

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.theijs.com

Definitive or conservative surgery for perforated gastric ulcer? – An unresolved problem

Sistla Sarath Chandra*, S. Siva Kumar

Department of Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry 605006, India

ARTICLE INFO

Article history:

Received 16 December 2008

Accepted 17 December 2008

Available online 25 December 2008

Keywords:

Duodenal ulcer

Stomach ulcer

Peptic ulcer perforation

ABSTRACT

Background: Gastric ulcer perforation has not been the focus of many studies. In addition there is a need to analyze the results of gastric perforation separately and not along with duodenal perforations, to identify the factors influencing the outcome and to develop strategies for its management.

Materials and methods: Retrospective analysis of 54 patients presenting with gastric perforation.

Results: Mean age of the patients was 44.5 years with male preponderance. Morbidity following closure of the perforation, acid reduction surgery and resection was not significantly different. Overall mortality was 16.6% with highest mortality 24.1% following simple closure. Mortality following simple closure and definitive surgery was not significantly different. Univariate analysis revealed preoperative shock, associated medical illness and surgical delay to be significant factors for mortality whereas on multivariate analysis, preoperative shock was the only independent predictor of mortality. Mortality increased with increasing Boey score but the association between the type of surgery and probability of survival was not statistically significant.

Conclusion: Boey risk score is useful in predicting the outcome of surgical treatment for gastric perforation. Definitive surgery is not associated with greater morbidity or mortality compared to simple closure.

© 2008 Surgical Associates Ltd. Published by Elsevier Ltd. All rights reserved.

1. Introduction

Perforation remains a frequent and a lethal surgical complication despite the availability of effective medical treatment for peptic ulcer.^{1,2} Gastric perforation though less common, is associated with greater morbidity and mortality compared to duodenal ulcer.³ Information on gastric perforations is limited and the recommendations for its management are not clear. The clinical profile, etiopathogenesis and the surgical options for gastric perforation are different from duodenal perforation. Hence there is a need for analyzing gastric perforations separately and not along with the more common duodenal ulcer perforations, to evolve a proper strategy for their management and to achieve better immediate and long term results.

2. Materials and methods

This is a retrospective analysis of 54 patients presenting with gastric perforation during the last ten years, to determine factors

influencing the outcome of surgical treatment. Demographic data, medical history and operative findings and operative procedure performed were obtained from the case records. Boey risk score was calculated from the clinical data. The main outcome measures were morbidity and mortality. Factors found to be significant on univariate analysis were subjected to multivariate analysis. Mortality rates were analyzed in these patients who were stratified based on Boey risk score. Chi-square test and logistic regression were used for statistical analysis and $p < 0.05$ was considered statistically significant.

3. Results

A total of 54 patients with gastric perforation were managed over a period of ten years. Their age ranged from 21 to 67 years with a mean age of 44.5 years. There were only two female patients.

Past history of peptic ulcer disease was present in 79% (43 of 54) of patients. Prepyloric ulcers constituted 61% (33 of 54) and giant ulcers 13% (7 of 54) (Table 1). Of the factors used in calculating Boey risk score, long standing perforation (>24 h) was the commonest factor of Boey's risk score and was seen in 74% of the patients while 30% of our patients presented with shock. Associated major medical illness was present in only 16% of patients in this study.

* Corresponding author. Tel.: +91 0413 2272033.

E-mail address: sarathsisitla@hotmail.com (Sistla Sarath Chandra).

Table 1
Incidence of risk factors.

Risk factor	Number of patients (%)
Ulcer history	
Positive	43 (79)
negative	11 (21)
Alcoholism	
Positive	34 (63)
negative	20 (37)
Smoking	
Positive	30 (55)
negative	24 (45)
Duration of perforation	
<24 h	14 (26)
>24 h	40 (74)
Site of ulcer	
Prepyloric	33 (61)
Lesser curvature	14 (26)
Antrum	6 (11)
Greater curve	1 (2)
Size of ulcer	
<3 cm	47 (87)
≥3 cm	7 (13)

Simple closure was the surgical procedure in 29 patients and gastric resection in 17 patients. Closure combined with acid reduction procedure truncal vagotomy and drainage was performed in 8 patients.

Morbidity rates following simple closure, closure with acid reduction surgery and resection were 27.5, 37.5 and 5.2 respectively and this difference was not statistically significant (Table 2).

Overall mortality rate was 16.6%, with the highest mortality in simple closure group 24.1% (7 out of 29). Simple closure combined with drainage had a mortality rate of 20% (1 out of 5). Resection was associated with 6% mortality and there were no deaths in patients who underwent closure combined with vagotomy and drainage. The difference in mortality rates was not statistically significant ($p > 0.05$) (Table 3).

There was no mortality in 38 patients with risk score of ≤ 1 irrespective of the type of surgery. Mortality rate in patients with risk score of 2 and 3 was 50% and 75% respectively. Logistic regression revealed that as the scores increased the odds of death increased by 91% and this was statistically significant. However the association between the type of surgery and probability of survival was not statistically significant (Table 4).

In univariate analysis, preoperative shock, major medical illness and duration of perforation had significant influence on mortality.

Table 2
Morbidity related to type of surgery.

Type of surgery	Morbidity	Total no. (%)
Simple closure ($n = 29$)	a. Pulmonary embolism (1)	8 (27.5)
	b. Septicemia (4)	
	c. Respiratory failure (1)	
	d. Wound infection (1)	
Closure + Acid reduction procedure ($n = 8$)	a. Stomal obstruction (1)	3 (37.5)
	b. Post operative anastomotic leak with septicemia (1)	
	c. Gastric fistula (1)	
Gastric resection ($n = 17$)	a. Wound infection (1)	6 (35.2)
	b. Duodenal blow out (1)	
	c. Respiratory failure (4)	

P value = 0.797 (Chi square = 0.45).

Table 3
Mortality associated with different surgical procedures for gastric perforation.

Type of surgery	Mortality no (%)	Cause of death
Simple closure ($n = 29$)	7 (24.1)	Pulmonary embolism (1) Respiratory failure (1) Septicemia (5)
Closure + acid reduction surgery ($n = 8$)	1 (12.5)	Septicemia
Resection ($n = 17$)	1 (5.8)	Respiratory failure

P value 0.260, (Chi square = 2.69).

Preoperative shock was the only significant risk factor on Multivariate analysis (Table 5).

4. Discussion

This study group comprised predominantly of young male patients with previous history of peptic ulcer (79.6%) and smoking (56%) as opposed to western studies where elderly women with ulcerogenic drug usage were more common. Mean age of the patients in this study was 44.5 years and there were only two women. A changing trend of decreasing incidence in younger patients and increasing incidence in older patients has been observed by Bardhan et al.¹

Age greater than 65 years was seen by So et al. to be associated with high mortality in patients undergoing emergency gastric resection for peptic perforation.⁴ Though this is generally considered to be due to associated co morbid conditions, high mortality was noted among elderly patients with peptic perforation irrespective of co morbidity status.⁵ In our study however age was not a significant factor for mortality. Sweeney et al. observed female gender to be an additional risk factor for Perioperative mortality.⁶

It is not clear from the existing literature if patients with previous ulcer history suggesting chronicity require definitive surgery. Seventy nine percent of patients in this study had a history of chronicity. Jordon et al. suggest that the preoperative condition of the patient and not the chronicity of the ulcer should determine the type of surgery in perforated pyloroduodenal ulcers.⁷ Ng et al. observed prolonged dyspepsia along with younger age and male preponderance to be more commonly associated with *Helicobacter pylori* positive ulcers compared to *H. pylori* negative ulcers.⁸

As our patients were predominantly young men NSAID usage was not common and was seen in only three patients. Thomsen observed

Table 4
Distribution of risk scores and its correlation with the type of surgery and mortality rate.

Type of surgery	Risk score							
	0		1		2		3	
	No of pts	Mortality	No of pts	Mortality	No of pts	Mortality	No of pts	Mortality
Simple closure ($n = 29$)	3	0	16	0	8	5	2	2
Closure + acid reduction surgery ($n = 8$)	4	0	2	0	0	0	2	1
Gastric resection ($n = 17$)	2	0	11	0	4	1	0	0
Total	9	0	29	0	12	6	4	3
	β coefficient							p Value
<i>Logistic regression</i>								
Scores			0.912			0.046		
Surgery			-0.193			0.653		

Table 5
Significance of risk factors.

Risk factor	Univariate analysis			Multivariate analysis
	Number of patients			
	Survived	Expired	p ¹	
Age(yrs)				
<45	20	2	NS	NS
≥45	25	7		
Duration of perforation				
<24 h	14	0		
>24 h	31	9	0.048	NS
Alcoholism				
Yes	28	6	NS	NS
No	17	3		
Smoking				
Yes	23	7	NS	NS
No	22	2		
Ulcer history				
Yes	36	7	N.S	NS
No	9	2		
Co existing medical illness				
Yes	6	4	0.049	NS
No	39	5		
Preoperative shock				
Yes	8	8	0.0009	0.0066
No	37	1		
Reperforation				
Yes	0	1	NS	NS
No	45	8		
Site of the ulcer				
Prepyloric	27	6	NS	NS
Others	18	3		
Size of the ulcer				
<3 cm	38	7	NS	NS
>3 cm	7	2		
Type of surgery				
Simple closure	23	7	NS	NS
Definitive surgery	22	2		

higher mortality in patients of peptic perforation who were on NSAIDs and diabetics.^{9,10} He also found COPD to adversely affect the outcome.¹¹ Smokers constituted 55% of the patients in this study. However smoking did not influence the outcome in this study.

Simple closure followed by *H. pylori* eradication is reported to decrease the risk of ulcer recurrence in patients with duodenal ulcer perforation, obviating the need for definitive surgery. However some researchers doubt the role of *H. pylori* in perforated peptic ulcer. It is also suggested that peptic ulcer and peptic perforation may have a different etiology and perforation may not be just a complication of peptic ulcer.¹² Marked regional variation in incidence of *H. pylori* is also known. Hence simple closure and *H. pylori* eradication is applicable only in places with high incidence.¹³ An earlier study from our institute found no association between *H. pylori* infection and peptic perforation.¹⁴

Information regarding the incidence of *H. pylori* in patients with gastric perforation is limited. One study showed similar incidence of *H. pylori* in gastric and duodenal perforations.¹⁵ Bobrzyński et al. suggest that NSAID usage commonly associated with gastric ulcers, causes suppression of *H. pylori*.¹⁶ Simple closure followed by *H. pylori* eradication is not applicable to perforated gastric ulcers according to some authors.¹⁷

In this study definitive surgery in the form of truncal vagotomy and drainage was performed in 8 patients and gastric resection in 17 patients. The surgical procedure was decided by the operating surgeon.

Whether definitive surgery should be performed routinely or selectively in good risk patients, patients with recurrence or chronicity, for large ulcers or for *H. pylori* negative ulcers is still unresolved.

Acid reducing gastric surgery is recommended by Nivatvongs in patients with NSAID usage and also in patients with *H. pylori* infection.¹⁸ Kocer et al. suggest definitive surgery for selected patients as definitive surgery was a significant risk factor for mortality in their study.¹⁹ Wysocki observed emergency gastrectomy to be a safe procedure but feasible in only a small percentage of patients.²⁰ According to Bachev II, Gastric resection surgery is not recommended in elderly and senile patients.²¹ Tsugawa et al. recommend gastric resection because of low recurrence rates associated with it.²²

Size of the perforation is another factor which influences the type of surgery. In our study 5 out of 7 patients with perforation greater than 3 cm were subjected to definitive surgery. However size of the ulcer did not determine the outcome. Turner et al. recommend gastric resection for large ulcers and prepyloric ulcers.²³ Diameter of the perforation had a significant influence on the outcome in elderly patients with peptic perforation in a study by Ucheddu et al.²⁴ The difference in the mortality rates between perforated prepyloric ulcers and ulcers at other sites was also not statistically significant in our study.

In many studies on peptic perforation, gastric ulcers are grouped with duodenal perforations while assessing the risk of morbidity associated with definitive surgery. It is necessary to study gastric perforations separately to assess the outcome and to recommend strategies for their management. In this study the overall morbidity rate was 31.4%. Morbidity rates of simple closure (27.5%), closure with acid reduction surgery (37.5%) and gastric resection (35.2%) were not significantly different.

There are conflicting reports about the safety of emergency gastric resection for gastric perforation. Resection surgery was a significant risk factor for mortality according to Noguiera.²⁵ On the contrary, definitive surgery was associated with lower mortality (11.3%) compared to non-definitive surgery (22.9%) in a study by Hodnett.²⁶ In our study simple closure was associated with the highest mortality of 24.1%. Acid reduction surgery combined with closure was associated with 12.5% mortality and gastric resection with 6% mortality, though the difference was not statistically significant. However Madiba et al. observed that gastric resection was associated with a mortality of 26% compared to only 5% with patch closure.²⁷

In the present study, co-existing medical illness, preoperative shock and long standing perforation were found to be associated with fatality on univariate analysis. Multivariate analysis revealed only preoperative shock to be an independent predictor of mortality. Chan et al. in a similar study observed progressive rise in mortality with increasing number of these risk factors.²⁸ Thirty one out of 54 patients in this study presented more than 24 h after perforation of whom 9 patients expired. There was no mortality in patients presenting within 24 h of perforation. Delay in surgery was responsible for higher morbidity, prolonged hospital stay and higher mortality in another series of patients with gastro duodenal perforations.¹⁹ Age more than 65 years, hypotension, low hemoglobin, high pulse rate at admission, creatinine levels and ASA grade were the risk factors which were found to have a significant influence on outcome by other workers.^{4,19,29}

It is important to compare the results of definitive and non-definitive surgery in similar risk groups to eliminate selection bias.

There are many scoring systems of which the Boey and Hacettepe scores are specific to peptic perforation. We stratified our patients into different risk groups using the Boey score to compare the outcome of surgery. We found that mortality rates increased as the risk score increased. The mortality rates were 0%, 0%, 50% and 75% with risk scores of 0, 1, 2 and 3 respectively. A similar trend was observed in a study by Lee et al. Boey score was useful in predicting mortality but not morbidity, whereas Apache II score predicted both morbidity and mortality in their study. They also found Boey's score to be useful in predicting the chance of conversion from laparoscopic to open repair of perforation.³⁰

In the present series, as the Boey score increased, the odds of death increased by 91% and it is statistically significant ($p = 0.046$). The difference in mortality between definitive and non-definitive procedures in different risk groups was not statistically significant. In other words, the association between type of surgery and probability of survival was statistically not significant.

The influence of various risk factors on the outcome was studied by Egberts et al. and they observed that surgical procedure had no influence on the outcome when matched for POSSUM-phys score in patients with complicated peptic ulcer disease.³¹ The Hacettepe score, which utilizes coexisting medical illness, acute renal failure, leucocytosis and male sex, was found to have a high predictive value by Altaca et al. They compared it with Mannheim Peritonitis Index in patients with peptic perforation.³² As mentioned earlier, many of these studies were on peptic perforation in general and did not assess outcome of gastric perforation separately.

In conclusion, we found Boey's score useful in predicting the outcome in patients with gastric perforation. Definitive surgery in the form of gastric resection or acid reduction surgery is safe and is not associated with any increased morbidity or mortality. Definitive surgery still has an important role in the management of gastric perforation, in the absence of any concrete evidence of its causation by *H. pylori*. The outcome of patients with gastric perforation depends on their preoperative condition and not on the type of surgery.

Conflict of interest statement

None to declare.

Funding

None.

Ethical approval

None.

References

- Bardhan KD, Williamson M, Royston C, Lyon C. Admission rates for peptic ulcer in the Trent region, UK, 1972–2000. Changing pattern, a changing disease? *Dig Liver Dis* 2004;**36**(9):577–88.
- Towfigh S, Chandler C, Hines OJ, McFadden DW. Outcomes from peptic ulcer surgery have not benefited from advances in medical therapy. *Am Surg* 2002;**68**(4):385–9.
- Svanes C, Lie RT, Svanes K, Lie SA, Søreide O. Adverse effects of delayed treatment for perforated peptic ulcer. *Ann Surg* 1994;**220**(2):168–75.
- So JB, Yam A, Cheah WK, Kum CK, Goh PM. Risk factors related to operative mortality and morbidity in patients undergoing emergency gastrectomy. *Br J Surg* 2000;**87**(12):1702–7.
- Christensen S, Riis A, Nørgaard M, Sørensen HT, Thomsen RW. Short-term mortality after perforated or bleeding peptic ulcer among elderly patients: a population-based cohort study. *BMC Geriatr* 2007;**17**(7):8.
- Sweeney KJ, Faolain MO, Gannon D, Gorey TF, Kerin MJ. Surgical management of perforated peptic ulcer disease. *Ir J Med Sci* 2006;**175**(2):50–4.
- Jordan Jr PH, Thornby J. Perforated pyloroduodenal ulcers. Long-term results with omental patch closure and parietal cell vagotomy. *Ann Surg* 1995;**221**(5):479–86.
- Ng EK, Chung SC, Sung JJ, Lam YH, Lee DW, Lau JY, et al. High prevalence of *Helicobacter pylori* infection in duodenal ulcer perforations not caused by non-steroidal anti-inflammatory drugs. *Br J Surg* 1996;**83**(12):1779–81.
- Thomsen RW, Riis A, Munk EM, Nørgaard M, Christensen S, Sørensen HT. 30-day mortality after peptic ulcer perforation among users of newer selective COX-2 inhibitors and traditional NSAIDs: a population-based study. *Am J Gastroenterol* 2006;**101**(12):2704–10.
- Thomsen RW, Riis A, Christensen S, Nørgaard M, Sørensen HT. Diabetes and 30-day mortality from peptic ulcer bleeding and perforation: a Danish population-based cohort study. *Diabetes Care* 2006;**29**(4):805–10.
- Christensen S, Thomsen RW, Tørring ML, Riis A, Nørgaard M, Sørensen HT. Impact of COPD on outcome among patients with complicated peptic ulcer. *Chest* 2008;**133**(6):1360–6.
- Reinbach DH, Cruickshank G, McColl KE. Acute perforated duodenal ulcer is not associated with *Helicobacter pylori* infection. *Gut* 1993;**34**(10):1344–7.
- Plummer JM, McFarlane ME, Newnham. Surgical management of perforated duodenal ulcer: the changing scene. *West Indian Med J* 2004;**53**(6):378–81.
- Kate V, Ananthakrishnan N, Badrinath S. Effect of *Helicobacter pylori* eradication on the ulcer recurrence rate after simple closure of perforated duodenal ulcer: retrospective and prospective randomized controlled studies. *Br J Surg* 2001;**88**(8):1054–8.
- Metzger J, Styger S, Sieber C, von Flüe M, Vogelbach P, Harder F. Prevalence of *Helicobacter pylori* infection in peptic ulcer perforations. *Swiss Med Wkly* 2001;**131**(7–8):99–103.
- Bobrzyński A, Konturek SJ, Płonka M, Bielański W, Karcz D. *Helicobacter pylori* and nonsteroidal anti-inflammatory drugs in perforations and bleeding of peptic ulcers. *Med Sci Monit* 2005;**11**(3):CR132–5.
- Rodríguez-Sanjuán JC, Fernández-Santiago R, García RA, Trageda S, Seco I, la de Torre F, et al. Perforated peptic ulcer treated by simple closure and *Helicobacter pylori* eradication. *World J Surg* 2005;**29**(7):849–52.
- Nivatvongs S. Is there any role of acid reducing gastric surgery in peptic ulcer perforation? *J Med Assoc Thai* 2005;**88**(Suppl. 4):S373–5.
- Kocer B, Sürmeli S, Solak C, Unal B, Bozkurt B, Yildirim O, et al. Factors affecting mortality and morbidity in patients with peptic ulcer perforation. *J Gastroenterol Hepatol* 2007;**22**(4):565–70.
- Wysocki A, Biesiada Z, Beben P, Budzynski A. Perforated gastric ulcer. *Dig Surg* 2000;**17**:132–7.
- Bachev II. Choice of the emergency surgical method in gastric and duodenal peptic ulcer complications. *Vestn Khir Im I I Grek* 1982;**128**(1):57–9 [article in Russian].
- Tsugawa K, Koyanagi N, Hashizume M, Tomikawa M, Akahoshi K, Ayukawa K, et al. The therapeutic strategies in performing emergency surgery for gastro duodenal ulcer perforation in 130 patients over 70 years of age. *Hepatogastroenterology* 2001;**48**(37):156–62.
- Turner Jr WW, Thompson Jr WM, Thal ER. Perforated gastric ulcers. A plea for management by simple closures. *Arch Surg* 1988;**123**(8):960–4.
- Uccheddu A, Floris G, Altana ML, Pisanu A, Cois A, Farci SL. Surgery for perforated peptic ulcer in the elderly. Evaluation of factors influencing prognosis. *Hepatogastroenterology* 2003;**50**(54):1956–8.
- Nogueira C, Silva AS, Santos JN, Silva AG, Ferreira J, Matos E, et al. Perforated peptic ulcer: main factors of morbidity and mortality. *World J Surg* 2003;**27**(7):782–7.
- Hodnett RM, Gonzalez F, Lee WC, Nance FC, Deboisblanc R. The need for definitive therapy in the management of perforated gastric ulcers. Review of 202 cases. *Ann Surg* 1989;**209**(1):36–9.
- Madiha TE, Nair R, Mulaudzi TV, Thomson SR. Perforated gastric ulcer – reappraisal of surgical options. *S Afr J Surg* 2005;**43**(3):58–60.
- Chan WH, Wong WK, Khin LW, Soo KC. Adverse operative risk factors for perforated peptic ulcer. *Ann Acad Med Singapore* 2000;**29**(2):164–7.
- Arici C, Mesci A, Dincer D, Dinçkan A, Colak T. Analysis of risk factors predicting (affecting) mortality and morbidity of peptic ulcer perforations. *Int Surg* 2007;**92**(3):147–54.
- Lee FY, Leung KL, Lai BS, Ng SS, Dexter S, Lau WY. Predicting mortality and morbidity of patients operated on for perforated peptic ulcers. *Arch Surg* 2001;**136**(1):90–4.
- Egberts JH, Summa B, Schulz U, Schafmayer C, Hinz S, Tepel J. POSSUM score. Impact of preoperative physiological risk profile on postoperative morbidity and mortality after emergency operation of complicated peptic ulcer disease. *World J Surg* 2007;**31**(7):1449–57.
- Altaca G, Sayek I, Onat D, Cakmakçi M, Kamiloğlu S. Risk factors in perforated peptic ulcer disease: comparison of a new score system with the Mannheim Peritonitis Index. *Eur J Surg* 1992;**158**(4):217–21.