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Original Research Article

OUTCOME IN PATIENTS OF ACUTE INTESTINAL OBSTRUCTION AND ACUTE PERFORATIVE PERITONITIS WITH REFERENCE TO INTERLEUKIN-6 AND LACTATE DEHYDROGENASE

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ABSTRACT

Background: Acute intestinal obstruction and acute perforative peritonitis are common surgical emergencies associated with significant morbidity and mortality. Early identification of disease severity and prediction of outcomes remain challenging using conventional clinical parameters alone. Biomarkers such as interleukin-6 (IL-6) and lactate dehydrogenase (LDH) may provide valuable insights into systemic inflammation and tissue injury. The aim of this study was to evaluate the outcomes in patients with acute intestinal obstruction and acute perforative peritonitis with reference to IL-6 and LDH.

Materials and Methods: The prospective observational study was conducted at a tertiary care teaching hospital over a period of 18 months. 63 patients diagnosed with acute intestinal obstruction (n=41) and acute perforative peritonitis (n=22) were included for the study. Serum IL-6 and LDH levels were measured and correlated with disease severity, bowel viability, organ dysfunction, ICU admission, postoperative complications, and mortality. Statistical analyses included chi-square test, t-test, ANOVA, correlation analysis, logistic regression, and ROC analysis.

Results: IL-6 levels were significantly higher in perforative peritonitis compared to intestinal obstruction ($p = 0.008$), whereas LDH levels showed no significant difference between groups. Both IL-6 and LDH increased significantly with disease severity ($p < 0.001$). IL-6 demonstrated a strong correlation with severity ($r = 0.864$), while LDH showed a significant association with bowel gangrene ($p < 0.001$). ICU admission and length of hospital stay increased significantly with severity ($p < 0.05$). ROC analysis showed that IL-6 had acceptable predictive ability for organ dysfunction (AUC = 0.729), whereas LDH showed modest performance (AUC = 0.625).

Conclusion: IL-6 is a reliable marker of inflammatory severity and predictor of adverse outcomes, while LDH is more closely associated with tissue injury and bowel viability. Combined assessment of these biomarkers may improve early risk stratification and clinical decision-making in acute abdominal emergencies.

Keywords: Acute intestinal obstruction, Acute perforative peritonitis, Interleukin-6, Lactate dehydrogenase, Biomarkers.

INTRODUCTION

Acute intestinal obstruction and acute perforative peritonitis are among the most critical surgical emergencies encountered in general surgery, often associated with high morbidity and mortality despite advances in diagnostic and therapeutic strategies. These conditions represent the terminal pathway of a variety of underlying gastrointestinal pathologies, leading to inflammatory, ischemic, and metabolic disturbances that disrupt systemic homeostasis. The clinical outcome depends on the severity and duration of the insult, rapidity of diagnosis, and timely surgical intervention; however, early differentiation between reversible and irreversible injury remains challenging. In this context, biochemical markers such as Interleukin-6 (IL-6) and Lactate Dehydrogenase (LDH) have gained importance in assessing disease severity and predicting outcomes.[1,2]

Acute intestinal obstruction leads to luminal blockage, causing distension, ischemia, and potential necrosis with bacterial translocation, triggering cytokine release including IL-6. Similarly, perforative peritonitis results in peritoneal contamination and systemic inflammatory response, which may progress to sepsis and organ dysfunction. Thus, disease severity is influenced not only by local pathology but also by the host inflammatory response.[2,3]

Interleukin-6 is a key cytokine involved in the acute phase response, rising early during inflammation and correlating with disease severity. Elevated IL-6 levels have been associated with increased peritoneal contamination, hemodynamic instability, and postoperative complications, making it a valuable early prognostic marker.[3,4]

Lactate Dehydrogenase, an intracellular enzyme released during cellular injury, serves as a marker of tissue damage and hypoxia. Elevated LDH levels in intestinal obstruction and perforative peritonitis reflect ischemia, necrosis, and systemic metabolic stress, and correlate with disease severity and outcomes.[4,5]

The combined assessment of IL-6 and LDH provides insight into both inflammatory and metabolic aspects of these conditions, improving prediction of complications, sepsis, and mortality. Serial monitoring may further aid in evaluating treatment response and guiding management decisions.[5,6]

Traditional clinical and laboratory parameters have limitations in early prognostication, whereas IL-6 and LDH offer better correlation with disease severity indices and tissue injury. Their integration into clinical practice may enhance early risk stratification and outcome prediction.[6,7]

Thus, both conditions involve complex interactions between ischemia, infection, and inflammatory responses, leading to systemic complications.[8,9]

The aim of this study was to evaluate the outcome in patients of acute intestinal obstruction and acute perforative peritonitis with reference to interleukin-6 and lactate dehydrogenase.

MATERIALS AND METHODS

The prospective observational study was conducted in the Department of General Surgery at Dr. D. Y. Patil Medical College, Hospital and Research Institute, Kolhapur, over a period of 18 months. Ethical clearance was obtained from the Institutional Ethics Committee before starting the study. Consecutive sampling technique was used and 63 participants fulfilling the inclusion criteria were selected for the study.

Inclusion Criteria

Patients aged 18 years and above, with a confirmed diagnosis of acute intestinal obstruction, established through a combination of clinical presentation and supportive imaging findings, confirmed diagnosis of acute perforative peritonitis, established through clinical signs (e.g., guarding, rigidity, rebound tenderness), radiological evidence of free air, or confirmation during surgical exploration, ready to provide written informed consent.

Exclusion Criteria

Patients with significant comorbid conditions such as chronic renal failure, known malignancy, ongoing radiotherapy or chemotherapy, and collagen vascular diseases, pre-existing chronic inflammatory conditions that could confound the interpretation of IL-6 and LDH levels, those who had undergone major abdominal surgery within the preceding 30 days, those on immunosuppressive therapy or high-dose corticosteroids, pregnant women, patients with known conditions or factors that directly interfere with the accurate measurement of LDH or IL-6, unwilling to provide informed consent.

The study procedure was meticulously standardized. Upon admission of a patient with a suspected diagnosis of acute intestinal obstruction or perforative peritonitis, they were initially stabilized and managed as per the hospital's standard emergency protocol. After initial assessment, eligible patients were approached for participation. The study's nature, purpose, procedures, potential risks, and benefits were explained in detail, and written informed consent was obtained. Following consent, a pre-operative blood sample (approximately 5 ml of venous blood) was drawn under aseptic precautions. This sample was used for the analysis of IL-6, LDH, CBC, LFT, and RFT. The blood for IL-6 and LDH was centrifuged, and the serum was separated and stored at -80°C until batch analysis was performed using standardized kits (e.g., ELISA for IL-6 and spectrophotometry for LDH). The patients then underwent the necessary surgical intervention (exploratory laparotomy) as decided by the treating surgical team, independent of the study. Intra-operative findings, including the cause of obstruction or the site of perforation, were documented. Post-operatively, all patients were monitored closely in the

surgical ward or intensive care unit as required. Their clinical progress was tracked daily, and any deviation suggesting a complication or organ dysfunction was recorded. The final patient outcome (discharge or death) was noted at the end of the hospital stay.

Data was collected using a structured proforma and entered into Microsoft Excel. Statistical analysis was performed using SPSS version 27.0 Descriptive statistics were employed to summarize the demographic and clinical characteristics of the study population; continuous variables were presented as mean ± standard deviation or median with interquartile range based on their distribution, while categorical variables were expressed as frequencies and percentage. A p-value of less than 0.05 was considered statistically significant for all tests.

RESULTS

Table 1: Baseline Characteristics and Clinical Profile of Study Participants (n = 63)

Variable	Category	Acute Intestinal Obstruction (n=41)	Acute Perforative Peritonitis (n=22)	Total (n=63)	χ^2 (df)	p-value
Age Range (years)	18–30	4	6	10	4.951 (3)	0.175
	31–50	13	7	20		
	51–70	13	7	20		
	71–90	11	2	13		
Sex	Female	16	11	27	0.704 (1)	0.401
	Male	25	11	36		
Bowel Viability	Gangrenous	6	3	9	0.012 (1)	0.914
	Viable	35	19	54		
Organ Dysfunction	No	30	16	46	0.001 (1)	0.970
	Yes	11	6	17		

There was no statistically significant association between age distribution and diagnostic group (p = 0.175), although younger patients (18–30 years) were relatively more frequent in the perforative peritonitis group.

Similarly, sex distribution was comparable between the two groups, with a slight male predominance overall, and no statistically significant difference (p = 0.401).

Bowel viability also did not differ significantly between groups (p = 0.914), with the majority of patients in both groups having viable bowel.

Furthermore, the incidence of organ dysfunction was similar in both conditions, with no statistically significant association observed (p = 0.970).

Overall, these findings indicate that both diagnostic groups were comparable at baseline in terms of demographic and key clinical parameters, suggesting that subsequent outcome differences are less likely to be influenced by these factors.

Table 2: Postoperative Outcomes and Clinical Events (n = 63)

Variable	Category	Acute Intestinal Obstruction (n=41)	Acute Perforative Peritonitis (n=22)	Total (n=63)	χ^2 (df)	p-value
Postoperative Complications	No	27	15	42	0.035 (1)	0.852
	Yes	14	7	21		
Type of Complication	Anastomotic leak	1	2	3	3.262 (5)	0.660
	Intra-abdominal abscess	3	0	3		
	Respiratory complication	2	1	3		
	Sepsis	1	1	2		
	Wound infection	7	3	10		
	None	27	15	42		
ICU Admission	No	23	14	37	0.336 (1)	0.562
	Yes	18	8	26		
Mortality	Alive	37	21	58	0.532 (1)	0.466
	Died	4	1	5		

The overall rate of postoperative complications was comparable between the two groups, with no statistically significant difference (p = 0.852).

The distribution of specific types of complications, including anastomotic leak, intra-abdominal abscess, respiratory complications, sepsis, and wound infection, was also similar across both groups (p =

0.660), indicating no distinct pattern of complications associated with either condition.

ICU admission rates did not differ significantly between the groups (p = 0.562), suggesting a comparable requirement for intensive postoperative care.

Similarly, mortality rates were low and comparable in both groups, with no statistically significant difference observed (p = 0.466).

Overall, these findings indicate that both acute intestinal obstruction and acute perforative peritonitis have similar postoperative outcomes in terms of complications, ICU requirement, and mortality within this study population.

Table 3: Distribution and Comparison of Serum IL-6 and LDH Levels (n = 63)

Biomarker	Parameter	Overall (n=63)	Acute Intestinal Obstruction (n=41)	Acute Perforative Peritonitis (n=22)	Test Statistic	p-value
IL-6 (pg/mL)	Mean ± SD	109.73 ± 84.61	85.10 ± 55.53	155.64 ± 108.96	t = −2.85*	0.008
	Range (Min–Max)	19.9 – 393.2	—	—		
LDH (U/L)	Mean ± SD	605.90 ± 210.61	588.93 ± 201.21	637.55 ± 228.55	t = −0.87	0.387
	Range (Min–Max)	282 – 1083	—	—		

Welch t-test used for IL-6 (unequal variances)

Serum IL-6 levels showed wide variability, with a relatively high mean value, reflecting a predominantly moderate to severe disease population. Notably, IL-6 levels were significantly higher in patients with acute perforative peritonitis compared to those with intestinal obstruction (p = 0.008), indicating a greater degree of systemic inflammatory response in perforative peritonitis.

In contrast, serum LDH levels were also elevated across the study population, suggesting significant tissue injury and metabolic stress; however, the difference between the two diagnostic groups was not statistically significant (p = 0.387).

Overall, these findings suggest that IL-6 is a more sensitive biomarker than LDH in differentiating between acute intestinal obstruction and perforative peritonitis, while both markers reflect the underlying severity of disease.

Table 4: Comparison of Serum IL-6 and LDH Across Disease Severity (n = 63)

Severity	n	Mean IL-6 (pg/mL)	Mean LDH (U/L)
Mild	21	38.29	429.52
Moderate	27	93.95	601.89
Severe	15	238.16	860.07

- IL-6: ANOVA F (2,60) = 131.31, p < 0.001
- LDH: ANOVA F (2,60) = 43.18, p < 0.001 (Post-hoc Tukey: all pairwise comparisons significant, p < 0.001)

Serum IL-6 levels increased markedly from mild to severe cases, with severe cases showing nearly a six-fold higher mean value compared to mild cases. This difference was statistically highly significant (p < 0.001).

Similarly, serum LDH levels showed a progressive rise with increasing severity, indicating greater tissue injury and metabolic stress in more severe disease states. The differences across severity categories were also statistically highly significant (p < 0.001), with post-hoc analysis confirming significant differences between all groups.

Overall, both IL-6 and LDH exhibit a strong positive relationship with disease severity, supporting their role as important biomarkers for assessing the extent of inflammation and tissue damage in acute intestinal obstruction and perforative peritonitis.

Table 5: Association of Disease Severity with Clinical Outcomes (n = 63)

Parameter	Severity	n	Outcome Measure	Statistical Test	p-value
Postoperative Complications	Mild	21	3 (14.3%)	$\chi^2 = 5.23$ (df = 2)	0.073
	Moderate	27	12 (44.4%)		
	Severe	15	6 (40.0%)		
ICU Admission	Mild	21	4 (19.0%)	$\chi^2 = 10.64$ (df = 2)	0.005
	Moderate	27	11 (40.7%)		
	Severe	15	11 (73.3%)		
Length of Hospital Stay (days)	Mild	21	5.90	F = 37.07 (df = 2,60)	<0.001
	Moderate	27	11.48		
	Severe	15	15.73		

Fatty liver status and grade of fatty liver showed a statistically significant association with duration of diabetes. The highest mean duration of diabetes was observed in patients with bright echotexture/CLD. This suggests that liver parenchymal changes may be associated with longer diabetes duration, although

simple fatty liver grades did not show a progressive increase across Grade 1, Grade 2, and Grade 3.

Table 6: Predictive and Correlation Analysis of IL-6 and LDH (n = 63)

Analysis	Variable / Comparison	Statistic	p-value
Correlation (Pearson r)	IL-6 vs LDH	0.659	<0.001
	IL-6 vs Severity	0.864	<0.001
	LDH vs Severity	0.761	<0.001
Logistic Regression (Organ Dysfunction)	Severity (Mild vs Severe)	OR = 0.04	0.149
	Severity (Moderate vs Severe)	OR = 0.50	0.635
	IL-6 (per unit increase)	OR ≈ 1.00	0.603
	LDH (per unit increase)	OR ≈ 1.00	0.297
Model Fit	$\chi^2(4) = 11.90$; Nagelkerke $R^2 = 0.25$	—	0.018
ROC Analysis (AUC)	IL-6	0.729	—
	LDH	0.625	—
Biomarkers vs Bowel Viability	IL-6 (Gangrenous vs Viable)	t ≈ 1.10	0.295
	LDH (Gangrenous vs Viable)	t = 5.55	<0.001

Both biomarkers showed a strong positive correlation with each other and with disease severity, with IL-6 demonstrating a particularly strong correlation (r = 0.864), indicating its close association with the progression of disease.

Logistic regression analysis revealed that although the overall model was statistically significant (p = 0.018), none of the individual predictors, including IL-6 and LDH, independently predicted organ dysfunction in this cohort.

Receiver Operating Characteristic (ROC) analysis demonstrated that IL-6 had acceptable discriminatory ability for predicting organ dysfunction (AUC = 0.729), whereas LDH showed only modest performance (AUC = 0.625).

In relation to bowel viability, LDH levels were significantly higher in patients with gangrenous bowel (p < 0.001), suggesting its usefulness as a marker of tissue necrosis, while IL-6 did not show a significant difference (p = 0.295).

Overall, these findings indicate that IL-6 is a strong marker of disease severity and systemic inflammation, whereas LDH is more reflective of tissue injury and ischemia, with both biomarkers offering complementary roles in clinical assessment.

DISCUSSION

Acute intestinal obstruction and acute perforative peritonitis are among the most important surgical emergencies and are frequently associated with rapid clinical deterioration, systemic inflammatory response, bowel ischemia, septic complications, and high morbidity and mortality if diagnosis and treatment are delayed. In routine clinical practice, diagnosis and management are usually based on symptoms, clinical examination, laboratory parameters, and imaging findings; however, these methods may not always accurately reflect the degree of inflammatory burden, tissue injury, or risk of adverse outcome at the time of presentation. The aim of the present study was to evaluate the outcome in patients with acute intestinal obstruction and acute perforative peritonitis with special reference to serum interleukin-6 (IL-6) and lactate dehydrogenase (LDH), and to determine their usefulness as biochemical markers of disease severity, bowel viability, organ dysfunction, postoperative complications, ICU requirement, mortality, and length of hospital stay.

The present study showed no significant association between age, sex, bowel viability, or organ dysfunction with diagnostic group, indicating comparable baseline characteristics between acute intestinal obstruction and perforative peritonitis. Similar observations have been reported in the literature, where demographic factors play a limited role in differentiating acute abdominal conditions. Instead, studies by Sutherland et al,[10] and Ravishankaran et al,[11] emphasized that disease severity is more closely related to inflammatory and metabolic responses, particularly IL-6 levels, rather than demographic variables. Thus, the absence of baseline differences in this study supports the concept that acute abdominal pathology is primarily driven by underlying pathophysiological processes rather than patient demographics.

Postoperative complications, ICU admission, and mortality were comparable between the two diagnostic groups, with no statistically significant differences observed. This suggests that outcomes are not solely dependent on the type of pathology. Ravishankaran et al,[11] demonstrated that biomarkers such as IL-6 and lactate are more reliable indicators of prognosis in acute abdomen than diagnostic categorization alone. Similarly, Montagnana et al,[12] highlighted that clinical outcomes are influenced by the degree of ischemia and inflammatory burden. Therefore, the comparable outcomes in this study likely reflect similar severity profiles across both groups.

The study demonstrated significantly higher IL-6 levels in perforative peritonitis compared to intestinal obstruction, while LDH levels did not differ significantly. This finding indicates that IL-6 is more sensitive in reflecting the heightened inflammatory response associated with perforation. Comparable findings were reported by Gürleyik et al,[13] who observed markedly elevated IL-6 levels in perforated appendicitis, and by Sutherland et al,[10] who reported

substantial IL-6 elevation in ischemic bowel conditions. Ravishankaran et al,[11] also confirmed the strong diagnostic and prognostic utility of IL-6. In contrast, LDH appears to reflect generalized tissue injury rather than diagnosis-specific differences.

Both IL-6 and LDH showed a significant stepwise increase with increasing disease severity, highlighting their strong association with clinical progression. IL-6 demonstrated a particularly marked rise, supporting its role as a sensitive inflammatory marker. These findings are consistent with studies by Ravishankaran et al,[11] who reported high sensitivity and specificity of IL-6 in severe sepsis, and Sutherland et al,[10] who documented extreme IL-6 elevations in intestinal ischemia. Similarly, Prakash et al,[14] and Yoga et al,[15] reported higher IL-6 levels in more severe inflammatory states. The rise in LDH with severity aligns with findings by Prathapan et al,[16] indicating its association with tissue injury and necrosis.

Disease severity showed a strong association with ICU admission and length of hospital stay, while postoperative complications showed an increasing trend without statistical significance. These findings indicate that severity is a key determinant of clinical outcomes. Ravishankaran et al,[11] demonstrated that elevated IL-6 and lactate correlate with worse prognosis, supporting the present observations. Montagnana et al,[12] also emphasized the importance of early identification of severe disease to improve outcomes. The prolonged hospital stay in severe cases further highlights the clinical and resource burden associated with advanced disease.

A strong positive correlation was observed between IL-6, LDH, and disease severity, indicating that inflammatory response and tissue injury progress in parallel. IL-6 showed better discriminatory ability than LDH for predicting organ dysfunction, as reflected by ROC analysis. These findings are consistent with Ravishankaran et al,[11] who reported high prognostic accuracy of IL-6, and Sutherland et al,[10] who demonstrated significant IL-6 elevation in severe ischemic states. Logistic regression in the present study did not identify independent predictors, likely due to overlap between variables, a phenomenon also noted by Gürleyik et al,[13] and Rastgoo Haghi et al.[17] Additionally, LDH was significantly associated with bowel non-viability, supporting findings by Prathapan et al,[16] and highlighting its role as a marker of tissue necrosis.

Strength and Limitations

The present study has several strengths that enhance its clinical relevance, including the integrated evaluation of two major surgical emergencies—acute intestinal obstruction and acute perforative peritonitis—within a single framework, allowing meaningful comparison. The simultaneous assessment of serum interleukin-6 and lactate dehydrogenase provided insight into both inflammatory response and tissue injury, while structured severity categorization enabled clear demonstration of trends in biomarker levels, ICU admission, and hospital stay. Additionally, inclusion of clinically significant outcomes and advanced statistical analyses such as correlation, logistic regression, and ROC analysis strengthened the prognostic value and applicability of the findings. However, certain limitations must be considered, including the relatively small sample size and unequal group distribution, which may have reduced statistical power. The reliance on single-time biomarker measurements limited understanding of dynamic changes, and the focus on only two biomarkers may not fully capture the complexity of acute abdominal pathology. Being a single-center study, generalizability is restricted, and the absence of long-term follow-up limits assessment of extended outcomes. Furthermore, multivariable analysis did not identify independent predictors, likely due to overlapping variables and limited events. Overall, while the study provides valuable insights, the findings should be interpreted cautiously and warrant further validation.

CONCLUSION

Overall, the study concludes that diagnosis alone is insufficient to predict outcome in acute intestinal obstruction and acute perforative peritonitis. Instead, outcome is better understood through severity-linked inflammatory and tissue injury markers. IL-6 is a valuable biomarker of inflammatory severity and organ dysfunction risk, particularly because it was significantly higher in perforative peritonitis, strongly correlated with severity, and showed acceptable predictive value for organ dysfunction. LDH is an important marker of tissue injury and bowel gangrene, particularly because it rose significantly with severity and was markedly elevated in gangrenous bowel. Therefore, combined interpretation of IL-6 and LDH, along with clinical severity assessment, can improve early risk stratification, help identify patients at risk of organ dysfunction or gangrenous bowel, support ICU triage, and provide better prognostic evaluation in patients with acute intestinal obstruction and acute perforative peritonitis.

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