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ORIGINAL RESEARCH

Associated Factors of Leaked Repair Following Omentopexy for Perforated Peptic Ulcer Disease; a Cross-sectional Study

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Abstract: **Introduction:** Previous studies have reported numerous clinico-pathologic risk factors associated with increased risk of leaked repair following omental patch for perforated peptic ulcer disease (PPUD). This study aimed to analyze the risk factors associated with leaked repair of omental patch and document the management and outcome of established cases of leaked repair in a resource-poor setting. **Methods:** This is a multicenter cross-sectional study of leaked repair after omental patch of PPUD between January 2016 to December 2022. Following primary repair of PPUD with omental pedicle reinforcement, associated factors of leaked repair were evaluated using univariate and multivariate analyses. **Results:** Overall, 360 cases were evaluated (62.8% male). Leaked repair rate was 11.7% (42 cases). Those without immunosuppression were 3 times less likely to have leaked repair (aOR= 0.34; 95% CI: 0.16 - 0.72; p = 0.003) while those with sepsis were 4 times more likely to have leaked repair (aOR=4.16; 95% CI: 1.06 - 12.36; p = 0.018). Patients with delayed presentation (>48 hours) were 2.5 times more likely to have leaked repair than those who presented in 0 - 24 hours (aOR=2.51; 95% CI: 3.62 - 10.57; p = 0.044). Those with Perforation diameter 2.1-3.0 cm were 8 times (aOR=7.98; 95% CI: 2.63-24.21; p<0.0001), and those with perforation diameter > 3.0cm were 33 times (aOR=33.04; 95% CI: 10.98-100.25; p<0.0001) more likely to have leaked repair than those with perforation diameter of 0-1.0 cm. Similarly, in those with no perioperative shock, leaked repair was 4 times less likely to develop than those with perioperative shock (aOR= 0.42; 95% CI: 0.41-0.92; p = 0.041). There was significant statistical difference in morbidity (p = 0.003) and mortality (p < 0.0001) rates for cases of leaked repairs and successful repairs. **Conclusion:** Leaked repair following omentopexy for peptic ulcer perforation was significantly associated with large perforation diameter, delayed presentation, sepsis, immunosuppressive therapy, and perioperative shock.

Keywords: Helicobacter pylori; Peptic ulcer perforation; Laparotomy; Peritonitis; Risk factors; Sepsis

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1. Introduction

Laparotomy for perforated peptic ulcer disease (PPUD) is a common emergency general surgical operation in our environment. It is commonly associated with significant morbidity and mortality despite recent advances in both Helicobacter pylori (H. pylori) eradication therapy and laparoendoscopic services (1-4). In the past, the options for the operative management of PPUD was varied. However, surgical management, over the last two decades has shifted from the traditional definitive surgery involving mainly gastroduodenal or vagal resections and drainage procedures to the less invasive simple closure with omental patch (2-6).

The modified Graham patch has thus become universally accepted due to its simplicity, ease of execution, reduced operation time and overall reduction in adverse postoperative outcomes (2, 5, 6). However, its major drawback is related to postoperative leakage and subsequent generalized peritonitis (1, 3-7). Peritonitis originating from perforation of a hollow viscus deserves special attention, more so when a repair failure from a previous emergency laparotomy result in

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leaked repair. Though classical pedicled omental patch remains the gold standard for repair of gastroduodenal perforations arising from peptic ulcer disease, leaked repair rates after a patch ranging between 8-16% and mortality rates as high as 10-15% have been quoted (6-9).

Published data from both local and international studies revealed the impact of numerous patient- and surgeon-related factors that contribute to repair failures after open or laparoscopic modified Graham's omentopexy (4, 7-11). Available clinical data showed that perforation diameter > 1.5cm, advancing age, presence of malignancy, immunosuppression, preoperative hypotension, and raised serum creatinine are uniformly associated with high leaked repair rates (7, 9-14).

Nevertheless, a simple repair with omental reinforcement is still preferred for PPUD (1, 2, 4, 7). Rather than engaging in search of more elaborate procedures with less leaked repair rates, strategies and studies to improve understanding of the complex clinicopathologic elements and technical errors associated with high leaked repair rates are salutary. A fast and less invasive procedure is particularly relevant and preferred in a resource-constrained setting like ours where patients commonly present late, often in shock, and with high American Society of Anesthesiologists (ASA) score (III-V).

It is gainful to avoid postoperative leak and re-laparotomy because the risks associated with re-operation are more grievous than those recorded for native laparotomy (5, 8-11). Generally, re-laparotomy entails higher operative risks and involves more difficult and hazardous explorations (5, 7, 8). No studies evaluating the risk factors of leaked repair have been done in our environment despite the relative frequency of this complication in our practice. The aim of this study was to analyze the various risk factors associated with leaked repair of omental patch and document the management and outcome of established cases of leaked repair in our environment.

2. Methods

2.1. Study design and setting

This was a retrospective multicenter cross-sectional study from four hospitals between January 2016 to December, 2022. From the patients' profiles, the data of patients with both successful and failed primary repair of PPUD were determined and the association between different variables and leaked repair were evaluated. Results were reported according to "Strengthening the Reporting of Observational Studies in Epidemiology" (STROBE) guidelines (15, 16). The study protocol was approved by the hospitals' ethics and research board. The Research and Ethical Board approval numbers are BSH/NSK/AD/15/12, MMH/AD/14/31, DHN/AD/EA/15/04.

2.2. Participants

Case files of all consecutive adult patients aged 16 years and above who had laparotomy for PPUD were retrieved. Those who died in the immediate perioperative period, those with clinical and radiological features of PPUD who died before laparotomy, and those with significant missing data were excluded.

2.3. Data gathering

Demographic, clinical, and laboratory variables including age, sex, degree of delay, surgeon cadre, perforation diameter, histology of biopsy, co-existing abdominal pathology, location of settlement, occupation and presence/absence of immunosuppression, sepsis, perioperative shock or renal/cardiac impairment, serum albumin, and haemoglobin were recorded and entered into a proforma. Severity of postoperative morbidities for successful and failed repairs were compared. The proportions of leaked repair cases selected for either re-exploration or non-operative management (NOM) were noted and recorded. The impact of various indices on mortality of the re-laparotomy cases was noted. For the quantitative variables, serum albumin <2.5g/dl was considered low, while > 2.5g/dl was regarded as normal level. Also, delay in presentation to hospital of 12-24 hours was considered mild, 25-48 hours moderate, and >48 hours prolonged. Perforation diameters > 1.1cm were considered large, while those >3.0 cm were deemed giant perforations.

2.4. Surgical procedures

The various surgical techniques/procedures employed to manage leaked repair (jejunal serosal patch, proximal gastrojejunostomy, modified Graham's patch, falciform ligament patch, and cholecystoduodenoplasty) were noted and recorded. Their success rates were recorded. Jejunal serosal patch is ideal for large perforations, but requires skills and experience. Omental patch is the quickest method of dealing with peptic ulcer perforation. Closure is achieved by insertion of three or four interrupted fine absorbable sutures. Sutures are inserted in the long axis of the gut to avoid postoperative luminal narrowing. The sutures are tied very gently to prevent laceration of the friable tissue.

The closure is reinforced with omentum by separating the long ends of the previously tied sutures and placing a tongue of omentum along the suture line (a modified Graham's patch). The tissue may be so indurated and the sutures tend to 'cheese-wire' through the tissues, making it necessary to seal the perforation by anchoring omentum directly over the ulcer (true Graham's patch). Modified omental patch has the limitation of performing poorly when healthy omentum is absent, perforation diameter is 1.0 cm or more, or when presentation is delayed. Strangulation of the omental pedicle with suture may occur when surgical technique is poor or performed by an inexperienced surgeon.

2.5. Outcomes

The primary measured outcome was leaked repair. Mortality, morbidities, and length of hospital stay were measured as second outcomes. In order to eliminate bias, only in-patient deaths, which were recorded in the patients' files were con-

sidered.

2.6. Statistical analysis

Analysis was done using Statistical Package for Social Science (SPSS) Software version 22.0 (IBM, CHICAGO, IL, USA 2015). For categorical variables, data were summarized in proportions and frequency tables. For continuous variables, we computed the ranges and mean. During analysis, we computed p-values for categorical variables using Chi-square and Fisher's exact test in accordance with the size of the dataset. We also determined the association between selected clinical variables and selected outcome measures (leaked repair, mortality) using multivariate logistic regression analyses. Confidence interval was calculated at 95% and significance at 5% probability level (p<0.05).

3. Results

3.1. Baseline characteristics of studied cases

A total of 420 patients with clinical and imaging features of PPUD were initially examined. 30 (7.1%) died before operative treatment, while 10 (2.4%) died within 24 hours after primary laparotomy and were excluded. Twenty (4.8%) cases had significant missing data and were similarly excluded. The remaining 360 (85.7%) patients met the inclusion criteria and entered the study (Figure 1). The ages of the patients ranged from 16 to 90 years with a mean of 57.8 ± 18.77 years (62.8% male).

3.2. Risk factors of leaked repair

Table 1 shows the association of baseline characteristics with the incidence of leaked repair after open omentopexy. The significant factors associated with leaked repair were Immunosuppression, delayed presentation >48hours, perforation diameter >1.0cm, sepsis, and perioperative shock (p < 0.05 for all measures).

Based on multivariate logistic regression analysis, those with no immunosuppression were 3 times less likely to have leaked repair than those with immunosuppression/steroid therapy (aOR= 0.34; 95% CI: 0.16-0.72; p=0.003). Patients with delayed presentation >48 hours were 2.5 times more likely to have leaked repair than those who presented 0-24 hours later (aOR=2.51; 95% CI: 3.62-10.57; p = 0.044).

Perforation diameter of 2.1-3.0 cm was 8 times (aOR=7.98; 95% CI: 2.63-24.21; p < 0.0001), and a diameter of >3.0 cm was 33 times (aOR=33.04; 95% CI: 10.98-100.25) more likely to have leaked repair compared to those with perforation diameter of 0.0-1.0 cm. Similarly, those with sepsis were 4 times more likely to develop leaked repair compared to those without sepsis (aOR=4.16; 95% CI: 1.06-12.36; p = 0.018). In those with no perioperative shock, leaked repair was 4 times less likely to develop than those with perioperative shock (aOR= 0.42; 95% CI: 0.24-0.92; p = 0.041).

3.3. Outcome of operative repair

Overall, there were 274 (76.11%) morbidity and 28 (7.77%) mortality cases (some patients developed more than one morbidity). Wound infection rate was 39.0% in the successful repair compared to 66.7% in the leaked repair group (p=0.003; OR=2.62; CI= 0.18-0.64).

Similarly, mortality rate was 6.9% for successful repair compared to 14.3% for leaked repair (p < 0.0001). There were significant statistical differences in length of hospital stay (LOHS) (p=0.022; OR=5.22; CI=2.38-16.68) between the two groups, the LOHS being uniformly longer for the leaked repair group (table 2).

The Clavein-Dindo (17) classification was used to compare postoperative outcomes of the two groups (Table 3). Overall, 42(11.7%) cases of leaked repair were recorded. Of the 42 cases, 39 (92.9%) had re-laparotomy, while 3(7.1%) were either too frail for second laparotomy or progressively improved and subsequently scheduled for NOM. The operative techniques and the success rates of each technique during re-laparotomy varied. Among 42 cases with failed primary repair, 39 were managed by relaparotomy, while 3 received NOM. Of the 42 leaked repair cases, perforations in 30 (71.4%) were sealed (29 in the relaparotomy group and one in the conservative management group). However, 12 (28.6%) continued to leak (10 from re-laparotomy group and 2 from NOM group). Of the 12 persistently leaking cases, 6 (50.0%) patients died (2 deaths from NOM and 4 deaths from operative management (OM)). The perforations in the remaining 6 (all from OM group) patients with leaked repair were sealed following prolonged NOM. The highest success rate (81.5%) was recorded in those who had jejunal serosal patch. The surgical methods used to manage the leaked repair included jejunal serosal patch (27 cases, 22 successful), proximal gastrojejunostomy (3 cases, 2 successful), modified Graham's patch (5 cases, 3 successful), cholecystoduodenoplasty (2 cases, 1 successful), and falciform ligament patch (2 cases, 1 successful). There was significant statistical difference with respect to the success rates among the various relaparotomy repair techniques (p = 0.026). Impact of clinical and therapeutic variables on mortality among leaked repair cases is shown below (Table 4).

4. Discussion

The main factors that were significantly associated with leaked repair following omentopexy for perforated peptic ulcer disease were large perforation diameter, delayed presentation, sepsis, immunosuppression/steroid therapy, and perioperative shock. Morbidity and mortality rates were significantly higher for leaked repair compared to successful repair. In this study, jejunal serosal patch was the most effective surgical technique for managing leaked repair. Our study population comprised mainly males and middle-aged persons who were predominantly rural and semi-urban dwellers. Majority were subsistence farmers and traders. The develop-

ment of leaked repair after repair of PPUD has a long history. Its occurrence has the reputation of poor prognosis and tasks the resources of the surgeon, endoscopist, nurses and intensivist (3, 11-13, 18, 19). Our observations on the patients' demographics are comparable with findings reported by previous investigators from Tanzania (7), Turkey (14), Cameroon (20), Egypt (21), Indonesia (22), Germany (23) and Netherlands (24). The positive link between tobacco smoking, crack/cocaine use, with or without alcohol consumption, and PPUD has been reported by several researchers (24-27) and this may partly explain the male preponderance in this study.

The higher incidence of PPUD in the middle-aged and elderly patients may be related to increased, unregulated use of non-steroidal anti-inflammatory drugs (NSAIDS) and steroids in this population. Published studies indicate that both groups of drugs increase the risk of PPUD (24, 26, 27). Indeed, about 25% of chronic NSAID users will develop peptic ulcer disease (PUD) and 2-4% will bleed or perforate ultimately (7, 25-27). It has been cited that the risk and prevalence of Helicobacter pylori (H. Pylori) infection are higher in areas with low socio-economic status and sub-optimal hygiene (26, 27). These may partly explain the higher incidence in rural dwellers who often have low socio-economic profile and poor waste disposal facilities.

Leaked repair after laparotomy for PPUD is a global phenomenon, though rates vary from region to region and within regions (1, 3, 28). It ranges between 3-30% (1, 13, 21, 28). In a Danish study involving a large series of 726 patients operated for PPUD, 124 (17.1%) underwent re-laparotomy and persistent leak was the most frequent indication (28). In India (29), leaked repair rate was 14.0% akin to a rate of 11.3% quoted in a referral hospital in Pakistan (13), 10.9% in Ethiopia (1) and 11.7% observed in this study. In Egypt and Iran, lower rates of 3.9% and 4.0%, respectively, were quoted (29, 30). Reasons adduced for lower rate in Iran may be related to retrospective nature of the study, exclusion of malignant and trauma cases, and abhorrence of alcohol intake (Islamic nation) (30).

The complexities of risk factors for leaked repair requires understanding of international guidelines for managing complicated PPUD (31-33). Socio-demographics, expertise of surgeon, availability of laparo-endoscopic services, and several clinicopathologic factors are important considerations (31-33). In a referral hospital in Pakistan, the mean age of patients who developed leaked repair after Graham's patch was 53.33 years compared to 42.32 years for the control group (13). Though age did not have a significant association with leaked repair in our study, we observed that the rate of leaked repair increased with age (Table 1). It has been cited that intra-abdominal infections pose greater challenge in the older population due to a variety of physiologic alterations, multiple comorbidities, diminished tissue perfusion, atypical clinical presentation (hence, delayed diagnosis), and higher propensity towards sepsis and bowel gangrene (24, 34-39).

We observed that immunosuppression (P=0.003) and delayed presentation beyond 48 hours (P=0.044) were significantly associated with increased leaked repair rates and poor outcome. Similar findings were reported in Pakistan (13), Egypt (21, 32), Nigeria (2, 3, 21, 32), Ethiopia (1), Cameroon (20), Indonesia (22), and Netherlands (24). Immunosuppression and sepsis synergistically diminish immune defense and pave way for a cascade of metabolic, biochemical, physiological, endocrine, and immunological derangements that accompany PPUD and laparotomy (12, 30, 37, 38).

The problem with delayed presentation is two-pronged. First, in the preoperative period, it predisposes the patient to insults by both local and systemic effects of acute-phase reactants (12, 37, 38). In the peri and postoperative phases, patients in this category have high anaesthetic risks with poor hemodynamic performance and are prone to sepsis, organ dysfunction and leaked repair (12, 13, 37, 38).

Second, delayed presentation often leads to advanced disease with significant intra-peritoneal soilage, and weak and cheesy gastro-duodenal wall that predisposes to insecure closure and difficult laparotomy (3, 13, 20, 36, 38). Generally, delayed presentation of acute abdominal conditions is common among rural dwellers in developing nations (1-4, 7, 20-22, 29, 37, 38, 40) and perhaps, was partly responsible for the higher rate of leaked repair rates in patients from rural locations in this study.

We found that leaked repair rate was higher in those with perforation diameter greater than 1.0cm, malignant histology of biopsied edge, and shock. The above findings conform with published data from Africa (1-3, 7, 20, 21, 32, 41), Asia (9, 11-13, 29, 42) and Europe (14, 18, 23, 24, 26, 28). In a large series involving 162 cases of duodenal perforation repair in India, Gupta and coworkers found that leaked repair rates were 2.5% and 13.2% in those with perforation diameters <1cm and >1 cm, respectively (9). In Pakistan, Rajput and Associates reported that none of the 6 cases (11.3%) of reperforations in a cohort of 53 cases of Graham's patch repairs had perforation size less than 6.0mm and that the mean perforation diameter was 8.01mm compared to 4.5mm in those who did not have leaked repair (control group) (13). The above findings overlapped with our results where reperforations occurred exclusively in those with perforation diameters 10.0mm and above.

Over the years, the debate to operate or withhold relaparotomy in the event of leaked repair has continued (13, 18, 23). Recently, published data favor re-laparotomy-on-demand strategy (10, 13, 23, 30, 31). Hitherto, criteria for performing relaparotomy are not explicit and are based on non-quantitative, subjective arguments or hospital doctrine (10, 23, 30, 32). However, emerging clinical data indicate that prompt abdominal imaging studies, especially computed tomography (CT) of the abdomen, represent the gold standard for early detection of leaked repair (23).

We assessed the success rates of different operative techniques and conservative approach for the 42 leaked repair

cases. At the moment, investigators still have varied opinions on the optimum technique for closure of PPU globally (2, 8-13, 18, 21, 43-45). We utilized jejunal serosal patch method in repairing nearly two-third of the leaked repair cases and omental patch in slightly over a tenth of the cases. Though jejunal serosal patch outperformed other techniques, we have not dismissed the usefulness of the versatile omental pedicle patch in managing selected cases of leaked repair as three (60.0%) of five cases fixed with omental patch were sealed and the two that failed had coexisting medical diseases and each had perforation diameter >2.0cm.

One important universal mechanism of omental patch failure is through gangrenous degeneration of the pedicled omental tongue (30, 41).

During relaparotomy, Maghsoudi et al., working in Iran, found that omental patch had gangrenous appearance in five (29.4%) of the 17 patients compared to 14 (35.9%) cases in our study (30). The import of this finding lies with the need for greater care when mobilizing and inserting an omental pedicle into the perforation site so as to avoid tenuous vascular supply and strangulation of the pedicle with sutures. Other mechanisms that have been implicated were high intra-luminal pressure, extrusion of duodenal or gastric mucosa through the closure line and autodigestion by the pancreatic enzymes and bile (11).

The rates and severity of morbidities, mortality, and LOHS in the leaked repair group were higher than those in the 'successful repair' group. These findings are consistent with previous reports (1, 2, 9, 12, 13, 30, 32). The mortality rate of 14.3% recorded in the leaked repair group was lower than a value of 29.4% quoted in Iran (30). This is despite the fact that mortality for the primary closure was 0.0% in the Iranian (30) series compared to 6.9% in this study. The higher mortality rate of primary closure in our series may be due to delayed presentation, higher proportion of cases with large perforation diameter (>1cm), inclusion of patients with malignant perforation (malignant perforations were excluded in Iran (30)) and higher proportions of patients with sepsis and immunosuppression. Elsewhere, the role of these prognostic factors in increasing morbidity and mortality in patients with generalized peritonitis has been determined from logistic regression analyses (14, 20, 25, 26, 34, 35, 46-48). In consideration of the foregoing, the following strategies are suggested to reduce the burden of PPUD in our environment. First, robust training and retraining of surgical trainees on preoperative, intraoperative, and postoperative management, particularly the execution of omental patch and other techniques for PPUD is salutary. Second, public enlightenment programs and awareness campaigns through media and organized health crusades on the risk factors of PPUD and need for early presentation are important strategies. Third, proper disposal of wastes, provision of clean water, wider coverage of National Health Insurance Scheme (NHIS) and improved sanitation through government interventions will reduce overall incidence and severity of PPUD.

4.1. Limitations

First, the intra-operative assessment of perforation diameter was not done with caliper, but by an estimation method. This may reduce the accuracy and reliability of the evaluation. Second, some patients were malnourished and anaemic before onset of PPUD and this may affect the laboratory estimation of serum albumin and haemoglobin, respectively, and therefore, the value of their estimation as markers of re-perforation. Third, the evaluation of the degree of delay before presentation was difficult in some cases due to background chronic or acute-on-chronic epigastric pain and atypical clinical features in the elderly and mentally impaired patients.

5. Conclusions

Leaked repair after omental patch of PPUD was relatively common and associated with higher morbidity and mortality. Immunosuppression/steroid therapy, large perforation diameter, delayed presentation, sepsis, and perioperative shock were significantly associated with leaked repair.

6. Declarations

6.1. Acknowledgments

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6.2. Conflict of interest

None.

6.3. Funding

None.

6.4. Authors' contribution

Ogbuanya AU, the principal investigator of this study was involved in concept, design, drafting of manuscript, data analysis and manuscript editing. Eni UE, Umezurike DA, Akputa O, and Ikpeze S assisted the principal researcher in data acquisition, data analysis, interpretation of data, and critical revision of manuscript for intellectual content. All authors read and approved the final version of this manuscript before submission.

6.5. Using artificial intelligence chatbots

None.

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Table 1: Association of baseline characteristics with the incidence of leaked repair after open omentopexy for perforated peptic ulcer disease

Characteristics	Total	Leaked repair	P value
Age range (year)			
16-44	79 (21.9)	7 (8.9)	0.112
45-64	179 (49.7)	21 (11.7)	
>64	102 (28.4)	14 (13.7)	
Sex			
Male	226 (62.8)	28 (12.4)	0.066
Female	134 (37.2)	14 (10.4)	
Location of settlement			
Rural	149 (41.4)	22 (14.8)	0.246
Semi-urban	121 (33.6)	13 (10.7)	
Urban	90 (25.0)	7 (7.8)	
Occupation			
Farming	113 (31.4)	15 (13.3)	0.082
Trading	82 (22.8)	10 (12.2)	
Artisan	67 (18.6)	8 (11.9)	
Civil servant	37 (10.3)	3 (8.1)	
Other	61 (16.9)	6 (9.8)	
Delayed presentation (hours)ours)			
0-24	69 (19.2)	4 (5.8)	0.044
25-48	133 (36.9)	14 (10.5)	
>48	158 (43.9)	24(15.2)	
Laboratory parameters			
Serum albumin > 2.5 (g/dl)	216 (60.0)	20 (9.3)	0.081
Hemoglobin > 10 (g/dl)	238 (66.1)	24 (10.1)	0.191
Sepsis			
Present	78 (21.7)	14 (17.9)	0.018
Absent	282 (78.3)	28(9.9)	
Immuno-suppression therapy			
Yes	50 (13.9)	12 (24.0)	0.003
No	310 (85.1)	30 (9.7)	
Renal/cardiac impairment			
Present	71 (19.7)	13 (18.3)	0.052
Absent	289 (80.3)	29 (10.0)	
Perforation diameter (cm)			
0.0-1.0	161 (44.7)	5 (3.1)	<0.0001
1.1-2.0	110 (30.6)	8 (7.3)	
2.1-3.0	54 (15.0)	11 (20.4)	
>3.0	35 (9.7)	18 (51.4)	
Biopsy findings			
Benign	332 (92.2)	39 (11.7)	0.604
Malignant	11 (3.1)	2 (18.2)	
No biopsy	17 (4.7)	1(5.9)	
Perioperative shock			
Present	117 (32.5)	19 (16.2)	0.041
Absent	243 (67.5)	23 (9.5)	
Co-existing intra-abdominal pathology			
Present	29 (8.1)	5 (17.2)	0.329
Absent	331 (91.9)	37 (11.2)	
Cadre of surgeon			
Board certified	136 (37.8)	15 (11.0)	0.769
Trainee/other	224 (62.2)	27 (12.1)	

Data are presented as number (%).

Table 2: Postoperative outcomes of patients who underwent open omentopexy following perforated peptic ulcer disease

Outcome	Successful repair n= 318	Leaked repair n = 42	p-value
Morbidity*			
Wound infection	124 (39.0)	28 (66.7)	0.003
Intra-peritoneal collection	15 (4.7)	11 (26.2)	
Sepsis	43 (13.5)	10 (23.8)	
Burst Abdomen	17 (5.3)	5 (11.9)	
Atelectasis	5 (1.6)	2 (4.8)	
Incisional hernia	11 (3.5)	3 (7.1)	
Length of hospital stay (day)			
0-5	21 (6.6)	0 (0.0)	0.022
6-10	91 (28.6)	4 (9.5)	
11-15	132 (41.5)	15 (35.7)	
>15	74 (23.3)	23 (54.8)	
Mortality			
Yes	22 (6.9)	6 (14.3)	< 0.0001

*Some patients had more than one morbidity. Data are presented as number (%).

Table 3: Relative rates of Clavein-Dindo postoperative outcomes for both groups of repairs

Complications	Total	Grade							P value
		I	II	IIIa	IIIb	IVa	IVb	V	
Intraabdominal abscess									
Successful repair	15	0	0	1	1	6	2	5	0.002
Leaked repair	11	0	0	2	2	4	2	1	
Wound infection									
Successful repair	124	2	24	73	5	12	6	2	0.040
Leaked repair	28	0	4	12	3	4	4	1	
Burst abdomen									
Successful repair	17	0	0	4	5	3	3	2	0.036
Leaked repair	5	0	0	0	1	2	2	0	
Sepsis									
Successful repair	43	0	2	1	2	18	10	10	<0.0001
Leaked repair	10	0	0	0	0	3	4	3	
Incisional hernia									
Successful repair	11	0	0	7	4	0	0	0	<0.0001
Leaked repair	3	0	0	2	1	0	0	0	
Atelectasis									
Successful repair	5	0	0	0	0	2	0	3	0.008
Leaked repair	2	0	0	0	0	0	1	1	
Total*									
Number	274	2	30	102	24	52	34	28	-

* Some patients had more than one morbidity.

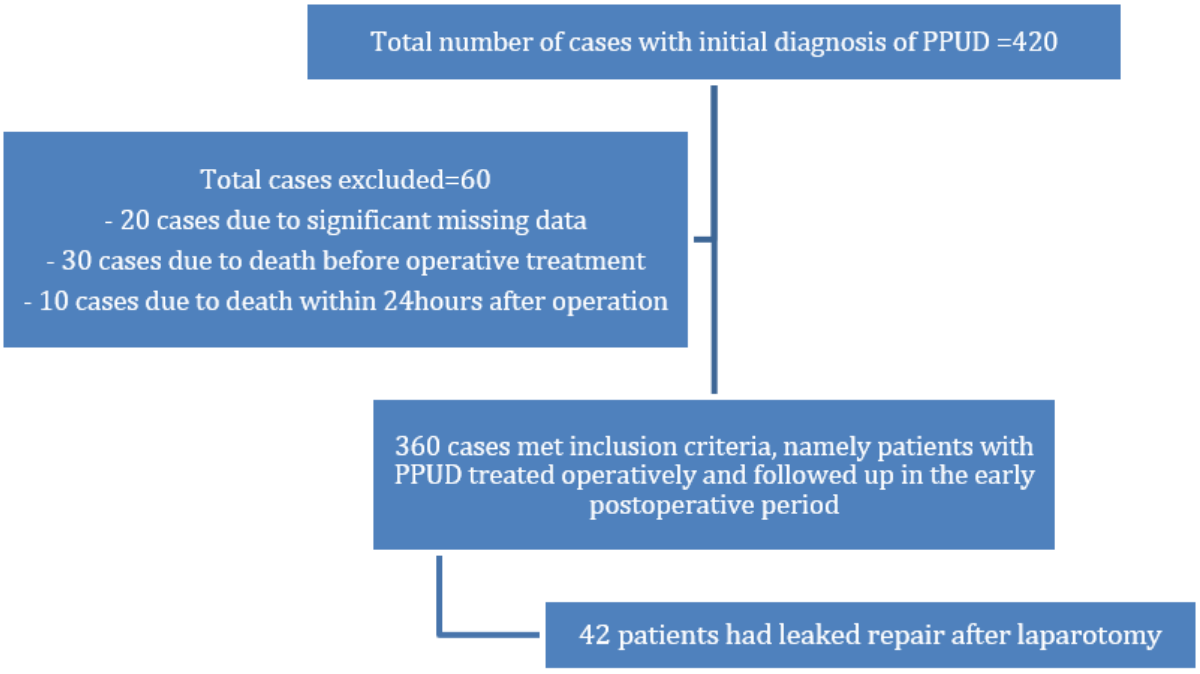

Figure 1: Flow Diagram of patients' inclusion in the study. PPUD: perforated peptic ulcer disease.

Table 4: Impact of clinical and therapeutic variables on mortality among leaked repair cases

Variables	Number (%)	Mortality (%)	p-value
Perforation diameter (cm)			
0-1	15 (35.7)	1 (6.7)	
1.1-2	16 (38.1)	2 (12.5)	0.011
>2	11 (26.2)	3 (27.3)	
Delayed re-laparotomy (hours)*			
0-24	5	0 (0.0)	
25-48	20	1 (5.0)	0.036
>48	14	3 (21.4)	
Age (years)			
16-44	14 (33.3)	1(7.1)	
45-64	18 (42.9)	2(11.1)	0.028
>65	10 (23.8)	3(30.0)	
Method of treatment			
Operative	39 (92.8)	4(10.3)	< 0.0001
Non-operative	3 (7.2)	2(66.7)	
Comorbidity			
Present	11 (26.2)	2 (18.2)	0.061
Absent	31 (73.8)	4 (12.9)	
Perioperative shock			
Present	5	2(40.0)	0.011
Absent	37	4(10.8)	

Data are presented as number (%). * The sum of the number is not 42 because 3 cases were managed conservatively and did not have undergo re-laparotomy. There were 2 mortality cases from the conservative group and that is why mortality is not up to 6, but 4.