The Egyptian Journal of Hospital Medicine (April 2021) Vol. 83, Page 1456-1461

Study of the Outcome of Emergency Small Bowel Resections Regarding Morbidity and Mortality

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ABSTRACT

Background: Management of small intestinal diseases in the emergency setting, imposes a challenge and is associated with incidence of perioperative mortality and morbidity. Many factors may contribute to this adverse outcome, it may be patient-related factors, associated colonic injuries or related to presenting derangement locally or systemically.

Objective: To rate the reported morbidity and mortality after small bowel emergencies with resections and re-anastomosis and the impact of preoperative, operative and postoperative factors on patients' outcomes.

Patients and Methods: A total of 60 patients who underwent emergent small bowel resection were included in this study. This study was performed using data from patients of both sexes aged above 12 years old who presented with small bowel emergencies that needed emergency resection, which were managed in the General Surgery Department of Aswan University Hospital, during the period from March 2019 until February 2020.

Results: There was a statistically significant difference between them regarding age groups, the prevalence of comorbidities and previous abdominal surgeries. We found that associated injuries were associated with the most added risk of morbidity and time of presentation in the multivariate module, followed by hemodynamic instability. The two independent modifiable variables were the hemodynamic instability after initial resuscitation and the choice of simplest shortest appropriate operative option.

Conclusion: Regarding morbidity, there was significant effect of age and the presence of comorbidities. These results may aid the acute-care surgeons in identifying patients with a high-risk for postoperative complications and fatal outcomes.

Keywords: Morbidity and Mortality, Small bowel emergency.

INTRODUCTION

Emergency small bowel resection represents a challenge for the surgeon. There is a wide number of pathologies, which involve the small bowel beside the different forms of traumatic injuries [(1)].

The small intestine is a complex organ with several functions. In fact it is capable of digestion, absorption and secretion, endocrine function and protects the internal environment against noxious ingested substances and against luminal bacteria and their toxins. The potential surface area available for digestion and absorption is amplified 600-times by circular mucosa folds, villus mucosal architecture and the microvillus surface of epithelium [(2)].

Jejunum and ileum are suspended by a mobile mesentery covered by a visceral peritoneal lining that extends onto the external surface of the bowel to form the serosa [(3)]. Management of small bowel diseases in the emergency setting is regarded as an independent risk factor for postoperative mortality and morbidity [(4)].

Multiple studies of small bowel emergency surgeries estimated the overall mortality and morbidity between 15 to 30 percent depending on the causing pathology, timing of presentation (early or late) and associated comorbidities (metabolic, cardiovascular, infectious, respiratory or obesity related comorbidities). These factors substantially increase the incidence of mortality [(5)].

Patients presenting with trauma related small bowel injury are a significantly lower risk of complications than patients with large bowel injury [(6)].

The majority of these complications are infectious, such as sepsis, wound infection, and abscess, as well as complications related to intestinal diversion, anastomotic leak and burst abdomen [(7)]. Though many surgical techniques have been used, use of temporary intestinal diversion in morbid patients up to segmental intestinal resection and primary anastomosis [(8)]. The purpose of this study was to rate the reported morbidity and mortality after small bowel emergencies with resections and re-anastomosis and the impact of preoperative, operative and postoperative factors on patients' outcomes.

PATIENTS AND METHODS

This is a prospective analytical study of surgical management and outcome of emergency small bowel resection patients, comparing patients presented with different patterns of clinical presentations, in order to determine the factors affecting perioperative outcome of emergency small bowel resections. The study included patients presented to the Emergency Unit of General Surgery Department of Aswan University Hospital, with total number of 60 cases of both sexes above the age of 12 years old during the period from March 2019 until February 2020.

Received:21 /1 /2021
Accepted:18 /3 /2021

Inclusion Criteria: Patients with small bowel emergencies that need emergency resection, e.g. trauma patients including iatrogenic trauma, and other emergency small bowel resections i.e. ischemia, hernia related, and intestinal obstruction related.

Exclusion Criteria: Patients younger than 12 years, and patients with elective small bowel resection.

Protocol based assessment of the general condition was done with the evaluation of:

- Vital signs assessment.
- Full clinical assessment.
- Laboratory investigations (including: CBC, RBS, Electrolytes, KFT, LFT and ABG).
- Blood cross matching.
- Ryle tube insertion.
- Urinary catheter insertion.
- FAST assessment for the trauma patient.

Hemodynamically unstable patients were defined as patients with the following signs and symptoms according to Advanced Trauma Life Support (ATLS) [(9)]: Blood pressure < 90 systolic, capillary refill time > 2 seconds, altered level of consciousness, shortness of breath (Respiratory rate >22 breath/second), and pulse > 120 BPM.

Unstable patients were resuscitated first according to ATLS and Care of the Critically Ill Surgical Patient (CCrISP) guidelines [(9)]. Patients presenting with sepsis, severe sepsis and septic shock were treated according to the International Guidelines for management of severe sepsis and Septic Shock (surviving sepsis guidelines). After full resuscitation of patients and completing the primary survey, careful history taking was done to assess comorbidities, obesity was considered a comorbidity when patient BMI was over 30. Diagnosis of specific etiology was made mainly clinically and by imaging. Erect abdominal X-ray was done to diagnose obstruction or perforation, abdominal CT with IV (+/- oral) contrast also was done for better assessment of abdominal pathology. Also diagnostic laparoscopy was used in assessment of some selected cases. All patients were provided with the routine preoperative preparations in the form of (Drip and Suck) (insertion of nasogastric Ryle, patients were kept NPO (nothing by mouth) and IV fluids were given through two wide-bore cannula).

Selection of the surgical treatment modality (diversion, resection and primary anastomosis...etc.) was decided according to: general condition of the patient, site and severity of pathology**,** bowel wall edema and friability, and experience of the surgical team. The operative principles of small intestinal resections, anastomoses, and use of ostomies were followed. Operations were divided into four types of operation for analysis:

(1) Patient who had limited resection and primary repair without diversion. (2) Resection of part of the small bowel with diversion but with no anastomosis. (3) Resection and anastomosis with diversion. (4) Frozen abdomen and closure.

All patients were followed up until their discharge and for the 30 days postoperative in the surgery outpatient clinic. The Clavien-Dindo classification of surgical complications were used for identification and classification of complication [(10)]**.**

When performing analysis of significance and multivariate analysis of perioperative morbidity, grade I Clavien-Dindo classification was considered in the no morbidity group, grade II, III and IV are the focus of the morbidity analysis, since grade V was analyzed with mortality.

Ethical consent:

An approval of the study was obtained from Aswan University Academic and Ethical Committee. Every patient signed an informed written consent for acceptance of the operation.

Statistical analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for the Social Sciences) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA). Qualitative data were represented as frequencies and relative percentages. Chi square test (χ^2) was used to calculate difference between two or more groups of qualitative variables. Quantitative data were expressed as mean ± SD (Standard deviation). P value < 0.05 was considered significant.

RESULTS

Total number of patients included was 60 cases. 34 of them were males and 26 were females (Table 1). Range of age was 14-84 with the most frequent age group was 30 - 39 years old.

Table (1): Descriptive statistics of demographic data collected on the studied patients

Mean age: Mean ± SD	46.13 ± 16.02	
Sex distribution	**No.**	**%**
Male	34	57
Female	26	43

Among the 60 cases, there were 31 (52%) cases with medical co-morbidity and 29 (48%) cases with previous abdominal surgery (the most frequent abdominal surgeries were caesarian sections, appendectomies and cholecystectomies) (Table 2).

Table (2): Descriptive statistics of previous history data collected on the studied patients

Comorbidities	**NO. 31 (60)**	**% 52 (100)**
Cardiac	5	8
HTN	9	26
DM	8	23
Hepatic	7	20
Renal	2	5
Obesity	5	8
Others	5	8
Multiple Comorbidities	11	18
Special Habits	**NO. 28 (60)**	**% 47 (100)**
Smoking	24	40
Drug Addiction	7	12
Alcohol	2	3

Furthermore, cases were classified according to presentation into 2 groups: first pathological with colicky abdominal pain, or manifestations of intestinal obstruction, which represented the majority of cases and second traumatic almost with evidence of penetrating injury which affected ileum more than jejunum.

Table (3): Different modalities of presentation

Presentation		**NO.**	**%**
Pathological (n=50) 83%	Acute Abdomen	26	43
	Vomiting	13	22
	Distension	5	8
	Intestinal Obstruction	5	8
	Swelling	1	2
Traumatic (n=10) 17%	Stab	7	11
	Firearm	1	2
	Blunt Abdomen	1	2
	Poly Trauma	1	2

According to Clavien-Dindo classification[10], the most frequent morbidity cases were of grade II (8 cases) and almost were for ileus or wound site related. Grade IV cases were 4 cases that required postoperative ICU admission (3 were revised early for burst abdomen, retracted stoma and anastomotic leak, and 1 case with incisional hernia postponed for elective conditions). Time of presentation was considered as golden factor for postoperative outcome regarding Clavien-Dindo classification as cases who presented late (after 24 hours.) supposed for more complications (Grade III, IV even mortality Grade V) (Table 4).

Table (4): Relation between time of presentation and postoperative score

Time of presentation	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
Early < 24 hours	2	0	0	0
Late >24 h	6	3	4	2

Different modes of complications were recorded in our study varies from paralytic ileus, chest infection, wound site infection up to kidney injury and death beside multiple other surgical and medical complications as recorded (Table 5).

Table (5): Postoperative complications

Complications	**NO.**	**%**
Seroma	3	5
Paralytic Ileus	4	7
Chest Infection	3	5
Incisional Hernia	1	2
Burst Abdomen	2	3
Retracted Stoma	1	2
Acute Kidney Injury	1	2
Recurrence	1	2
Anastomotic leak	2	3

However, in explored patients, factors like age, gender, comorbidities and history of previous abdominal surgery were clarified in those patients after their classification according to Clavien-Dindo Score (Grade I is regarded not morbid) and analyzed statistically. Multivariate analysis was done to clarify the effect of all studied factor on the morbidity outcome. There was a statistical significant difference regarding age groups, the prevalence of co-morbidities and previous abdominal surgeries. There was no statistical significant difference between groups regarding gender, and special habits (Table 6).

Table (6): Comparative statistics of previous history data collected on the studied patient

Statistical Analysis		No. of cases and %	No Recorded Complications (No., %)	Grade II (No., %)	Grade III and IV (No., %)	Grade V (Mortality) (No., %)	Univariate P-value	Multivariate P- value
Age group	**< 50 years**	32 (53%)	22 (37%)	8 (13%)	2 (3%)		0.007	0.087
	≥ 50 years	28 (47%)	15 (25%)	7 (12%)	4 (7%)	2 (3%)		
Gender	**Male**	34 (57%)	25 (42%)	6 (10%)	4 (7%)		0.719	…
	Female	26 (43%)	12 (20%)	9(15%)	2 (3%)	2 (3%)		
Comorbidities	**No**	29 (48%)	19 (32%)	9(15%)	0		0.002	0.989
	Yes	31 (52%)	18 (30%)	6 (10%)	6 (10%)	2 (3%)		
Past surgeries	**No**	31 (52%)	23 (38%)	5 (8%)	1 (2%)		0.003	0.082
	Yes	29 (48%)	14 (23%)	10 (17%)	5 (8%)	2 (3%)		
Special Habits	**Smoking**	24 (40%)	15 (25%)	7 (12%)	2 (3%)	2 (3%)	0.303	…
	Addiction	7 (12%)	5 (8%)	2 (3%)	0			
Etiology	**Pathological**	50 (83%)	30 (50%)	12 (20%)	6 (10%)	2 (3%)	0.637	…
	Traumatic	10 (17%)	7 (12%)	3 (5%)	0			
Vital Stability	**Stable**	40 (67%)	31 (52%)	5 (8%)	4 (7%)		0.158	0.03
	Unstable	20 (33%)	6 (10%)	10 (17%)	2 (3%)	2 (3%)		
Associated Injury	**No**	53 (88%)	34 (57%)	11 (18%)	6 (10%)	2 (3%)	0.071	0.006
	Yes	7 (12%)	2 (3%)	2 (3%)	0			
Extent of Resection	**<50 cm**	35 (58%)	24 (40%)	10 (17%)	1 (2%)		0.077	0.566
	≥50 cm	25 (42%)	13 (22%)	5 (8%)	5 (8%)	2 (3%)		
Time of Presentation	**Early (within 24 hours)**	19 (32%)	13 (22%)	6 (10%)	0		0.303	0.014
	Late (after 24 hours)	41 (68%)	24 (40%)	9(15%)	6 (10%)	2 (3%)		
Procedure	**1ry Anastomosis**	48 (80%)	31 (52%)	12 (20%)	5 (8%)		0.001	0.885
	Diversion with stoma	12 (20%)	6 (10%)	3 (5%)	1 (2%)	2 (3%)		

Associated injury was found with 7 cases, 2 of them in stomach, which was repaired with the resection anastomosis and had no significant effect on the outcome, then two traumatized patients showed associated colonic injuries, one of them needed a repair of injury in the transverse colon and postoperatively complicated by paralytic ileus (grade II), patient vital instability and prolonged operation time shared the roles; though the other case needed diversion with double loop colostomy with no recorded postoperative obstacles in recovery (grade I); one patient who presented with acute abdominal pain of 15 days early post caesarian delivery and who stabilized then investigated and explored to find a frozen abdomen with amalgamation of a missed towel with the ileum, cecum and right adnexa, with abscess formation, operated with peritoneal wash, right hemi-colectomy and right salpyngo-ovariectomy, double loop temporary ileostomy faced postoperative paralytic ileus (grade II); left diaphragmatic repair in stab case; appendectomy required in another one, and both with no recorded postoperative complications.

There was no statistical significant difference between the groups regarding mode of presentation, presenting etiology, hemodynamic instability and associated injuries. There were 2 cases of mortality and 15 cases of morbidity. In table 7, they were classified according to site of pathology.

Table (7): Comparative statistics and analysis of operative and perioperative outcome data according to site

Outcome data	Jejunum (n=13)	Jejuno-ileal (n=5)	Ileal (n=42)	P-value*
Morbidity (No, %)	5 (8%)	1 (2%)	9 (15%)	0. 447
Mortality (No, %)	0	1 (2%)	1 (2%)	0.087

There was no statistical significant difference in site of pathology regarding operative management, morbidity or mortality. Due to the very low numbers of mortality in relation to the number of studied patients which need further study with higher numbers of mortality, however the statistical significance is indisputable.

DISCUSSION

Small bowel cases that present to ER department involve wide number of pathologies beside the different forms of traumatic injuries. The rationale of this study is to clarify the rate of reported morbidity and mortality in small bowel emergencies (after exclusion of duodenal cases) in relation to: small bowel pathophysiology, associated patient comorbidities, mode and time of presentation, extent of resection and surgical management in emergency setting.

The present study observed 60 patients presenting to Aswan University Hospital with emergency presentations that involve small bowel after exclusion of duodenal cases (jejunum and ileum only). These patients were managed according to the protocols adopted in this teaching hospital. Observed morbidity and 30 day mortality were recorded for final assessment. Morbidity cases were 15 cases (25%) and mortality cases were 2 cases (3%).

Patients were classified on basis of presentation and clinical data into 2 major categories: pathological and traumatic patients. Small bowel pathology or trauma sites were divided into jejunal, jejuno-ileal or ileal.

Surgical emergencies that affect GIT has both local and systemic effects. Systemic effects occur through affection of hemodynamic status of the patient through sepsis, induced hypovolemia (as dehydration or 3rd space loss) or cardiogenic compromise. Local effects result from interaction of 3 factors: luminal contents (acidic or alkaline), wall characteristics (organs with large surface area of the wall are more liable to be involved in trauma).

Lesions produced by surgical emergencies are either obstructive (hernia or adhesions), cases with wall disruption or vascular lesions; microvascular obstruction (MVO) and there are some sort of interactions in between e.g. obstruction mainly manifest by colicky abdominal pain and may be dehydration, wall disruption mainly manifest by continuous abdominal pain and may be dehydration too due to 3rd space loss and vascular lesions are presented by hemorrhage or continuous abdominal pain.

Univariate analysis of the study for morbidity revealed that the most added risk to morbidity and mortality is the presence of comorbidity then the presence of vital instability. In multivariate analysis, the high rate of both conditions (52% and 20% respectively) reflects the relatively low incidence of mortality in this study.

The presence of associated lesions as colonic lesions adds to the problems encountered in management of small bowel emergencies; the presence of anaerobic organisms in the colon that could aggravate septic complications in these cases or extensive resection and its postoperative derangements.

Preoperative hemodynamic instability may reflect the systemic effect of the lesions in the small bowel during emergency status. These systemic effects may be due to hypovolemia (directly affects mortality), sepsis (directly affects mortality and morbidity) or the presence of comorbidity that couldn't withstand the stress of the emergency.

The univariate analysis of results in relation to mortality revealed that the highest mortality is associated with peritonitic abdomen with comorbid old persons. The absence of significance in multivariate analysis regarding these parameters indicate that these parameters affect mortality through inducing preoperative hemodynamic instability with bad general condition. Multivariate analysis of morbidity revealed that the highest risk is with resection procedures and hemodynamic instability. Postoperative hemodynamic instability may be due to septic conditions which predispose to postoperative sepsis related morbidities. Resection with/without stoma is associated with risk of spell of septic contents and predispose to postoperative sepsis related morbidities.

Univariate analysis of morbidity revealed the significant effect of age and comorbidities in occurrence of postoperative morbidity. The absence of significance on applying multivariate analysis of morbidity in relation to these two factors indicate that age and comorbidity probably exert their effect through the impact on preoperative hemodynamic instability.

Reviewing available literature usually lead to confusion secondary to the different inclusion and exclusion criteria adopted by the various research authorities. Other studies were focusing on the most common forms of small bowel emergencies whether mechanical small bowel obstruction, small bowel neoplasms or acute mesenteric ischemia such as study by **Vallicelli *et al.* [(2)],** which revealed that acute mechanical obstruction of the intestine is a common surgical emergency and a major cause of admission to emergency surgery departments while small intestinal neoplasm is very rare. The same in our study was clarified as the most common presentation was colicky abdominal pain. which is usually associated with mechanical obstruction either by adhesions or foreign body ingestion and there were few neoplastic cases.

Furthermore, study by **Park *et al.* [(11)]** concluded that male gender is associated with higher risk of complications and anastomotic leak after intestinal resection and anastomosis. In our study, there were only 2 cases of anastomotic leak, both were males but low incidence defecting to considerate.

On reviewing literature like study by **Duron *et al.* [(12)]** that studied prospectively 286 patients operated on for adhesive postoperative small bowel obstruction, the conclusion was that the early postoperative mortality is strongly linked with the age and the ASA class and the long-term mortality with postoperative complications. On the other hand, some studies focused on the outcome of strangulated inguinal hernia and looking for features associated with morbidity and

mortality such as study by **Abbas *et al.* [13].**

Regarding patients classification according to the diseased site (jejunal, jejuno-ileal, and ileal), there was a statistical significant difference between the groups regarding age groups, the prevalence of co-morbidities and previous abdominal surgeries. There was no statistical significant difference between the two groups regarding gender, and special habits.

Study by **Oyasiji *et al.* [14]** conducted a retrospective analysis of SBO (small bowel obstruction) database comparing 482 patients admitted to surgical service and 153 patients admitted to medical service at a single institution over a 5-year period (January 2003 to December 2007). Study outcomes included length of hospital stay (LOS), time to surgery (TTS), hospital charges, incidence of bowel resection, and mortality. Both groups were comparable for age, gender, and race. The surgical service group had a shorter LOS (6.1 vs. 7.5 days; P = 0.01), less hospital charges ($29,549 vs. $35,789; P = 0.06), shorter TTS (log rank comparison; P = 0.006), and less mortality.

Regarding previous surgical history, there were 29 cases that underwent previous abdominal surgeries such as caesarian sections, appendectomies, cholecystectomies and other procedures, among which 3 cases presented with adhesive intestinal obstruction (IO) (most frequently post appendectomies and abdominal explorations).

In study of **Cox *et al.* [15]**, postoperative adhesions accounted for 64-79% of admissions with small bowel obstruction (SBO) and band adhesions were commonly found following appendectomy, colorectal resections or gynecological operations.

Most studies indicate that blunt abdominal trauma is more common than abdominal stab wounds, and that abdominal stab wounds are more common than abdominal fire arm wounds in the civilian population as shown in analytical study of **Abri *et al.* [16].** However, in our study, most trauma cases were of penetrating type with 6 cases, more than blunt with 2 cases, and lastly one case fire arm.

CONCLUSION AND RECOMMENDATIONS

Patients' comorbidity and the presentation as a pathological sequel of small intestinal emergencies, are independent non-modifiable factors affecting perioperative mortality. They serve as an index for vigilance in the management of these emergencies.

The simplest shortest appropriate operative option should be adopted in small intestinal emergency, since it is a modifiable independent factor affecting outcome. The other modifiable factor is hemodynamic instability after initial resuscitation. We suggest the use of ‘damage control resuscitation principles’ in these patients.

Most added risk to mortality in the small bowel emergency cases is the presence of associated colonic injury then the presence of hemodynamic instability and both these two conditions had a low incidence. In the other hand, factors like presentation with peritonitic abdomen and resection with stoma formation procedure has significant effect on univariate analysis of mortality but not on multivariate analysis.

Regarding morbidity, the multivariate analysis revealed that the highest risk is with resection procedures and hemodynamic instability. While the univariate analysis revealed the significant effect of age and the presence of comorbidities.

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