REVIEW
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Peptic perforation is the most serious and important complication of gastroduodenal ulceration. The earliest mention of duodenal ulcer in the medical literature is in the London "Medico-Chisurgical Transaction" of 1817. Mr. Travers there reports 2 cases of perforated duodenal ulcer.

In the second edition of "Pathological and practical research on disease of the stomach" by Dr. John Abercrombie five cases stored in literature are collected together.

The fist clear description is usually attributed to cruelhier (1829) whose name it bore for many years as the round ulcer of Cruveilhier but Methew Baillie pictured the lesion in a series of engravings published in 1979. The first paper specially devoted to this subject appeared in 1861, it dealt solely with perforating ulcer and notes were given of cases collected form literature.

In 1894 H.P. Dean recorded the first successful case of perforating ulcer treated by operation, LA Dun followed him. The results of these two cases drew conspicuous attention to the subject, and other success quickly followed. Wair gave an
excellent summary of the early cases, together with a critical review of the whole subject of perforating duodenal ulcer in his presidential address to the American Surgical Association.

Rosenow (1921) in Mayo Clinic produced peptic ulceration in rabbits by the intravenous injection of streptococci from human ulcers. Ivy (1920) produced similar results by injection of sterile broth. Braithwaite (1923) suggested a lymphatic infection. Seley and Colp (1941) have proved the presence of pathogens in peptic ulcer perforation.

Cushing’s (1932) neurogenic theory in the causation of peptic ulcer is well documented. Mc Carrison (1924) has observed that the incidence of peptic ulcer is 50 times higher in south India than in North India. In 1936, it was pointed out by Mc Carrison, Somervell, and Orr that dietetic factors were of paramount importance in causation of peptic ulcer. Diets poor in protein and vitamins A, B and C and fat have all been blamed.

Recently smoking has erupted up as an important etiological factor in the causation of peptic ulcer. In 1947 Jamieson et al studied the smoking habits of 437 cases of perforated peptic ulcer and concluded that heavy smoking was associated with severe
symptoms. A carefully controlled study by Doll et al (1958) showed that smoking could be a factor in the production of peptic ulcer. Gastric secretion is stimulated by smoking has been proved by Gray 1930, Crohn (1938), Chrenfeld and Stutevart (1941) and Steigmenn, (1954).

Dodds and his associates (1934) produced chronic ulcer with perforation by oral and subcutaneous administration of pituitarin in rabbits, which produces mucosal ischemia by spasm. Mann and Williamson (1923) showed if the duodenal contents were diverted to the ileum and the jejunum exposed to undiluted gastric juice a typical chronic peptic ulcer developed almost invariably, proving the importance of hyperacidity in the causation of peptic ulcer.

Genetic influences are important in predisposition to duodenal ulcer, which are as follows:

i) Duodenal ulcer is about three times more common in first-degree relations of ulcer patient that in general population.

ii) A 50% concordance for duodenal ulcer has been observed in monozygotic twins as compared with 14% in dizygotic twins.
iii) Individuals of blood group ‘O’ are about 37% more likely to develop duodenal ulcer than those with other blood groups.

iv) An increase incidence of HLA b-5 antigens also has been identified in white males with duodenal ulcer.

v) The genetic trait with pepsinogen hypersecretion segregated as an autosomal dominant trait is hailed as a marker for predisposition to duodenal ulcers.

Duodenal ulcer is more frequent in patients with alcoholic cirrhosis, chronic renal failure and hyperparathyroidism. In general, duodenal ulcer patients have higher mean basal acid output and maximal acid output than do normal controls and significantly higher levels than present in patients with gastric ulcer.

There is evidence linking the recently isolated organism ‘Helicobacter pylori’\textsuperscript{20, 53}. \textit{H Pylori} has been isolated from the gastric mucosa in 90% of patients with duodenal ulcers, 70% with gastric ulcers and 60% with non-ulcer dyspepsia (Marshal et al, 1985). The pathogenic role of \textit{H. pylori} has yet to be confirmed, current evidence suggests that this organism is probably one of
the several contributory factors in pathogenesis of peptic ulceration.

Treatment of peptic duodenal perforation by aspiration of the stomach was first employed by Wangesteen in patients too ill to withstand operation. However, it was Mullen who first used the method deliberately in ordinary uncomplicated cases. In 1939 Mullen presented in surgical society of scuttle a report on 8 cases treated in this way without fatality. As a result the method was used elsewhere, perhaps rather prematurely, and three deaths occurred in 27 patients, a mortality of 11% Although one of these 3 cases was hopeless when first seen\textsuperscript{40, 41,44}.

In England the first report of the deliberate treatment of uncomplicated perforated ulcer by gastric aspiration was by Bedford Turner in 1945. He described 6 cases that he treated without a death, while he was resident at the Royal Sussex Country Hospital\textsuperscript{43}.

Taylor (1946,1957)\textsuperscript{50-51} has been strong proponent of non-operative treatment for perforated duodenal ulcer. Seeley et al (1965) also reported success with non-operative treatment and depended primarily on nasogastric suction and spontaneous
sealing of perforation. Most surgeons in United States had little enthusiasm for non-operative treatment in all such patients. Using the strict selection criteria (< 24 hours duration of perforated peptic ulcer and stable haemodynamic condition), Kean et al (1988) successfully treated 81% of the 42 patients (complication occurred in 14%).

However, Brenne and Donovan (1989) reported success with non-operative treatment in selected cases of perforated duodenal ulcer. An earlier report from the surgical department of University of Southern California stated that only 40% patients out of 350 cases had sealed perforated ulcer at the time of hospital admission as determined by gastroduodenogram using diatrizoate meglumine (Hypaque). Unsealing was infrequent in their experience. Some of the patients responded excellently on conservative regimen using nasogastric suction, parenteral fluids and antibiotics. However if abdominal finding did not improve with in 6 hours, operative treatment was advised. Donovan recommended surgeons to adopt non-operative treatment in patients whose operative risk is excessive. He also commented that patients over 70 years age are
less likely to respond to non-operative treatment and should have an urgent operative repair of perforation\textsuperscript{39,41}. 

Still most of the authors point that non-operative is not the treatment of choice for healthy individuals nor it can be expected to save the lives of severely ill patients who are literally dead when first seen. Non-operative treatment can, therefore, benefit in occasional patient but the identification of such a patient is difficult and requires a prospective study stratified according to the risk factors.

\textbf{Operative Treatment}

At present management of perforated duodenal ulcer is mostly surgical. In 1983 Edward Crisp reported 50 patients of acid peptic diseases and described clinical course of those with peptic ulcer perforation. He also suggested possibility of operative closure of perforation.

Mikulicz made earliest attempt of surgical closure of perforated duodenal ulcer in 1884 but this remained unsuccessful. Kriege closed a perforated duodenal ulcer successfully surgically for the first time in 1892. Subsequently Dean also reported another successful case in 1894.
Most widely used therapeutic options today are Graham's omentopexy\textsuperscript{13}. The Graham's omentopexy of a perforated duodenal ulcer is a time tested procedure and in an otherwise healthy subject carries a very low mortality rate in small sized perforation (<1 cm.). Moreover, it is simple enough to be done by a trainee surgeon without being under direct supervision. Since perforation of a duodenal ulcer presents as an emergency at odd hours, Graham's omentopexy has another reason to be an attractive option. Results of the Graham's omentopexy have been almost uniformly good with low mortality rate. Another commonly used method is simple closure its mortality rate varying from 2-18\% in most of the recent studies. Sawyer in a study of 254 patients treated by simple closure reported a mortality of 6.7\% and mortality of 21\%. Boey et al\textsuperscript{26} in 1982 in a prospective, randomised double blind trial observed no deaths among 35 patients of perforated duodenal ulcer treated with simple closure. Panda et al, (1976) reported a mortality of 13.4\% among 246 patients treated with simple closure where as Kohli et al (1988) observed 4 deaths in 43 cases\textsuperscript{39}. 
Adarzi et al (1993) used laparoscopic omental patch repair of perforated duodenal ulcer with an automated stapler. Laparoscopic omental patch repair followed by administration of H2 antagonists was performed successfully in 11 patients with perforated peptic ulcer by Masao Matsuda et al (1995)\textsuperscript{44}. Since 2/3\textsuperscript{rd} of the patients continue to have ulcer symptoms and more than 1/3\textsuperscript{rd} after simple closure of perforated duodenal ulcer. So interest has increased in performing a definitive procedure in emergency to control ulcer diasthesis in addition to closure of perforation, but with the advent of proton pump inhibitors (PPI) in 1960 definitive procedures are no longer being carried out. This is because of more effective medical management using PPI's which can make a patient virtually achlorhydric\textsuperscript{15}. Moynihan recommended closure of perforation in 1901 and later Finsterer (1919) urged the use of partial gastrectomy. The first large experience with definitive operation of perforated duodenal ulcer was treated by immediate gastric resection with mortality of 8.9 percent.

Further support to the advocates of definitive surgery was given by Debakey's initial report in 1940 and subsequent report from Jordon (1979)\textsuperscript{22,23,24,25} demonstrating that resection can be
performed with a mortality rate of only 1%. Sawyer's\textsuperscript{42} in a study of 106 patients who underwent definitive operation at the time of perforation observed a mortality of only 2.8% and morbidity of 15% Jordon and Debackey\textsuperscript{43} in their total experience of 327 patients who underwent immediate gastrectomy observed an overall mortality of 2.1% whereas the overall surgical mortality rate for hemigastrectomy and vagotomy was 2.5% Recurrence rate in this series was 73%, 69% and 0% for those treated with simple closure , gastrectomy (Bitroth I or II) and hemigastrectomy and vagotomy respectively . But all these reports had selection bias in favour of definitive surgery by excluding high-risk group form definitive surgery. Boey and colleagues\textsuperscript{28,31} reported the first prospective, controlled, randomized trial of immediate definitive surgery versus closure in 1982. Demiguel (1982) and Jordon & Thornby (1987)\textsuperscript{21} obtained excellent results of elective treatment of duodenal ulcer by partial cell vagotomy, it was logic to evaluate this treatment for perforated duodenal ulcer. First study to compare proximal gastric vagotomy (PGV)\textsuperscript{43} with truncal vagotomy & pylorooplasty was conducted by Boey and coworkers. Caeneviva et al (1986)\textsuperscript{40}
compared PGT versus simple closure for perforated duodenal ulcer. The recurrence rates were 5% and 58% respectively.

Michael L Cheatham et al (1995) presented a 20 year report on a prospective study of omental patch closure and parietal cell vagotomy for treatment of perforated duodenal ulcer. This operation is an ideal procedure to cope with the immediate problem of perforation and simultaneously provide definite ulcer therapy in selected cases. Christine F Kollmorgen et al (1996)\textsuperscript{38} compared open and laparoscopic vagotomy for efficacy of acid reduction and preservation of normal gastric emptying.

Boey (1987) evaluated risk factors for mortality as follows:\textsuperscript{15,18,46}.

1. Presence of serious medical illness
2. Pre-operative shock
3. Long standing perforation (>24 hrs.).

When three risk factors were present, all patients died, with two risk factors mortality was 45.5%. However it decreased to 10% with only one risk factor. In absence of all these risk factor no patient died. The above data as reported by Boey's\textsuperscript{15} support that presence of risk factors significantly influences the mortality.
Therefore only closure of perforated duodenal ulcer is advised instead of definitive procedure when any of risk factors is present. When there is no risk factor operative mortality is same as for definitive procedure. For closure of perforated duodenal ulcer various methods have been evolved from time to time. Their superiority is assessed in terms of post-operative leakage of perforated duodenal ulcer.

Surgical intervention in an emergency demands an operative technique, which combines speed and simplicity so that degree of shock already existing shall not be made more profound by prolonged anesthesia.

1. **Simple Closure Technique**

   Simple closure technique involves placement of multiple full thickness sutures, in long axis of duodenum across the perforation. At least two stitches must travel through perforated ulcer. These sutures are tied in such a manner to achieve perfect apposition of perforated margin with avoidance of inversion or eversion of margin. It is preferable to use synthetic monofilament absorbable suture such as polydioxanone (PDS). The absorption characteristics of these materials are more predictable than those
of Catgut and suture more easily than do woven synthetic absorbable suture.

**DISADVANTAGES OF SIMPLE CLOSURE TECHNIQUE**

It is suitable only for smaller perforation, because when an attempt is made to approximate margins of large perforated duodenal ulcer, sutures bite away due to undue tension. This increases the incidence of post-operative leakage.\(^{41,49}\)

It is not suitable even for smaller perforation in presence of edema and induration in surrounding duodenal wall. If fibrosis is present, it has to be excised before closure and excision makes the perforation larger, thereby it become less feasible to approximate perforated margin properly by simple closure only. In presence of oedema and induration sutures do not hold in duodenal wall and they bite away when an attempt is made to tie them.

Read and Thompson (1975) reported a high incidence of gastric outlet obstruction after simple closure of perforated duodenal ulcer. On other hand Playforth and Mc Mahon (1978) reported 3% incidence of gastric outlet obstruction after simple closure. This wide difference in the frequency of stenosis suggest
either some local variation in natural history of ulcer or more likely the effect of varying surgical techniques for closure of the perforation.

Graham’s omentopexy

In 1937 Graham Steel\textsuperscript{13} described omentopexy technique as a rapid method for treatment of perforated duodenal ulcer, which is practiced widely.

When simple apposition is not possible because of induration and oedema then omentopexy technique is useful. In this technique three full thickness lembert sutures are placed across the perforation in long axis of duodenum. At least one stitch must run though the perforated ulcer. Stitches are placed approximately half an inch away from the margin of perforation. A tag of healthy omentum with adequate blood supply is drawn under these sutures and tied.

**OMENTAL PATCH TECHNIQUE**

In 1929 Cellan Jones\textsuperscript{48} proposed an identical technique for closure of perforated duodenal ulcer but he suggested use of free omental graft. This technique is seldom used as this is associated with very high incidence of post-operative leakage due to the
reason that omental graft tend to necrose because of lack of vascular supply.

**Surgical option in large Duodenal Ulcer Perforation**

When the perforation is very large and is not suitable for emergency closure by any of the above described method than various types of pyloroplasty with vagotomy and gastroenterostomy recommended (Passos and Colleagues. 1986). Out of which Heinke-Mikulicz pyloroplasty and trunical vagotomy is most suitable as emergency procedure.

When Dragstedt introduced vagotomy in 1943, gastric acidity was effectively controlled in patients with duodenal ulcer but vagotomy leads to alteration in gastric tone and muscular activity and thus results in gastric stasis (Thomas 1957). Pyloroplasty alleviates this side effect of vagotomy and effectively facilitates the gastric emptying⁵³.