is as follows: a soft 22F Pezzer catheter is inserted through the open end of the duodenal stump to a depth of 4-5cm. the holes on the catheter tip may be widened to improve drainage and also to make removal as atraumatic as possible. A purse string suture is then invaginated into the lumen to keep the catheter in place. A viable omental pedicle may be secured around the junction of the tube end and duodenum. A closed suction drain (Jackson-Pratt) is then left near the tube duodenostomy. Depending on the surgeon, the duodenostomy tube stays in place between 10-21 days. The choice of the site of introduction of the catheter, either through the lateral duodenal wall or the duodenal stump, is of great importance. Conceptually these two techniques differ. Lateral duodenostomy through the 2nd part of the duodenum is primarily used for intra-luminal decompression, but it has been shown that this does not lead to a significant decrease in intra-duodenal pressures. End tube duodenostomy is an effort to create a controlled duodenal fistula, and is employed when technical factors prevent adequate surgical closure of the duodenal stump.

3.2.2. Perforated Gastric Ulcer

Distal gastrectomy was always considered the preferred surgical management of perforated gastric ulcers. However, gastric ulcers are now curable by medical treatment, therefore omental patch closure and ulcer excision are being increasingly employed as alternatives to gastrectomy. The complication rate is significantly lower in patch closure patients than in both the gastrectomy and ulcer excision groups. The focus of surgical therapy is to manage the complication effectively and not necessarily to cure the ulcer. This makes simple operations such as omentopexy and ulcer excision possible primordials for all, not just being confined to elderly, unfit or unstable high-risk patients. Biopsy of perforated gastric ulcers is mandatory due to the reported incidence of malignancy being between 3-14%. Candida may also be an associated pathogen. In addition, endoscopy should be performed post operatively to re-biopsy and follow up persistent ulcers until healed. Considering the early and late morbidity associated with gastrectomy, this procedure should be reserved for giant, penetrating or atypically situated perforations that preclude a patch or excision and repair for technical reasons.

4. Gastric Outlet Obstruction

Gastric outlet obstruction (GOO) occurs in 6-8% of patients with duodenal ulcer disease. Before the H. pylori era most patients with outlet obstruction required surgical intervention, including those who underwent endoscopic balloon dilatation. The prevalence of H. pylori varies widely (33-91%) in reported series on GOO and the association appears to be less established when compared with the other complications. Patients with gastric outlet obstruction are frequently malnourished, hypovolemic, and have metabolic alkalosis. Operation is usually indicated if the obstruction fails to resolve after 72 hours with correction of fluid and electrolyte abnormalities, antisecretory therapy, and nasogastric tube decompression.

Several reports have now shown that H. pylori eradication with or without balloon dilatation can successfully overcome GOO in the short to midterm, including patients who have an associated fibrotic stricture. However not all reports are favourable and there is increasing evidence that NSAID users are less likely to respond. More data is required to assess the efficacy of combining H pylori eradication and endoscopic balloon dilatation of stenosis but, at present, it would seem reasonable to try balloon dilatation before considering surgery.

The conventional treatment for GOO was vagotomy and a drainage procedure or alternatively vagotomy and antrectomy. As with bleeding and perforated ulcers, in this situation definitive operations have also become obsolete and addressing the obstruction is all that is needed after successful eradication of H. Pylori. For “burnt-out” ulcers with residual fibrotic strictures a pyloroplasty or Jaboulay gastroduodenostomy is all that is required. A more difficult question is what to offer patients with persistent or recalcitrant penetrating ulcers despite successful H. Pylori eradication. The reason why these ulcers fail to heal remains uncertain, but an important local healing process may play an important role. Nevertheless, a limited distal resection with excision or exclusion of the ulcer should be performed in these situations.

5. Non healing or recurrent ulcers.

The definition of a non-healing ulcer is failure to heal, after appropriate treatment, in two months for DU or three months for GU. It must be said that these are rare, especially in the developing world. A diagnostic dilemma in these cases has been observed. H. pylori persistence or re-infection needs to be ruled out, as does Zollinger Ellison syndrome (a gastrinoma secreting abnormally high levels of gastrin). Other aggravating factors - NSAIDS, smoking, alcohol - need to be eliminated if possible. If the ulcer recurs, one option is long term PPI therapy. If there is failure to heal on these, surgery becomes indicated. In GU, particularly Type I, the standard procedure has been the Billroth I gastrectomy with excision of the ulcer. Preperi-operative biopsies should be performed to make sure the ulcer is not malignant and a larger resection not required. For DU, the modern options have been some form of vagotomy, truncal vagotomy with drainage or highly selective vagotomy (parietal cell vagotomy) versus vagotomy and antrectomy. The latter procedure has an improved cure rate with increased side effects. Recurrence of ulcer after surgery has long been a problem, often requiring more aggressive surgery.
6. Conclusions

With the discovery of H. Pylori, and the availability of effective acid suppressing drugs and eradication therapy, one needs to question the validity and appropriateness of vagotomy and gastrectomy and its numerous variations to control acid secretion. The present generation surgeon is modestly trained and not equipped with the experience of elective gastric surgery. Surgeons should therefore only intervene when complications of peptic ulceration present and then too, should the surgery be tailored and kept to a minimum procedure. With perforation and bleeding, the surgeon should allow for selective conservative treatment under appropriate conditions, simple patching which may be performed via minimal access or more conventional open surgery and, under-run a bleeding vessel when endoscopic haemostasis has failed. Early surgery is still recommended in the elderly in view of the associated high morbidity and mortality. The surgeon should leave acid control and eradication of H. Pylori to drug therapy. Occasionally when operating for a bleeding ulcer or gastric outlet obstruction, a distal gastrectomy may be necessary for scarring. But even here the resection should be limited and undertaken for technical reasons and not for long term control.

In an editorial in the BMJ in 1991, appropriately titled “A requiem for vagotomy, despite the last ditch efforts of surgeons”, John Alexander-Williams predicted that “vagotomy for ulcers will soon go the way of vagotomy for tabes, made obsolete by the conquest of spiral organisms”. These prophetic words have now become a reality. Surgeons should graciously accept their diminishing role in the management of peptic ulcer disease, a role now confined, in the main, to conservative surgery for complications - which ultimately is to the benefit of our patients. (42)

7. Summary and Recommendations:

- GENERAL:
  - The major complications of peptic ulcer disease (PUD) include bleeding, perforation, and gastric outlet obstruction.
  - The overall incidence of PUD has declined significantly, due to better medical therapy, including proton pump inhibitors (PPI), regimens for eradication of Helicobacter pylori, and improvements in endoscopic methods for control of hemorrhage. Surgery for peptic ulcer disease is now typically confined to high risk patients.
  - Early surgical consultation for patients with complications of PUD is required to assure stabilization of the patient, collaboration among services, and agreement on initial nonoperative therapy.
- BLEEDING:
  - Most patients with bleeding ulcers are treated with fluid resuscitation to correct hypovolemia, blood transfusions as necessary, medical therapies, and endoscopic intervention. Surgery is required when endoscopic techniques are unsuccessful or if the patient is hemodynamically unstable or has continued bleeding.
  - The major endoscopic predictors of persistent or recurrent bleeding include
    - Active bleeding during endoscopy - 90 percent recurrence
    - Visible vessel - 50 percent recurrence
    - Adherent clot (in elderly patients particularly with large ulcers) - 25 to 30 percent recurrence
- PERFORATION:
  - For patients with a perforated ulcer, initial management includes insertion of a nasogastric tube, intravenous hydration, and broad spectrum antibiotics. Operation is almost always indicated and the surgical approach will depend upon whether the ulcer is duodenal or gastric.
- GASTRIC OUTLET OBSTRUCTION:
  - For patients with gastric outlet obstruction, a simple drainage procedure is indicated if the obstruction fails to resolve after 72 hours of nasogastric suction and intravenous PPI.
  - The indications for a definitive ulcer operation, which generally involves an acid-reducing procedure (such as a truncal, selective, highly-selective, or parietal-cell vagotomy), are now very limited.

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