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Management of Small Bowel Obstruction (SBO) in older adults (≥80 years): a propensity score-matched analysis on predictive factors for a (un) successful non-operative management (NOM)

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Abstract. – OBJECTIVE: Small Bowel Obstruction (SBO) is a common emergency in older patients. The most appropriate treatment strategy is still matter of debate. The aim of this study was to compare a non-operative management (NOM) *vs.* a surgical procedure for patients ≥ 80 years with SBO.

PATIENTS AND METHODS: All patients ≥ 80 years admitted to our Emergency Department (ED) for SBO between January 1st, 2015, and December 31st, 2020 were included in this study. In order to correct for baseline covariates and factors associated to clinical management, we used a 1:1 propensity score matching (PSM) analysis. The primary outcome was to compare the overall in-hospital mortality. Secondary outcomes included occurrence of major complications and in-hospital length of stay (LOS).

RESULTS: A total of 561 patients were enrolled. After propensity score matching (PSM) analysis, 302 patients (151 each group) were included in the analysis. Mortality did not differ between the two groups.

After PSM mechanical ventilation, sepsis, cumulative major complications, and LOS were significantly higher in the operative treatment group [15.9% *vs.* 1.5%, 9.4% *vs.* 4.1%, 27.6% *vs.* 19.2%, and 9.4 (6.4-14.3) days *vs.* 8.1 (4.5-13.3) days, respectively; $p<0.001$, $p=0.013$, $p=0.025$, and $p=0.003$, respectively].

CONCLUSIONS: In patients ≥ 80 years with SBO, a NOM could yield similar results, in terms of overall mortality, compared to a surgical management. Thus, particularly in patients with multiple comorbidities or functional impairments, a conservative approach should always be considered.

Key Words:
Small Bowel Obstruction, Elderly, Surgery, Non-operative management (NOM), Morbidity, Mortality.

Introduction

Small Bowel Obstruction (SBO) represents a common emergency in elderly patients that accounts for ~ 15% of hospital admissions for acute abdominal pain in the USA and ~ 20% of cases needing acute surgical treatment. Overall, only in the USA, SBO is responsible for near 30,000 deaths each year[1]. Its occurrence increases together with the increasing number of elderly patients who needs acute medical or surgical cares[2].

In 90% of cases, SBO is caused by adhesions, hernias, and neoplasms[1]. Patients ≥ 80 years with a diagnosis of SBO at the Emergency Department (ED) admission, are estimated to be approximately 10-12%[2,3].

These patients are often treated surgically, and just the involved procedures are among the highest at risk for morbidity and mortality related to emergency surgery[4]. Moreover, it is well established that any not elective surgical procedure in elderly patients is associated with a higher morbidity and mortality rate[4-6].

In a recent comparative study[7] in patients affected by adhesive SBO, we concluded that elderly patients present higher mortality rate and occurrence of major complications respect to

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younger ones. Therefore, a comprehensive geriatric assessment is recommended to optimize the diagnostic and clinical strategies in case of SBO.

Over the last decade, management of SBO has advanced and treatment results for the general population have strictly improved[8]. Nowadays, less than 30% of SBO are treated by a surgical approach, avoiding all the possible risks of an invasive procedure[9].

It is a matter of debate if elderly patients ≥ 80 years with SBO would benefit from the evolution in the treatment because of specific challenges and demands in diagnosis and treatment in this frailer population[10].

An ongoing debate in the management of SBO is the duration of NOM that is advisable to wait before the decision to operate, if the SBO is not resolved by medical management. It is well recognized by the majority of national and international guidelines the role of 72-h safe-time rule for duration of initial NOM, irrespective of age[9]. It seems, however, that in the elderly, the NOM is chosen more often from the beginning and that the duration of NOM is longer compared to the younger population, arguing that the risks of complications and loss of quality of life associated with operation are then avoided[9].

The present study has been conducted in order to evaluate predictive factors for a successful NOM in elderly patients (≥ 80 years) presenting with SBO at ED. We compared patients treated with NOM *vs*. patients treated with surgery. Primary endpoint of the study was the overall in-hospital mortality; as secondary endpoint, we evaluated the cumulative major complications and the LOS.

Patients and Methods

Study Design

A monocentric retrospective study has been carried out in an academic tertiary referral ED with an annual attendance of ~ 75,000 patients (more than 87% adults). After approval by our Institutional Review Board, all the clinical records of consecutive patients ≥ 80 years admitted to our ED from January 1st 2015 to December 31st 2020 were evaluated. All patients with diagnosis of SBO, either as a primary diagnosis or as secondary diagnosis of abdominal pain or cancer as a primary diagnosis [International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) ICD-9-CM codes 560.0, 560.80, 560.81, 560.89, 560.90], were enrolled in the study.

We excluded from analysis patients < 80 years, those who underwent directly to operating room from ED (within 12 hours from ED admittance) because of clinical instability, peritonitis, evidence of complications, clinical, laboratory or radiologic signs of strangulation or bowel ischemia, those with large bowel obstruction, and those who underwent an elective operative procedure beyond 72 hours from ED admittance. All patients were assigned to NOM or surgical group according to type of treatment:

- NOM: defined as best supportive medical treatment alone in the absence of any formal surgical, endoscopic, or radiological intervention. Aggressive intravenous fluid therapy and correction of electrolyte imbalance were crucial in the initial management of SBO. Nasogastric tube could be diagnostically useful to analyze gastric contents and allow decompression of the stomach and prevent aspiration[9].
- Operative management: in case of an open or laparoscopic procedure later than 12 and within 72 hours from ED admission.

Diagnosis

SBO diagnosis was initially clinical, according to patients' medical history. Laboratory evaluation of patients with suspected SBO included a complete blood count and metabolic panel. Electrolyte disturbances and elevated blood urea nitrogen levels were consistent with dehydration and noted in patients with severe emesis. The white blood cell count could be elevated if intestinal bacteria translocate into the bloodstream, causing the systemic inflammatory response syndrome or sepsis. SBO diagnosis was radiologically confirmed by an abdominal CT scan in all patients.

Data Collection

The following demographic and clinical data were collected: Age and gender; symptoms at ED presentation including fever, abdominal pain, vomit, diarrhea, gastrointestinal bleeding, constipation, shock (defined as systolic blood pressure at admission < 100 mmHg); abdominal complications at presentation: abdominal tumor, intestinal adhesions, peritoneal carcinomatosis, abscess/abdominal collection; comorbidities, defined according to Charlson Comorbidity Index[11]. All the elderly patients accessing our institution were evaluated for frailty according to a clinical frailty scale[12,13]. We considered as 'frail' a patient with 'clinical frailty scale' (CFS) score ≥ 6 out of 9 points.

Study Outcomes

Primary endpoint of the study was in-hospital death. All causes of death in the ED and after admission were combined.

As secondary endpoints of the study we evaluated LOS, calculated from ED admission to discharge/death, and occurrence of major complications during hospital stay. Cumulative major complications considered were death, admission to ICU or need of mechanical ventilation, progression to sepsis and septic shock. Sepsis was defined according to Sepsis-3[14].

Statistical Analysis

Categorical variables were reported as counts (percentages), while continuous variables (age, LOS, Charlson Comorbidity Index) were reported as median (interquartile range). Categorical variables were compared by Chi-square test, with Yates correction or Fisher's test as appropriate. Continuous variables were compared by Mann-Whitney U test. A two-sided p-value ≤ 0.05 was considered as significant. Data were analyzed using SPSS for Windows, version 25 (IBM Corp., Armonk, NY, USA).

A description of PSM analysis and distribution before and after match is provided in the **Supplementary Material**.

Results

During the study period, a total of 561 patients ≥ 80 years (241 males and 320 females with a median age of 80 (82-89) years) were admitted to our ED with a diagnosis of SBO. 391 (69.7%) patients that received NOM were compared to a group of 170 (30.3%) patients who underwent a surgical procedure. Table I shows patients demographic and clinical characteristics. Patients that received NOM were significantly older respect to those undergoing surgery [86 (82-90) years *vs.* 84 (82-88) years, p=0.002].

As far as ED presentation is concerned, abdominal pain, vomit, and constipation were significantly associated to surgical treatment (72.4% *vs.* 41.2%, 51.8% *vs.* 32.5%, and 34.1% *vs.* 22.0%, respectively; p<0.001, p<0.001, and p=0.003, respectively).

Regarding abdominal complications, patients with abdominal tumors and intestinal adhesions were significantly higher in the surgical group (34.7% *vs.* 15.6% and 21.2% *vs.* 6.6%, p<0.001 in all cases).

As far as comorbidities are concerned, ischemic heart disease, congestive heart failure, peripheral vascular disease, and chronic kidney disease were significantly associated to patients that received a NOM (19.4% *vs.* 10.0%, 15.1% *vs.* 7.6%, 30.4% *vs.* 10.6%, 17.9% *vs.* 10.0%, and 13.4% *vs.* 7.7%, respectively; p=0.006, p=0.015, p<0.001, and p =0.017, respectively). On the contrary, the presence of a malignancy was strictly related to a surgical treatment (48.8% *vs.* 23.8%, p<0.001).

Comparing outcomes, need for mechanical ventilation, sepsis, cumulative major complications, and LOS were significantly higher in patients surgically treated [15.9% *vs.* 1.5%, 9.4% *vs.* 4.1%, 27.6% *vs.* 19.2%, and 9.4 (6.4-14.3) days *vs.* 8.1 (4.5-13.3) days, respectively; p<0.001, p=0.013, p=0.025, and p=0.003, respectively].

Comparison of PSM Groups

After propensity-score matching, 302 patients (151 for each group) were included in the analysis (Table II).

Presence of abdominal pain at ED presentation was significantly more associated to surgery (74.2% *vs.* 53.0%, p=0.001).

We found overall that hospital mortality was similar in the two groups, whereas mechanical ventilation, cumulative major complications, and LOS were significantly higher in the operative group [16.6% *vs.* 1.3%, 27.8% *vs.* 15.9%, 9.2 (6.3-13.4) days *vs.* 8.1 (5.4-13.3) days, respectively; p<0.001, p=0.018, and p=0.043, respectively] (Table II).

Overall hospital survival in PSM population, after correction for clinical covariates, is reported on Figure 1. Survival rates were similar for NOM and surgical treatment groups (p=0.819).

Factors Associated to Survival

Factors associated to survival at univariate and multivariate analysis are shown in Table III. Male sex, vomit, intestinal adhesions, and congestive heart failure were negative prognostic factors for survival only at univariate analysis. Interestingly, no difference was observed regarding NOM *vs.* surgical approach (p= 0.599).

Factors Associated to Cumulative Major Complications

Factors associated to cumulative major complications at univariate and multivariate analysis are reported in Table IV. Sex male, abdominal tumor, intestinal adhesions, abscess/abdominal collection, Charlson Comorbidity Index, conges-

Table I. Population demographics before propensity score match.

Variable	All population n = 561	NOM group n = 391	Surgery group n = 170	*p*-value
Age (years)[§§]	85 [82-89]	86 [82-90]	84 [82-88]	0.002
Sex (Male)	241 (43.0%)	172 (44.0%)	69 (40.6%)	0.454
ED Presentation				
Abdominal pain	284 (49.4%)	161 (41.2%)	123 (72.4%)	<0.001
Vomit	215 (38.3%)	127 (32.5%)	88 (51.8%)	<0.001
Constipation	144 (25.7%)	86 (22.0%)	58 (34.1%)	0.003
Fever	71 (12.7%)	44 (11.3%)	27 (15.9%)	0.130
Diarrhea	26 (4.6%)	16 (4.1%)	10 (5.9%)	0.354
Gastrointestinal bleeding	5 (0.9%)	2 (0.5%)	3 (1.8%)	0.166
Shock	19 (3.4%)	15 (3.8%)	4 (2.4%)	0.455
Abdominal Complications				
Abdominal tumor	120 (21.4%)	61 (15.6%)	59 (34.7%)	<0.001
Intestinal adhesions	62 (11.1%)	26 (6.6%)	36 (21.2%)	<0.001
Peritoneal carcinomatosis	15 (2.7%)	11 (2.8%)	4 (2.4%)	1.000
Abscess/abdominal collection	4 (0.7%)	1 (0.3%)	3 (1.8%)	0.085
Comorbidities				
Charlson Comorbidity Index[§]	6 [5 - 8]	6 [5 - 8]	6 [4 - 7]	0.157
Severe obesity	5 (0.9%)	3 (0.8%)	2 (1.2%)	0.642
Ischemic heart disease	93 (16.6%)	76 (19.4%)	17 (10.0%)	0.006
Congestive heart failure	72 (12.8%)	59 (15.1%)	13 (7.6%)	0.015
Peripheral vascular disease	137 (24.4%)	119 (30.4%)	18 (10.6%)	<0.001
Dementia	72 (12.8%)	57 (14.6%)	15 (8.8%)	0.061
COPD[*]	78 (13.9%)	56 (14.3%)	22 (12.9%)	0.664
Diabetes	82 (14.6%)	63 (16.1%)	19 (11.2%)	0.128
Chronic kidney disease	87 (15.5%)	70 (17.9%)	17 (10.0%)	0.017
Malignancy	176 (31.4%)	93 (23.8%)	83 (48.8%)	<0.001
Outcomes				
Death	84 (15.0%)	64 (16.4%)	20 (11.8%)	0.160
Mechanical Ventilation	33 (5.9%)	6 (1.5%)	27 (15.9%)	<0.001
Sepsis	32 (5.7%)	16 (4.1%)	16 (9.4%)	0.013
Cumulative major complications[@]	122 (21.7%)	75 (19.2%)	47 (27.6%)	0.025
LOS (days)[£]	8.5 [5.2-13.5]	8.1 [4.5-13.3]	9.4 [6.4-14.3]	0.003
ED readmission within 6 months[&]	60 (10.7%)	25 (6.4%)	35 (20.6%)	0.062

[#]Hypotension/Shock was defined as systolic blood pressure < 100 mmHg at emergency department admission; [§]Values are expressed as Median [Interquartile range]; [@]Cumulative major complications include: death, admission to ICU/Ventilation, biliary fistula, sepsis. [£]Length of Hospital Stay. [*]Chronic obstructive pulmonary disease. NOM: non-operative management. [&]Readmission was calculated on discharged patients in each group (103 were lost at follow-up).

tive heart failure, diabetes, and malignancy were negative prognostic factors for survival only at univariate analysis.

NOM was a protective factor for cumulative major complications (p=0.012), but only at univariate analysis.

Discussion

NOM has the advantages of shorter LOS, less mortality and lower readmission rate[15]. Considering that older patients with acute conditions present more co-morbidities, functional disabilities, and cognitive impairment[16,17], it could be assumed a possible benefit from a conservative approach and NOM rather than invasive procedures. Management of SBO has advanced over recent years resulting in improved treatment results in the general population[8]. It is a matter of debate if elderly patients with SBO could benefit from the progress in the management of this condition[1,9].

It is more frequent in elderly patients an atypical presentation of symptoms, causing a delay in diagnosis and progressed disease at first presentation[18]. To the best of our knowledge, our study represents the largest experience evaluating the management of elderly (≥ 80 years) patients with

SBO in an emergency setting. We retrospectively reviewed the course and outcome of elderly patients admitted for SBO over a 5-year period, before and after PSM analysis.

In our paper, we found that the presence of abdominal pain at presentation was significantly associated to an operative treatment (Table II). Interestingly, in elderly patients with acute abdominal conditions, the absence of abdominal pain was reported to be an independent predictor of poor outcome[18]. This is consistent with other studies reporting a reduction of pain in elderly patients in ED, that is probably related to a greater capacity to endure or, more frequently, to the impossibility to complain with it[19].

It is well established that 'frail elderly patient', due to their own clinical characteristics, present worse outcomes in terms of functional decline, more complications and prolonged LOS, regardless of treatment[4,20,21]. Given the recent increase of life expectancy, we chose the age cut-off of ≥ 80 years to specifically analyze the SBO clinical course and possible complications in this population that will represent a large part of patients in the near future[22].

Our data suggest that, after adjusting for baseline covariates and other confounding factors, no difference was observed regarding mortality between NOM and surgery, but we found that surgically managed patients had a significantly higher cumulative major complications rate and a longer LOS when compared to NOM patients (p=0.018 and p=0.043, respectively – Table II).

The pillars of a NOM for SBO caused by adhesions are represented by 'nil by mouth', stomach decompression and fluid resuscitation. This management does not differ for younger and older patients. A NOM, especially in the 'frail older patient', should include correction of electrolyte alterations and nutritional support[23-25]. NOM is effective in ~70-90% of patients with adhesive SBO in general[14,25]. Though it has a significant failure rate and important randomized trial have already demonstrated that routine placement of a naso-gastric/naso-jejunal tube is not necessary in elective surgical oncology procedures[26], the nasogastric decompression plays an important role in the conservative treatment of SBO to initially relieve symptoms and avoid aspiration and possible pneumonia[9,27].

In our study, we found that NOM for patients ≥ 80 years with SBO was not inferior to surgical treatment in terms of in hospital mortality, whereas had better results only in terms of overall major complications and LOS.

As far as the duration of a conservative treatment is concerned, it is advisable to wait before the decision to operate, if the SBO is not resolved by NOM.

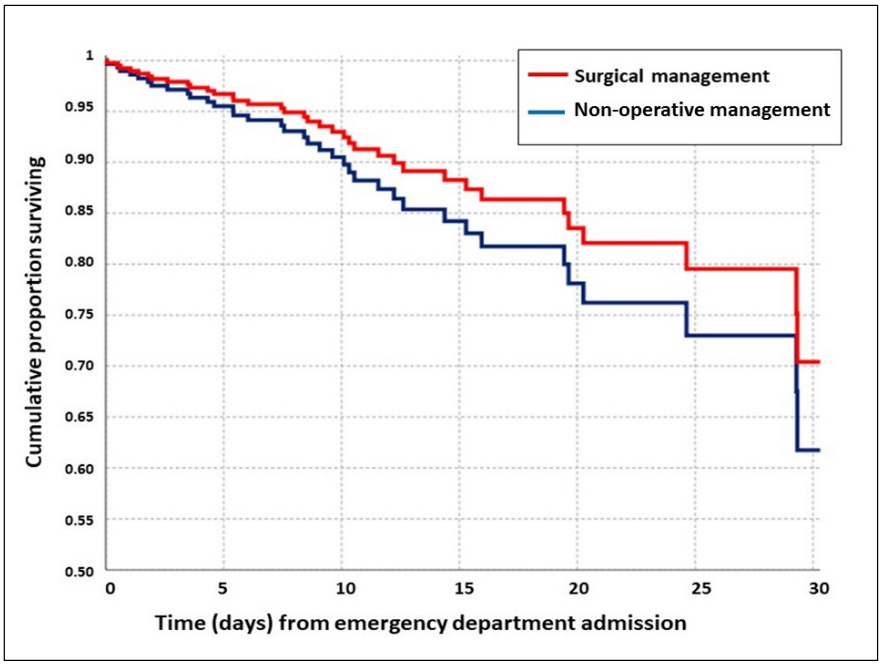

Figure 1. Overall, in hospital survival in PSM population, after correction for clinical covariates. Survival rates were similar for NOM and operative management (p=0.819).

The majority of authors apply the '72-h safe-time rule' for duration of initial conservative approach irrespective of age[9,28]. However, in elderly patients, it seems that a NOM is chosen more frequently and that the duration of it is longer respect to younger patients[29].

In a prospective cohort study, Springer et al[30] enrolled patients ≥ 70 years with SBO. The authors reported that patients who underwent surgery experienced more complications (64% *vs.* 27%, p=0.002) and a higher LOS (10 *vs.* 3 days, p<0.001) compared to patients managed non-operatively. Moreover, they reported a 14% mortality in elderly patients undergoing delayed surgery compared to 3% with early surgery, however this difference was not statistically significant[30].

In a study by Krause and Webb[31], which compared elderly (≥ 65 years of age) and non-elderly patients admitted with bowel obstruction, no differences were observed among admission characteristics, treatment, time to or type of surgery, LOS, or overall complications. Cardiac complications (15% *vs.* 0%, p=0.0082) and subacute care facility discharge (29% *vs.* 5%, p<0.001) were more common for geriatric patients.

As far as SBO due to malignancy is concerned, our study confirms that malignancy is a negative prognostic factor for survival. Moreover, NOM

Table II. Population comparison after propensity score match.

Variable	All population n = 302	NOM group n = 151	Surgery group n = 151	*p*-value
Age (years)[§]	84 [82-88]	85 [82-89]	84 [82-88]	0.301
Sex (Male)	126 (41.7%)	68 (45.0%)	58 (38.4%)	0.243
ED Presentation				
Abdominal pain	192 (63.6%)	80 (53.0%)	112 (74.2%)	<0.001
Vomit	148 (49.0%)	68 (45.0%)	80 (53.0%)	0.167
Constipation	102 (33.8%)	49 (32.5%)	53 (35.1%)	0.626
Fever	45 (14.9%)	21 (13.9%)	24 (15.9%)	0.628
Diarrhea	15 (5.0%)	7 (4.6%)	8 (5.3%)	0.791
Gastrointestinal bleeding	5 (1.7%)	2 (1.3%)	3 (2.0%)	1.000
Shock	3 (1.0%)	1 (0.7%)	2 (1.3%)	1.000
Abdominal Complications				
Abdominal tumor	102 (33.8%)	51 (33.8%)	51 (33.8%)	1.000
Intestinal adhesions	54 (17.9%)	24 (15.9%)	30 (19.9%)	0.368
Peritoneal carcinomatosis	12 (4.0%)	8 (5.3%)	4 (2.6%)	0.378
Abscess/abdominal collection	4 (1.3%)	1 (0.7%)	3 (2.0%)	0.622
Comorbidities				
Charlson Comorbidity Index[§]	6 [4 - 8]	6 [4 - 8]	6 [4 - 8]	0.936
Severe obesity	3 (1.0%)	1 (0.7%)	2 (1.3%)	1.000
Ischemic heart disease	36 (11.9%)	20 (13.2%)	16 (10.6%)	0.477
Congestive heart failure	23 (7.6%)	11 (7.3%)	12 (7.9%)	0.828
Peripheral vascular disease	28 (9.3%)	12 (7.9%)	16 (10.6%)	0.427
Dementia	27 (8.9%)	13 (8.6%)	14 (9.3%)	0.840
COPD*	43 (14.2%)	21 (13.9%)	22 (14.6%)	0.869
Diabetes	28 (9.3%)	10 (6.6%)	18 (11.9%)	0.112
Chronic kidney disease	34 (11.3%)	19 (12.6%)	15 (9.9%)	0.466
Malignancy	134 (44.4%)	62 (41.1%)	72 (47.7%)	0.247
Outcomes				
Death	37 (12.3%)	20 (13.2%)	17 (11.3%)	0.599
Mechanical Ventilation	27 (8.9%)	2 (1.3%)	25 (16.6%)	<0.001
Sepsis	16 (5.3%)	4 (2.6%)	12 (7.9%)	0.069
Cumulative major complications[@]	66 (21.9%)	24 (15.9%)	42 (27.8%)	0.018
LOS (days)[£]	8.6 [5.4-13.3]	8.1 [5.4-13.3]	9.2 [6.3-13.4]	0.043
ED readmission within 6 months[&]	43 (14.2%)	15 (9.9%)	28 (18.5%)	0.478

[#]Hypotension/Shock was defined as systolic blood pressure < 100 mmHg at emergency department admission; [§]Values are expressed as Median [Interquartile range]; [@]Cumulative major complications include: death, admission to ICU/Ventilation, biliary fistula, sepsis. [£]Length of Hospital Stay. [*]Chronic obstructive pulmonary disease. NOM: non-operative management. [&]Readmission was calculated on discharged patients in each group (103 were lost at follow-up).

Table III. Factors associated to survival at univariate and multivariate analysis (logistic regression model).

Variable	Survived n = 265	Deceased n = 37	Univariate *p*-value	Hazard Ratio [95% Confidence Interval]	Multivariate
Age (years)§	84 [82-88]	86 [82-90]	0.430		
Sex (Male)	103 (38.9%)	23 (62.2%)	0.007	1.86 [0.95-3.64]	0.070
ED Presentation					
Abdominal pain	173 (65.3%)	19 (51.4%)	0.099		
Vomit	136 (51.3%)	12 (32.4%)	0.031	0.57 [0.28-1.14]	0.111
Constipation	92 (34.7%)	10 (27.0%)	0.354		
Fever	39 (14.7%)	6 (16.2%)	0.810		
Diarrhea	12 (4.5%)	3 (8.1%)	0.408		
Gastrointestinal bleeding	3 (1.1%)	2 (5.4%)	0.115		
Shock	2 (0.8%)	1 (2.7%)	0.325		
Abdominal Complications					
Abdominal tumor	85 (32.1%)	17 (45.9%)	0.095		
Intestinal adhesions	54 (20.4%)	0	0.001		
Peritoneal carcinomatosis	9 (3.4%)	3 (8.1%)	0.169		
Abscess/abdominal collection	3 (1.1%)	1 (2.7%)	0.409		
Comorbidities					
Charlson Comorbidity Index§	6 [4 - 8]	6 [5 - 8]	0.129		
Severe obesity	3 (1.1%)	0	1.000		
Ischemic heart disease	32 (12.1%)	4 (10.8%)	1.000		
Congestive heart failure	17 (6.4%)	6 (16.2%)	0.035	2.79 [0.79-9.78]	0.108
Peripheral vascular disease	27 (10.2%)	1 (2.7%)	0.224		
Dementia	23 (8.7%)	4 (10.8%)	0.757		
COPD*	36 (13.6%)	7 (18.9%)	0.449		
Diabetes	22 (8.3%)	6 (16.2%)	0.120		
Chronic kidney disease	32 (12.1%)	2 (5.4%)	0.401		
Malignancy	114 (43.0%)	20 (54.1%)	0.206		
Therapy					
NOM	131 (49.4%)	20 (54.1%)	0.599	1.01 [0.53-2.23]	0.819

Hypotension/Shock was defined as systolic blood pressure < 100 mmHg at emergency department admission; §Values are expressed as Median [Interquartile range]; @Cumulative major complications include: death, admission to ICU/Ventilation, biliary fistula, sepsis. *Chronic obstructive pulmonary disease. NOM: non-operative management

shows high failure rates, although palliative treatment could be considered[32]. The real effects of palliative surgery on mortality, morbidity and functional decline in the elderly population are not known in detail; however, increased age in general and emergency surgery are known risk factors for morbidity and mortality in malignant bowel obstruction[30,31]. Therefore, any type of surgery should be avoided in frail elderly patients in order to preserve patient's quality of life.

Limitations

Despite our study represents the largest experience on SBO clinical course in patients ≥ 80 years of age, some major limitations should be underlined. First of all, its retrospective nature is responsible of potential biases, even after PSM had been done. Secondly, its monocentric accrual does not permit to represent all patients admitted with a bowel obstruction diagnosis in a general ED. Lastly, this study was focused on short-term prognosis of SBO treatment only, and cannot provide definitive indications in case of long-standing disease.

Conclusions

The management of SBO in the elderly requires more than just a 'copy and paste' of recommendations and guidelines designed for younger patients[32]. In selected elderly patients, with multiple comorbidities or functional impairments, a NOM should always be considered.

Table IV. Factors associated to cumulative major complications at univariate and multivariate analysis (Cox Regression Model).

Variable	None or minor complications	Cumulative major complications n = 66	Univariate *p*-value	Hazard Ratio [95% Confidence Interval]	Multivariate *p*-value
Age (years)[§]	84 [82-88]	85 [82-91]	0.189		
Sex (Male)	103 (37.7%)	37 (56.1%)	0.008	1.42 [0.87-2.34]	0.163
ED Presentation					
Abdominal pain	154 (65.3%)	38 (57.6%)	0.252		
Vomit	115 (48.7%)	33 (50.0%)	0.855		
Constipation	80 (33.9%)	22 (33.3%)	0.932		
Fever	34 (14.4%)	11 (16.7%)	0.649		
Diarrhea	10 (4.2%)	5 (7.6%)	0.270		
Gastrointestinal bleeding	3 (1.3%)	2 (3.0%)	0.322		
Shock	2 (0.8%)	1 (1.5%)	0.524		
Abdominal Complications					
Abdominal tumor	72 (30.5%)	30 (45.5%)	0.023	1.48 [0.89-2.46]	0.127
Intestinal adhesions	48 (20.3%)	6 (9.1%)	0.035	0.63 [0.27-1.46]	0.278
Peritoneal carcinomatosis	9 (3.8%)	3 (4.5%)	0.729		
Abscess/abdominal collection	1 (0.4%)	3 (4.5%)	0.034	0.77 [0.18-3.24]	0.717
Comorbidities					
Charlson Comorbidity Index[§]	6 [4 - 8]	6 [5.5-9]	0.010		
Severe obesity	3 (1.3%)	0	1.000		
Ischemic heart disease	26 (11.0%)	10 (15.2%)	0.359		
Congestive heart failure	14 (5.9%)	9 (13.6%)	0.037	1.86 [0.84-4.14]	0.129
Peripheral vascular disease	23 (9.7%)	5 (7.6%)	0.591		
Dementia	19 (8.1%)	8 (12.1%)	0.306		
COPD*	34 (14.4%)	9 (13.6%)	0.874		
Diabetes	16 (6.8%)	12 (18.2%)	0.005	1.41 [0.75-2.67]	0.289
Chronic kidney disease	30 (12.7%)	4 (6.1%)	0.131		
Malignancy	96 (40.7%)	38 (57.6%)	0.015	2.02 [0.87-4.70]	0.103
Therapy					
NOM	127 (53.8%)	24 (36.4%)	0.012	0.73 [0.43-1.24]	0.242

[#]Hypotension/Shock was defined as systolic blood pressure < 100 mmHg at emergency department admission; [§]Values ae expressed as Median [Interquartile range]; [@]Cumulative major complications include: death, admission to ICU/Ventilation, sepsis. [*]Chronic obstructive pulmonary disease. NOM: non-operative management.

Conflicts of Interest

None of the authors has any conflict of interest or financial ties to disclose.

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None.

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Ethics Approval

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1964 and later versions. The study was reviewed and approved by the Ethics Committee of Fondazione Policlinico Universitario A. Gemelli IRCCS (#0058741/20).

Informed Consent

Written informed consent was obtained from participants (or their parent/legal guardian/next of kin) to partici-pate in the study.

Authors' Contributions

Study conception and design: Rosa, Covino, Fransvea, Franceschi, Alfieri. Acquisition of data: Rosa, Covino, Simeoni, Fransvea, Pacini, Quero, Fiorillo. Analysis and interpretation of data: Rosa, Covino, Simeoni,

Pacini, Sganga, Franceschi, Gasbarrini, Alfieri. Drafting of manuscript: Rosa, Covino, Fransvea, Quero, Pacini, Fiorillo, Simeoni, La Greca, Sganga, Franceschi, Alfieri. Critical revision: Rosa, Covino, Fransvea, Quero, Pacini, Fiorillo, Simeoni, La Greca, Sganga, Franceschi, Gasbarrini, Alfieri.

Data Availability

All data are available at the Emergency Department Database (Gipse®) of the Fondazione Policlinico Universitario A. Gemelli IRCCS.

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