Research Article

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A study of preoperative predictive factors of strangulation in acute small intestinal obstruction

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ABSTRACT

Background: Acute small intestinal obstruction is a common surgical emergency where outcomes are often influenced by the presence of strangulation. Identification of criteria which can predict strangulation among patients presenting with acute small intestinal obstruction can help in early decision making regarding management and thereby can ensure better outcomes. A prospective observational study was carried out among 54 patients presenting with acute small intestinal obstruction to document clinically the signs and symptoms which can predict strangulation early along with laboratory parameters and findings on imaging using ultrasound and color doppler.

Methods: A delayed presentation beyond 72 hours with bleeding per rectum and fever along with marked tachycardia with hypotension were the significant criteria observed among patients with strangulated obstruction.

Results: On laboratory evaluation, leukocytosis with an elevated serum lactate was significant in strangulated obstruction whereas on imaging ultrasound abdomen supplemented with a color doppler proved to be an investigation of choice in predicting strangulation.

Conclusions: A combination of clinical, laboratory and imaging criteria can be useful in predicting strangulation among patients presenting with acute small intestinal obstruction thereby ensuring an early surgical intervention and better outcomes.

Keywords: Intestinal Obstruction, Color doppler

INTRODUCTION

Acute intestinal obstruction is a common surgical emergency with small bowel obstruction being the most common cause accounting for more than 80% of the cases.¹

Obstructed hernias had been the commonest cause for acute intestinal obstruction in the past. In the recent times with increase in the number of laparotomies performed for various reasons, post-operative adhesions has been the most common cause documented.

The most critical factor affecting the outcome among these patients is whether obstruction has progressed to the point of strangulation or not.²

The accurate and early recognition of the presence of intestinal strangulation in patients with mechanical bowel obstruction is important to plan an early exploratory laparotomy as delayed diagnosis and intervention can result in higher incidence of postoperative morbidity and mortality.²⁻⁴

Although advances in diagnosis and management have reduced the mortality rate of simple intestinal obstruction

to a range of 3-7% but the mortality for strangulated obstruction continues to be in range of 20-30%.⁵

Identification of defined clinical criteria predictive of strangulation among patients with small bowel obstruction will allow an early decision making regarding exploratory laparotomy and thereby can lead to improved outcomes. Several laboratory parameters which can predict strangulation like serum amylase, serum lactate, serum LDH have been investigated though none of them have been proved to be neither sensitive nor specific. Imaging wise only CT scan has been proved to be of some value in the detection of strangulation among patients with small bowel obstruction but most often it is not a readily available investigation and it often predicts strangulation only after irreversible ischemia has already set in. 1

Plain X ray abdomen erect with multiple air fluid levels can establish the diagnosis of obstruction but is not useful in predicting strangulation ultrasound of the abdomen with doppler remains a less explored modality in patients presenting with acute small intestinal obstruction. Inspite of its limitations in evaluating the patients with intestinal obstruction it can be a useful tool not only in identifying the cause but also in predicting strangulation when combined with a doppler. Since it is a widely available investigation that can recognize strangulation early in patients with Intestinal Obstruction it can be made use of during evaluation and management, thereby decreasing postoperative morbidity and mortality to a larger extent.

In the present study an assessment of comprehensive array of clinical, biochemical and radiological parameters was carried out that could predict strangulation preoperatively among patients with acute small intestinal obstruction.

The objective of this study was to study the symptomatology on history and clinical signs on physical examination in patients presenting with acute small intestinal obstruction that would predict strangulation. And study the biochemical markers and classical findings on imaging which would suggest strangulation among patients with Acute Small Intestinal Obstruction.

METHODS

A prospective observational study was conducted in the department of general surgery, Gandhi hospital, Secunderabad, tertiary care hospital in the state of Telangana. The study was carried out for a period of 2 years from January 2014 to October 2015.

Methodology

All the patients presenting with suspected acute small intestinal obstruction to the emergency surgical ward were included in the study. The patients were initially evaluated symptomatically based on the history and

further by clinical signs on physical examination. Later these patients were subjected to plain X-ray abdomen erect to document multiple air fluid levels suggestive of intestinal obstruction followed by an ultrasound abdomen to look for the possible cause by using the probe in a lateral direction to avoid the hampering of imaging by bowel gases. Color Doppler was employed to look at the decreased blood flow in the mesenteric vessels which can predict strangulation.

Though ultrasound is routinely done in patients presenting with acute abdomen its role in acute intestinal obstruction was often uncertain as the bowel gases interfere with the evaluation. This limitation can be overcome by placing the probe in lateral or oblique direction while viewing the abdomen. Due to its availability and ease of performance, ultrasound with

Doppler can be used for more than once making it ideal for monitoring the patient for a possible vascular compromise in mechanically obstructed small bowel. It also plays an important role in patients who are being managed conservatively where the patients are subjected for multiple scans to ensure that no vascular compromise sets in during the course.

An array of Serological investigations like serum creatinine, serum electrolytes, serum lactate, serum amylase levels along with complete blood picture and arterial blood gas analysis were carried out in each patient. Subsequently all these patients were subjected to exploratory laparotomy after necessary resuscitation and intra-operatively viability of the bowel was noted and an appropriate procedure was contemplated accordingly.

The patients were divided into two groups one with small intestinal obstruction showing no evidence of strangulation and the other group with strangulation. Clinical signs and symptoms along with biochemical markers with findings on imaging were compared among both the groups and their significance was calculated using chi square test.

A total number of 54 patients presenting with Acute Small intestinal obstruction were included during the study period.

Inclusion criteria

All the patients presenting on a particular day of the week to the emergency wing of the surgical department with features of acute small intestinal obstruction and subjected to exploratory laparotomy were included in the study.

Exclusion criteria

- Patients with sub-acute intestinal obstruction managed conservatively
- Patients presenting with adynamic obstruction.

RESULTS

Table 1: Cause of small bowel obstruction.

Cause of small bowel obstruction	Number of patient
Adhesions due to previous laparoto	omies 23
Obstructed hernia	22
Inguinal	11
Incisional	05
Umbilical	06
Ileocaecal tuberculosis	07
Bezoars	02

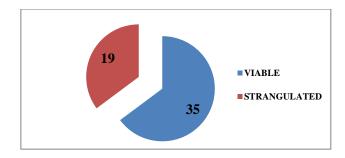


Figure 1: Bowel viability.

Table 2: Demographics and history.

Serial number	Demographics and history	Simple small intestinal obstruction- 35 patients		Strangulated small intestinal obstruction-19 patients	
1)	Age	Average age 30-50 years		Average age 40-60 years	
2)	Gender	23 males	12 females	12 males	7 females
3)	Duration of	<72 hours	>72 hours	<72 hours	>72 hours
	presentation	17 patients	18 patients	8 patients	11patients
	Cardinal symptoms of intestinal obtruction	Abominal pain colicy 35patients	Vomitings present. Ryles tube aspiration showing bilious aspirate	Abdominal pain continous 13 patients	Vomitings ryles tube aspiration showing blood stained aspirate in 2 patients
		Abdominal distension	Constipation	Abdominal distension	Constipation
4)	History of bleeding PR	Present in 2 patients		Present in 5 patients	
5)	Fever	3 patients		6 patients	
6)	Comorbid conditions (hypertension/diabetes)	6 patients		8 patients	

Clinical evaluation

Tachycardia

- More than 120/minute
- Less than 120/minute

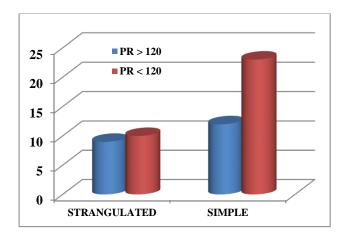


Figure 2: Clinical evaluation.

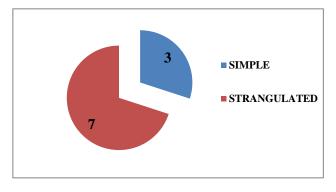


Figure 3: Hypotension.

Physical examination

Palpation of the Abdomen

Tenderness, an important clinical sign suggestive of a possible strangulation was elicited among 48 patients whereas Rebound Tenderness was seen only in 10 patients and both were seen among 4 patients.

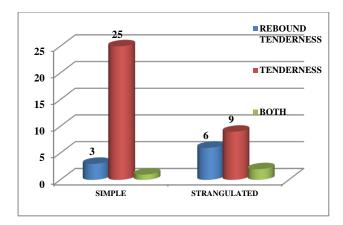


Figure 4: Palpation of the abdomen.

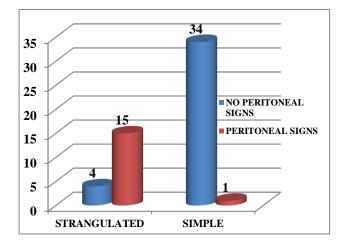


Figure 5: Guarding/rigidity.

Auscultation

Exaggerated bowel sounds; a cardinal feature of small bowel obstruction was present in 38 cases whereas normal frequency was noted in 5 cases. 11 cases had absent bowel sounds on auscultation of which 7 patients had strangulated obstruction intra operatively.

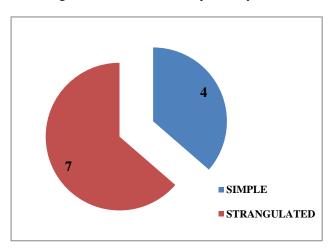


Figure 6: Absent bowel sounds.

Digital rectal examination

Out of 54 cases only 3 cases had blood stained finger on per rectal examination.

Laboratory evaluation

Leukocytosis: A total of 26 out of 54 patients had leukocytosis with 12 out of 19 patients from the strangulated group and 14 out of 35 patients from the non-strangulated group had marked leukocytosis.

Serum lactate was seen elevated among 3 patients with simple obstruction whereas 7 patients from the strangulated group had elevated serum lactate levels

Serum amylase was seen elevated among 35 patients presenting with acute small intestinal obstruction. 11 patients from the strangulated group and 24 patients without strangulation had elevated serum amylase levels.

Table 3: Laboratory evaluation.

Parameter	Simple obstruction	Strangulated obstruction	
Leukocytosis	14/35	12/19	
Serum lactate	4/35	7/19	
Serum amylase	24/35	11/19	

Imaging

All the patients presenting with acute small intestinal obstruction were subjected to plain X-ray abdomen erect. Multiple air fluid levels suggestive of small intestinal obstruction were reported on X- ray in all the patients. 6 patients who were subjected to repeat X-ray's showed persistent bowel loop and among them strangulated bowel was observed intra-operatively only in 4 patients.

USG abdomen

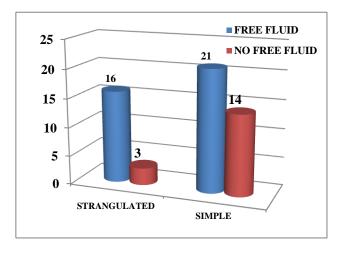


Figure 7: Free fluid in the abdomen.

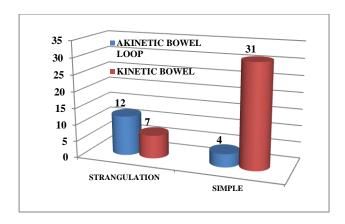


Figure 8: Visualisation of an aperistaltic bowel loop.

Thickened bowel loop

A difficult sign to look for on sonogram in the presence of gaseous distension was seen only among 3 out of 54 patients. All of them had strangulated obstruction intraoperatively.

Doppler study

Decreased blood flow was detected in 10 cases out of which 6 cases had strangulated bowel.

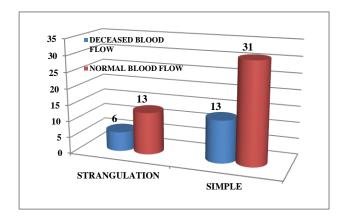


Figure 8: Doppler study.

A comparison of clinical, laboratory and findings on imaging predictive of strangulation among patients presenting with acute small intestinal obstruction.

Table 4: Doppler study.

Parameter	Simple obstruction	Strangulated obstruction	P value
Duration of obstruction >72 hours	18	11	0.33
Continuous pain	24	13	0.49
Fever	3	6	0.02
Bleeding PR	2	5	0.02
Tachycardia	12	9	0.1

Hypotension	3	7	0.03
Tenderness	25	17	0.07
Rebound tenderness	4	6	0.04
Guarding/rigidity	1	15	< 0.01
Absent bowel sounds	4	7	0.01
Leukocytosis	14	12	0.05
Serum amylase	24	11	0.2
Serum lactate	4	7	0.01
Free fluid on USG	21	16	0.03
Akinetic bowel loop on USG	4	12	0.01
Decreased blood flow on doppler	4	6	0.04

DISCUSSION

Strangulated small bowel obstruction is one of those clinical conditions for which no significant improvement has been made despite advances in diagnosis and management. Failure to predict strangulation early among these patients often delays surgical intervention there by leaving a significant impact on the outcomes. On history strangulation can be predicted among patients presenting with small intestinal obstruction based on delayed presentation beyond 72 hours with continuous abdominal pain, bleeding per rectum or blood stained aspirate in the nasogastric tube and with high grade fever. I

In the present study although the above findings were noticed among patients presenting with strangulated obstruction but only history of fever and bleeding per rectum were statistically significant.

On examination an increased pulse rate beyond 120/minute with hypotension is an ominous sign of Strangulation among patients presenting with Acute Small Intestinal Obstruction which favours an urgent need for exploratory laparotomy. Although marked tachycardia was a significant feature among patients with strangulated obstruction, statistically it was not significant whereas hypotension was found to be statistically significant.

Peritoneal signs like tenderness, rebound tenderness and guarding/rigidity, classical signs of compromised blood supply were observed in patients with strangulation but statistically only guarding/rigidity with rebound tenderness were significant.

Patients with acute intestinal obstruction often present with exaggerated bowel sounds. Localized Ileus with absent bowel sounds can be an important predictor of strangulation in the presence of obstruction. Out of 11 patients who had localized Ileus on auscultation, 7 of them had strangulation intra-operatively making it statistically significant.

On laboratory evaluation, leukocytosis was a significant finding documented among patients presenting with strangulated small intestinal obstruction. Although leukocytosis was reported in both the groups but it was more marked with higher counts among patients with strangulation. Serum amylase which is often seen elevated in patients presenting with Ischemic bowel was found to be raised in both the group of patients there by making it to be a non-specific biomarker. Elevated serum lactate levels were reported in patients with strangulated obstruction there by making it a sensitive and a specific marker of Ischemic bowel.

Plain X ray abdomen erect showing pneumoperitoneum can predict strangulation among patients presenting with obstruction. But this often is a delayed sign noticed among patients with hollow viscous perforation following strangulation and it fails to predict strangulation before perforation.

On imaging persistent bowel loop on repeat plain X ray abdomen erect suggestive of a possible strangulation and there by necessitating an urgent need for exploratory laparotomy was not a significant finding documented in the present study

On ultrasound presence of free fluid along with a kinetic bowel loop and diminished mesenteric blood flow on Doppler which could predict strangulation were documented among patients with acute small intestinal obstruction in the present study. A kinetic bowel loop was found to be significant with a p value of <0.01 and Free fluid in the abdomen was also found to be significant with a p value of 0.01 but had low specificity. Doppler was employed in all the cases to study the mesenteric blood flow which could detect a compromised blood flow among 10 patients with a p value of 0.04 and was statistically significant.

This emphasises the role of ultrasound and doppler in predicting signs of strangulation among patients presenting with acute small intestinal obstruction.

Although CECT abdomen can diagnose strangulation among patients presenting with small bowel obstruction preoperatively but it was not a part of the routine emergency workup.

CONCLUSION

In the present study symptomatology related to strangulation based on history among patients presenting with acute small intestinal obstruction were duration of presentation beyond 72 hours with fever and bleeding per rectum.

Clinical signs which favored strangulation were pulse rate more than 120/minute along with hypotension. On palpation of the abdomen, rebound tenderness along guarding/rigidity were strongly suggestive of Strangulation

On laboratory evaluation leukocytosis with elevated serum lactate were the important and significant biomarkers observed among patients with strangulation. On imaging ultrasound findings suggestive of free fluid in the abdomen along with an a kinetic bowel loop and Doppler showing evidence of a compromised blood supply were features strongly predicting strangulation among patients with Small Intestinal obstruction.

The present study has proved that there is no single factor which can strongly predict strangulation either clinically or by Investigations. It is only a combination of factors which can help us predict strangulation in patients with mechanical small bowel obstruction. The role of ultrasound along with a Doppler should be strongly considered and also recommended to plan an early intervention and ensure better outcomes.

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Ethical approval: The study was approved by the

institutional ethics committee

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