

Role of Serum Lactate in Predicting Strangulation in Intestinal Obstruction: A Prospective Study in Southern Part of Odisha

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Abstract:

Background: Strangulation is one of the grave complications of intestinal obstruction that requires emergency laparotomy. Time is an essence, with an earlier diagnosis of strangulation favouring increased patient's survival. Lactic acid is the normal endpoint of the anaerobic breakdown of glucose in the tissues. L-lactate and D-lactate are the two optical isomeric forms of lactate. D-lactate is not produced in mammalian tissue, but it is detected in a situation of an abnormal proliferation of enteral bacterial flora due to mucosal injury following mesenteric ischemia.

Aim and Objective: The aim of this prospective observational study is to evaluate the role of Serum Lactate as an early marker of strangulation in bowel obstruction

Patients and Methods: 50 cases admitted in Emergency General Surgery Ward M K C G Medical college, Berhampur with clinical suspicion of intestinal obstruction for a period of one year (November 2022 to October 2023). Blood samples are taken at the time of presentation in the emergency within 20 minutes of their arrival and sent to the Dept of Biochemistry for estimation of serum lactate. Assessment and comparison of serum lactate levels in various outcomes of intestinal obstruction is done

Results: In this study a group of 50 cases of intestinal obstruction with no comorbidities had been taken for assessment of various outcomes of obstruction and their relation to levels of serum lactate. Out of 50 patients, 72% had strangulation and bowel gangrene as intra-op findings and the rest were simple obstruction. The mean serum lactate value in the patients was 5.16 mmol/L ranging between 1.70 to 8.60 mmol/L. The cut off values of strangulation, simple obstruction and those subacute cases managed conservatively were 4.3, 3.4 and less than 2.3 respectively. Based on these values, 72% were classified strangulation, 22% with strong suspicion and 6% of them were normal.

Conclusion: A positive correlation between elevated serum lactate and strangulation bowel obstruction had been established via this study. Further studies incorporating various biomarkers and their correlation with clinical presentation and radiological findings should be sought. Such studies would help in reducing the time interval to surgery in cases of acute intestinal obstruction with strangulation as well as decreasing unwarranted laparotomy in those cases of intestinal obstruction without strangulation that can be managed conservatively depending on other parameters and clinical findings. These biomarkers can be made readily available in the emergency setting after due consideration given to their clinical relevance at the institutional level. This study does add to the current literature regarding the need of decision-making policy for management of acute intestinal obstruction incorporating the role of biomarkers for predicting strangulation at the time of presentation.

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Introduction

Intestinal obstruction is one of the commonest clinical problems encountered in surgical practice. Strangulation is one of the grave complications of

intestinal obstruction that requires emergency laparotomy. Ischemia, that complicates 7 to 42% of bowel obstructions, significantly increases

mortalities associated with bowel obstruction Time is an essence, with an earlier diagnosis of strangulation favouring increased patient's survival.

The diagnosis of strangulation is primarily clinical with a sudden onset of pain i.e., continuous rather than colicky, the early appearance of shock, and the presence of fever, tachycardia, marked abdominal tenderness, guarding, rebound tenderness and a tender abdominal mass are all in Favor of the diagnosis of strangulation. Various biochemical markers such as serum tumour necrosis factor α , C reactive protein, interleukin 6, lactate, intestinal fatty acid binding protein (I-FABP), creatine kinase B, isoenzymes of lactate dehydrogenase have been studied.

Therefore, studies investigating the role of biomarker in predicting strangulation patients of acute bowel obstruction are needed. Lactic acid is the normal endpoint of the anaerobic breakdown of glucose in the tissues. L-lactate and D-lactate are the two optical isomeric forms of lactate. L – lactate is the final end product of anaerobic glycolysis. During this process it is formed out of pyruvic acid by the enzyme lactate dehydrogenase (LDH). During ischemia the cells will start anaerobic dissimilation and the serum lactate rises. D-lactate is not produced in mammalian tissue, but it is detected in a situation of an abnormal proliferation of enteral bacterial flora due to mucosal injury following mesenteric ischemia.

Aim and Objective of the Study: The aim of this prospective observational study is to evaluate the role of Serum Lactate as an early marker of strangulation in bowel obstruction

Materials:

50 cases admitted in Emergency General Surgery ward with clinical suspicion of intestinal obstruction for a period of one year (November 2022 to October 2023).

Inclusion criteria:

1. Patients of age group > 12 years and both sexes.
2. Patients with clinical suspicion of acute intestinal obstruction.

Exclusion criteria:

Patients with co-existing medical illness such as chronic kidney disease, diabetes mellitus, any cardiac ailment and coagulopathies as they lead to false positive results.

Patients with any intraoperative finding apart from simple or strangulated bowel obstruction

Methods:

Written and informed consent will be sought. Blood samples are taken at the time of presentation in the emergency within 20 minutes of their arrival and sent to the Dept of Biochemistry for estimation of serum lactate. Assessment and comparison of serum lactate levels in various outcomes of intestinal obstruction is done.

Results and Data Analysis:

Symptoms

The following table and figure show the symptoms of the patients. All of them had tenderness, eight (16%) of them had shock, 35 (70%) had guarding and 32 (64%) of they had exaggerated bowel sounds.

Table 1: Symptoms

Symptom	Frequency	Percentage
Shock	8	16
Tenderness	50	100
Guarding	35	70
Bowel Sounds		
Absent	18	36
Exaggerated	32	64

Diagnosis: The following table shows the diagnosis of the patients.

Table 2: Diagnosis

Diagnosis	Frequency	Percent
Acute Intestinal Obstruction	21	42.0
Obstructed Incisional Hernia	6	12.0
Obstructed Left Inguinal Hernia	4	8.0
Obstructed Recurrent Incisional Hernia	1	2.0
Obstructed Right Inguinal Hernia	6	12.0
Obstructed Right Paraumbilical Hernia	1	2.0
Obstructed Umbilical Hernia	6	12.0
Subacute Intestinal Obstruction	5	10.0
Total	50	100.0

Etiology: Out of the 50 cases of obstruction, 40% are due to hernia, 12% are due to adhesive bands and 6% are due to postoperative adhesions.

Table 3: Etiology

Intraoperative Findings	Frequency	Percent
Postoperative Adhesions	4	8.0
Adhesion Bands	6	12.0
Hernia	40	80
Total	50	100.0

Level of Obstruction: Out of the 50 cases, 96% are small bowel obstruction and remaining 4% are large bowel obstruction.

Table 4: Level of Obstruction

Level of obstruction	Frequency	Percent
Small Bowel	48	96
Large Bowel	2	4

Strangulation: Out of 50 patients, 72% of them (n=36) had strangulation while the rest had no strangulation.

Serum Lactate Level: The mean serum lactate level in the patients are 5.16 mmol/L (S. D=1.708) ranging between 2-9 mmol/L.

Table 5: Serum Lactate Level

Characteristic	Serum lactate mmol/L
Mean	5.16
Median	5.30
Mode	6
Std. Deviation	1.708
Minimum	2
Maximum	9

Classification of Patients Based on Serum Lactate Values: Based on the serum lactate levels, 72% of them were classified as strangulation, 6% of them as normal and 22% of them with strong suspicion.

Table 6: Classification

Classification	Frequency	Percent
Normal	3	6.0
Strangulation	36	72.0
Strong Suspicion	11	22.0
Total	50	100.0

Table Classification of Patients Based on Serum Lactate Level

Comparison of Serum Lactate Classification with Actual Strangulation: Chi-square analysis shows that serum lactate levels significantly differ in groups with and without strangulation.

Table 7: Chi-Square Analysis

		Strangulation		Total	Chi-Square p-value
		Present			
Classification	Normal	No	Yes	3	50.00 P=0.00653
		Strangulation	0		
strong suspicion	11	0	11		
Total		14	36	50	

Comparison of Serum Lactate Values between Different groups: Kruskal-Wallis Test for comparison of serum lactate values across the three groups with normal, strangulation and strong suspicion shows that the results are significant with a chi-square value of 30.23 with $p=0.00123$ (highly significant).

Table 8: Comparison of Serum Lactate Values Between Different Groups

	Normal	Strong Suspicion	Strangulation
Patients	3	11	36
Mean	1.8333	3.4091	5.9722
Median	1.8000	3.6000	5.6000
Mode	1.70 ^a	3.50 ^a	5.60
Std. Deviation	.15275	.61230	1.17731

Minimum	1.70	2.10	4.60
Maximum	2.00	3.90	8.60

Discussion

Acute intestinal obstruction possess strangulation as a grave complication and requires prompt diagnosis [3] This is easier said than done, especially in an emergency setting. Acute intestinal obstruction with reported mortality rates have found association with delay in surgical management with progression to strangulation in many cases [3,4].

Most of the lactate found in the human body is L – lactate. Van Noord⁸ et al studied 49 patients with chronic gastrointestinal ischemia and found that L – lactate elevation was significantly increased as compared with the non-ischaemic group. Markogiannakis [1] et al and Mahmut B [9] et al had also reported finding in favour of serum lactate as predictor of ischemia and strangulation.

In this study a group of 50 cases of intestinal obstruction with no comorbidities had been taken for assessment of various outcomes of obstruction and their relation to levels of serum lactate. Out of the 50 cases, 96% were small bowel obstruction and 4% were large bowel obstruction with a mean age of distribution 54.44 years. About 36% of the sample had previous history of surgery of which 6% had postoperative adhesions causing obstruction or strangulation.

With regard to operative findings, hernia and adhesions were the most common findings. Out of 50 patients, 72% had strangulation and bowel gangrene as intraop findings and the rest were simple obstructions. The mean serum lactate value in the patients was 5.16 mmol/L ranging between 1.70 to 8.60 mmol/L. The cut off values of strangulation, simple obstruction and those subacute cases managed conservatively were 4.3, 3.4 and less than 2.3 respectively. Based on these values, 72% were classified as strangulation, 22% with strong suspicion and 6% of them were normal. Kruskal-Wallis test for comparison of serum lactate values across the three groups with normal, strong suspicion and strangulation shows that the results are significant with a chi-square value of 30.23 with $p=0.00123$ (highly significant).

The study has shown that serum lactate levels were significantly raised in strangulated bowel obstruction as compared with simple bowel obstruction. The main strength of this study lies in the fact that it is a prospective study with applicability in an emergency setting in a developing country, where availability of computed tomography (CT) and other costly biomarkers is beyond the reach of poor patients. Also, this study included both small and large bowel obstruction.

Conclusion

A positive correlation between elevated serum lactate and strangulation bowel obstruction had been established via this study. Further studies incorporating various biomarkers and their correlation with clinical presentation and radiological findings should be sought. Such studies would help in reducing the time interval to surgery in cases of acute intestinal obstruction with strangulation as well as decreasing unwarranted laparotomy in those cases of intestinal obstruction without strangulation that can be managed conservatively depending on other parameters and clinical findings.

These biomarkers can be made readily available in the emergency setting after due consideration given to their clinical relevance at the institutional level. This study does add to the current literature regarding the need of decision-making policy for management of acute intestinal obstruction incorporating the role of biomarkers for predicting strangulation at the time of presentation.

Bibliography:

1. Sabiston textbook of surgery. The biological basis of modern surgical practice, 20th edition 2016. Chapter 45: Acute abdomen 1120-1138.
2. Maingot's abdominal operations, 13th edition, chapter 38: Small bowel obstruction.
3. Shackelford's surgery of the alimentary tract, chapter 72 : Small bowel obstruction
4. Bailey & Love's Short practice of surgery, 27th edition, Chapter 71: Intestinal obstruction. 1280-1299
5. Hamilton Bailey's Emergency surgery, 13th edition, Chapter 37: Intestinal obstruction-general principles. 420-445
6. van Noord D, Mensink PB, de Knecht RJ, Ouwendijk M, Francke J, van Vuuren AJ, Hansen BE, Kuipers EJ. Serum markers and intestinal mucosal injury in chronic gastrointestinal ischemia. Dig Dis Sci. 2011 Feb; 56(2):506-512.
7. Markogiannakis H, Messaris E, Dardamanis D, Pararas N, Tzertzemelis D, Giannopoulos P, Larentzakis A, Lagoudianakis E, Manouras A, Bramis
8. Acute mechanical bowel obstruction: clinical presentation, etiology, management and outcome. World J Gastroenterol. 2007 Jan 21; 13(3):432-437.
9. Mahmut B, Ahmet B, Ahmet K, Akçay F, Selçuk SA. Serum D-lactate and nitric oxide (NO) levels in acute intestinal ischemia. Tr J Med Sci. 1999; 29:37-40.