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Original Article

An analytical cross-sectional study of risk factors associated with postoperative leaks and mortality in cases of gastrointestinal perforation.

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Abstract

Background
Gastrointestinal (GI) perforation is a life-threatening surgical emergency that often results in severe peritonitis, sepsis, and multi-organ failure. Despite advancements in surgical techniques and perioperative care, postoperative anastomotic leaks and associated mortality remain significant concerns. This study aimed to evaluate the risk factors influencing postoperative leakage and mortality in patients undergoing surgery for GI perforations at a tertiary care center.

Methods
An analytical cross-sectional study was conducted at the Department of Surgery, RIMS, Ranchi, over 18 months. A total of 89 adult patients presenting with non-traumatic GI perforation involving the stomach, duodenum, jejunum, or ileum were included. Patients with esophageal, colonic, iatrogenic, traumatic, or malignant perforations were excluded. "Clinical, demographic, biochemical, and surgical data were collected and analyzed using statistical methods to identify associations with postoperative leaks and 30-day mortality.

Results
The incidence of postoperative leaks was 19.1%, with a mortality rate of 20.2%. Statistically significant risk factors for postoperative leaks included advanced age (p=0.013), delayed presentation (p=0.001), pre-existing acute kidney injury (p=0.013), gastric site of perforation (p=0.031), and the type of surgery performed (p=0.047). Biochemical predictors such as elevated CRP and WBC counts and low serum albumin levels were strongly associated with leak occurrence (p<0.001). Postoperative leaks were significantly correlated with higher mortality (82.35% vs. 5.56%, p<0.001).

Conclusion
Postoperative anastomotic leak significantly increases the risk of mortality in patients with GI perforation. Early diagnosis, risk stratification using clinical and biochemical markers, and appropriate surgical planning are essential to improve outcomes.

Recommendation
Early identification of high-risk patients and timely surgical intervention, along with preventive strategies like protective stoma and improved perioperative care, are recommended to reduce postoperative leaks and mortality.

Keywords: *Gastrointestinal perforation, Postoperative leak, Anastomotic dehiscence, Mortality, Risk factors, Acute abdomen, Surgical outcomes, Peritonitis, C-reactive protein, Serum albumin*
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Introduction

GI perforation is a common emergency room surgical emergency. The gastrointestinal tract wall perforates completely, leaking intraluminal chemicals into the peritoneal cavity. Without prompt treatment, this illness causes peritonitis, sepsis, and multi-organ failure, causing severe morbidity and death [1]. Despite advancements in surgery, antibiotics, and intensive care, fatality rates remain high, especially in delayed surgery or severe peritoneal contamination [2]. Stomach and duodenum perforations are serious gastrointestinal crises. Before, peptic ulcer disease (PUD) caused most stomach and duodenal perforations. However, widespread use of proton pump inhibitors (PPIs) and improved Helicobacter pylori treatment have reduced PUD perforations [3]. Due to anatomical and physiological differences, duodenal ulcers perforate more than stomach ulcers [4, 5]. Although rare, peptic ulcer perforations can signify malignancy, especially in large ulcers. Numerous studies imply that all peptic ulcers are cancerous until proven otherwise [6]. Bowel perforations in the small or large bowel require immediate surgery. Intestinal perforations can result from ischaemic colitis, intestinal obstruction, infectious illnesses, trauma, and cancer [7, 8]. Intestinal perforations had a 30% mortality rate in simple cases and over 70% in diffuse peritonitis [9]. Malignancy, inflammatory bowel disease, and ischemic colitis perforations had a worse prognosis than iatrogenic colonoscopy perforations, which have a lower mortality rate [10].

One of the worst side effects of abdominal surgery is anastomotic leakage after gastrointestinal perforation repair. Leaks dramatically increase morbidity, hospitalization, and mortality. Leaks between the third and sixth postoperative days might cause peritonitis, intra-abdominal abscesses, and septic shock [11]. Anastomotic leaks have a 10–30% mortality rate, depending on comorbidities and peritoneal contamination. Multiple systemic and local risk factors for anastomotic leaking have been identified. Advanced age, malnutrition, vitamin deficiency, diabetes, smoking, anaemia, hypotension, and radiation treatment are systemic risk factors [12, 13]. High anastomosis stress, poor vascular perfusion, and abdominal cavity pollution cause leakage. Diagnostic delays of more than eight hours before surgery increase postoperative leakage and death [14].

Leak management after surgery is difficult. Surgical re-exploration, percutaneous drainage, or cautious TPN and broad-spectrum antibiotics are alternatives. Research has demonstrated that early identification of high-risk individuals allows for preventive interventions such as protective stomas, anastomoses tightening, and intra-abdominal drain usage. [15] GI perforations are treated surgically to restore bowel continuity, perform peritoneal lavage, and prevent septic complications. The surgical approach relies on the perforation's size and location, the patient's hemodynamic stability, and any malignancy or comorbidities [16]. Primary closure with an omental patch (Graham's patch) is common for gastric or duodenal ulcer perforations [17]. In severe perforations, malignancy, or ischaemic bowel disease, segmental resection and anastomosis or stoma implantation may be needed.

Many categorization systems assess gastrointestinal perforation severity and predict surgical results. MPI, APACHE II, and SOFA scores are examples [18]. The MPI has been widely utilized to predict peritonitis mortality and postoperative sequelae. Adverse outcomes are dramatically higher in MPI scores over 29. The 2009 revised intra-abdominal infection guidelines emphasize prompt resuscitation, broad-spectrum antibiotics, and surgical intervention. These guidelines did not reduce diffuse peritonitis mortality, which was 29% [19]. Understanding risk indicators for postoperative leakage and mortality is crucial for improving surgical outcomes in gastrointestinal perforation. Surgeons can improve perioperative management, surgical procedures, and leakage prevention by identifying high-risk patients. Leaks cause severe morbidity; thus, prompt detection and treatment are crucial [20].

Aim of the study

- To evaluate the surgical outcome and risk factors associated with postoperative leak and mortality in case of gastrointestinal perforation in RIMS Ranchi.

Primary objectives

- To estimate the mortality rate and leak rate within 30 days of surgery.

Secondary objectives

- To determine the risk factors for mortality and leak.

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- To estimate the baseline characteristics.

Material and method

Study design

Analytical cross-sectional study.

Study setting

The study population was selected from the patients presenting to the surgical emergency department of Rajendra Institute of Medical Science with non-traumatic perforation. Hollow viscus, in this study, included only the gastrointestinal tract. Patients developing post-operative peritonitis due to anastomotic leak during hospital stay were also included in the study sample.
Study period -18 months from January 2023 to June 2024.

Study subjects

Patients of gastrointestinal perforation who were operated for Perforation located in the stomach, duodenum, jejunum, and ileum.

Inclusion criteria

- Patient of gastrointestinal perforation located in the stomach, duodenum, jejunum, and ileum.
- Age 18 years or above
- Patients of both genders.
- Patients were treated in the Department of Surgery, RIMS, during the study period.

Exclusion criteria

- Patients with associated perforation of the Oesophagus or Colon
- Iatrogenic perforations during surgery.
- Traumatic perforation
- Perforations due to malignancy or the patient has a known malignant condition.

Sampling procedure

Every consecutive patient who underwent surgery for gastrointestinal perforations in the department of surgery at RIMS Ranchi was included in the study.

Sample size

sample size calculated for
95% confidence level
90% Power
P is the mortality rate (30%) of intestinal perforation as estimated by Rumi
Shin et al. [23]
Sample Size calculation: Z^2 x Px (100-P)/ D^2
= (1.96)2 x 30 x 70/ 100
= 81 (adding 10% for lost to follow up)
= 89

Details of the technique used for data collection

Data was collected in a Google form. All patients who had qualified for the eligibility criteria were assessed and baseline data, i.e, age, gender, and exposure variables like presence or absence of DM, hypertension, surgical variables like site of perforation, and type of surgery done. Laboratory variables, i.e., CRP, Sr Albumin, and Total WBC count, were recorded. Outcome variables recorded were anastomotic leak and mortality as categorical variables.

Data analysis

Quantitative variables such as age, CRP levels, WBC count, and serum albumin were expressed as means ± standard deviations. These variables were analyzed using independent t-tests or ANOVA to compare groups. Associations between variables and outcomes like postoperative leak and mortality were assessed using chi-square tests and logistic regression analysis.

Ethical consideration

Ethical approval for the study was obtained from the Institutional Ethics Committee of Rajendra Institute of Medical Sciences (RIMS), Ranchi, on 15th March 2023, with approval number IEC/RIMS/2023/127. Written informed consent was obtained from all participants after explaining the study's purpose and procedures. Participant confidentiality was strictly maintained by anonymizing personal data, and all information was stored securely to ensure privacy and data protection.

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The study protocol was pre-approved by the Institutional Ethics Committee.

Images

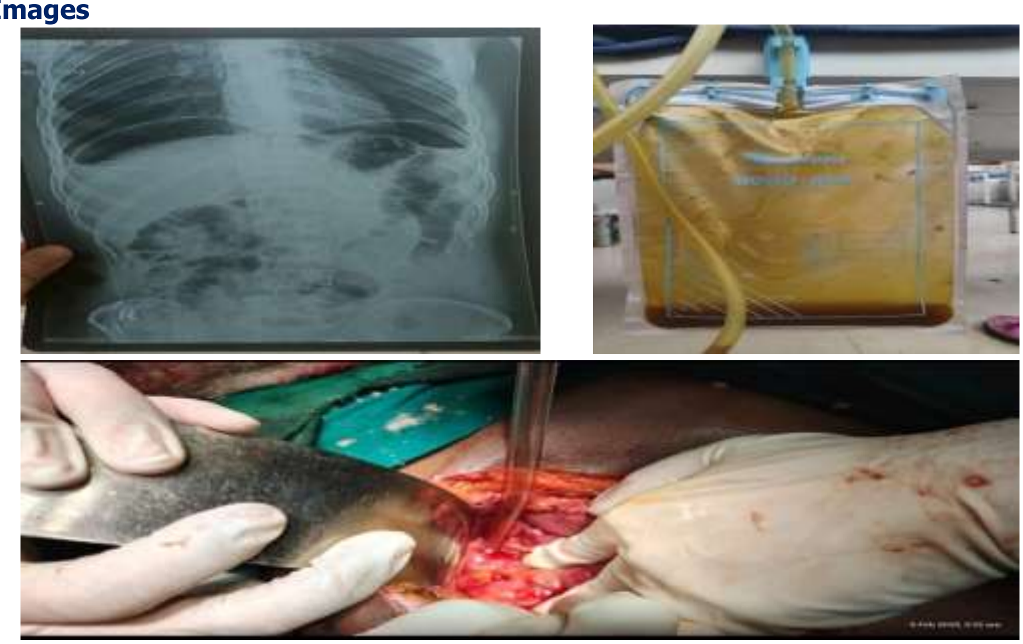

Image 1: Erect X-ray abdomen of patient with perforation.

Image 2: Drain output in patients with anastomotic leak.

Duodenum perforation

Image 3: Gastric antral perforation

Jejunal perforat

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Observation & results

Table 1: Demographic Profile of Participants (n = 89)

Variable	Category	n (%)
Age Group	18–30 years	12 (13.5%)
	31–45 years	21 (23.6%)
	46–60 years	32 (36.0%)
	>60 years	24 (27.0%)
Gender	Male	64 (71.9%)
	Female	25 (28.1%)
Residence	Urban	36 (40.4%)
	Rural	53 (59.6%)
Co-morbidities	Present	38 (42.7%)
	Absent	51 (57.3%)

Table 2: Age Distribution of Patients with Gastrointestinal Perforation

		n	%
Age (years)	≤20 years	5	5.62
	21-30 years	16	17.98
	31-40 years	12	13.48
	41-50 years	23	25.84
	51-60 years	19	21.35
	61-70 years	9	10.11
	>70 years	5	5.62
	Mean±SD	44.73±15.53	

The age distribution of gastrointestinal perforation patients is shown in Table 2. The 41-50 age group had 23 patients (25.84%), followed by 51-60 years with 19 (21.35%). The 21-30 age group had 16 patients (17.98%), and the 31-40 age group had 12 (13.48%). Gastrointestinal perforation decreased with age, with 9 patients (10.11%) in the 61-70 age range and 5 (5.62%) above 70. The youngest age group, ≤20 years, included 5 patients (5.62%), suggesting that gastrointestinal perforation is less common in extreme age categories. The average patient age was 44.73 ± 15.53 years, indicating that middle-aged adults are more susceptible to this illness.

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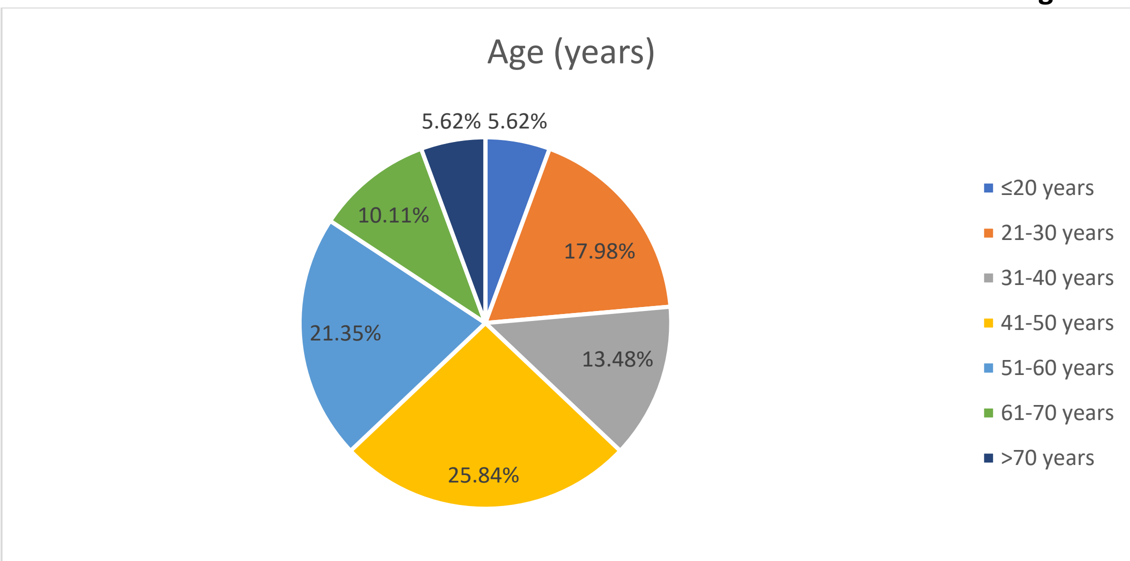

Figure 1. Age Distribution of Patients with Gastrointestinal Perforation

Table 3: Gender distribution of patients with gastrointestinal perforation

		n	%
Gender	Male	70	78.65
	Female	19	21.35

Table 3 shows the distribution of patients with gastrointestinal perforation according to gender. Out of 89 total patients, 70 (78.65%) were male, while 19 (21.35%) were female.

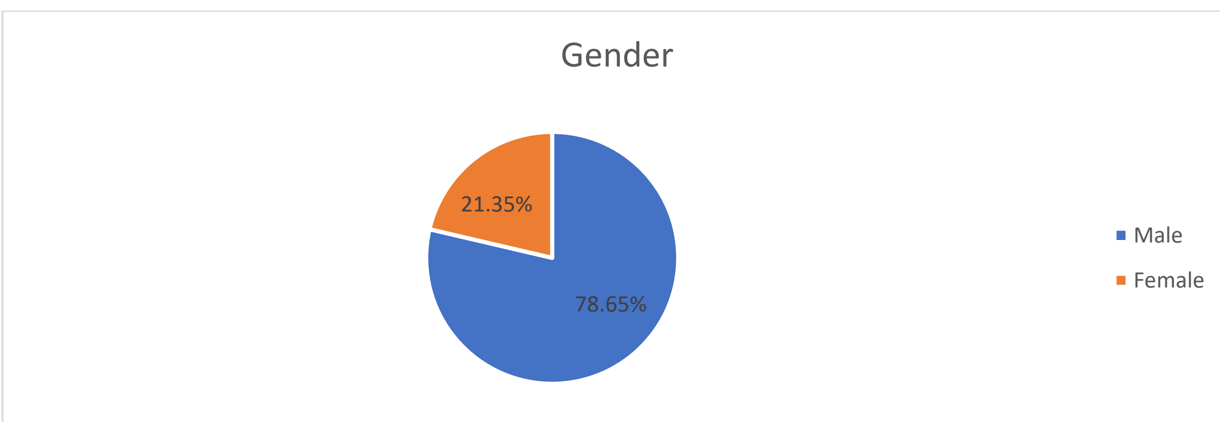

Figure 2. Gender Distribution of Patients with Gastrointestinal Perforation

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Table 4: Distribution of chief complaints among patients with gastrointestinal perforation

		n	%
Chief complaints	Pain In the Abdomen	88	98.88
	Distension of the Abdomen	10	11.24
	Vomiting	8	8.99

Table 4 shows the distribution of chief complaints among patients with gastrointestinal perforation. The most common presenting symptom was pain in the abdomen, reported by 88 patients (98.88%), making it the predominant complaint. Abdominal distension was observed in 10 patients (11.24%), while vomiting was reported in 8 patients (8.99%).

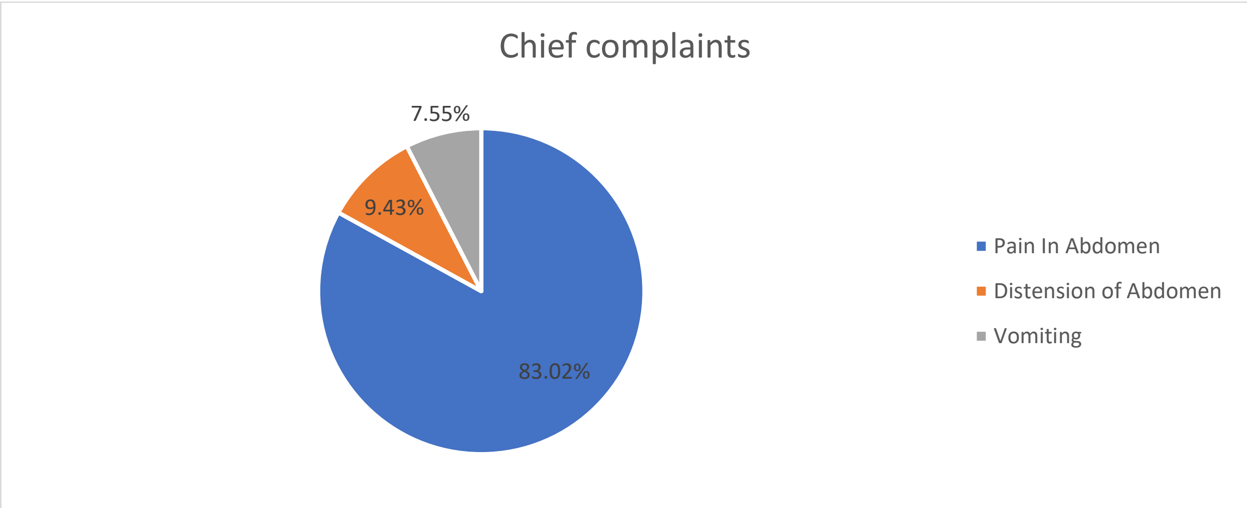

Figure 3. Distribution of chief complaints among patients with gastrointestinal perforation

Table 5: Distribution of patients based on the duration of symptoms

		n	
Duration of symptoms (days)	1	3	3.37
	2	26	29.21
	3	23	25.84
	4	17	19.10
	5	19	21.35
	6	1	1.12
	Mean±SD	3.19±1.23	

Table 5 shows the distribution of patients by symptom duration before medical attention. The majority of 89 individuals (26, 29.21%) sought medical assistance on the second day of symptoms, followed by 23 (25.84%) on the third. Only 3.37 percent of patients reported symptoms for one day before seeking care, while 1.12% waited six days. Symptoms lasted an average of 3.19 ± 1.23 days before seeking medical assistance.

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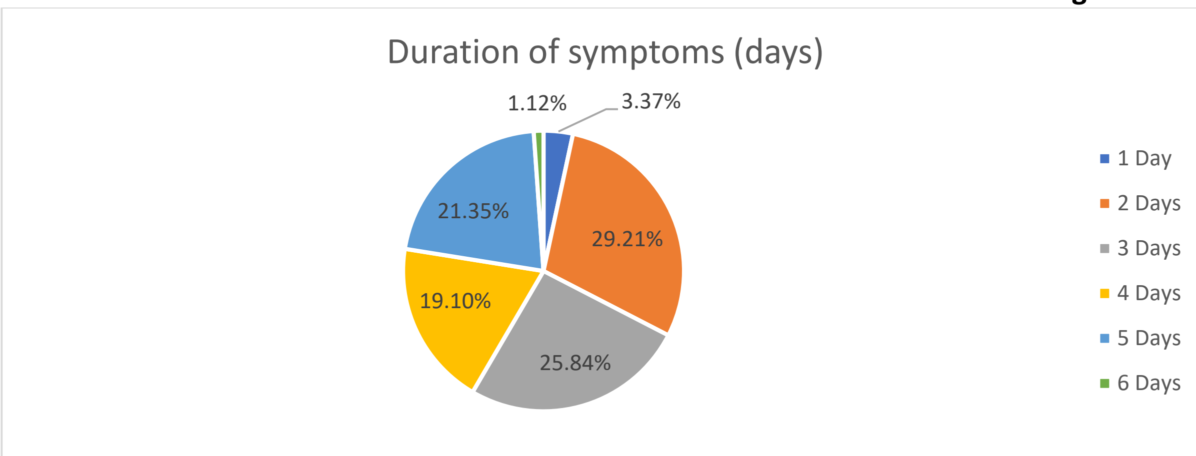

Figure 4. Distribution of patients based on the duration of symptoms

Table 6: Distribution of past medical history among patients with gastrointestinal perforation

		n	%
Past medical history	AKI	9	10.11
	DM	13	14.61
	Cardiovascular disease	12	13.48

Table 6 presents the distribution of past medical history among patients with gastrointestinal perforation. The most common pre-existing condition was diabetes mellitus (DM), reported in 13 patients (14.61%), followed by cardiovascular disease in 12 patients (13.48%) and acute kidney injury (AKI) in 9 patients (10.11%).

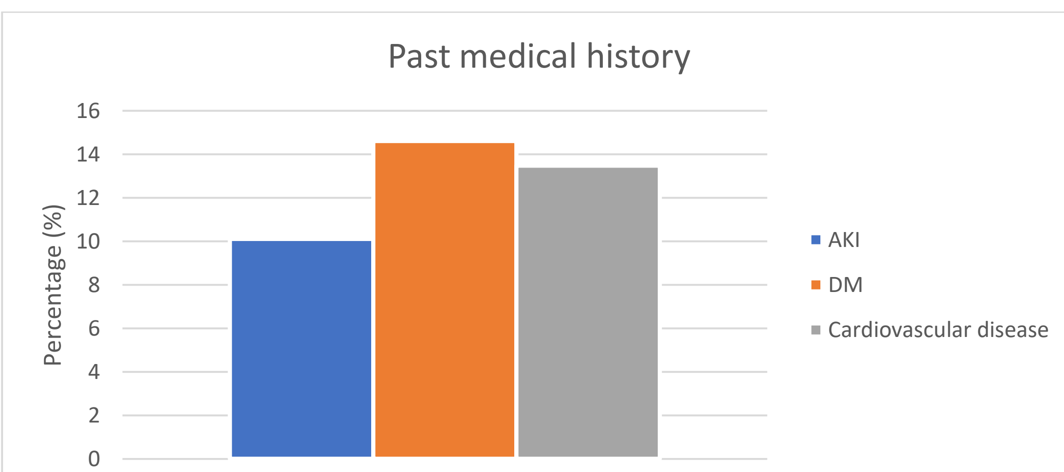

Figure 5. Distribution of past medical history among patients with gastrointestinal perforation

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Table 7: Distribution of site of perforation among patients with gastrointestinal perforation

		n	%
Site of perforation	Gastric Perforation	22	24.72
	Dudenum Perforation	32	35.96
	Ilum Perforation	28	31.46
	Jejunum	7	7.87

Table 7 presents the distribution of the site of perforation among patients with gastrointestinal perforation. The most common site was the duodenum, with 32 patients (35.96%) experiencing duodenal perforation. This was followed by ileal perforation, occurring in 28 patients (31.46%), and gastric perforation, seen in 22 patients (24.72%). Jejunal perforation was noted in 7 patients (7.87%).

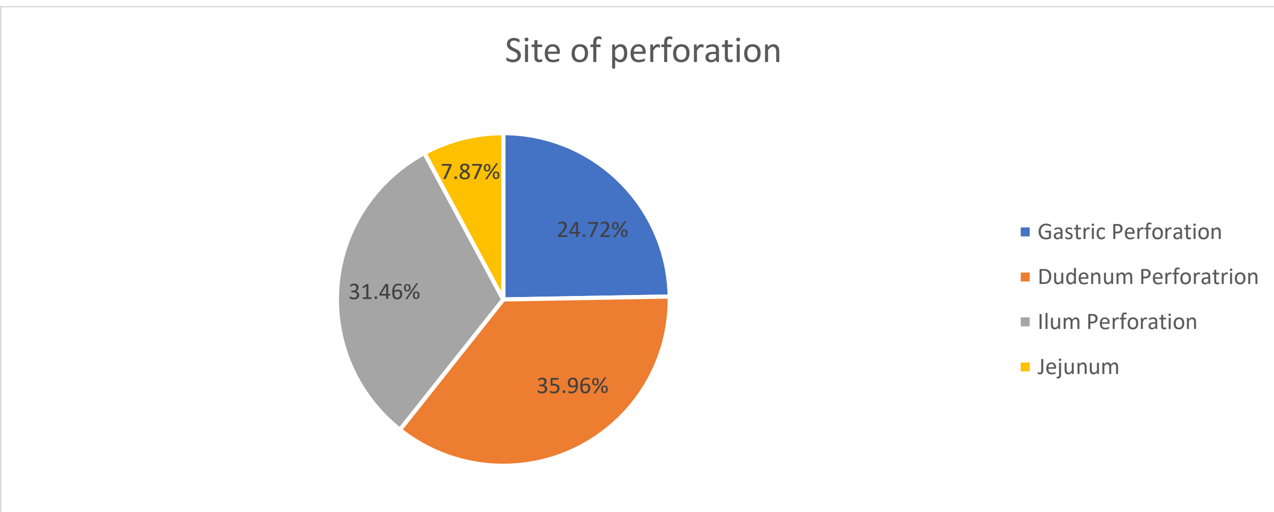

Figure 6. Distribution of the site of perforation among patients with gastrointestinal perforation

Table 8: Distribution of patients based on the type of surgery performed for gastrointestinal perforation

		n	%
Type of surgery	Primary Repair	17	19.10
	Loop Ileostomy	13	14.61
	Modified Grahms Patch Repair	53	59.55
	Primary repair with loop ileostomy	6	6.74

Table 8 shows the distribution of patients by gastrointestinal perforation operation type. The most prevalent surgical method for perforated peptic ulcers was Modified Graham's Patch Repair, performed on 53 patients (59.55%). In cases where direct perforation closure was possible, 17 patients (19.10%) underwent primary repair. In 13 patients (14.61%), loop ileostomy was performed for distal small bowel perforations or extensive contamination, while 6 patients (6.74%) needed primary repair, probably as a precaution in high-risk instances.

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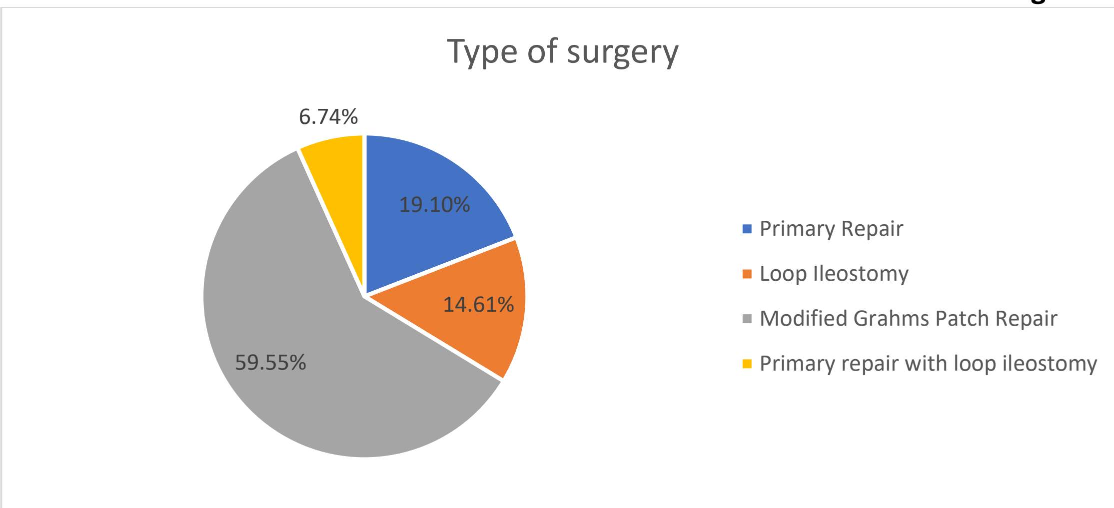

Figure 7. Distribution of patients based on the type of surgery performed for gastrointestinal perforation

Table 9: Incidence of postoperative leak among patients who underwent surgery for gastrointestinal perforation

		n	%
Post-operative leak	Present	17	19.10
	Absent	72	80.90

Table 9 presents the incidence of postoperative leak among patients who underwent surgery for gastrointestinal perforation. A significant proportion of patients, 17 (40.45%), developed a postoperative leak, indicating a notable risk associated with the surgical management of perforations. Meanwhile, 72 patients (59.55%) did not experience this complication.

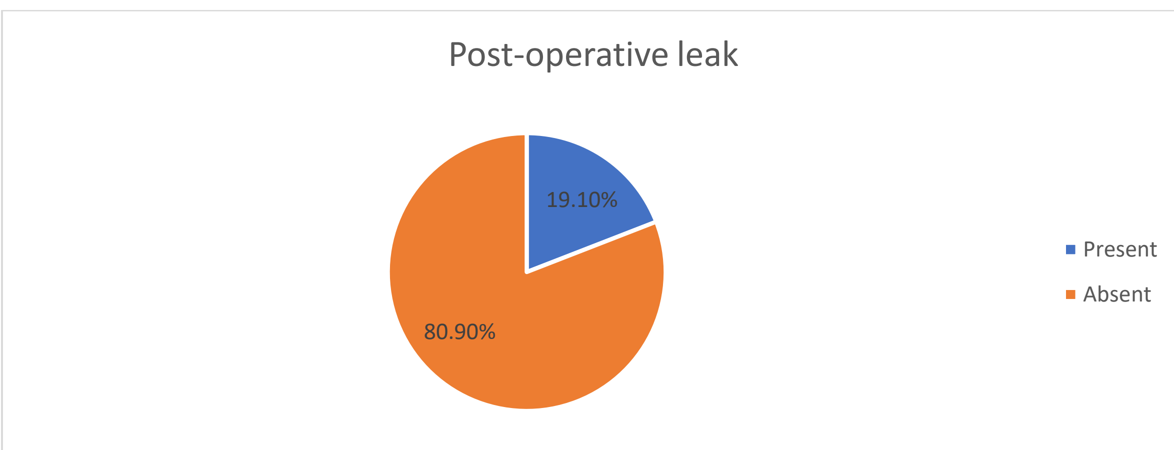

Figure 8. Incidence of postoperative leak among patients who underwent surgery for gastrointestinal perforation

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Table 10: Comparison of Age between Patients with and Without Postoperative Leak

	No leakage (n=72)		Leakage (n=17)		t	p-Value
	Mean	±SD	Mean	±SD		
Age (years)	42.76	15.60	53.06	12.47	-2.534	0.013

Table 10 compares the age distribution between patients with and without postoperative leaks. The mean age of patients without leakage was 42.76 ± 15.60 years, whereas the mean age of those with leakage was 53.06 ± 12.47 years. The difference in mean age was found to be statistically significant (t = -2.534, p = 0.013), indicating that older patients may have a higher risk of developing postoperative leaks.

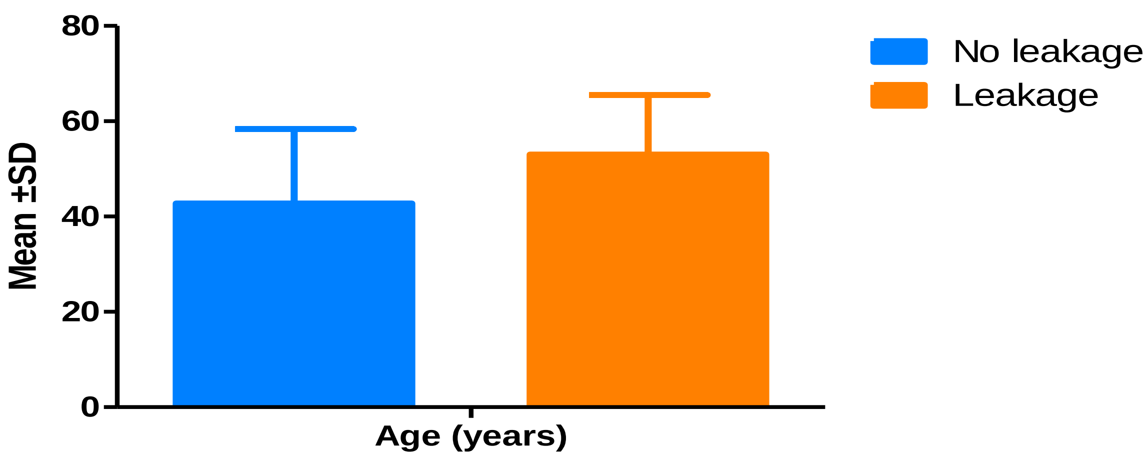

Figure 9. Comparison of Age between Patients with and Without Postoperative Leak

Table 11: Gender distribution between patients with and without postoperative leaks

		No leakage (n=72)		Leakage (n=17)		p-Value
		n	%	n	%	
Gender	Male	56	77.78	14	82.35	0.932
	Female	16	22.22	3	17.65	

Table 11 compares the gender distribution between patients with and without postoperative leaks. Among the 72 patients without leakage, 56 (77.78%) were male, while 16 (22.22%) were female. In the 17 patients who developed a postoperative leak, 14 (82.35%) were male, and 3 (17.65%) were female. The p-value (0.932) indicates that there is no statistically significant association between gender and the occurrence of postoperative leaks.

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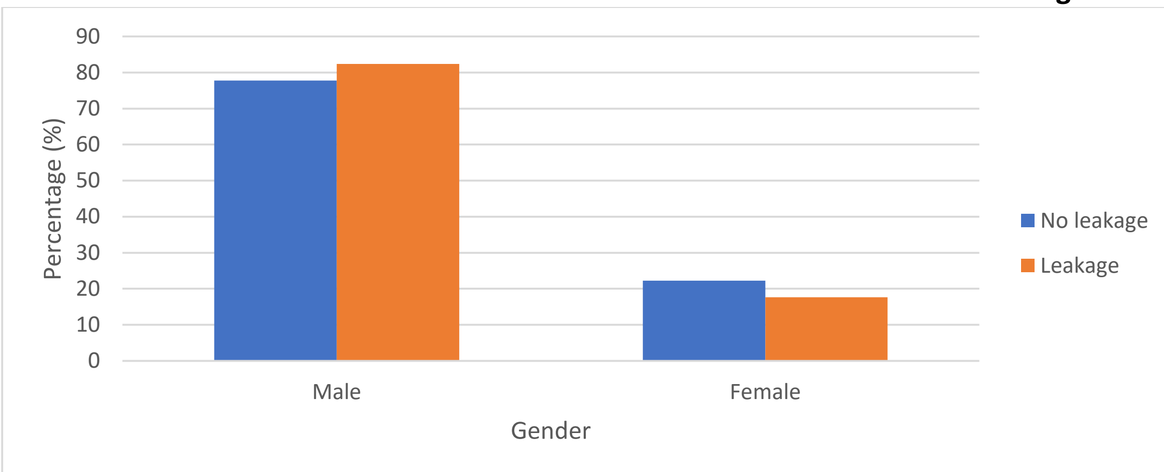

Figure 10. Gender distribution between patients with and without postoperative leaks

Table 12: Compares the chief complaints between patients with and without postoperative leaks

		No leakage (n=72)		Leakage (n=17)		p-Value
		n	%	n	%	
Chief complaints	Pain in Abdomen	71	98.61	17	100.00	0.625
	Distension of Abdomen	9	12.50	1	5.88	0.726
	Vomiting	7	9.72	1	5.88	0.979

Table 12 compares the chief complaints between patients with and without postoperative leaks. Among the 72 patients without leakage, 71 (98.61%) reported pain in the abdomen, while all 17 (100%) patients in the leakage group had the same complaint ($p = 0.625$), indicating no statistically significant difference. Abdominal distension was present in 9 (12.50%) of the no-leak group and 1 (5.88%) in the leakage group ($p = 0.726$), suggesting no significant association. Similarly, vomiting was reported by 7 (9.72%) in the no-leak group and 1 (5.88%) in the leakage group ($p = 0.979$), also showing no statistically significant difference.

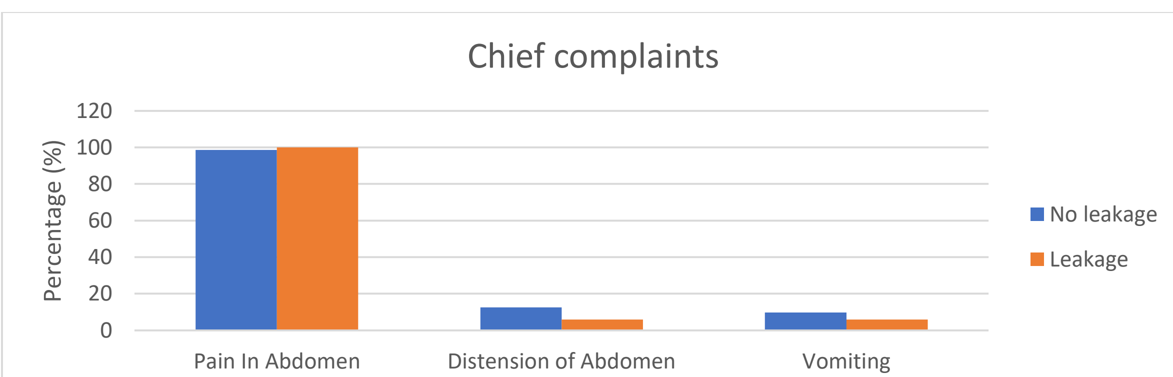

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Figure 11. Compares the chief complaints between patients with and without postoperative leaks

Table 13: Compares the duration of symptoms between patients with and without postoperative leaks

	No leakage (n=72)		Leakage (n=17)		t	p-Value
	Mean	±SD	Mean	±SD		
Duration of symptoms (days)	3.08	1.12	4.18	1.29	-3.511	0.001

Table 13 compares the duration of symptoms between patients with and without postoperative leaks. The mean duration of symptoms before seeking medical attention was 3.08 ± 1.12 days in patients without leakage, whereas it was 4.18 ± 1.29 days in patients with leakage. The difference in symptom duration was found to be statistically significant (t = -3.511, p = 0.001), indicating that a longer duration of symptoms before surgery may be associated with a higher risk of postoperative leaks.

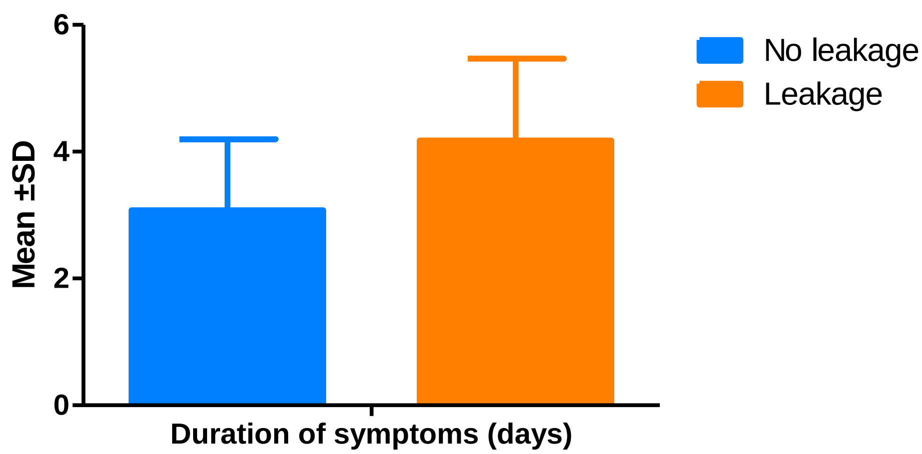

Figure 12. Compares the duration of symptoms between patients with and without postoperative leaks

Table 14: Comparison of Past Medical History between Patients with and Without Postoperative Leak

		No leakage (n=72)		Leakage (n=17)		p-Value
		n	%	n	%	
Past medical history	AKI	4	5.56	5	29.41	0.013
	DM	11	15.28	2	11.76	0.712
	Cardiovascular disease	8	11.11	4	23.53	0.340

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Table 14 examines how medical history affects surgical outcomes in patients with and without postoperative leaks. Postoperative leakage was associated with Acute Kidney Injury (AKI), which was 29.41% more common in the leaking group than in the no-leakage group (5.56%). AKI patients may have a higher risk of leakage due to poor healing and increased systemic inflammation. Diabetes mellitus (DM) was observed in 11 patients (15.28%) without leakage and 2 patients (11.76%) with leakage, with a p-value of 0.712. A p-value of 0.340 showed no statistically significant difference in cardiovascular disease between 8 patients (11.11%) without leakage and 4 (23.53%) with leakage. These findings suggest that AKI may increase postoperative leakage, while DM and cardiovascular disease may not.

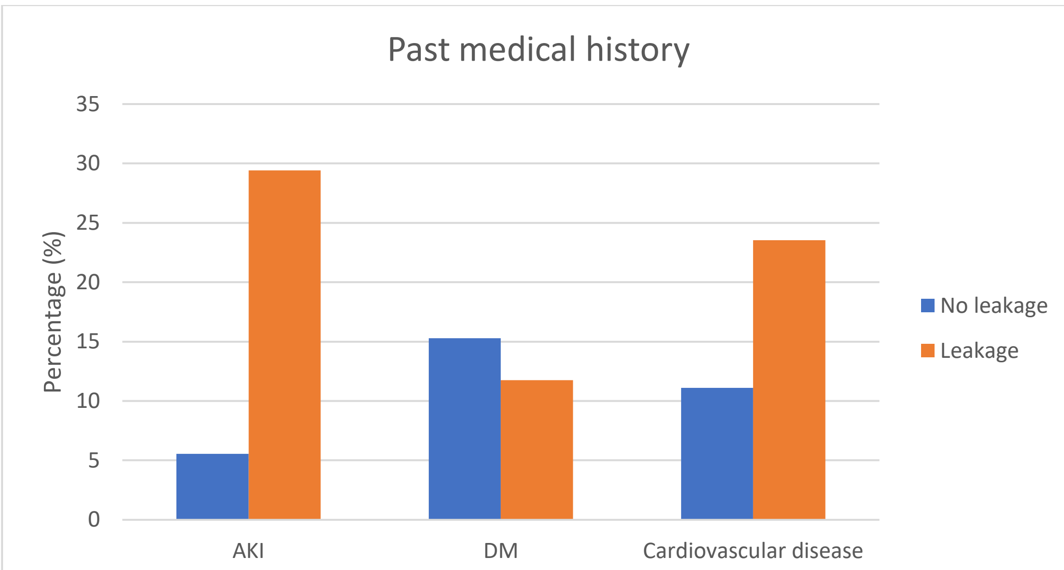

Figure 13. Comparison of Past Medical History between Patients with and Without Postoperative Leak

Table 15: Comparison of Site of Perforation between Patients with and Without Postoperative Leak

Site of perforation	No leakage (n=72)		Leakage (n=17)		Chi Sq.	p-Value
	n	%	n	%		
Dudenum Perforation	25	34.72	7	41.18	8.88	0.0310
Gastric Perforation	14	19.44	8	47.06		
Ilum Perforation	27	37.50	1	5.88		
Jejunum	6	8.33	1	5.88		

Table 15 compares perforation sites in patients with and without postoperative leakage. We found duodenal perforation in 25 (34.72%) individuals without leakage and 7 (41.18%) with leakage. Gastric perforation was found in 14 patients (19.44%) without leakage and 8 (47.06%) with leaking. Ileal perforation was found in 27 individuals (37.50%) without leakage and 1 (5.88%) with leakage. Jejunal perforation was found in 6 (8.33%) leak-free patients and 1 (5.88%) leaky patient. A statistically significant correlation between perforation site and postoperative leakage was found by the Chi-square value of 8.88 and p-value of 0.0310.

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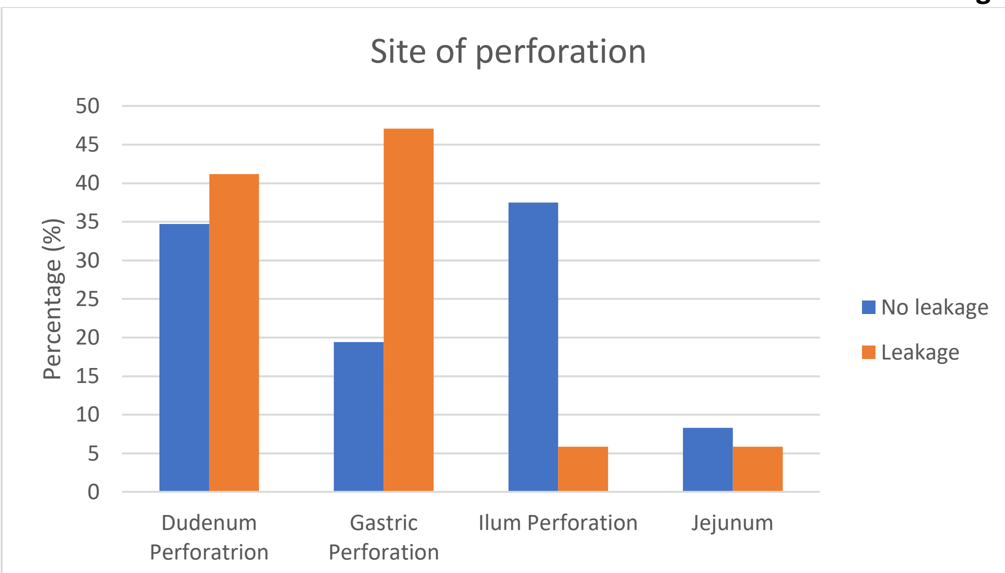

Figure 14. Comparison of the site of perforation between patients with and without postoperative leak

Table 16: Comparison of the type of surgery between patients with and without postoperative

		No leakage (n=72)		Leakage (n=17)		Chi Sq.	p-Value
		n	%	n	%		
Type of surgery	Primary Repair	15	20.83	2	11.76	7.96	0.047
	Loop Ileostomy	13	18.06	0	0.00		
	Modified Grahms Patch Repair	40	55.56	12	70.58		
	Primary repair with loop ileostomy	3	4.17	3	17.65		

Patients with and without postoperative leaking undergo different surgeries, as shown in Table 16. The most prevalent method among 72 patients without leakage was Modified Graham's Patch Repair (40, 55.56%), followed by Primary Repair (15, 20.83%), Loop Ileostomy (13, 18.06%), and Primary Repair with Loop Ileostomy (3, 4.17%). However, Modified Graham's Patch Repair was the most common procedure (13 patients, 70.58%) among the 17 patients who developed leakage, followed by Primary Repair with Loop Ileostomy (3 patients, 17.65%) and Primary Repair (2 patients, 11.76%). Loop Ileostomy was not performed in leaky patients. A Chi-Square test found a significant association ($p < 0.05$) between surgery type and postoperative leakage, with a Chi-Square value of 7.96 and a p-value of 0.047.

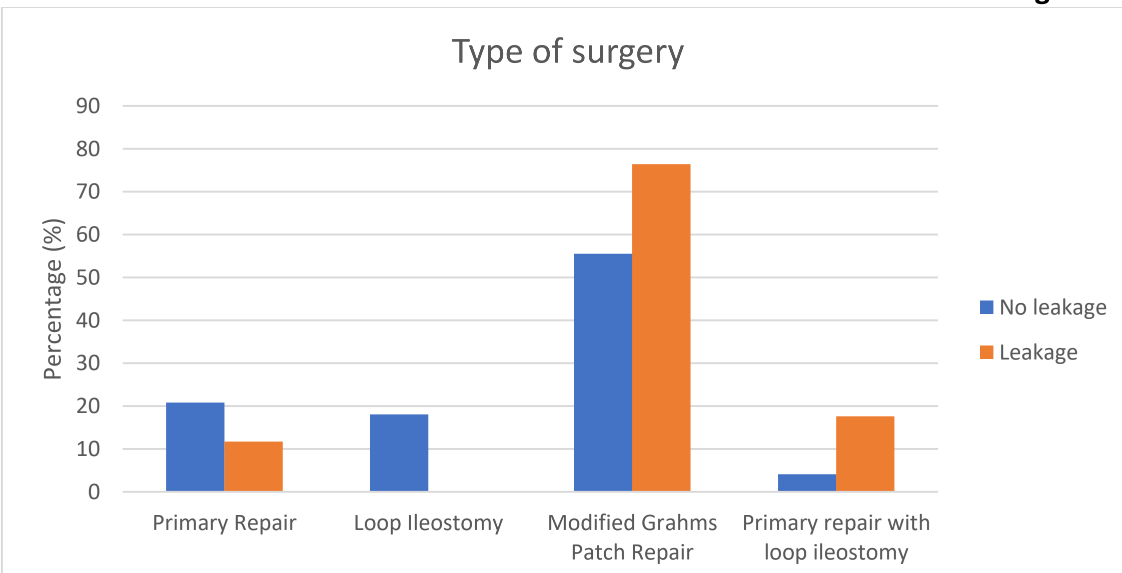

Figure 15. Comparison of the type of surgery between patients with and without postoperative

Table 17: Compares the mean preoperative levels of C-reactive protein (CRP), serum albumin, and white blood cell (WBC) count between patients with and without postoperative

	No leakage (n=72)		Leakage (n=17)		t	p-Value
	Mean	±SD	Mean	±SD		
CRP (mg/l)	61.31	15.15	147.41	35.68	-15.556	<0.001
Serum albumin(g/dl)	3.10	0.36	2.62	0.38	4.926	<0.001
WBC count(cells/microliter)	11.18	3.62	18.59	3.37	-7.688	<0.001

Table 17 shows the mean preoperative CRP, serum albumin, and WBC counts of patients who had a postoperative leak versus those who did not. CRP levels: Patients without leakage had a mean CRP of 61.31 ± 15.15 mg/L, while those with leakage had a substantially higher mean of 147.41 ± 35.68 mg/L. The statistically significant difference between groups was shown by the t-test value of -15.556 (p-value <0.001). Higher CRP levels seem to predict postoperative leaking. The mean serum albumin levels were 3.10 ± 0.36 g/dL in the no-leaking group and 2.62 ± 0.38 g/dL in the leakage group. The t-test value of 4.926, with a p-value <0.001, indicates a significant difference. Lower serum albumin levels in the leaking group may indicate malnutrition or delayed healing, causing surgical problems. The no-leakage group had a mean WBC count of 11.18 ± 3.62 cells/μL, while the leakage group had a considerably higher mean of 18.59 ± 3.37 cells/μL. A statistically significant difference was confirmed by a t-test value of -7.688, with a p-value <0.001. Leakage patients have increased WBC counts, indicating systemic inflammation and infection risk.

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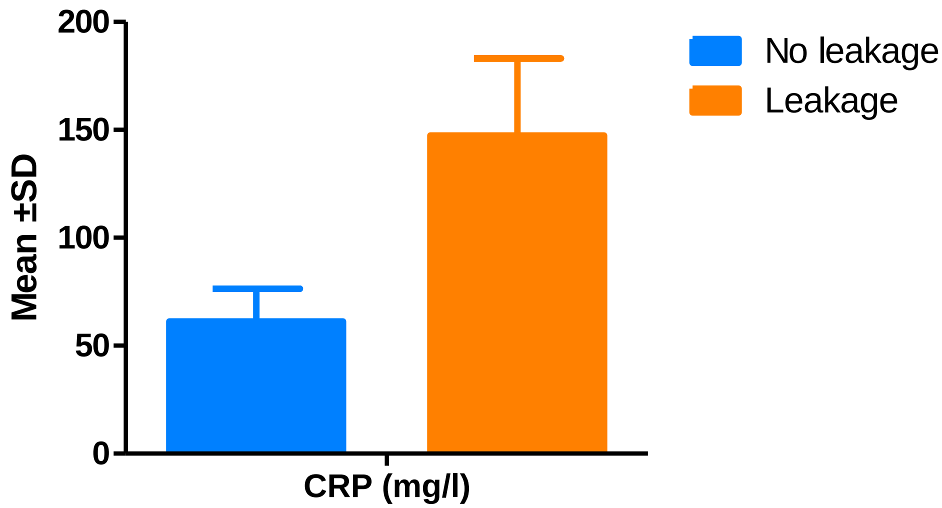

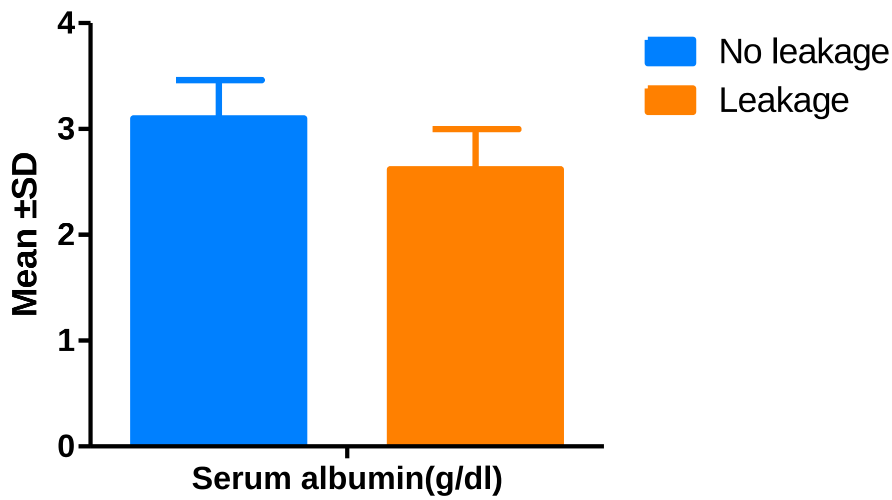

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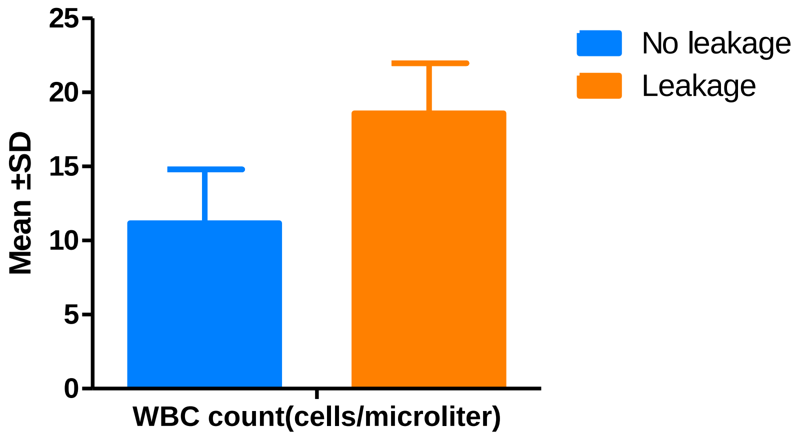

Figure 16. Compares the mean preoperative levels of C-reactive protein (CRP), serum albumin, and white blood cell (WBC) count between patients with and Without Postoperative

Table 18: Association between postoperative leakage and patient outcomes

		No leakage (n=72)		Leakage (n=17)		p-Value
		n	%	n	%	
Outcome	Discharge	68	94.44	3	17.65	<001
	Death	4	5.56	14	82.35	

Table 18 demonstrates a significant association between postoperative leakage and patient outcomes. Among the 72 patients without leakage, 68 (94.44%) were successfully discharged, while only 4 (5.56%) succumbed to complications. In contrast, of the 17 patients who experienced postoperative leakage, only 3 (17.65%) were discharged, whereas 14 (82.35%) did not survive. The p-value was <0.001, indicating a statistically significant difference in outcomes between the two groups.

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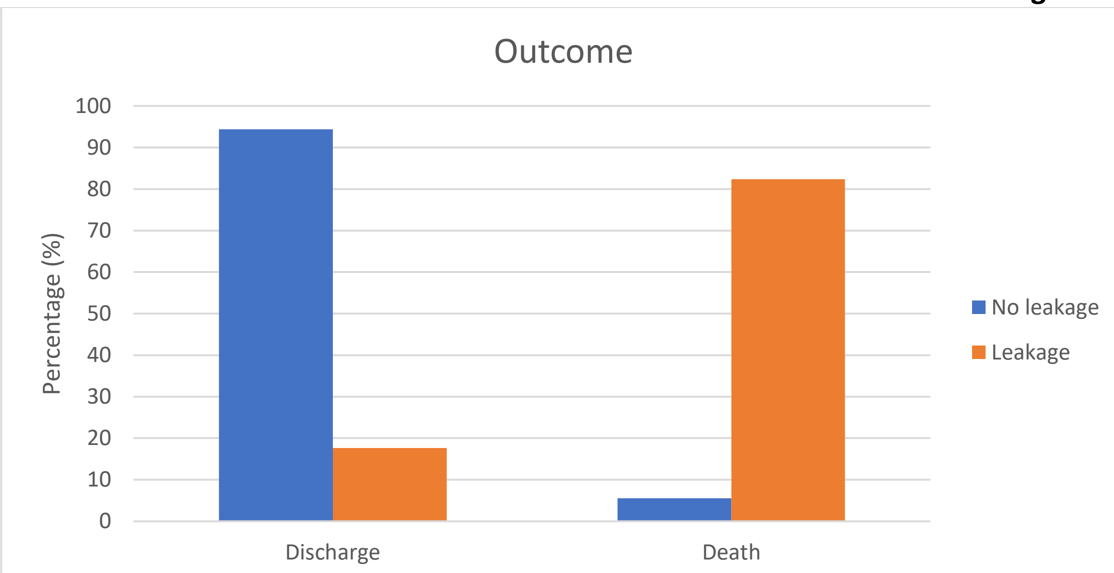

Figure 17. Association between postoperative leakage and patient outcomes

Discussion

This study provides crucial insights into the clinical, biochemical, and procedural risk factors associated with postoperative anastomotic leakage and mortality in patients undergoing surgery for gastrointestinal (GI) perforations. Our findings emphasize that older age, delayed presentation, pre-existing acute kidney injury (AKI), gastric site of perforation, and specific surgical approaches significantly affect postoperative outcomes. The mean age among patients with leaks (53.06 years) was significantly higher than those without leaks (42.76 years, p=0.013), reinforcing earlier studies that age-related decline in tissue perfusion and healing contributes to increased surgical complications. A significant correlation was found between delayed hospital presentation and postoperative leak rates (p=0.001), supporting global literature that emphasizes early surgical intervention reduces morbidity. Delays beyond 24 hours likely contribute to extensive peritoneal contamination and systemic deterioration, as noted by studies from [21, 22]. Biochemical markers such as elevated CRP, leukocytosis, and hypoalbuminemia were strong predictors of leakage (p<0.001). These findings align with existing evidence that systemic inflammation and malnutrition undermine tissue integrity and healing. Low serum albumin, in particular, has consistently been identified as a risk factor in. Interestingly, loop ileostomy was associated with zero leaks in our cohort, underscoring its protective role. Comparative studies like that of [23, 24] also advocate for temporary diverting stomas in high-risk anastomoses to mitigate leak risk. Furthermore, gastric perforations, especially when repaired using modified Graham's patch, had higher leak rates, suggesting that anatomical location and surgical technique must be carefully matched. Most importantly, postoperative leak was strongly associated with mortality (82.35% in leak group vs. 5.56% in non-leak group, p<0.001). This mirrors global data indicating that anastomotic dehiscence significantly worsens survival rates, often due to ensuing sepsis and multiorgan failure. These interpretations affirm the need for multifactorial preoperative assessments and individualized surgical planning. By correlating clinical and biochemical markers with outcomes, this study strengthens the body of evidence advocating proactive risk stratification and perioperative optimization.

Generalizability

The study was conducted in a tertiary care teaching hospital (RIMS, Ranchi), which manages a high burden of emergency surgical cases. Therefore, the findings are most generalizable to similar public sector institutions across India and other low- and middle-income countries (LMICs) with comparable resource constraints, disease patterns, and surgical practices. However, generalization to private

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hospitals, well-resourced settings, or Western healthcare systems may be limited due to differences in infrastructure, operative protocols, and postoperative monitoring capabilities. Further multicentric and international studies are needed to confirm these results in broader contexts.

Conclusion

This study identifies age, delayed presentation, AKI, low serum albumin, and elevated inflammatory markers as key predictors of postoperative leaks and mortality in GI perforation cases. Surgical technique and anatomical site also significantly affect outcomes. Early recognition and targeted intervention are essential to reduce complications and improve survival.

Limitations

The study was single-centered and may not reflect outcomes from other regions or institutions.
A relatively small sample size (n=89) may limit the statistical power for some subgroup analyses.
Follow-up was restricted to 30 days, and long-term complications like stricture or reoperations were not evaluated.
Intraoperative variables such as peritoneal contamination level or surgeon experience were not standardized or recorded.
Loss to follow-up in 6 patients (6.7%) could affect result accuracy.

Recommendations

Implement preoperative risk stratification using clinical and biochemical markers (age, CRP, albumin, AKI status).
Encourage early surgical referral to reduce the delay in presentation and intervention.
Use a protective stoma (e.g., loop ileostomy) in high-risk anastomoses to minimize leaks.
Adopt Enhanced Recovery After Surgery (ERAS) protocols to improve overall outcomes.
Promote larger, multicenter prospective studies to validate findings across diverse healthcare settings.

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Conclusion

Critical risk factors for postoperative leakage and mortality in gastrointestinal perforation patients were discovered in this investigation. The data show that 41–50-year-olds are most affected. Men dominated group, making up 79%. A modified Graham's patch repair was the most common surgery for duodenum, ileum, and stomach perforations. Postoperative leakage occurred in 40.45% of patients due to advanced age, delayed presentation, and severe renal injury. Early detection and surgical treatment are crucial because delayed medical intervention increased leakage. This study also found a strong link between perforation location and postoperative leaking, with stomach holes being especially vulnerable. Postoperative leakage was linked to biochemical indicators such higher CRP and WBCs and decreased serum albumin. Diet and systemic inflammation affect surgery outcomes, as shown by this discovery. The surgical procedure affected problem prediction; modified Graham's patch repair was more associated with postoperative leaking. Mortality was 5.56% in the group without postoperative leakage and 82.35% in the group with it. Because this gap underlines the devastating consequences of postoperative leakage, more accurate surgery, improved perioperative care, and proactive control of modifiable risk factors such as malnutrition, infection, and delayed presentation are needed. This findings emphasise the need of immediately treating gastrointestinal perforations, enhancing patient health, and monitoring postoperative recovery.

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Lists of abbreviations

GI- Gastrointestinal perforation
PUD- Peptic ulcer disease

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Conflict of interest

The Author declares no conflict of interest.

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Dr Binay Kumar– Drafting, supervising and proofreading of this manuscript.
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