



Original Article

A Study of Serum LDH Levels in Intestinal Obstruction as a Predictor of Bowel Gangrene

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ABSTRACT

Background: Intestinal obstruction is a common surgical emergency, and early detection of bowel gangrene is crucial to reduce morbidity and mortality. Serum Lactate Dehydrogenase (LDH) has been proposed as a potential biochemical marker for bowel ischemia.

Aim: To evaluate the role of serum LDH levels as a predictor of bowel gangrene in patients with intestinal obstruction.

Materials and Methods: This prospective observational study was conducted on 51 patients with intestinal obstruction undergoing surgical intervention over one year. Serum LDH levels were measured at admission and correlated with intraoperative findings. Statistical analysis was performed using the Chi-square test and Student's t-test, with $p < 0.05$ considered significant.

Results: Out of 51 patients, 18 (35.3%) had bowel gangrene. Mean serum LDH levels were significantly higher in patients with gangrene (734.44 ± 245.21 U/L) compared to those without (330.48 ± 125.62 U/L) ($p < 0.05$). A strong correlation was observed between increasing LDH levels and bowel gangrene. Notably, all patients with LDH >800 IU/L had gangrenous bowel.

Conclusion: Serum LDH is a simple, cost-effective, and useful predictor of bowel gangrene in intestinal obstruction. Elevated LDH levels, especially >800 IU/L, can aid in early diagnosis and timely surgical management.

Keywords: Intestinal obstruction, Serum LDH, Bowel gangrene, Ischemia, Biomarker.

INTRODUCTION

Intestinal obstruction is a common and potentially life-threatening surgical emergency characterized by the interruption of the normal flow of intestinal contents. It accounts for a significant proportion of acute abdominal conditions requiring hospital admission and surgical intervention. Despite advances in diagnostic modalities and surgical techniques, intestinal obstruction continues to be associated with considerable morbidity and mortality, particularly when complicated by bowel ischemia and gangrene [1].

The etiology of intestinal obstruction varies across different populations. Postoperative adhesions are the most common cause in developed countries, while obstructed hernias, malignancies, and volvulus are also significant contributors, especially in developing regions [2,3]. Clinically, patients usually present with abdominal pain, distension, vomiting, and obstipation. However, these symptoms are often non-specific and do not reliably indicate the severity of obstruction or the viability of the bowel [4].

The most critical factor determining prognosis in intestinal obstruction is the early identification of bowel ischemia and gangrene. Delayed diagnosis may lead to irreversible bowel necrosis, perforation, sepsis, and increased mortality rates

[5]. Therefore, timely recognition of compromised bowel viability is essential for appropriate surgical decision-making and improved outcomes.

Although imaging modalities such as plain abdominal radiography, ultrasonography, and contrast-enhanced computed tomography (CECT) are widely used in the evaluation of intestinal obstruction, their ability to accurately predict bowel ischemia in the early stages remains limited [6]. As a result, there has been growing interest in identifying reliable biochemical markers that can aid in the early detection of bowel compromise.

Serum Lactate Dehydrogenase (LDH) is an intracellular enzyme involved in anaerobic glycolysis, and its levels increase in response to tissue hypoxia and cellular necrosis. Elevated LDH levels have been reported in various ischemic conditions, including myocardial infarction, hemolysis, and intestinal infarction [7,8]. In the setting of intestinal obstruction, compromised blood supply to the bowel leads to anaerobic metabolism and release of LDH into the circulation, suggesting its potential role as a marker of bowel ischemia.

Several studies have explored the role of LDH as a predictor of bowel viability, with findings indicating a correlation between elevated LDH levels and intestinal ischemia or gangrene [9–11]. However, the clinical utility of LDH as a reliable and early predictor of bowel gangrene remains a subject of ongoing research, particularly in resource-limited settings where advanced imaging techniques may not be readily available.

Therefore, the present study was undertaken to evaluate the role of serum LDH levels in patients with intestinal obstruction and to determine its effectiveness as a predictor of bowel gangrene by correlating preoperative LDH levels with intraoperative findings.

MATERIALS AND METHODS

Study Design and Setting

This was a non-randomised prospective observational study conducted in the Department of Surgery at Maharana Bhupal Government Hospital, attached to Rabindranath Tagore Medical College, Udaipur, Rajasthan. The study was conducted over 1 year, from January 1, 2022, to December 31, 2022.

Study Population

The study included patients admitted to the surgical wards with a clinical diagnosis of **intestinal obstruction** who subsequently underwent surgical intervention.

Inclusion Criteria

- Patients presenting with clinical features suggestive of intestinal obstruction and **undergoing surgical management**.

Exclusion Criteria

- Patients with intestinal obstruction managed **conservatively**.
- **Pregnant women**.
- Patients aged **less than 12 years**.

Data Collection

All patients fulfilling the inclusion and exclusion criteria were enrolled in the study after detailed clinical evaluation. A thorough history was obtained, including **time of onset and duration of symptoms**, and a complete physical examination was performed.

Laboratory Investigations

Blood samples were collected from all patients **at the time of admission**, before any surgical intervention. **Serum Lactate Dehydrogenase (LDH)** levels were estimated for each patient using standard laboratory methods.

Intraoperative Assessment

All patients underwent surgical exploration. Intraoperative findings were recorded carefully, and the serum LDH levels were correlated with intraoperative bowel pathology, including the presence or absence of bowel ischemia, strangulation, or necrosis.

Outcome Measures

The primary objective was to assess the **association between preoperative serum LDH levels and intraoperative findings** in cases of intestinal obstruction.

Statistical Analysis

Data were entered and analyzed using Microsoft Excel (version 10) and SPSS (Statistical Package for Social Sciences) version 16.

- Categorical variables were expressed as frequency and percentage and analyzed using the Chi-square test.
- Continuous variables were presented as mean \pm standard deviation (SD) and compared using the Student's t-test.
- A p-value < 0.05 was considered statistically significant.

RESULT AND OBSERVATIONS

Table 1. Age and Gender Distribution of Patients

Variable	Category	No. of Patients	Percentage (%)	P value
Age (years)	<20	3	6.0	
	20–40	15	30.0	
	41–60	15	30.0	
	61–80	18	36.0	0.560*
	Total	50	100	
Gender	Male	27	52.9	
	Female	24	47.1	0.464*
	Total	51	100	

Test used: Chi-square test; $P > 0.05$ (Not Significant)

Table 2. Chief complaints

Chief complaints	No. of patients	%
Abdominal pain	51	100.0
Obstipation	48	94.1
Vomiting	28	54.9
Irreducible swelling	8	15.7

The chief complaint was abdominal pain in all patients (100%) followed by obstipation (94.1%) and vomiting (54.9%). 15.7% patients presented with irreducible swelling.

Table 3. Duration of symptoms

Duration	No. of patients	%
≤ 2 days	8	15.7
> 2 days	43	84.3
Total	51	100.0

84.3% of patients presented to the hospital >48 hours of onset of symptoms and 15.7% in 24 to 48 hours.

Table 4. Intra-operative findings

Intra-op. Findings	No. of patients	%
Adhesive band	7	13.7
Adhesive intestinal obstruction	9	17.6
Gangrenous bowel	18	35.29
Malignant growth	5	9.8
Median arcuate ligament compressing celiac artery	1	2.0
Obstructed hernia	5	9.8
Obstruction followed by perforation	2	3.9
Volvulus	4	7.8
Total	51	100.0

Table 5. Correlation of Bowel Gangrene with LDH

Bowel Gangrene	LDH						Total
	0-200	201-400	401-600	601-800	801-1000	>1000	
No	1 (100.0%)	24 (96.0%)	7 (53.8%)	1 (25.0%)	0 (0.0%)	0 (0.0%)	33 (64.7%)
	0 (0.0%)	1 (4.0%)	6 (46.2%)	3 (75.0%)	6 (100.0%)	2 (100.0%)	18 (35.3%)
Total	1 (100.0%)	25 (100.0%)	13 (100.0%)	4 (100.0%)	6 (100.0%)	2 (100.0%)	51 (100.0%)

Chi-square value = 29.365 P<0.05

Table 6. Comparison of LDH

Bowel Gangrene	LDH (U/L)	P value
No	330.48±125.62	<0.05
Yes	734.44±245.21	

Table 7. Correlation with Bowel Gangrene with High LDH

Bowel gangrene	LDH<800U/L	LDH>800U/L	Total	p-value
Yes	10 (55.56%)	8 (44.45%)	18	<0.05
No	32 (100%)	0	32	

DISCUSSION

Intestinal obstruction remains a major cause of acute abdomen, and its clinical outcome is largely dependent on the early identification of bowel ischemia and gangrene. The present study evaluated serum LDH as a biochemical predictor of bowel gangrene, and the findings correlate well with both pathophysiological mechanisms and previously published literature.

In this study, the highest number of patients belonged to the 61–80 years age group (36%), although the association between age and intestinal obstruction was not statistically significant ($p > 0.05$). Similar age distributions have been reported in earlier studies, where elderly patients are more commonly affected due to higher incidence of adhesions, malignancy, and comorbidities [2,4]. The nearly equal gender distribution observed in this study is consistent with previous findings indicating no strong gender predilection for intestinal obstruction [3].

Clinically, abdominal pain was the most common presenting complaint (100%), followed by obstipation (94.1%) and vomiting (54.9%). These findings are in agreement with classical descriptions of intestinal obstruction reported in the literature [4,5]. However, these symptoms are non-specific and do not differentiate between simple obstruction and complicated cases with bowel ischemia or gangrene.

A significant observation in this study was that 84.3% of patients presented more than 48 hours after the onset of symptoms. Delayed presentation is a well-known factor associated with increased risk of bowel ischemia, necrosis, and poor outcomes [6]. This delay likely contributed to the relatively high incidence of bowel gangrene (35.29%) observed intraoperatively in the present study.

Regarding etiology, adhesions (both bands and adhesive obstruction) were the most common causes, followed by obstructed hernias, malignancy, and volvulus. These findings are consistent with earlier studies that identify postoperative adhesions as the leading cause of intestinal obstruction, particularly in adults [2,3].

The most important finding of this study was the strong and statistically significant association between elevated serum LDH levels and bowel gangrene. The distribution of LDH levels demonstrated a clear trend, where the proportion of gangrenous bowel increased progressively with rising LDH values. At lower LDH levels (0–400 U/L), most patients had viable bowel, whereas at higher levels (>600 U/L), the likelihood of gangrene increased substantially. Notably, all patients with LDH levels greater than 800 U/L had gangrenous bowel, indicating a very high predictive value.

The Chi-square analysis ($\chi^2 = 29.365$, $p < 0.05$) confirmed a statistically significant association between LDH levels and bowel gangrene. Furthermore, the mean serum LDH level in patients with gangrene (734.44 ± 245.21 U/L) was significantly higher than in those without gangrene (330.48 ± 125.62 U/L). These findings are consistent with the role of LDH as a marker of tissue hypoxia and cellular necrosis, as described in biochemical and clinical studies [7,8].

The analysis of LDH cut-off values revealed that LDH >800 U/L is highly specific for bowel gangrene, as none of the patients without gangrene had LDH levels above this threshold. Although some patients with gangrene had LDH values below 800 U/L, indicating limited sensitivity, this threshold can still be considered a strong indicator for the presence of bowel necrosis. Similar findings have been reported by Kocer et al., who identified elevated LDH as a significant predictor of bowel ischemia in patients with obstruction [9].

Evennett et al., in a systematic review of biomarkers for intestinal ischemia, also emphasized the potential role of LDH as a useful adjunct in the diagnosis of bowel ischemia, although they highlighted its lack of specificity when used alone [10]. Acosta and Björck further supported the importance of early biochemical markers in improving outcomes in intestinal ischemia [11].

However, it is important to note that LDH is a non-specific enzyme and may be elevated in other conditions such as liver disease, hemolysis, and myocardial infarction [7]. Therefore, while elevated LDH levels—particularly above 800 U/L—strongly suggest bowel gangrene, they should be interpreted in conjunction with clinical findings and imaging studies. Overall, the findings of this study demonstrate that serum LDH is a simple, cost-effective, and readily available biomarker that shows a strong correlation with bowel gangrene. Its use can aid in early diagnosis, risk stratification, and timely surgical intervention, especially in resource-limited settings where advanced imaging modalities may not be easily accessible.

CONCLUSION

Serum Lactate Dehydrogenase (LDH) is a simple, cost-effective, and clinically useful biomarker for predicting bowel gangrene in patients with intestinal obstruction. The present study demonstrates a strong and statistically significant correlation between elevated serum LDH levels and the presence of bowel ischemia and gangrene.

Patients with gangrenous bowel had significantly higher mean LDH levels compared to those with viable bowel, and notably, LDH values >800 U/L were highly specific for bowel gangrene. Although LDH alone is not entirely sensitive and may be elevated in other conditions, its use in conjunction with clinical assessment and radiological findings can enhance early diagnosis. Thus, serum LDH can serve as an important adjunct in the early identification of high-risk patients, facilitating timely surgical intervention and potentially reducing morbidity and mortality associated with intestinal obstruction.

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