

Association of *Helicobacter Pylori* Infection and Surgical Outcomes in Gastroduodenal Perforation: A Prospective Comparative Study of Graham's Patch and Modified Graham's Patch Repair

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Abstract: *Background:* Gastroduodenal perforation due to acid peptic disease remains a major emergency surgical condition, particularly in resource-limited settings. *Helicobacter pylori* infection is an important etiological factor in peptic ulcer disease, while the choice of operative repair may influence postoperative recovery. This study evaluated the association of *H. pylori* infection with gastroduodenal perforation and compared outcomes between Graham's Patch Repair and Modified Graham's Patch Repair. *Aim:* To determine the prevalence of *H. pylori* infection among patients with gastroduodenal perforation and compare the postoperative outcomes of Graham's Patch Repair and Modified Graham's Patch Repair. *Materials and Methods:* This prospective comparative study was conducted in the Department of Surgery, B.R.D. Medical College, Gorakhpur, from 2024 to 2026. A total of 114 patients with gastroduodenal perforation and peritonitis undergoing operative intervention were included. Patients with suspected malignant perforation, traumatic perforation, penetrating abdominal injury, or refusal of consent were excluded. Patients underwent either Graham's Patch Repair or Modified Graham's Patch Repair. *H. pylori* status was assessed using available intraoperative diagnostic methods. Postoperative complications, duration of hospital stay, time to resume oral feeding, recurrence and mortality were compared between groups. Data were analysed using appropriate statistical tests, with $p < 0.05$ considered significant. *Results:* The study included 114 patients, most commonly aged 31–40 years (29.82%), with male predominance 78.07%. Acute abdominal pain was present in all patients, followed by vomiting 70.18% and abdominal distension 56.14%. Alcohol consumption 34.21% and smoking 30.70% were common risk factors. *H. pylori* positivity was observed in 36.84% of cases. Both surgical groups were equally distributed, with 50% undergoing Graham's Patch Repair and 50% undergoing Modified Graham's Patch Repair. There was no significant association between *H. pylori* status and surgical technique ($p = 0.846$). Modified Graham's Patch Repair was associated with significantly shorter hospital stay (8.12 vs 10.56 days, $p < 0.001$) and earlier oral feeding (2.18 vs 2.86 days, $p < 0.001$). Recurrence was lower in the modified group but not statistically significant (5.26% vs 15.79%, $p = 0.067$). Mortality was 0% in both groups. *Conclusion:* *H. pylori* infection was present in nearly one-third of patients with gastroduodenal perforation. Modified Graham's Patch Repair provided faster postoperative recovery than standard Graham's Patch Repair, with shorter hospital stay and earlier oral feeding, without increasing complications or mortality. Routine *H. pylori* testing, eradication therapy, timely surgery and structured postoperative care are important for reducing recurrence and improving outcomes.

Keywords: *Helicobacter pylori*; Gastroduodenal perforation; Graham's Patch Repair; Modified Graham's Patch Repair; Peptic ulcer disease; Surgical outcome.

1. Introduction

Gastroduodenal perforation secondary to peptic ulcer disease remains one of the most serious emergency presentations in general surgery. Despite advances in proton pump inhibitors, antimicrobial therapy and perioperative care, perforated peptic ulcer continues to be associated with significant morbidity because patients often present with peritonitis, sepsis, fluid imbalance and delayed referral. Surgical management is therefore directed toward rapid source control, closure of the perforation, peritoneal lavage and prevention of postoperative leak. Recent surgical reviews continue to support operative closure as the cornerstone of treatment, particularly in patients with generalized peritonitis or clinical instability.¹

The choice of technique for perforated peptic ulcer has remained a subject of clinical discussion for several decades. Conventional Graham's patch repair is widely practiced because it is simple, reproducible and suitable for emergency settings. However, the debate regarding simple closure, omental patch reinforcement and modified closure techniques continues, especially in relation to postoperative leak, intra-abdominal collection, delayed recovery and need for re-

exploration. Mahmoud et al. emphasized that the issue of whether to close or patch perforated peptic ulcers remains clinically relevant even after nearly a century of operative experience.²

Modified Graham's patch repair has been proposed as a technically stronger alternative in which the perforation is primarily closed before reinforcement with a vascularized omental patch. This dual-layer concept may provide better mechanical stability than the standard omental patch alone, particularly in small-to-moderate perforations with inflamed but suturable margins. Recent comparative studies have reported favourable postoperative recovery with modified omentopexy in perforated duodenal ulcers.³ Similar findings have also been reported by Shailendra Kumar et al., who compared Graham's patch with modified Graham's patch technique in duodenal ulcer perforation and highlighted the practical relevance of modified repair in emergency surgical practice.⁴

Apart from the operative technique, the underlying etiological factor is also important in the management of gastroduodenal perforation. *Helicobacter pylori* is a well-established cause of peptic ulcer disease and remains highly prevalent in

developing countries. Its role in perforated ulcer disease is clinically important because persistent infection may contribute to ulcer recurrence after surgical closure. Studies from India and other resource-limited settings have reported variable rates of *H. pylori* positivity among patients presenting with perforated peptic ulcer. Naeem et al. evaluated *H. pylori* infection in perforated duodenal ulcer, while Pradhan et al. reported the incidence of *H. pylori* infection among perforated peptic ulcer patients from the Garhwal region of Uttarakhand, supporting the need for local Indian data.^{5,6}

Postoperative outcomes after omental patch repair are influenced by multiple factors, including timing of presentation, size of perforation, degree of peritoneal contamination, nutritional status, sepsis, comorbid illness and adequacy of repair. Khare et al. compared Graham's patch omentopexy with modified Graham's patch omentopexy in duodenal perforation and observed that technique-related differences may affect recovery parameters.⁷ Ogbuanya et al. further emphasized that leaked repair after omentopexy is an important determinant of adverse outcome in perforated peptic ulcer disease.⁸ These findings highlight that both surgical technique and patient-related risk factors must be considered when assessing postoperative recovery.

Although several studies have separately evaluated *H. pylori* prevalence or compared omental patch techniques, limited prospective data are available from North Indian tertiary-care emergency surgical settings assessing both aspects together. This gap is relevant because patients in such settings often present late, with advanced peritonitis and variable access to early diagnostic and eradication therapy. Khan et al. compared modified Graham's patch repair with Graham's patch repair in terms of postoperative morbidity and mortality, while Eedara Sri Kousalya et al. also compared standard and modified omentopexy in perforated duodenal ulcers, supporting the need for further comparative clinical evidence.^{9,10}

Therefore, the present study was conducted to determine the prevalence of *H. pylori* infection among patients with gastroduodenal perforation and to compare postoperative outcomes between Graham's patch repair and modified Graham's patch repair. The study specifically assessed postoperative complications, recovery profile, hospital stay, recurrence and mortality, with the aim of generating clinically useful evidence for emergency general surgical practice in a tertiary-care Indian setting. The selected references are from the thesis reference list, including recent studies from 2022–2025 on perforated peptic ulcer, *H. pylori* and Graham's versus modified Graham's repair.

2. Materials and Methods

Study Design

This was a **prospective comparative clinical study** conducted to evaluate the association of *Helicobacter pylori* infection with gastroduodenal perforation and to compare postoperative outcomes between Graham's Patch Repair and Modified Graham's Patch Repair. The study was designed to assess both etiological association and surgical recovery

outcomes in patients undergoing operative management for peptic gastroduodenal perforation.

Study Setting

The study was conducted in the **Department of Surgery, B.R.D. Medical College, Gorakhpur, Uttar Pradesh**, among patients presenting with gastroduodenal perforation and peritonitis requiring emergency operative intervention.

Study Duration

The study was carried out from **2024 to 2026**, with a **12-month patient enrolment period** and follow-up for each patient after surgery.

Study Population

The study population included patients diagnosed with **gastroduodenal perforation with peritonitis** who underwent operative intervention in the Department of Surgery. Patients were evaluated clinically and radiologically before surgery and were enrolled after written informed consent.

Sample Size

The thesis protocol calculated a minimum sample size of **100 patients** based on expected *H. pylori* prevalence in the Indian population and the formula $n = Z^2P(1-P)/d^2$. In the final analysed thesis results, **114 patients** were included.

Inclusion Criteria

Patients were included if they had gastroduodenal perforation with peritonitis requiring operative intervention and provided written informed consent.

Exclusion Criteria

Patients were excluded if they had suspected malignant perforation, perforation due to blunt abdominal trauma, perforation due to penetrating injury, or refusal to participate in the study.

Data Collection Procedure

After obtaining informed consent, eligible patients underwent detailed history taking, clinical examination and emergency evaluation. Sociodemographic details, clinical presentation, comorbidities, personal habits, risk factors, previous peptic ulcer disease, NSAID/steroid intake and operative findings were recorded in a standard semi-structured case record proforma. Emergency investigations included complete blood count, renal and liver function tests, serum electrolytes, erect chest/abdominal radiographs for pneumoperitoneum, and ultrasonography or computed tomography of abdomen when indicated. Risk assessment was performed using the Boey score, based on shock at admission, duration of perforation more than 24 hours and associated medical illness.

All patients underwent emergency exploratory laparotomy or laparoscopy under general anaesthesia. In **Group A**, Graham's Patch Repair was performed by placing interrupted non-absorbable sutures around the perforation, followed by placement and fixation of a pedicled omental patch without primary closure of the perforation. In **Group B**, Modified Graham's Patch Repair was performed by primary closure of the perforation using interrupted absorbable sutures, followed by reinforcement with a pedicled omental patch. In both

groups, peritoneal lavage with warm normal saline was done, subhepatic drain placement was performed at the surgeon's discretion and nasogastric decompression was instituted postoperatively.

Samples for *H. pylori* detection were obtained intraoperatively from the ulcer margin or adjacent gastric mucosa. Detection was performed using Rapid Urease Test and histopathological examination where available. Patients were classified as *H. pylori* positive if either test was positive. Postoperatively, all patients received intravenous antibiotics, proton pump inhibitors, analgesics and supportive care. Patients confirmed to be *H. pylori* positive were started on standard eradication therapy once oral intake was tolerated.

Study Variables

The recorded variables included age, sex, presenting symptoms, duration of pain, vomiting, abdominal distension, smoking, alcohol intake, NSAID/steroid use, previous peptic ulcer disease, comorbidities, preoperative clinical status, Boey score parameters, operative technique, *H. pylori* status, postoperative complications, duration of hospital stay, time to resume oral feeding, need for re-exploration, recurrence and mortality.

Outcome Measures

The **primary outcomes** were incidence of *H. pylori* infection in gastroduodenal perforation and postoperative leakage from the repair site. The **secondary outcomes** included surgical site infection, intra-abdominal abscess, ileus, duration of hospital stay, need for re-exploration and mortality. Patients were followed during hospital stay and later at **2 weeks and 6 weeks post-discharge** for wound healing, gastrointestinal symptoms and overall recovery.

Statistical Analysis

Data were entered in **Microsoft Excel** and analysed using **SPSS version 26.0**. Categorical variables were expressed as frequencies and percentages. Continuous variables were expressed as mean with standard deviation or median with interquartile range, as appropriate. The Chi-square test was used to assess association between type of surgery and patient outcomes. A **p-value <0.05** was considered statistically significant.

Ethical Considerations

Institutional Ethics Committee approval was obtained before initiation of the study. Written informed consent was taken from all patients before enrolment. Patient information was recorded using the study proforma, and postoperative complications were observed and documented during follow-up.

3. Result

Among **114 patients** with gastroduodenal perforation, the most common age group was **31–40 years (29.82%)**, followed by **41–50 years (21.05%)**, showing predominance of young and middle-aged adults. Males constituted **78.07%** of the study population. Acute abdominal pain was present in all patients, while vomiting **70.18%** and abdominal

distension **56.14%** were frequent associated symptoms. Alcohol intake **34.21%** and smoking **30.70%** were the major documented risk factors. *H. pylori* positivity was found in **36.84%** patients. Both surgical groups were equally distributed, with **57 patients each** undergoing Graham's Patch Repair and Modified Graham's Patch Repair. Modified Graham's Patch Repair showed faster recovery, with significantly shorter hospital stay and earlier oral feeding, while complications, recurrence and mortality were not significantly different between groups.

Table 1: Distribution of *H. pylori* Status and Type of Surgical Procedure

Variable	Category	n	%
<i>H. pylori</i> status	Positive	42	36.84
	Negative	72	63.16
Surgical procedure	Graham's Patch Repair	57	50
	Modified Graham's Patch Repair	57	50

In the present study, *Helicobacter pylori* infection was detected in 42 patients (36.84%), while 72 patients (63.16%) were negative, indicating that nearly one-third of gastroduodenal perforation cases had documented *H. pylori* positivity. The surgical management was equally distributed, with 57 patients (50.00%) undergoing Graham's Patch Repair and 57 patients (50.00%) undergoing Modified Graham's Patch Repair, ensuring balanced comparison between both operative techniques. This distribution provides an appropriate basis for evaluating postoperative outcomes between the two repair methods while also assessing the clinical relevance of *H. pylori* infection in gastroduodenal perforation.

Table 2: Comparison of Postoperative Outcomes Between Surgical Groups

Outcome	Graham's Patch Repair (n=57)	Modified Graham's Patch Repair (n=57)	p-value
Wound infection	13 (22.81%)	6 (10.53%)	0.118
Leakage	6 (10.53%)	2 (3.51%)	0.273
Intra-abdominal abscess	5 (8.77%)	2 (3.51%)	0.436
Sepsis	4 (7.02%)	1 (1.75%)	0.362
Mean hospital stay, days	10.56	8.12	<0.001
Time to resume oral feeding, days	2.86	2.18	<0.001
Recurrence	9 (15.79%)	3 (5.26%)	0.067
Mortality	0 (0.00%)	0 (0.00%)	—

Postoperative complications were numerically lower after **Modified Graham's Patch Repair**, including wound infection **10.53% vs 22.81%**, leakage **3.51% vs 10.53%**, abscess **3.51% vs 8.77%**, and sepsis **1.75% vs 7.02%**, although these differences were not statistically significant. However, modified repair showed significantly better recovery, with shorter mean hospital stay **8.12 vs 10.56 days** and earlier oral feeding **2.18 vs 2.86 days (p<0.001 each)**. Recurrence was also lower in the modified group **5.26% vs 15.79%**, while mortality was **0%** in both groups.

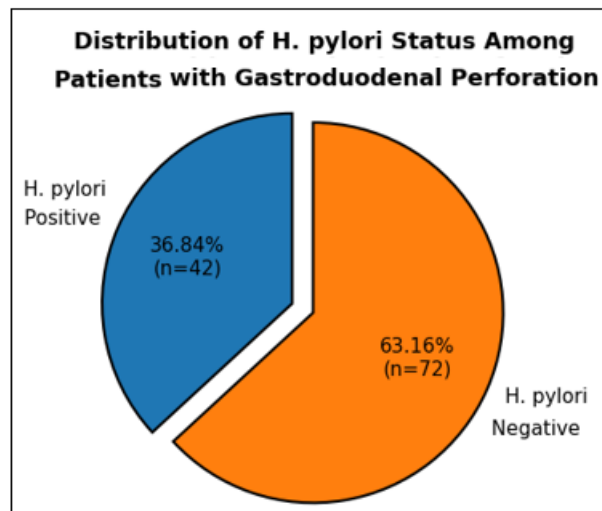


Figure 1: Distribution of *H. pylori* Status among Patients with Gastroduodenal Perforation

Pie chart showing *H. pylori* positive 42 (36.84%) and negative 72 (63.16%).

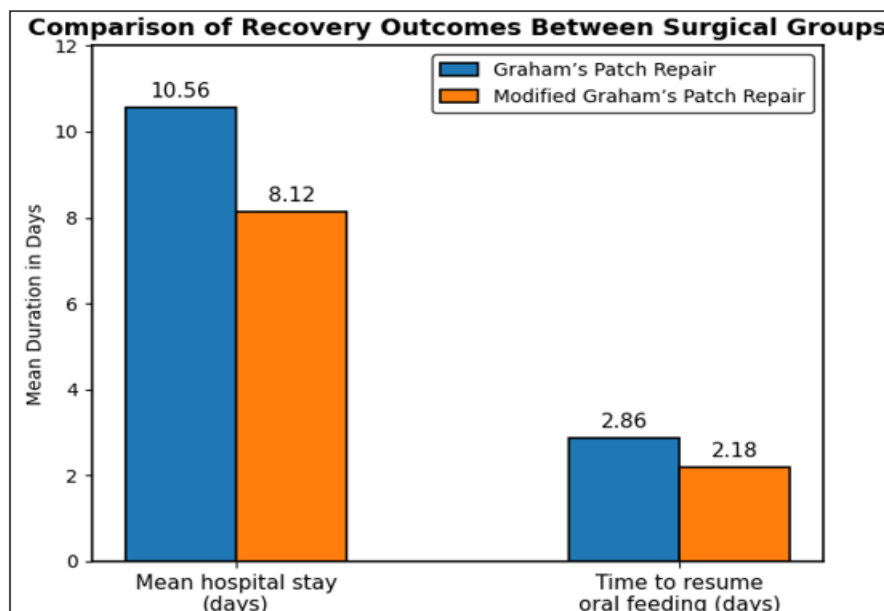


Figure 2: Comparison of Recovery Outcomes Between Surgical Groups

Bar chart comparing mean hospital stay and time to resume oral feeding between Graham's Patch Repair and Modified Graham's Patch Repair. Use values: hospital stay **10.56 vs 8.12 days** and oral feeding **2.86 vs 2.18 days**.

4. Discussion

The present study evaluated the association of *Helicobacter pylori* infection with gastroduodenal perforation and compared postoperative outcomes between Graham's Patch Repair and Modified Graham's Patch Repair. The principal findings were that *H. pylori* positivity was observed in **36.84%** of patients, while both operative groups were equally distributed with **57 patients each**. Modified Graham's Patch Repair showed significantly better recovery outcomes, with shorter mean hospital stay (**8.12 vs 10.56 days, $p < 0.001$**) and earlier resumption of oral feeding (**2.18 vs 2.86 days, $p < 0.001$**). Although wound infection, leakage, intra-abdominal abscess, sepsis and recurrence were numerically

lower in the modified repair group, these differences were not statistically significant. Mortality was **0%** in both groups.

The observed *H. pylori* positivity supports its continuing relevance in patients with perforated peptic ulcer disease, although the prevalence was not universal. Similar variability has been reported in previous studies, suggesting that gastroduodenal perforation is multifactorial and may also be influenced by NSAID use, smoking, alcohol intake, delayed presentation and acid-peptic injury. Naeem et al. reported *H. pylori* infection among patients with perforated duodenal ulcer, emphasizing the need for testing and eradication therapy in confirmed cases.⁹ Edyedu et al. also highlighted demographic and exposure-related factors associated with peptic ulcer perforation, supporting the view that infection is one component of a broader risk profile.⁸

The better recovery profile in the Modified Graham's Patch group is clinically explainable. In the modified technique, primary closure of the perforation before omental

reinforcement provides a more secure mechanical seal and reduces dependence on the omental plug alone. This may explain the lower numerical rates of leakage, abscess and sepsis and the significantly earlier return of gastrointestinal function. Similar findings were reported by Eedara Sri Kousalya et al., who observed favourable outcomes with modified Graham's omentopexy in perforated duodenal ulcers.³ Shailendra Kumar et al. also found modified Graham's Patch Repair to be a practical and effective alternative to conventional Graham's Patch in duodenal ulcer perforation.⁴

The findings are also comparable with Khare et al., who reported that modified Graham's patch omentopexy may improve selected postoperative parameters in duodenal perforation.⁶ Singh et al. observed lower leakage and shorter hospital stay in patients undergoing modified omentopexy, which is consistent with the recovery advantage seen in the present study.⁵ However, the absence of statistically significant differences in complications and recurrence in the present study indicates that both techniques remain safe when performed appropriately, and that patient-related factors such as sepsis, nutritional status, perforation size and delay in surgery may strongly influence outcomes. Ogbuanya et al. similarly emphasized that leaked repair after omentopexy is associated with adverse postoperative outcomes and should remain a key endpoint in such studies.⁷

Clinically, this study supports the use of Modified Graham's Patch Repair as a feasible technique in emergency surgical settings, particularly in Indian tertiary-care hospitals where open repair remains common and advanced laparoscopic facilities may not always be available. The significant reduction in hospital stay and earlier oral feeding may reduce patient burden, bed occupancy and postoperative morbidity. The study also reinforces the importance of routine *H. pylori* testing and eradication therapy after recovery to reduce ulcer recurrence risk.

The strength of this study lies in its prospective comparative design, equal distribution of surgical groups and inclusion of clinically meaningful postoperative outcomes. The main limitations include single-centre design, short follow-up duration and limited ability to assess long-term ulcer recurrence after eradication therapy. Future multicentric studies with larger sample size, longer follow-up, standardized *H. pylori* eradication confirmation and adjustment for perforation size, Boey score and delayed presentation are recommended to better define the long-term superiority of modified repair.

5. Conclusion

The present study showed that *Helicobacter pylori* infection was present in **36.84%** of patients with gastroduodenal perforation, indicating its relevant but not exclusive role in perforated peptic ulcer disease. Both Graham's Patch Repair and Modified Graham's Patch Repair were safe operative techniques, with no mortality in either group. Modified Graham's Patch Repair was associated with significantly faster postoperative recovery, reflected by shorter mean hospital stay **8.12 vs 10.56 days** and earlier resumption of oral feeding **2.18 vs 2.86 days**. Although wound infection,

leakage, abscess, sepsis and recurrence were numerically lower in the modified repair group, these differences were not statistically significant. Therefore, Modified Graham's Patch Repair may be considered a useful surgical option for gastroduodenal perforation, along with routine *H. pylori* testing and eradication therapy where indicated.

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