DOI: 10.7860/JCDR/2021/50065.15691

Original Article

Surgery Section

Small Bowel Obstruction in the Virgin Abdomen: A Retrospective Study for a New Management Pathway

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ABSTRACT

Introduction: Adhesions are the main cause of Small Bowel Obstruction (SBO) for patients with previous abdominal surgery. In this case, conservative management has traditionally been efficient. However, aetiologies and therapeutic decisions are less obvious to determine for patients without previous abdominal surgery.

Aim: To identify the accuracy of the results of clinical findings, laboratory investigations and Computed Tomography (CT) scan as tools to suggest a management pathway to deal with SBO in the virgin abdomen.

Materials and Methods: This retrospective study included 59 patients that had been admitted for SBO with a virgin abdomen between January 2008 and December 2016. Clinical, laboratory and radiological findings were assessed to determine the difference between the urgent surgical versus the non operative management groups. Statistical analyses were performed using SPSS version 24.0. Logistic regression was used to determine the independent predictive factor of an urgent surgery.

Results: Overall, 59 patients with no prior abdominal surgery were admitted to Department. There were 37 males and 22 females. The median age was 52 years. The CT scan performed in 52 cases, revealed the cause of obstruction in 35 cases (67.30%). The most common cause of obstruction was Crohn's disease present in 13 cases (22.03%). Twenty-nine patients (49.15%) underwent surgery. A rate of C-Reactive Protein (CRP) ≥135 mg/L was an independent predictor of an urgent surgery {p-value=0.010; OR=1.009 ; IC=95% (1.001-1.018)}.

Conclusion: Although there was compelling evidence that the CT scan was essential in the management pathway, it was not accurate in the present study in terms of determining the causes of obstruction and predicting the need for performing urgent surgery. A rate of CRP ≥135 mg/L was a predictive factor of urgent surgery.

Keywords: Adhesions, Abdominal distension, Bowel strangulation, C-reactive protein, Mesenteric torsion

INTRODUCTION

The Small Bowel Obstruction (SBO), characterised by abdominal pain, constipation, distension and vomiting, is one of the most common causes of surgical emergencies [1,2]. For patients with previous abdominal surgery, the cause of SBO is usually easy to assess based on clinical and radiological findings [3]. Adhesions, the leading cause of SBO in patients who have undergone previous abdominal surgery, account for more than 70% of the cases [2-6]. Some studies and recent guidelines have shown the efficacy of conservative management using bowel decompression and serial assessments in most of the cases [2,7].

However, among all cases of SBO, 9% of patients have not undergone previous abdominal surgery [8]. In these cases of SBO in the virgin abdomen, the causes of obstructions are less obvious to determine given their wide range and differences in frequencies between different studies [7-9]. This highlights the difficulty of the management of SBO in the virgin abdomen as both the aetiology and the severity signs should be timely taken into consideration [10]. Therefore, the challenge is to decide, in the context of emergency, between urgent operative versus conservative management [7].

Traditionally, the management of SBO in the virgin abdomen often consisted of a surgical intervention even in front of the non severity of the abdominal findings [11]. Several departments still advocate emergency surgery even though there is no evidence to support this practice [7]. Although urgent operative management would prevent possible complications, such as ischaemia and perforation, conservative management would decrease the prevalence of unnecessary surgeries that could possibly lead to future intestinal adhesions [2]. Other departments opt for a conservative management based on the recent increased safety of the radiological findings in the ability of detecting the signs of bowel strangulation [11]. However, therapeutic decision making should not be based only on the radiological findings despite the progress in imaging techniques [12]. Thus, for a better management of SBO in the virgin abdomen, it is important to take into account multiple factors including clinical, laboratory and radiological factors [12]. Even if a non operative treatment has been started, little is known about when to consider urgent surgery to avoid complications, more precisely the predictors of the need for an immediate surgery or the failure of a conservative management [3]. All of the above emphasise the fact that the therapeutic decision for SBO in the virgin abdomen remains a challenge for surgeons, especially in the absence of current guidelines in the management of SBO in the virgin abdomen [2,9].

Thus, this study aimed to identify the accuracy of the results of clinical, laboratory investigations and Computed Tomography (CT) scan as tools to suggest an appropriate management pathway to deal with SBO in the virgin abdomen.

MATERIALS AND METHODS

A retrospective and descriptive study was conducted between 1st September 2017 and 1st January 2019. The time period of the data collection was between 1st January 2008 and 1st December 2016. Overall, 59 patients with SBO in the virgin abdomen were admitted to the Surgery B Ward of the Charles Nicolle Hospital of Tunis. Ethical approval was granted by the Ethics Committee of the Faculty of Medicine of Tunisia (No. 25/18).

Inclusion criteria: The inclusion criteria were that all patients be over 16-year-old, with either mechanical bowel obstruction or mesenteric ischaemia. The diagnosis of mechanical bowel obstruction was based on both clinical and radiological findings or from surgical exploration.

- Clinical findings included the presence of atleast one of the signs of the occlusive syndrome including abdominal pain, nausea and vomiting, distension and the absence of gas passing through the rectum [2].
- Radiological findings consisted of the presence of air fluid levels in abdominal plain films and/or a dilated proximal small bowel, a transition point and a collapsed distal small bowel in the CT scan [Table/Fig-1].

[Table/Fig-1]: Transversal section of a CT image showing Small Bowel Obstruction (SBO) with a transition point (the white arrow).

- Surgical exploration included the identification of the transition point and the cause of obstruction. The diagnosis of mesenteric ischaemia was based on the CT findings or from surgical exploration. The CT findings included identification of vascular calcification and/or thrombi in the mesenteric arteries and/or veins. Surgical findings included presence of ischemia or necrosis of the small bowel wall without a mesenteric torsion or strangulation [13].

Exclusion criteria: Patients with previous abdominal surgeries, strangulated external abdominal hernias and functional SBO were excluded.

Study Procedure

The diagnosis of functional SBO in these cases was based on the radiological findings of uniform dilatation of the small intestine without any transition zone [8].

Two different groups were identified depending on the type of management:

- The conservative management group included patients for whom conservative management had demonstrated success, whether they underwent an elective procedure or not. Success of the conservative management was based on the improvement of the clinical signs by the appearance of flatus and stools or based on the absence of fluid levels on the abdominal X-ray.
- The urgent surgical management group included patients for whom the initial approach was surgical management or for whom the initial conservative management was not efficient and who ultimately underwent urgent surgery. The non efficacy of the conservative management was identified based on the persistent or worsening of clinical and/or the laboratory and/or the abdominal X-ray findings.

The primary endpoint of the study was the time of surgery based on the clinical, laboratory and CT scan findings.

STATISTICAL ANALYSIS

Statistical analysis was performed using Statistical Package for the Social Science (SPSS version 24.0). Univariate analysis was run to determine whether there were differences between clinical, laboratory and radiological findings in the urgent surgical management group versus the conservative management group. Quantitative variables were analysed using Fisher's-exact tests or t-tests. In all statistical tests, the significance level was set at 0.05. For statistically significant variables (p-value ≤0.05), a logistic regression was conducted to determine the predictive factors of performing urgent surgery.

RESULTS

Overall, 59 patients with no prior abdominal surgery were admitted to our department. There were 37 males and 22 females. The median age was 52 years (age range was 16 to 85 years). An association between the four occlusive signs including abdominal pain, nausea and vomiting, bloated abdomen and the absence of gas passing through the rectum was only identified in nine cases (15.42%). From the abdominal examination, abdominal distension and abdominal meteorism were found in 46 cases (77.96%). Abdominal palpation was normal in 11 cases (18.64%), while abdominal pain was shown in 46 cases (77.91%) and rebound tenderness in two cases (3.38%). Auscultation of the abdomen was normal in all cases.

A blood count was performed for 57 patients (96.61%). A total of 32 (54.23%) had leucocytosis (a level of white blood cells 10000/mm^3 or greater), 10 patients (16.94%) had leukopenia (a level of white blood cells 5000/mm^3 or lower) and 9 patients (15.25%) had anaemia. The CRP was performed in 55 cases (93.22%). CRP higher than 5 mg/L was found in 48 cases (87.27%).

A total of 48 (81.35%) underwent a plain abdominal X-ray. Air fluid levels were identified in 45 cases (93.75%). A CT scan of the abdomen was performed in 52 cases (88.13%). The transition point was identified in 51 cases (98.07%). Among the remaining eight cases, five patients had previous episodes of SBO in the virgin abdomen. The obstruction was due to Crohn's disease in four cases and abdominal tuberculosis in one case. The sixth patient was in shock, which limited the CT scan, the seventh patient underwent immediate urgent surgery for another diagnostic suspicion and the eighth patient underwent an urgent surgery for the diagnosis of appendicitis. Appendicitis was suspected based on the findings of the clinical and the abdominal ultrasound scan. The clinical findings consist of a pain located in the right iliac fossa and nausea, and the ultrasound scan findings consist of an effusion in the right iliac fossa. The transition point was identified in 51 cases (98%) and the signs of severity on CT were found in 4 cases (7.69%). All the clinical, laboratory and radiological characteristics of the study sample are summarised in [Table/Fig-2].

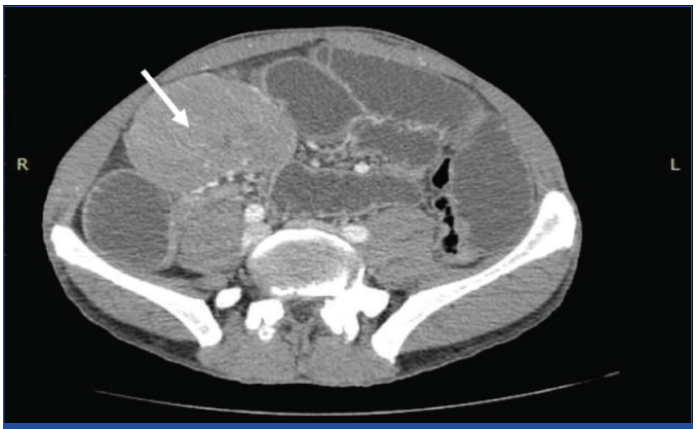
Variables	Urgent surgical management group (n=29)	Conservative surgical management group (n=30)	Total (N=59)
Clinical characteristics			
Abdominal distension	23 (79.31%)	23 (76.66%)	46 (77.96%)
Abdominal pain	23 (79.31%)	23 (76.66%)	46 (77.96%)
Abdominal rebound	2 (6.89%)	0 (0%)	2 (3.38%)
Normal abdominal auscultation	29 (100%)	30 (100%)	59 (100%)
Laboratory investigations			
Number of blood counts	29 (100%)	28 (93.33%)	57 (96.61%)
Leucocytosis	18 (62.06%)	14 (46.66%)	32 (54.23%)
Leukopenia	6 (20.68%)	4 (13.33%)	10 (16.94%)
Anaemia	3 (10.34%)	6 (20%)	9 (15.25%)
Number of CRP tests performed	29 (100%)	26 (86.66%)	55 (93.22%)
A level of CRP higher than 5 mg/L	27 (93.10%)	21 (70%)	48 (81.35%)
Radiological characteristics			
Number of plain abdominal X-ray	24 (82.75%)	24 (80%)	48 (81.35%)
Air fluid levels	22 (75.86%)	23 (76.66%)	45 (76.27%)
Number of CT scans	26 (89.65%)	26 (86.66%)	52 (88.13%)

Transition point	26 (89.65%)	25 (83.33%)	51 (86.44%)
No signs of severity in the CT scan	22 (75.86%)	26 (86.66%)	48 (81.35%)
Pneumoperitoneum	2 (6.89%)	0 (0%)	2 (3.38%)
Absence enhancement of bowel wall	1 (3.44%)	0 (0%)	1 (1.69%)
Pneumatosis intestinalis	1 (3.44%)	0 (0%)	1 (1.69%)

[Table/Fig-2]: Clinical, laboratory and radiological characteristics of the study sample. CRP: C-reactive protein; CT scan: Computed tomography scan

According to the clinical and radiological findings, mechanical SBO in the virgin abdomen was diagnosed in 58 cases. Before abdominal surgery, appendicitis had been suspected in one case.

The CT scan showed the cause of obstruction in 35 cases (67.30%). Based on the clinical and radiological findings, the aetiology was only predicted for 39 patients (66.10%). The most common suspected cause of obstruction was Crohn's disease in 16 cases (27.11%). Spontaneous adhesion was found in 10 cases (16.94%). The suspected aetiology, in this case, based on the CT scan findings was wrongly made in all cases thus one out of 10 was classified as internal herniation and the remaining nine were classified as unknown aetiologies. Small bowel tumours were found in 5 (8.47%) of the cases [Table/Fig-3]. Other aetiologies are summarised in [Table/Fig-4].



[Table/Fig-3]: Transversal section of a small bowel tumour (the white arrow) in an abdominal CT image.

Final aetiology	Number of cases (%)	Suspected aetiology	Number of cases (%)
Crohn's disease	13 (22.03%)	Crohn's disease	12 (20.33%)
		Unknown aetiology	1 (1.69%)
Spontaneous adhesions	10 (16.94%)	Unknown aetiology	9 (15.25%)
		Internal herniation	1 (1.69%)
Mesenteric ischaemia	5 (8.47%)	Mesenteric ischemia	4 (6.77%)
		Unknown aetiology	1 (1.69%)
Small bowel tumour	5 (8.47%)	Small bowel tumour	5 (8.47%)
Small bowel haematoma	5 (8.47%)	Small bowel haematoma	5 (8.47%)
Abdominal tuberculosis	4 (6.77%)	Crohn's disease	2 (3.38%)
		Abdominal tuberculosis	2 (3.38%)
Internal herniation	3 (5.08%)	Internal herniation	1 (1.69%)
		Unknown aetiology	2 (3.38%)
Foreign body	2 (3.38%)	Unknown aetiology	1 (1.69%)
		Foreign body	1 (1.69%)
Ileitis	2 (3.38%)	Crohn's disease	2 (3.38%)
Mesentery volvulus	1 (1.69%)	Unknown aetiology	1 (1.69%)
Intussusception	1 (1.69%)	Intussusception	1 (1.69%)
Gallstone ileus	1 (1.69%)	Gallstone ileus	1 (1.69%)
Peritoneal carcinomatosis	1 (1.69%)	Small bowel tumour	1 (1.69%)
Chronic mesenteric ischaemia	1 (1.69%)	Chronic mesenteric ischaemia	1 (1.69%)
Unknown aetiology	5 (8.47%)	Unknown aetiology	4 (6.77%)
		Functional small bowel obstruction due to an appendicitis	1 (1.69%)
Overall	59 (100%)	Overall	59 (100%)

[Table/Fig-4]: Suspected and final aetiology of bowel obstruction.

For management of the SBO, 29 patients (49.15%) underwent urgent abdominal surgery. Among them, surgery was performed immediately in 16 cases (55.17%) and after non efficiency of the initial conservative management in 13 cases (44.82%). A laparotomy was performed in 27 cases (93.10%) and a laparoscopy was performed in two cases. During the surgery, small bowel necrosis was noticed in 10 cases (34.48%) and peritonitis was identified in 7 cases (24.13%). Severity signs are given in detail in [Table/Fig-5].

Severity signs	Immediate surgery (n=16)	After the failure of the conservative management (n=13)	Total from operated patients (n=29)
Necrosis	6 (37.50%)	4 (30.76%)	10 (34.48%)
Peritonitis	4 (25%)	3 (23.07%)	7 (24.13%)

[Table/Fig-5]: Severity signs.

Conservative treatment was successful in 30 (50.84%) cases. Among them, elective surgery was performed for 7 patients (11.86%).

Out of 36 patients operated on, the suspected cause of the SBO was only accurate in 20 cases (55.55%). The final most frequent cause was Crohn's disease, found in 13 cases (22.03%). These findings are summarised in [Table/Fig-4].

The rate of morbidity was (11 cases) 18.64% overall and 37.93% among patients who underwent urgent surgery. The rate of mortality was (7 cases) 11.86% overall and 24.13% among people who underwent urgent surgery.

Predictive factors of urgent surgery: Regarding the clinical findings, previous functional bowel episodes were significantly less frequent in the operative group (17.24%) compared to the conservative management group (43.33%) with a level of significance at 0.047. The systolic blood pressure was slightly higher in the urgent surgery group (120 mmHg) compared to the conservative management group (113 mmHg). This difference was statistically significant (p-value=0.031).

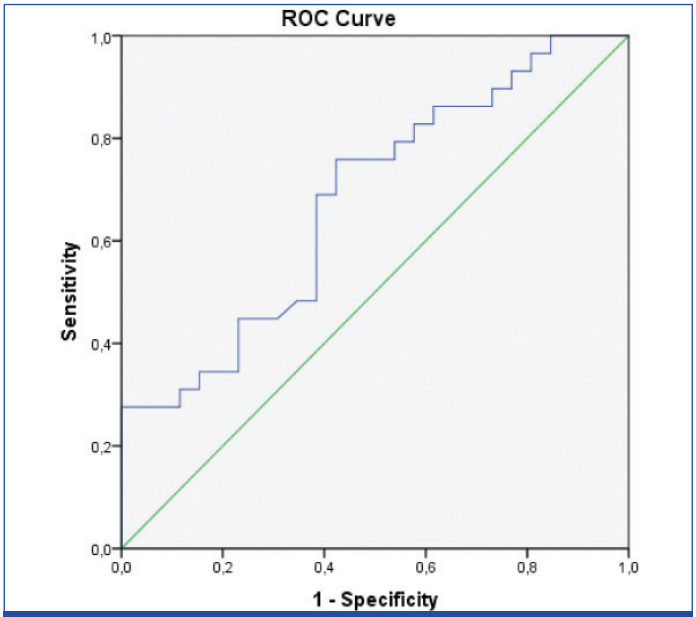
For the laboratory findings, the rate of CRP was higher (107 mg/L) in the urgent surgery group compared to the second group (41 mg/L). This difference was statistically significant (p-value=0.010). The CT findings (signs of severity) were not statistically significant. The predictive factors of urgent surgery are summarised in [Table/Fig-6].

The multivariate analysis showed that the CRP was an independent predictor of an urgent surgery with a cut-off point of 135 mg/L {p-value=0.010; OR=1.009; IC=95% (1.001-1.018)}. If CRP was ≥135 mg/L, urgent surgery was likely to be performed with 100% Specificity (Sp) and 24% Sensitivity (Se). The positive predictive value was 100% and the negative predictive value was 54% [Table/Fig-7].

Predictive factors	Urgent surgical management group (n=29)	Conservative surgical management group (n=30)	p-value
Clinical characteristics			
Age (in years)	57	52	0.378
Gender:			
Females	10 (34.48%)	12 (40%)	0.789
Males	19 (65.51%)	18 (60%)	
Co-morbidity*	14 (48.27%)	9 (30%)	0.187
Underlying disease**	3 (10.34%)	8 (26.66%)	0.181
Previous functional bowel obstructive episodes	5 (17.24%)	13 (43.33%)	0.047

Symptoms before admission (hours)	77	54	0.085
Systolic blood pressure (mmHg)	120	113	0.031
Diastolic blood pressure (mmHg)	71	71	0.961
Heart rate (beats per minutes)	88	80	0.096
Laboratory investigations			
White blood cells (units/mm^3)	13278	10049	0.051
Haemoglobin levels (g/dL)	13	12	0.218
Serum creatinine (mg/L)	161	100	0096
CRP (mg/L)	107	41	0.010
Radiological characteristics			
CT scan: signs of severity***	4 (13.79%)	0	0.110

[Table/Fig-6]: Predictive factors of urgent surgery.
*Co-morbidities: Diabetes, dyslipidaemia, respiratory diseases, cardiovascular diseases, kidney failure, haematology disorders, rheumatic disorders; **Underlying diseases: Crohn's disease in 8 cases, small bowel tumour in 2 cases, intestinal tuberculosis in 1 case; ***CT scan severity signs: Pneumoperitoneum, absence enhancement of bowel wall, pneumatosis intestinalis; Statistical tests performed for all the variables; T-test: Age, Co-morbidity, Symptoms before admission, Systolic blood pressure, Diastolic blood pressure, Heart rate, White blood cells, Haemoglobin levels, Serum creatinine; CRP; Fisher's-exact test: Signs of severity in the CT scan, Underlying disease, previous functional bowel obstructive episodes; χ^2 test: Gender



[Table/Fig-7]: The Receiver Operator Characteristic (ROC) Curve of CRP among the patients who underwent urgent surgery.

DISCUSSION

This study aimed to identify the accuracy of the results of clinical, laboratory and CT scan findings as tools to suggest a management pathway to deal with SBO in the virgin abdomen. Overall, 59 patients were included. A rate of CRP equal or higher than 135 mg/L was an independent predictor of an urgent surgery {p-value=0.010; OR=1.009 ; IC=95% (1.001-1.018)} with high specificity (Sp=100%) but low sensitivity (Se=24%).

The present study found that the abdominal CT scan was useful in diagnosing SBO in the virgin abdomen. However, the cause of obstruction was only found in 67.30% of all cases. The SBO in the virgin abdomen was more likely due to Crohn's disease in 22.03% of all cases, opposing other studies amongst similar population targets, which showed that spontaneous adhesions were the common cause of obstruction [7,14]. Regarding the specificity of the CT scan in the aetiological diagnosis, spontaneous adhesion was the most difficult cause to identify given the fact that adhesions were mis-diagnosed in all cases based on the CT scan findings. Indeed, one out of 10 was classified as internal herniation and the remaining nine were classified as unknown aetiologies based on the CT scan findings. This could be explained by the fact that adhesions are difficult to see on CT scans [6,15]. The second cause diagnosed wrongly based on the CT findings was internal herniation. In existing literature on the subject, the CT scan is the key to identifying herniation [5,16]. However, as internal herniation is a rare cause [16], radiologists are possibly not aware of this. Regarding the management pathway, from the clinical presentation factors, previous functional bowel obstruction episodes were significantly more frequent in the conservative management group (p-value=0.047). This is probably because these previous functional bowel obstruction episodes were incomplete, related to an underlying abdominal disease such as Crohn's disease, abdominal tumour or intestinal tuberculosis and thus the recurrence of the symptoms [17]. The second clinical factor was a higher systolic blood pressure in the urgent surgery management group. In the present study, the urgent surgery management group had higher levels of CRP. One study documented that a higher concentration of CRP was associated with higher systolic blood pressure but not diastolic blood pressure [18]. This could explain the significant higher systolic blood pressure in the urgent surgery management group compared to the conservative management group found in the univariate analysis (p-value=0.031) [18].

A study has shown that the CT scan has high sensitivity (Se=96%) and specificity (Sp=93%) in determining early signs of ischaemia could be promising [19]. Indeed, the presence of signs of severity, including transition point, small bowel faeces, high grade obstruction and abnormal vascular course, were found to be predictive factors of performing urgent surgery [5,20-22]. Even the presence of a focal and isolated transition has been identified in some studies as radiological predictive factors of performing urgent surgery with high sensitivity (Se=98%) but low specificity (Sp=37%) [3,15]. However, in the current study, the signs of severity in the CT scan, identified in 8% of all cases, were not statistically significant to predicting urgent surgery (p-value=0.110). Our findings support other studies demonstrating that CT scan findings alone, including signs of severity such as intraperitoneal fluid volume of at least 500 mL on CT scan and reduction of small bowel wall contrast enhancement, are not sufficient to warrant immediate surgery [10-23].

Nevertheless, we demonstrated that the laboratory findings, more specifically the rate of CRP equal or higher than 135 mg/L, were accurate in determining whether an urgent surgery is more likely to be performed with high specificity (Sp=100%) but low sensitivity (Se=24%). A new pathway in dealing with SBO in the virgin abdomen based on the results of laboratory investigations has been suggested in the current study. If the rate of CRP is ≥135 mg/L, operative management should be considered. This strategy enables a timely differentiation between patients qualifying for conservative or urgent operative treatment. In existing literature, little is known about the accuracy of the laboratory investigation factors. Some studies have demonstrated the relevance of white blood cell rates in performing urgent surgery [21,24,25] with cut-off points of 10,000/mm^3 [24] and 18,000/mm^3 [21]. The present study did not support this finding, as there were non significant differences in the white blood cell rates between the emergency surgery group and the conservative management group. In the literature, a score based on clinical, laboratory and radiological findings has been suggested to predict intestinal resection [20]. Even though this score could have a great contribution to decision making, we believe that it is better to intervene earlier before any complications arise that require intestinal resection. Comparisons between the findings of the present study and previous published studies to suggest a management pathway to deal with SBO are summarised in [Table/Fig-8] [1,21-23,26-28]. We need to highlight that these previous studies about SBO on the predictive factors for urgent surgery included patients with previous abdominal surgery.

This study has certain strengths. By studying 59 cases, this was the largest study of SBO in the virgin abdomen focusing on the predictive factors of performing urgent surgery. The CT scans were performed in 88% of the cases which is a high percentage. The predictive factors permit to shed light on the management pathway to deal with SBO in the virgin abdomen and allow a better indication of a patient's destination when admitted.

Author's names and years of study	Place of study	Inclusion criteria	Number of subjects	Conclusion
Schwenter F et al., 2010 [21]	Geneva, Austria	SBO	233	Urgent operative management if Clinical findings: A history of pain lasting 4 days or more Laboratory findings: CRP at least 75 mg/L Leucocyte 10000/mm^3 or greater Radiological findings: Severity signs including intraperitoneal fluid volume at least 500 mL on CT scan and reduction of CT small bowel wall contrast enhancement.
Pricolo VE and Curley F 2016 [23]	New bedford, United States of America	Adhesive SBO	108	None of the clinical (Age, gender, race, co-morbidities) laboratory (level of white blood cells) and radiological findings (transition point, small bowel faeces, high grade obstruction and abnormal vascular course) can predict the outcome of non operative management.
Bazaz R et al., 2017 [26]	Delhi, India	SBO Age group 1 to 80 years	92	Urgent operative management if Clinical findings: Continuous pain Tachycardia Peritonism Sluggish bowel sounds Laboratory investigation: Leucocytosis Acidosis Raised amylase.
Scrima A et al., 2017 [22]	Wisconsin, United States of America	SBO	179	Urgent operative management if clinical and laboratory findings None Radiological findings: Transition point Contrast to transition point Degree of obstruction Closed loop Small bowel diameter Severity signs including abnormal vascular course, mesenteric congestion.
Strajina V et al., 2019 [1]	Minnesota, United States of America	SBO in the virgin abdomen	60 (A retrospective review)	Criteria for conservative or surgical management were not explicitly reported.
Yang TW et al., 2021 [27]	Victoria, Australia	Small bowel obstruction in the virgin abdomen	416 (A systematic review including six retrospective studies)	A conservative management was successful in 95.6% of the cases Clinical and Radiological findings: hemodynamic stable patients with the absence of closed loop obstruction.
Amara Y et al., 2021 [28]	-	Small bowel obstruction in the virgin abdomen	A narrative review of seven retrospective cohorts (populations raging between 44 and 103)	Criteria for conservative or surgical management were not explicitly reported in the studies included.
Asma Chaabouni et al., 2021 (present study)	Tunis, Tunisia	Small bowel obstruction in the virgin abdomen	59	Urgent operative management if Clinical findings: Previous functional bowel obstruction episodes Systolic blood pressure Laboratory findings: CRP at least 135 mg/L Radiological findings: None.

[Table/Fig-8]: Comparison between the findings of the study and previous published studies in the accuracy of tools to suggest management pathway to deal with Small Bowel Obstruction (SBO) [1,21-23,26-28].
SBO: Small bowel obstruction; CRP: C-reactive protein

Limitation(s)

This study was also subjected to several limitations, several of which offer fruitful directions for future research. First, this study lacked representativeness due to the limited sample size. Further studies including larger samples are needed to generalise the findings. Secondly, the retrospective aspect of the study was a limitation to follow-up patients. In fact, the aetiology remained unknown for five patients. Therefore, authors highly encourage a replication of the study in a prospective larger sample.

CONCLUSION(S)

This study set out to suggest an appropriate management pathway to deal with SBO in the virgin abdomen based on radiological findings and laboratory investigations. Although the abdominal CT scan was found to be useful in diagnosing SBO in the virgin abdomen, it did not seem to be sufficiently accurate in determining the causes of the obstruction. The signs of severity on abdominal CT scans did not seem to be statistically significant in predicting urgent operative management. The laboratory investigations were found to have a great contribution to the decision-making pathway. Indeed, a rate of CRP equal or higher than 135 mg/L was a predictive factor of performing urgent surgery with a high specificity (100%). Scores including these factors in larger samples should be further explored.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Apr 24, 2021
- Manual Googling: Sep 22, 2021
- iThenticate Software: Oct 29, 2021 (3%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Apr 23, 2021**
Date of Peer Review: **Jul 30, 2021**
Date of Acceptance: **Oct 06, 2021**
Date of Publishing: **Nov 01, 2021**