

Predictors of Mortality and Leak Rate Following Omental Patch Repair (Graham Patch) for Perforated Peptic Ulcer: A Prospective Observational Study

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Received: 06.05.2026, Revised: 04.06.2026, Accepted: 01.07.2026

ABSTRACT

Background: Perforated peptic ulcer is a common surgical emergency, and omental patch (Graham patch) repair remains the standard operative approach for most perforations. Despite its widespread use, suture line leak and postoperative mortality continue to occur, and reliable clinical predictors are needed to guide risk stratification.

Aim: To determine the mortality and leak rate following Graham patch repair for perforated peptic ulcer and to identify clinical and biochemical predictors of these outcomes.

Methods: We conducted a prospective observational study of 70 patients who underwent emergency omental patch repair for perforated peptic ulcer between January and December 2024, with 30-day postoperative follow-up. Associations between clinical, biochemical, and operative variables and outcomes (mortality and leak) were analyzed using the chi-square test, with significance set at $p < 0.05$.

Results: Mortality occurred in 9 of 70 patients (12.9%), and suture line leak occurred in 7 of 70 patients (10.0%). A Boey score of 2 or 3, delay in presentation beyond 24 hours, ASA grade $\geq$ III, serum albumin < 3 g/dL, and shock at presentation were significant predictors of both mortality and leak ($p < 0.05$ for all). Reoperation was required in 8.6% of the total cohort.

Conclusion: Omental patch repair remains a safe and effective procedure for perforated peptic ulcer, but mortality and leak risk rise sharply with higher Boey score, delayed presentation, and physiological compromise at presentation. Early identification of high-risk patients using these readily available parameters can help guide perioperative optimization and individualized decision-making.

Keywords: Perforated peptic ulcer, omental patch, Graham patch, leak rate, mortality, boey score.

INTRODUCTION

Perforated peptic ulcer remains one of the most common gastrointestinal surgical emergencies worldwide, carrying a reported mortality of 10-30% despite advances in perioperative care.¹ Omental patch repair, first described by Graham in 1937, continues to be the procedure of choice for most perforations, particularly in patients presenting with hemodynamic instability or significant peritoneal contamination, owing to its simplicity and shorter operative time

compared with definitive acid-reducing procedures.²⁻³

Despite the technical simplicity of the procedure, suture line leak remains a serious and potentially fatal complication, with reported rates ranging from 4% to 16% in the literature.⁴⁻⁵ Both mortality and leak have been linked to delay in presentation, degree of physiological derangement at admission, and comorbid illness, and several scoring systems-

most notably the Boey score-have been developed to stratify risk in this population.⁶ Identifying which patients are at highest risk of mortality and leak after Graham patch repair is essential for informed perioperative planning, appropriate counselling, and judicious use of critical care resources, particularly in resource-limited tertiary care settings.

This study was undertaken to determine the mortality and leak rate following omental patch repair for perforated peptic ulcer in a tertiary care setting in India, and to identify clinical, biochemical, and operative factors associated with these outcomes.

MATERIALS AND METHODS

STUDY DESIGN AND SETTING: This prospective observational study was conducted in the Department of General Surgery, Government Medical College and Hospital, Cuddalore District, Tamil Nadu, India, between January 2024 and December 2024.

PARTICIPANTS: A total of 70 patients with a clinical and radiological diagnosis of perforated peptic ulcer who underwent emergency omental patch (Graham patch) repair were enrolled.

INCLUSION CRITERIA: Age 18-75 years; intraoperative confirmation of a perforated gastric or duodenal ulcer treated with omental patch repair; and willingness to provide informed consent.

EXCLUSION CRITERIA: Perforation due to malignancy, traumatic perforation, prior gastric surgery, and perforations managed with definitive ulcer surgery (e.g., partial gastrectomy, truncal vagotomy) rather than simple patch repair.

INTERVENTION: All patients underwent emergency exploratory laparotomy with omental patch repair of the perforation, peritoneal lavage, and broad-spectrum intravenous antibiotics, per institutional protocol. Boey score, ASA grade, and serum albumin were recorded preoperatively.

FOLLOW-UP: Patients were followed prospectively for 30 days postoperatively to identify leak, reoperation, and mortality. No patients were lost to follow-up.

OUTCOME DEFINITIONS: Leak was defined as clinical, radiological, or intraoperative evidence of suture line dehiscence with enteric content in the drain or peritoneal cavity. Mortality was defined as death from any cause within 30 days of surgery.

STATISTICAL ANALYSIS: Categorical variables were compared using the chi-square test, with a two-sided p-value < 0.05 considered statistically significant.

Table No. 1: Baseline Demographic and Clinical Characteristics (N = 70). Values are mean ± SD or n (%)

Variable	Value
Mean age (years)	45.8 ± 14.3
Male sex	78.6% (n = 55)
Female sex	21.4% (n = 15)
Duodenal ulcer perforation	71.4% (n = 50)
Gastric ulcer perforation	28.6% (n = 20)

**RESULTS
OVERVIEW**

All 70 patients who underwent omental patch repair for perforated peptic ulcer were followed for 30 days postoperatively, with no loss to follow-up.

DEMOGRAPHIC CHARACTERISTICS

The mean age of the cohort was 45.8 ± 14.3 years, with a marked male predominance (78.6%; Table 1). Duodenal perforations were more common than gastric perforations (71.4%

vs 28.6%). Neither sex nor ulcer location was significantly associated with mortality or leak (p > 0.05).

OVERALL MORTALITY AND LEAK RATE

Mortality occurred in 9 of 70 patients, an overall 30-day mortality rate of 12.9%. Suture line leak occurred in 7 of 70 patients, a leak rate of 10.0%. Four patients experienced both leak and mortality. The remaining 54 patients (77.1%) had an uneventful recovery without leak or death (Figure 1).

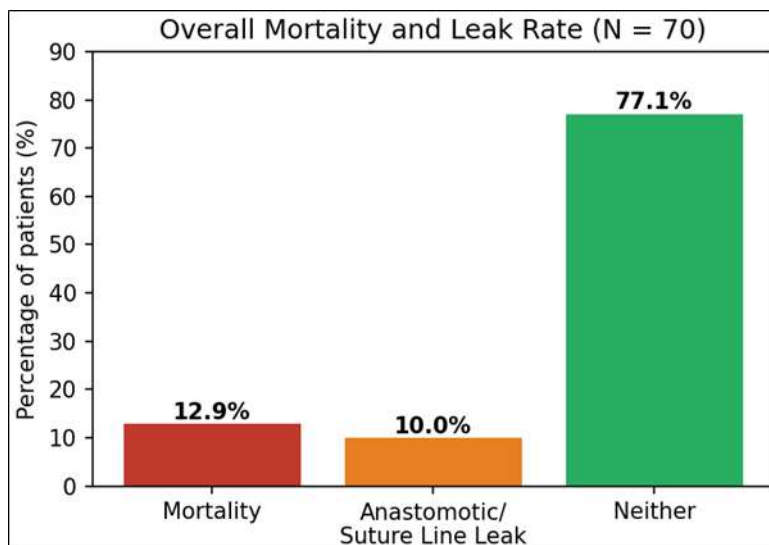


Figure No. 1: Overall mortality and leak rate at 30-day follow-up (N = 70)

OUTCOMES BY BOEY SCORE

Stratification by Boey score revealed a clear stepwise increase in both mortality and leak with increasing score. Patients with a Boey score of 0 (n = 28) had no mortality and a leak rate of

3.6%. Mortality and leak rose progressively with Boey score 1 (n = 24: mortality 8.3%, leak 8.3%), Boey score 2 (n = 13: mortality 30.8%, leak 15.4%), and Boey score 3 (n = 5: mortality 60.0%, leak 40.0%) (Figure 2).

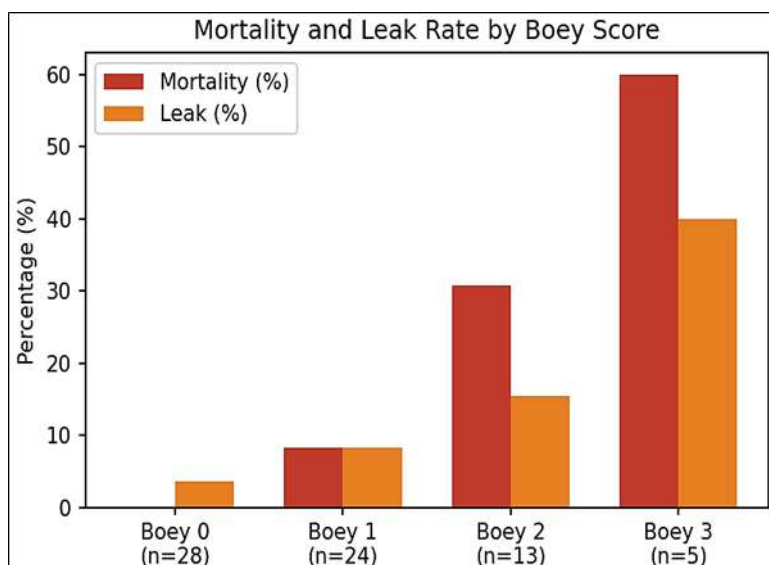


Figure No. 2: Mortality and leak rate stratified by Boey score

REOPERATION AND CRITICAL CARE NEEDS

Of the 7 patients with leak, 6 (8.6% of the total cohort) required reoperation, most commonly re-suturing with omental reinforcement or, in two cases, resectional surgery. The remaining patient with a minor, contained leak was managed conservatively with percutaneous drainage. ICU admission was required in 21.4% of the total cohort (n = 15), predominantly among patients with Boey score ≥ 2 .

RISK FACTOR ANALYSIS

Four factors were significantly associated with leak: delay in presentation beyond 24 hours, ASA grade $\geq$ III, serum albumin $<$ 3 g/dL, and shock at presentation (systolic blood pressure $<$ 90 mmHg) (Table 2, Figure 3). Shock at presentation showed the strongest association, with a leak rate of 33.3% among affected patients (p = 0.01). The same four factors, along with Boey score ≥ 2 , were also

significantly associated with mortality ($p<0.05$ for all).

Table No. 2: Factors Associated with Suture Line Leak

Factor	Leak Rate	p-value
Delay in presentation > 24 h	22.7%	0.02
ASA grade ≥ III	26.3%	0.01
Serum albumin < 3 g/dL	28.6%	0.01
Shock at presentation	33.3%	0.01

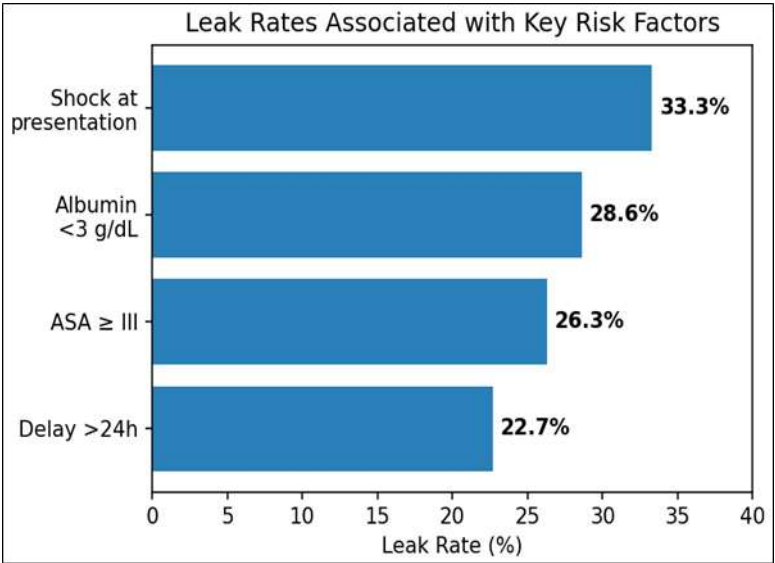


Figure No. 3: Leak rates associated with key risk factors

COMPARISON BETWEEN COMPLICATED AND UNCOMPLICATED GROUPS

Compared with patients who had an uneventful recovery, those who developed leak or died were more likely to have a higher Boey score, delayed presentation, lower serum albumin, and hemodynamic instability at admission. No significant differences in age, sex, or ulcer location were observed between the groups.

SUMMARY OF CLINICAL OUTCOMES

- **30-DAY MORTALITY RATE:** 12.9%.
- **SUTURE LINE LEAK RATE:** 10.0%.
- **REOPERATION RATE:** 8.6%.
- **ICU ADMISSION RATE:** 21.4%.
- **UNCOMPLICATED RECOVERY:** 77.1%.

DISCUSSION

In this prospective observational study, omental patch repair for perforated peptic ulcer was associated with a 30-day mortality rate of 12.9% and a leak rate of 10.0%, consistent with the ranges reported in previous series.¹⁻⁵ These findings reaffirm that, while Graham patch repair remains a safe and effective procedure

for most patients, both leak and death remain clinically significant risks that warrant careful preoperative risk stratification.

A notable finding was the strong stepwise relationship between Boey score and both outcomes, with mortality rising from 0% in patients with a score of 0 to 60% in those with a score of 3. This pattern is consistent with the original validation of the Boey score and subsequent series, and supports its continued use as a simple, readily applicable bedside tool for risk prediction in perforated peptic ulcer.⁶⁻⁷ Risk-factor analysis identified delay in presentation beyond 24 hours, ASA grade ≥ III, hypoalbuminemia, and shock at presentation as significant predictors of leak, mirroring findings from other reported cohorts.⁴⁻⁵ Delay in presentation likely reflects a longer duration of peritoneal contamination and tissue edema at the perforation site, compromising the integrity of the omental patch, while hypoalbuminemia and shock are markers of poor physiological reserve and impaired wound healing capacity. Despite these risks, the large majority of patients (77.1%) had an uneventful recovery,

underscoring that omental patch repair remains an appropriate and often life-saving procedure in the emergency setting, particularly given its shorter operative time relative to definitive ulcer surgery. Reoperation was required in only 8.6% of the cohort, and most leaks were identified and managed promptly without further mortality beyond the initial cohort figure.

This study has several limitations. The single-center design and relatively small sample size (n

= 70) may limit generalizability. Longer-term follow-up beyond 30 days was not performed, and this study did not construct a combined multivariable risk-prediction model incorporating all identified predictors; larger, multicentric studies are needed to validate these findings and develop a formal risk-stratification tool.

Table No. 3: Comparison of Mortality and Leak Rates with Previous Studies

Study	Sample Size	Mortality Rate	Leak Rate
Lohsiriwat <i>et al.</i> ⁴	212	14.6%	9.4%
Thorsen <i>et al.</i> ⁵	173	15.0%	12.7%
Present study	70	12.9%	10.0%

CONCLUSION

Omental patch (Graham patch) repair remains a safe and effective first-line surgical option for perforated peptic ulcer, with the majority of patients achieving an uneventful recovery. However, mortality and leak risk increase markedly with higher Boey score, delayed presentation beyond 24 hours, ASA grade $\geq$ III, hypoalbuminemia, and shock at presentation. These readily available clinical and biochemical parameters should be incorporated into preoperative risk assessment and perioperative planning. Larger, multicentric studies with extended follow-up are warranted to validate these predictors and to develop a formal, prospectively tested risk-stratification model.

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