

Original Research Article

A Prospective Study on Serum Lactate For Early Prediction of Strangulation in Intestinal Obstruction in A Single Institution

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ABSTRACT

Background - Laboratory tests are essential in patients with bowel obstruction because they may aid in the diagnosis and more importantly any underlying metabolic defects should be corrected prior to operative therapy. While no test is sensitive and specific enough to diagnose mesenteric ischemia reliably, a spectrum of laboratory tests may be helpful in determining the condition of the patient and should guide resuscitation. Arterial blood pH, serum lactate concentrations and amylase and lactic dehydrogenase activity may be useful tests in the evaluation of bowel obstruction, especially when trying to exclude the presence of strangulation or underlying bowel necrosis. An increase in serum lactate concentrations should raise the suspicion of intestinal ischemia. Intestinal fatty acid binding protein (I-FABP) is a highly sensitive marker for extensive mesenteric infarction. **Material and Methods** - The aim of this prospective observational study is to evaluate the role of Serum Lactate as a marker of strangulation in bowel obstruction. 50 cases admitted in Emergency General Surgery ward , S.C.B. Medical College, Cuttack with clinical suspicion of intestinal obstruction for a period of 6 months (February 2021 to Feb 2022). Assessment and comparison of serum lactate levels in various outcomes of intestinal obstruction is done. **Results** - The mean serum lactate value in the patients were 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). **Conclusion** - A positive correlation between elevated serum lactate and strangulation bowel obstruction had been established , i.e. serum lactate levels were significantly raised in strangulated bowel obstruction as compared with simple bowel obstruction.

Key words – Intestinal obstruction, Strangulation, Serum Lactate level.

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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 [1]. Ischemia, that complicates 7 to 42% of bowel obstructions, significantly increases mortalities associated with bowel obstruction [2]. Time is an essence, with an earlier diagnosis of strangulation favoring 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 [3]. Various biochemical markers such as serum tumor 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 in patients of acute bowel obstruction are needed [4]. 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 [5, 6, 7].

AIMS & OBJECTIVES

The aim of this prospective observational study is to evaluate the role of Serum Lactate as a marker of strangulation in bowel obstruction.

MATERIAL & METHODS

DESIGN OF STUDY

Non randomized prospective observational study

SAMPLE SIZE

50 cases admitted in Emergency General Surgery ward , S.C.B. Medical College, Cuttack with clinical suspicion of intestinal obstruction for a period of 6 months (February 2021 to Feb 2022)

INCLUSION CRITERIA:

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

EXCLUSION CRITERIA

1. 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.
2. Patients with any intraoperative finding apart from simple or strangulated bowel obstruction

METHODOLOGY

• Patients with clinical suspicion of acute intestinal obstruction who are admitted in Department of General Surgery are chosen (by criteria mentioned above), who may undergo laparotomy. 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 by eliciting comorbid history and its duration. Blood sample will be collected and sent to the Department of Biochemistry for separation of sera by centrifugation and storage in sterile vials at -20 degree Celsius and measurement of serum lactate levels are done. Assessment and comparison of serum lactate levels in various outcomes of intestinal obstruction is done

☑ Normal serum lactate value is less than 2mmol/L

☑ Cut off value for strangulation is 4mmol/L

☑ Values between 2-4mmol/L indicates strong suspicion

OBSERVATION & RESULTS

TABLE 1 : AGE DISTRIBUTION

The mean age of the patients is 54.44 years with standard deviation of 16.13 years, ranging between 15 years to 86 years. The following table the age distribution of the participants.

Characteristics	Age in years
Mean	54.44
Median	54.00
Mode	65
Standard Deviation	16.134
Minimum	15
Maximum	86

TABLE 2 : GENDER DISTRIBUTION

Out of 50 patients, 29 (58%) of them are males and 21 (42%) of are females.

Gender	Frequency	Percentage (%)
Female	21	42
Male	29	58
Total	50	100

TABLE 3 : SYMPTOMS

The following table and figure shows 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.

Symptom	Frequency	Percentage (%)
Shock	8	16
Tenderness	50	100
Guarding	35	70
Bowel sounds		
Absent	18	36
Exaggerated	32	64

TABLE 4 : DIGITAL RECTAL EXAMINATION

The digital rectal examination shows that it was roomy in 24 (48%) of the patients while in 26 (52%) of the patients, it was empty.

Digital Rectal Examination	Frequency	Percentage (%)
Empty	26	52
Roomy	24	48
Total	50	100

COMORBIDITIES

None of them had any comorbidity

HISTORY OF PREVIOUS SURGERY

Around 36% (n=18) of the patients had history of previous surgery.

TABLE 5 : DIAGNOSIS

The following table shows the diagnosis of the patients.

Diagnosis	Frequency	Percentage (%)
Acute Intestinal Obstruction	21	42
Obstructed Incisional Hernia	6	12
Obstructed Left Inguinal Hernia	4	8
Obstructed Recurrent Incisional Hernia	1	2
Obstructed Right Inguinal Hernia	6	12
Obstructed Right Para-umbilical Hernia	1	2
Obstructed Umbilical Hernia	6	12
Sub-acute Intestinal Obstruction	5	10
Total	50	100

TABLE 6 : 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.

Intra-operative Findings	Frequency	Percentage (%)
Post-operative adhesions	4	8
Adhesion Bands	6	12
Hernia	40	80
Total	50	100

TABLE 7 : LEVEL OF OBSTRUCTION

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

Level of obstruction	Frequency	Percentage (%)
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.

TABLE 8 : 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.

Characteristic	Serum Lactate Level (mmol/L)
Mean	5.16
Median	5.30
Mode	6
Standard Deviation	1.708
Minimum	2
Maximum	9

TABLE 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.

Classification	Frequency	Percentage (%)
Normal	3	6
Strangulation	36	72
Strong Suspicion	11	22
Total	50	100

TABLE 10 : CHI-SQUARE ANALYSIS - (COMPARISON OF SERUM LACTATE CLASSIFICATION WITH ACTUAL STRANGULATION)

Chi-square analysis shows that serum lactate levels significantly different in groups with and without strangulation.

		Strangulation Present		Total	Chi-Square p-value
		No	Yes		
Classification	Normal	3	0	3	50 P=0.00653 Highly Significant
	Strangulation	0	36	36	
	Strong Suspicion	11	0	11	
Total		14	36	50	

TABLE 11 : 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).

	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

Standard Deviation	0.15275	0.61230	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. 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.

Most of the lactate found in the human body is L – lactate. Van Noord studied 49 patients with chronic gastrointestinal ischemia and found that L – lactate elevation was significantly increased as compared with the nonischaemic group [8]. Markogiannakis et al had also reported finding in favour of serum lactate as predictor of ischemia and strangulation [9].

In present 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 intra-op findings and the rest were simple obstructions. The mean serum lactate value in the patients were 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 present 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.

LIMITATIONS

1. Study participants were less in number
2. Patients of paediatric age group were not a part of this study

3. Only serum lactate had been studied as a marker which is naturally inferior when compared to a study with combination of other parameters
4. D-lactate had not been studied due to the high cost of the kit
5. Radiological, postoperative outcome, length of hospital stay and follow up were not assessed by markers with regard to diagnosis of strangulation.

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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Conflict of Interest – None declared

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