Original Article

Management Of Perforated Peptic Ulcers

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Abstract

Background: In conjunction with the diagnosis,, an effective initial resuscitation should be done, and a management plan should be established. It should be noted that delayed presentation, hemodynamic instability, and preexisting co-morbidities necessitates aggressive resuscitation prior to surgery and close perioperative monitoring; to minimize the subsequent morbidity and mortality related to the condition, proper management plan regarding the treatment options of the perforation alone or addition of an ulcer definitive surgery should be addressed to each patient according to his condition. Conservative treatment is known as the Taylor method and consists of nasogastric aspiration, antibiotics, IV fluids, and Helicobacter pylori triple therapy. In 1946 Taylor presented the first series of successfully outcome of conservatively treated patients with perforated peptic ulcer, based on the theory that effective gastric decompression and continuous drainage will enhance self-healing. The idea for conservative treatment came from Crisp who in 1843 noted that perforations of the stomach were filled up by adhesions to the surrounding viscera which prevented leakage from the stomach into the peritoneum. But still there is an ongoing debate whether perforated peptic ulcer generally needs to be operated on or not. Many techniques have been described in the literature for the surgical treatment of perforated peptic ulcers starting from simple closure of the perforation with an omental patch, using an omental plug, a falciform ligament patch, a serosal jejunal patch and even proceeding to resection of perforation bearing duodenum and the antrum in the form of a partial gastrectomy with either a Billorth I or Billorth II anastomosis for larger perforations. Most of these techniques can be achieved using the open or the laparoscopic approaches.

Keywords: Perforated Peptic Ulcers

INTRODUCTION

Peptic ulcer disease results from an imbalance of acid secretion and mucosal defenses that resist acid digestion. Most gastric acid is produced by parietal cells, which are in the fundus and body of the stomach, the parietal cells are highly specialized in their role to secrete acid; they contain deep invaginations of their apical plasma membranes that form cannaliculi lined with microvilli. Located just below these cannaliculi, inside a resting parietal cell, are numerous tubular vesicular membranes thought to contain the [H+-K+- ATPase] pump or proton pump **(1).** Perforated peptic ulcer is a serious complication of peptic ulcer disease with potential risk of grave complications. Complication rates continued to remain the same despite overall reduction in incidence of peptic ulcer disease in recent decades. Mortality is higher in older patients. Boey's score found that age itself has no effect on patient's outcome, but he did find concurrent medical illness to have a significant detrimental effect. This indicates that higher mortality in old age might be due to associated medical illness as shown in. Concurrent medical illness had 3 times higher incidence in patients over 49 years. **(2).**

The clinical suspicion and diagnosis of perforated peptic ulcer is usually straightforward. Classically, when a patient's peptic ulcer perforates, it floods his peritoneum with the acid contents of his stomach and gives him a sudden agonizing pain. He may be able to tell you the moment the pain began; it is constant, it spreads across his entire upper abdomen and later all over and is made worse by deep breathing or movement. Usually, he lies still in excruciating pain, and breathes shallowly without moving his abdomen. He is pale, sweating, and hypotensive, with a fast pulse (usually), a normal temperature and a stomach which is not distended. Typically, his abdomen has a board-like rigidity, unlike that in any other disease, which may be so complete that you cannot elicit tenderness, except when you examine him rectally. After three to six hours his pain and rigidity has been lessened, he feels better and a "silent interval' begins. Then, at about six hours from gained sudden agonizing pain, signs of diffuse peritonitis develop, accompanied by abdominal distension and absent bowel sounds **(3).**

MANAGEMENT OF PERFORATED PEPTIC ULCERS

(I): Initial resuscitation:

In conjunction with the diagnosis, as previously discussed, an effective initial resuscitation should be done, and a management plan should be established. **(4).**

The initial resuscitation comprises:

- Assessment of the vital signs.
- IV Fluids and correction of electrolyte imbalances.
- IV Analgesics to relieve the pain (e.g., pethidine)
- IV Antibiotics (e.g., 3rd generation Cephalosporins) and Metronidazole intravenous infusion.
- IV protons pump inhibitors.
- Nasogastric (Ryle's) tube to decompress the stomach and minimize spillage of its contents into the abdominal cavity.
- Urinary catheter to monitor urine output.

It should be noted that delayed presentation, hemodynamic instability, and preexisting co-morbidities necessitates aggressive resuscitation prior to surgery and close perioperative monitoring; to minimize the subsequent morbidity and mortality related to the condition, proper management plan regarding the treatment options of the perforation alone or addition of an ulcer definitive surgery should be addressed to each patient according to his condition. **(4).**

(II): Conservative treatment:

(A): Method:

Conservative treatment is known as the Taylor method and consists of nasogastric aspiration, antibiotics, IV fluids, and Helicobacter pylori triple therapy. In 1946 Taylor presented the first series of successfully outcome of conservatively treated patients with perforated peptic ulcer, based on the theory that effective gastric decompression and continuous drainage will enhance self-healing. The idea for conservative treatment came from Crisp who in 1843 noted that perforations of the stomach were filled up by adhesions to the surrounding viscera which prevented leakage from the stomach into the peritoneum. But still there is an ongoing debate whether perforated peptic ulcer generally needs to be operated on or not **(5)**.

(B): Indications and Contraindications:

The decision of non-operative treatment might be considered wise in patients > 70 years, not eligible for surgical repair due to associated morbidity, with documented contrast studies showing that the perforation has completely sealed. But when the patient is in shock or the time point between perforation and start treatment > 12 hours simple closure should be the first choice of treatment. **(6).**

(C): Advantages and Disadvantages:

The advantages of conservative treatment are avoidance of morbidity risk caused by surgery and anesthesia, also nonoperative management was safe and only resulted in 3% intra- abdominal abscess formation. The mortality rate for patients treated operatively in their series was 6.2%, compared with a mortality rate of 3% in those patients treated non-operatively **(6).**
The disadvantages of non-operative management lack the benefit of laparoscopy or laparotomy as a diagnostic tool in case the patient was misdiagnosed, and it carries a high mortality rate in case if it failed **(6).**

(III): Surgical treatment

Many techniques have been described in the literature for the surgical treatment of perforated peptic ulcers starting from simple closure of the perforation with an omental patch, using an omental plug, a falciform ligament patch, a serosal jejunal patch and even proceeding to resection of perforation bearing duodenum and the antrum in the form of a partial gastrectomy with either a Billorth I or Billorth II anastomosis for larger perforations. Most of these techniques can be achieved using the open or the laparoscopic approaches. **(6).**

(A): Scoring System for Surgical Treatment Prognosis

As peptic perforation is life threatening, various scoring systems have evolved to prognosticate mortality and morbidity. Some systems take preoperative status into account whereas others take the laboratory parameters and intra-operative findings into account for scoring. The Boey's scoring system still stands the test of time and assess the condition of the patient accurately. The MPI, APACHE II, Hacetteppe systems contain detailed parameters to be investigated to arrive at a score. **(7)**
The scoring system should be simple and should optimally predict the outcome on admission itself taking only clinical parameters into account so that an opinion can be given to the patient's relatives about the prognosis which would allay any doubts **(7)**
Concurrent medical illness, pre-operative shock, and duration (more than 24h) are considered in **Boey's** score. **(7)**

Table (1): Boey's score (8)

Risk factors	No. of risk factors
None of below	**0**
Pre-operative SBP<100 mmHg	**1**
Delayed presentation>24 h	**1**
Major medical illness present	**1**

Table (2): Acute physiology and chronic health evaluation II (**APACHE II**) score **(2).**

	High abnormal range					Low abnormal range			
Score→	+4	+3	+2	+1	0	+1	+2	+3	+4
Temperature	>41	39-40.9		38.5-38.9	36-38.4	34-35.9	32-33.9	30-31.9	<29.9
Meanarterial pressure mmHg	>160	130-159	110-129		70-109		50-69	40-54	<39
Heart rate	>180	140-179	110-139		70-109		50-69	40-54	<39
Resp rate	>50	35-49		25-34	12-24	10-11	6-9		<5
Oxygenation	>500	350-499	200-349		<200				
ArterialpH	>7.7	7.6-7.69		7.5-7.59	7.33-7.49		7.25-7.32	7.15-7.24	<7.15
S Sodium	>180	160-179	155-159	150-154	130-149		120-129	128-119	<119
S Potassium	>7	6-6.9		5.5-5.9	3.5-5.4	2.9-3.4	2.5-2.9		<2.5
S Creatinine	>3.5	2-3.4	1.5-1.9		0.6-1.4		<0.6		
Hematocrit	>60		50-59.9	46-49.9	30-45.9		20-29.9		<20
WBC total/mm³ IN 1000	>40		50-39.9	15-19.9	3-14.9		1-2.9		<1
Glasgow coma scale (score-15)									
Total score									

Interpretation	
Score	**Death rate (%)**
0-4	4
5-9	8
10-14	15
15-19	25
20-24	40
25-29	55
30-34	75
>34	85

Mannheim peritonitis index (MPI) system considers the type of peritoneal exudates and the **Hacetteppe** score takes medical illness, acute renal failure, white cell count of more than 20×10^9 /l and male sex into consideration. **(2)**

Table (3): Mannheim peritonitis index **(2)**

Criteria	Score
Age>50 years	5
Female sex	5
Organ failure	7
Malignancy	4
Pre-operative duration of peritonitis>24 h	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
Exudate	
Clear	0
Cloudy, purulent	6
Fecal	12

Kidney failure=creatinine level>177 umol/L or urea level>167 mmol/L or oliguria<20 ml/h; pulmonary insufficiency=PO_2<50 mmHg or PCO_2>50 mmHg; Intestinal obstruction/paralysis>24 h

Table (4): Hacetteppe score **(2)**

Critera	Score
Coexisting medical illness	1
Acute renal failure	1
White cell count of more than 20×10^9	1
Male sex	1

It has been observed that likelihood of death could be predicted by the **Boey** score whereas the **APACHE II** score was better in predicting morbidity. Considering the large number of parameters that need to be evaluated in **APACHE** score that may not

be possible in all set ups particularly so in our rural area Boey score still stands the test of time. **(9)**.
The summary of all scoring system leads us to believe that delay in treatment, concurrent medical illness and presence of shock form a vicious triad for mortality. As these criteria are met by **Boey's** score it seems to be indicative of morbidity and mortality. Hence the scoring system should be regularly utilized for prognostication **(9).**

(B): Laparoscopic repair

(1) Advantages:

Laparoscopic repair offers several advantages. First, a laparoscopic procedure serves as a minimally invasive diagnostic tool. Other benefits are postoperative pain reduction and less consumption of analgesics and a reduction in hospital stay. Also, a reduction in wound infections, burst abdomen and incisional hernia due to shorter scars has been noted. Avoiding upper laparotomy might lower the incidence of postoperative ileus and chest infections **(10).**

(2) Disadvantages:

Drawbacks are a prolonged operating time, higher incidence of re-operations due to leakage at the repair site and a higher incidence of intra-abdominal collection secondary to inadequate lavage. The higher incidence of leakage in the laparoscopic group might be caused by the difficulty of the laparoscopic suturing procedure. This outlines the need for a dedicated laparoscopically trained surgeon to perform this procedure **(11).**
Alternative techniques to simplify the suturing process have been thought of some laparoscopic surgeons use omentopexy alone, Suture less techniques have been tried, in which fibrin glue alone or a gelatin sponge has been glued into the ulcer. The downside of this technique is that it only can be used to close small perforations **(12).**

(3) Conversion to open technique:

It should be noted that laparoscopic repair might convert to open. The average conversion rate is 12.4%. **(13).**
The most common reasons for conversion are size of perforation (often > 20mm), inadequate ulcer localization, and difficulties placing reliable sutures due to friable edges,**. (13).**

Table (5): A summary of the main reasons of conversion to open repair. 29 studies, n = 2346 **(13).**

Perforation size	9.4 %
Inadequate ulcer localization	6.6 %
Friable edges	6.4 %
Adhesions	5.9 %
Perforation galbladder	5.0 %
Cardiavascular instability	4.4 %
Suspected tumor	4.2 %
Severe peritonitis	4.2 %
Posterior localization	3.9 %
Definitive ulcer surgery	3.2 %
Technical difficulties	2.2 %
Pancreatic infiltration	1.0 %

(C) Open repair:

(1): Advantages

Advantages are less operating time than laparoscopic, lower incidence of re-operations due to leakage at the repair site and a lower incidence of intra-abdominal collection secondary to inadequate lavage. Also, can do operations in patients show difficulties in laparoscopic repair like patients come in sever peritonitis, perforation size very large, perforation located posterior, edges of perforation are friable, sever adhesions and there was associated other pathology **(10).**

(2): Disadvantages:

Drawbacks of open repair are severing postoperative pain and more consumption of analgesics and prolongation in hospital stay. Also, a higher incidence of wound infections, burst abdomen and incisional hernia due to longer scars has been noted. Upper laparotomy might increase the incidence of postoperative ileus and chest infections **(10).**

(D): Techniques of the surgical repair of perforated peptic ulcers

(1) Simple closure

(a): Omental patch (Graham's patch or Omentopexy):

The first description of simple closure was provided by Graham in 1937, He described placing 3 absorbable sutures (e.g., 2-0 Vicryl or PDS) in an interrupted fashion through the ulcer. A piece of omentum was then placed over the sutures and tied "just tight to hold the omentum in situ, no attempt is made actually to close the perforation." **(14)**.

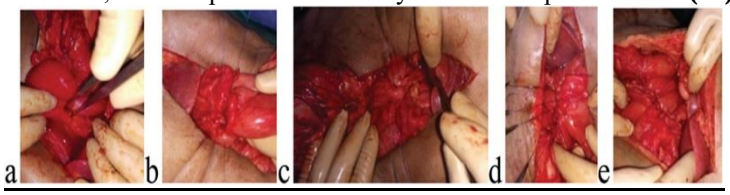

Figure (1): Primary closure of perforated duodenal ulcer by Grahm's technique of omentopexy. (a) perforated duodenal ulcer as seen from anterior; (b) Through and through sutures; (c) pedicled omentum laid over these sutures; (d) sutures are then tied; (e) Final repair of the defect with omentum secured in place on to the defect itself**. (14)**.

(b)Variations of the Graham's patch technique:

One variation of the classical technique consists of tying the sutures to close the perforation. Without cutting the sutures, a segment of omentum is then brought on top of the closed perforation. The same sutures are used to tie down the omental patch over the already approximated perforation, this technique now called Modified Graham's Omentopexy, **, (14)**.
However, concern exists regarding the seal obtained from the omentum when suture knots are interposed between the duodenal serosa and the omental patch. At the same time, the apposition of omentum is not as broad as with the original omental patch. Yet, no definitive conclusions can be drawn from studies regarding the differences in morbidity or mortality associated with each of these techniques. **(14)**.

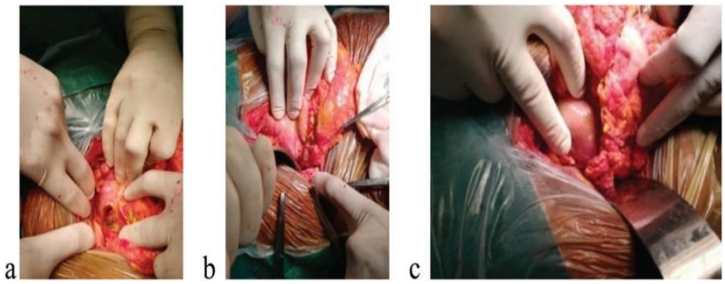

Figure (2): Closure of perforated duodenal ulcer by Modified Graham's Omentopexy. (a) perforated duodenal ulcer as seen from anterior; (b) first layer of knots; (c) Second layer of knots secured over the free vascularized omentum**. (14)**.

(c): Another variation; Two to four seromuscular sutures are placed as shown in**:** with bites proximal and distal to the perforation. After placement of all sutures, the omentum is drawn beneath the tagged sutures and then secured. This technique is simple, avoids placement of suture in inflamed tissue and is unlikely to compromise the duodenal lumen **(15)**

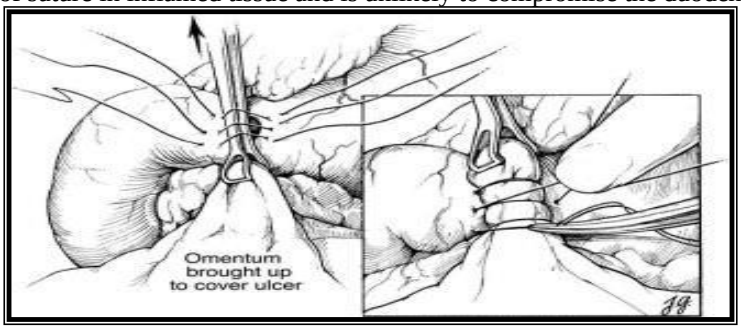

Figure (3): Another variation of the classic repair **(15)**

(d): Falciform ligament patch:

When the omentum is not available, the falciform ligament may be used as a patch. After division of the falciform at the anterior abdominal wall, the vascularized falciform graft based on its attachment to the liver easily reaches the duodenum,

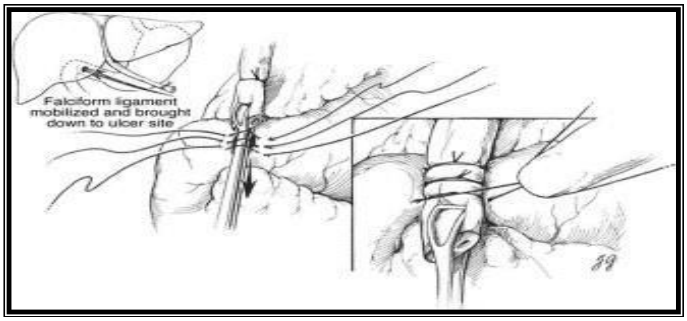

Figure (4): Falciform ligament patch **(15)**

(e): "Plug and Glue" technique:

Gelatin sponge is rolled into a plug or a plug of omentum is inserted into the perforation, secured in place, and covered with fibrin glue **(16).**

(2) Closure of large perforations (more than 3cm):

- Resection of the perforation bearing duodenum and the antrum in the form of a partial gastrectomy with either a Billorth I or Billorth II anastomosis.
- Conversion of the perforation into a pyloroplasty.
- Closure of the perforation using a serosal jejunal patch or a pedicled jejunal graft.
- However, it is advisable whenever 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. **(12).**

(3) Duodenal perforations associated with a bleeding ("kissing") ulcer:

- Pyloroplasty should be performed to allow under sewing of the posterior bleeder. The pyloroplasty will then include closure of the perforation. Pyloroplasty options include **Jabulay, Finney** or **Heinecke Mikulicz** techniques.
- Partial gastrectomy may be considered as a definitive procedure. **(17).**

(4): Ulcer definitive surgery

- When selecting a patient for a definitive ulcer operation, one must decide which procedure offers an acceptably low rate of recurrence while minimizing attendant side effects **(6).**
- The most effective forms of definitive surgery have been resection of the distal two-thirds of the stomach (hemigastrectomy) and (Vagotomy & Antrectomy). Currently, the former procedure is rarely performed because it causes significantly more operative mortality and risk of postoperative sequelae than do other operations, such as Vagotomy & Antrectomy or highly selective vagotomy **(4).**
- Consequently, most surgeons confine definitive therapeutic options to Vagotomy & Antractomy or Vagotomy & Drainge or highly selective vagotomy **(18).**
- However, even the strongest advocate for immediate definitive surgery for perforated peptic ulcer agrees that simple repair is indicated in patients who are poor surgical risks because of major concurrent medical illness or shock, in patients who have heavy bacterial contamination of the peritoneal cavity because of delay in surgery and when a surgeon experienced in ulcer definitive surgery is not available **(6).**

(E): Laparoscopic versus Open repair

Papers published results of randomized controlled trials (RCTs) comparing laparoscopic repair with open repair for PPU. **(19).**

Studies showed significant reduction in postoperative pain in the laparoscopic group. Quah Concluded that morbidity was significantly lower in the laparoscopic group. Groups of these studies concluded that operating time was significantly longer in the laparoscopic group, though the other group showed a shorter operating time. **(19).**

Table (6): Studies comparing laparoscopic and open repair. **(19).**

Author	Year	No. of pt.			Jadad score	Age (years)		Male gender (%)	
		Total	LR	OR		LR	OR	LR	OR
Lau[15]	1996	103	52	51	3	52.3	51.1	42 (80.7)	37 (72.5)
Lau[16]	1998	22	12	10	1	–	–	–	–
Siu[17]	2002	121	63	58	3	53.8	56.1	53 (84.1)	45 (77.6)
Bertleff[21]	2009	101	52	49	3	66	59	29 (55.8)	32 (65.3)
Schietroma[18]	2013	115	57	58	2	–	–	22 (38.6)	22 (37.9)
Shah[19]	2015	50	25	25	1	50	51	20 (80)	21 (84)
Ge[20]	2016	119	58	61	3	46.4	46.5	49 (84.5)	54 (88.5)
Total		631	319	312		53.7 ± 7.4	52.8 ± 4.9	215 (67.4%)	211 (67.6%)

	LR	OR	*p* value
ASA 1	75 (23.5%)	67 (21.5%)	0.6
ASA 2	75 (23.5%)	81 (26%)	0.75
ASA 3	24 (7.5%)	27 (8.7%)	0.7
ASA 4	4 (1.3%)	2 (0.6%)	0.65
ASA = not defined	141 (44.2%)	135 (43.2%)	n/a
Previous PUD	41	51	0.55
Use of NSAID	53	44	0.41
Site = duodenum	169 (53%)	143 (45.8%)	0.74
Site = gastric	41 (12.6%)	56 (17.9%)	0.59
Site = juxtapyloric	41 (12.6%)	38 (12.2%)	0.63
Site = not defined	68	75	n/a
Mean size of perforation (mm)	6.6	5.2	0.23

Studies written between January 1989 and May 2017 were selected and the data regarding the comparison between the open and the laparoscopic repair were extracted and summarized in **(19).**

Table (7): Comparison between open and laparoscopic repair of perforated duodenal ulcers **(19).**

n=1874	Laparoscopic n=843	Open n=1031
Operating time (min.)	70.8	59.3
Nasogastric tube (days)	23	3.0
Intra venous fluids (days)	2.8	3.1
Abdominal drains (days)	2.2	3.8
Urinary catheter (days)	2.3	3.7
Normal diet (days)	3.5	5.7
Prolonged ileus (days)	2.7	3.6
Hospital stay (days)	6.3	10.3
Woundinfection (%)	0.0	5.0
Suture leakage (%)	6.3	2.6
Mobilization (days)	1.9	3.3
Normal daily activity (days)	12.7	16.6
Morbidity (%)	14.3	26.9
Mortality (%)	3.6	7.2
VAS day 1	3.8	6.4
VAS day 3	1.9	3.3

The same studies summarized the results regarding the different techniques used in the laparoscopic repair,**.**

Table (8): Different techniques used in the laparoscopic repair **(20)**.

Closure of perforation	66% omental patch	24% mixed techniques	10% sutures only	
Pneumoperitoneum	26% Hassan trocar	47% veress needle	26% mixed	
Pneumoperitoneum	75% 12 mmHG	25% 11 or 14 mmHg		
Cameraposition	35% supraumbilical	35% umbilical	30% infraumbilical	
Number of trocars used	60% 4 trocars	40% 3 trocars		
Position surgeon	44% between legs	33% left side patient	16% between of left side	6% right side
Irrigation fluid	45% generous	55% between 2-6 liters		
Camera	80% 30 degrees	10% 40 degrees	10% 0 degrees	
Nasogastric tubing	94% yes	6% no		
Abdominal drains	79% yes	21% no		
Suture material	64% resorbable sutures	38% non-resorbable		
Knotting technique	64% intracorporeal	14% extracorporeal	14% mix	

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