A Retrospective Study of Preoperative Predictive Factors of Strangulation in Intestinal Obstruction

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Abstract

Proper management of bowel obstruction requires a methodology to prevent nontherapeutic laparotomy while minimizing the chance of overlooking strangulation obstruction causing intestinal ischemia. Our aim was to identify preoperative risk factors associated with strangulating SBO and to develop a model to predict the need for operative intervention *Context:* We chose to re-evaluate preoperative diagnostic capability for the recognition of strangulation in a retrospective study. *Aims:* To identify preoperative risk factors, associated with strangulated intestinal obstruction and to develop a model to predict the need for operative intervention in such cases. Retrospectively study the symptomatology, clinical signs, biochemical markers and findings on imaging. *Settings and Design:* Retrospective study of sixty two patients conducted in Victoria Hospital, Bangalore Medical College and Research Institute (BMCRI) for a period of six months. *Methods:* Sixty two patients who underwent exploratory laparotomy for intestinal obstruction were divided into two groups and their pre operative factors were compared and tested for significance. *Stastical Analysis Used:* Chi Square test for value of significance (p value <0.05). *Results:* Out of sixty two patients, strangulation was seen in twenty four cases. Vomiting, fever, guarding etc. were co relating. Laboratory parameters were leukocytosis (>12.3 +/- 3.3), serum lactate and acidosis on arterial blood gas analysis, free fluid and dilated, aperistaltic loops on ultrasound were significant. *Conclusions:* We conclude that no single factor is predictive, combination has high sensitivity, specificity and predictive value.

Keywords: Strangulation; Intestinal Obstruction.

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Introduction

Mechanical bowel obstruction is a physical blockage of the intestinal lumen. It can be intrinsic or extrinsic to the wall of the intestine or due to luminal obstruction from the intra luminal contents. Strangulation, a vascular compromise of the intestine, is increased markedly in complete obstruction and start as a reversible obstruction [1,2]. The traditional surgical dictum in patients with a complete small bowel obstruction (SBO) has been to operate within 12–24 h in proper scenarios—that is,'' The sun should never rise and set on a complete SBO''. Traditional management, however, can lead to non therapeutic laparotomy along with the associated morbidities and further adhesion and its potential sequelae [3,4]. Non operative management, using nasogastric decompression and fluid resuscitation with close and frequent clinical reassessment, has proven to be successful in a substantial percentage of selected patients with SBO. Unfortunately, a non selective, non operative plan can be dangerous [5,6]. Clinical parameters included in the history and physical examination, laboratory analysis, and imaging modalities can be used as clues to provide a better assessment of the risk of underlying strangulation and an appropriate plan of treatment [7,8].

Thus the urgency and importance of early diagnosis. The mortality for strangulated obstruction continues to be in range of 20-30% [11], thus the need for study and develop a predictive model for early intervention.

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Therefore our aim was to retrospectively study the pre operative factors co relating to strangulation.

Materials and Methods

After the admission the patients were evaluated symptomatically based on the history and clinical signs on physical examination. Patients were resuscitated and stabilised prior to surgery then were subjected to plain X-ray abdomen erect to document multiple air fluid levels suggestive of intestinal obstruction. Ultrasound abdomen done in all acute abdomen cases to look for the possible cause and look for free fluid in the abdomen. 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. All the patients who underwent exploratory laparotomy for intestinal obstruction were subjected to appropriate treatment based on viability of bowel like adhesiolysis, resection anastamosis etc. The patients were divided into two groups one with 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.

Inclusion Criteria

• All the patients presenting with features of acute 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. Previous h/o ascites

• Age less than 18 years

• Immunocompromised patients.

Results

On conducting the study retrospectively for a period of six months, sixty two patients who underwent exploratory laparotomy for acute intestinal obstruction were included and ruled out of exclusion criteria.

Out of sixty two patients the most common cause of intestinal obstruction was found to be adhesions 33 (62) and second most common was obstructed inguinal hernia 18 (62). Strangulated cases were found to be 24 (62), both simple and strangulated intestinal obstruction cases were compared in terms of sumptoms, signs, lab parameters and imaging studies (Figure 1).

Among symptoms vomiting had significant p value (0.022) compared to other symptoms like pain abdomen, distension, constipation etc. Co-morbities like Diabetes mellitus type two and smoking had significant contribution in strangulation with p value (0.05) and (0.04) respectively (Table 1).

On examination of vital parameters tachycardia (>120beats/minute) was found in both cases and not significant in predicting strangulation but fever(>38.5°celsius) was found in 11 (24) patients with p value 0.09, which was significant. Guarding/rigidity and rebound tenderness were stastically significant

Table 1: Comparison of factors based on history, co morbidities and examination findings between the simple and strangulated intestinal obstruction cases

Signs	Simple (n=38)	Strangulated (n=24)	P value
Pain abdomen	28	20	0.376
Vomiting	23	21	0.022
Abdominal distension	32	22	0.393
Constipation	16	09	0.718
Hypertension	08	10	0.08
Diabetes mellitus	06	09	0.05
Previous surgeries	11	02	0.067
Smoking	10	09	0.004
Pulse rate(>120/min)	25	17	0.679
Febrile(>38.5 c)	06	11	0.009
Tenderness	28	13	0.113
Guarding/rigidity	03	16	0.001
Rebound tenderness	01	11	0.002
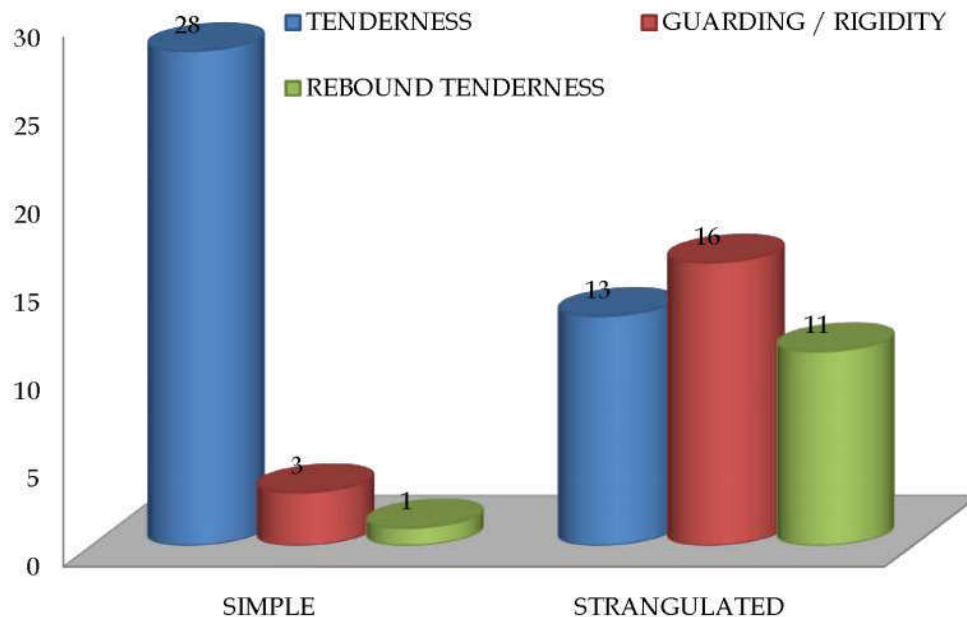
Graph 1: Chart showing Comparison between the two groups in terms of clinical and abdominal signs
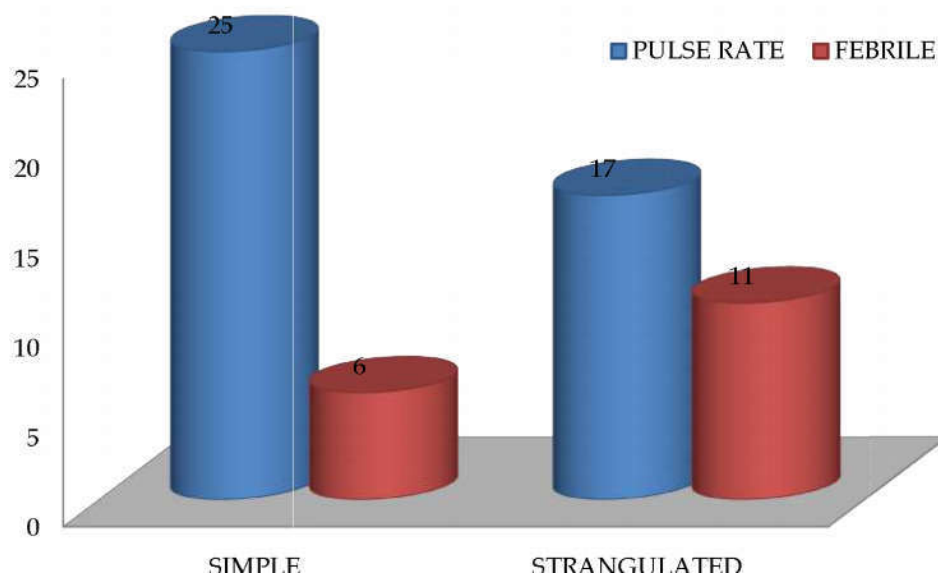
Graph 2: Chart showing comparison between the two groups in terms of investigation findings

Table 2: Comparison of laboratory finding and imaging between the two groups

Investigation	Simple	Strangulated	P value
Leukocytosis (TC = >10,500cells/dl)	15	19	0.02
⇑ S.Amylase(mmol/l)	26	11	0.07
⇑ S.Lactate	06	11	0.009
⇓ S. Sodium (<130mEq)	21	13	0.932
Presence of Free Fluid on USG	20	16	0.01
Presence of Dilated and Aperistaltic Loop on USG	07	13	0.003
Acidosis (pH= <7.35)	13	16	0.012

with p value 0.01 and 0.02 respectively. Laboratory parameters with significant p value were leukocytosis (p value 0.02) and serum lactate (p value 0.009) co-relating with strangulation. Acidosis (pH <7.35) on ABG analysis was found to be significant. (Table 2).

Rebound tenderness and guarding/rigidity had high specificity values (Table 3).

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Imaging study like ultrasound of abdomen and pelvis revealed presence of free fluid and dilated aperistaltic bowel loops in strangulated intestinal obstruction cases with high sensitivity of 83.33% and significant p value of 0.001. Rebound tenderness was found to have high specificity of 97.3% in strangulated cases (Table 4).

On comparison of our study with other studies like Zeilinski et al., Nandyala vnr et al. parameters like leukocytosis, serum lactate levels, acidosis and free

Table 3: Showing sensitivity, specificity, p value, positive and negative predictive values of different parameters

Parameter	P value	Sensitivity	Specificity	PPV	NPV
Pain Abdomen	0.376	83%	71.42%	42%	71%
Vomiting	0.022	87%	39%	47.7%	83%
Abdominal Distension	0.393	91%	15.7%	41%	75%
Constipation	0.718	87.5%	39.4%	36%	59%
Hypertension	0.08	41.6%	79%	42%	79%
Diabetes Mellitus	0.05	38%	84.2%	60%	68%
Smoking	0.004	37.5%	26%	24.3%	40%
Pulse Rate (>120/MIN)	0.679	71%	34%	40%	65%
Febrile (>38.5 C)	0.009	45.8%	84%	65%	71%
Tenderness	0.113	54%	26.3%	31.7%	47.6%
Guarding/Rigidity	0.001	67%	92%	84.2%	81.3%
Rebound Tenderness	0.002	45.8	97.3%	91.66%	77%
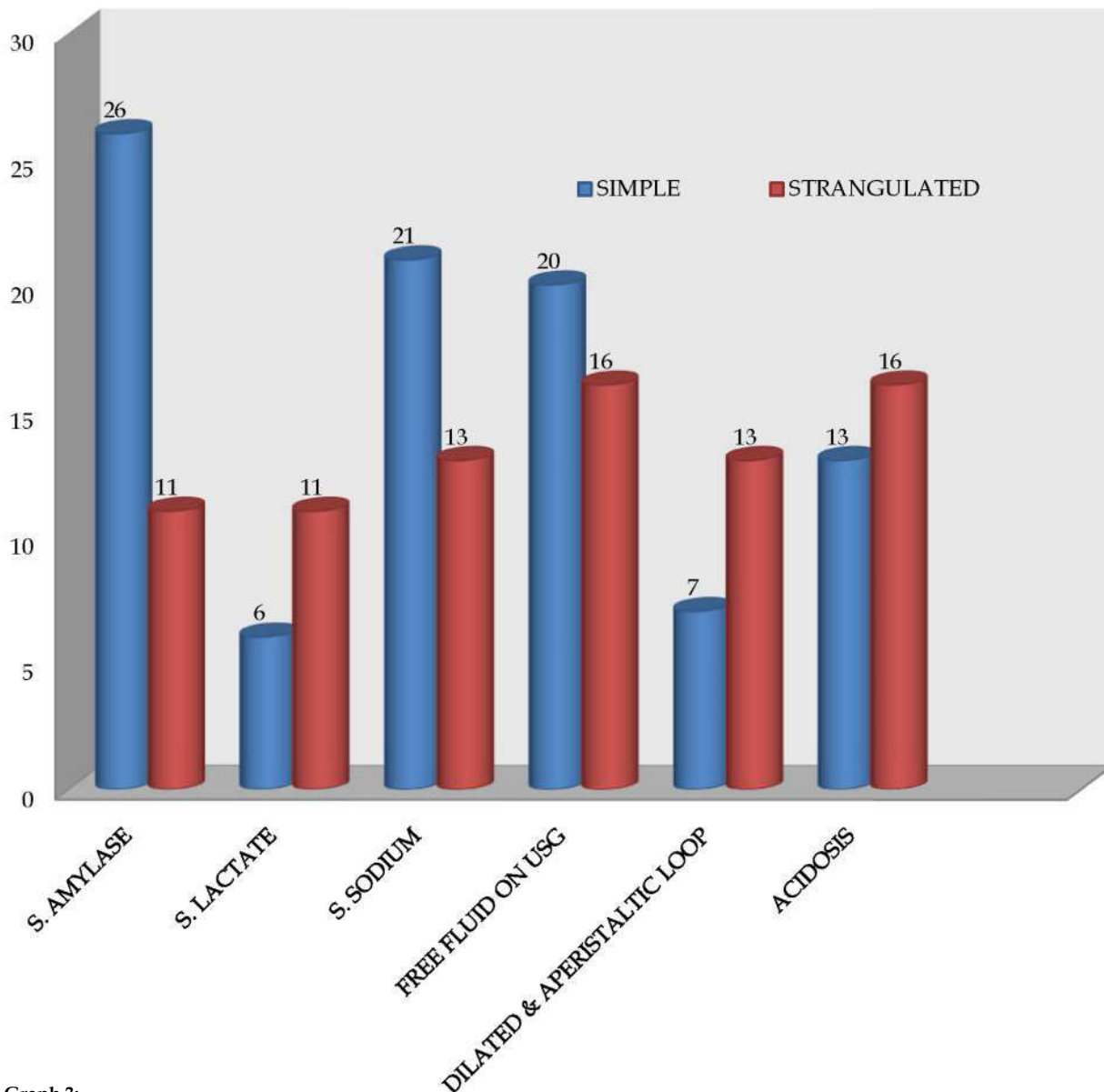
Graph 3:

Table 4: Investigations with its sensitivity, specificity, p value and positive/negative predictive values

Parameter	P Value	Sensitivity	Specificity	PPV	NPV
Leukocytosis (TC>10,500cells/dl)	0.02	79%	60.5%	56%	82%
⇑ S.Amylase	0.077	45%	37.5%	29.7%	48%
⇑ S.Lactate	0.009	45.8%	84.2%	64.7%	71%
⇓ S. Sodium	0.932	54%	44.7%	38.2%	60.7%
Presence of free Fluid on USG	0.001	83.33%	68.75%	55.6%	84.6%
Presence of Dilated AND Aperistaltic Loop ON USG	0.003	54.1%	81.5%	65%	73.8%
Acidosis (pH= <7.35)	0.012	67%	66%	55.1%	75.7%

fluid on ultrasound showed similar results and stastical significance (Table 6 and 7) Vomiting, fever, diabetes mellitus were shown not to have significant value in other studies but significant in present study. (Table 5).

Table 5: Comparison of present study with other studies in terms of p value,sensitivity amd specificity

Clinical parameters	Factors	Our Study	Zeilinski et al	Nandyala VNR et al
Vomiting	P value	0.022	0.20	-
	Sensitivity	87%	91%	-
	Specificity	39%	28%	-
Fever	P value	0.009	0.381	0.02
	Sensitivity	45.8%	9%	-
	Specificity	84%	97%	-
Diabetes mellitus	P value	0.05	0.402	-
	Sensititvy	38%	27%	-
	Specificity	84.2%	83%	-
Guarding/ rigidity	P value	0.001	-	0.01
	Sensitivity	67%	-	-
	Specificity	92%	-	-

Table 6: Comparison of present study with other studies in terms of p value, sensitivity amd specificity

Factors	Factors	Our Study	Zeilinski et al	Nandyala VNR et al
Rebound Tenderness	P value	0.02	0.001	0.04
	Sensitivity	45.3%	36%	-
	Specificity	97.3%	99%	-
Leukocytosis	P value	0.02	0.015	0.05
	Sensitivity	79%	73%	-
	Specificity	60.5%	68%	-
Serum Lactate	P value	0.08	0.002	0.01
	Sensitivity	45.8%	-	-
	Specificity	84.2%	-	-

Table 6: Comparison of present study with other studies in terms of p value, sensitivity amd specificity

Factors	Factors	Our Study	Zeilinski et al	Nandyala vnr et al
Free fluid on USG Abdomen	P value	0.001	0.031	0.03
	Sensitivity	83.3%	82%	-
	Specificity	68.7%	56%	-
Dilated and aperistaltic bowel loops on usg abdomen	P value	0.003	0.685	0.01
	Sensitivity	54.1%	91%	-
	Specificity	81%	13%	-

Discussion

Timely and appropriate operative treatment of SBO should improve morbidity and mortality rates, although accurately determining which patients should undergo operative therapy during the hospitalization can be difficult [5,7]. The significant predictors of our study were fever and vomiting (on history), guarding/rigidity and rebound tenderness (on examination). On history strangulation can be predicted among patients presenting with small intestinal obstruction based on delayed presentation beyond seventy two hours with continuous abdominal pain, bleeding per rectum or blood stained aspirate in the nasogastric tube and with high grade fever [1].

Diabetes mellitus type 2 was a significant co morbidity contributing to strangulation. Patients who were chronically smoking had significantly higher incidences of strangulation compared to non smokers. Laboratory parameters tested pre-operatively which predicted towards strangulation intestinal obstruction were leukocytosis (>12,000cells/cumm) and serum lactate levels (>2.3mmol/L).

Arterial Blood Gas analysis of acidotic patients had co-relation with bowel strangulation. Ultrasound abdomen was also suggestive of strangulation and was found to have high sensitivity and significant p value. Several studies have demonstrated a correlation of free intraperitoneal fluid with the need for operative intervention and small bowel ischemia, corroborating our findings and correlating with our clinical experience. A recent report was able to show a threefold increase in the need for operative intervention if free intraperitoneal fluid was present on imaging [9].

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.

Akinetic 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 [10].

Strength of our study was the simplicity of the parameters and affordability of patients during emergency situation and minimum investigations like ultrasound of abdomen and acidosis by ABG analysis.

Limitation of study was no single factor was predictive on its own. Larger study needs to be conducted with variety of other parameters to validate an effective model for detection of strangulation in intestinal obstruction cases.

Conclusion

The present study has proved that there is no single factor which can strongly predict strangulation either clinically or by investigations. Combination of factors can help us predict better.

Identification of the clinical features and appropriate reaction based on the investigations should decrease mortality and the morbidity in patients presenting with SBO.

Our model can be used in everyday practice and we believe that future prospective study in a larger population will conûrm these results.

Conflicts of Interest: None declared

Ethical approval: Approved by institutional ethical committee.

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