

# Management and outcomes of small bowel obstruction in older adult patients: a prospective cohort study

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This research was presented in poster format at the annual meeting of the Canadian Association of General Surgeons, Ottawa, Ont., September 2013.

Accepted for publication  
Apr. 22, 2014

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DOI: 10.1503/cjs.029513

**Background:** The purpose of this research was to examine the morbidity, mortality and rate of recurrent bowel obstruction associated with the treatment of small bowel obstruction (SBO) in older adults.

**Methods:** We prospectively enrolled all patients 70 years or older with an SBO who were admitted to a tertiary care teaching centre between Jul. 1, 2011, and Sept. 30, 2012. Data regarding presentation, investigations, treatment and outcomes were collected.

**Results:** Of the 104 patients admitted with an SBO, 49% were managed nonoperatively and 51% underwent surgery. Patients who underwent surgery experienced more complications (64% v. 27%,  $p = 0.002$ ) and stayed in hospital longer (10 v. 3 d,  $p < 0.001$ ) than patients managed nonoperatively. Nonoperative management was associated with a high rate of recurrent SBO: 31% after a median follow-up of 17 months. Of the patients managed operatively, 60% underwent immediate surgery and 40% underwent surgery after attempted nonoperative management. Patients in whom nonoperative management failed underwent surgery after a median of 2 days, and 89% underwent surgery within 5 days. The rate of bowel resection was high (29%) among those who underwent delayed surgery. Surgery after failed nonoperative management was associated with a mortality of 14% versus 3% for those who underwent immediate surgery; however, this difference was not significant.

**Conclusion:** These data suggest that some elderly patients with SBO may be waiting too long for surgery.

**Contexte :** Le but de cette recherche était d'analyser la morbidité, la mortalité et le taux de récurrence de l'occlusion intestinale associés au traitement de l'occlusion intestinale grêle (OIG) chez des adultes âgés.

**Méthodes :** Nous avons inscrit de manière prospective tous les patients de 70 ans ou plus présentant une OIG qui ont été admis dans un établissement de soins tertiaires entre le 1er juillet 2011 et le 30 septembre 2012. Nous avons recueilli les données concernant les tableaux cliniques, les épreuves diagnostiques, les traitements et leurs résultats.

**Résultats :** Parmi les 104 patients admis pour OIG, 49 % ont été traités non chirurgicalement et 51 % ont subi une intervention chirurgicale. Les patients soumis à la chirurgie ont présenté davantage de complications (64 % c. 27 %,  $p = 0,002$ ) et ont séjourné plus longtemps à l'hôpital (10 j. c. 3 j.,  $p < 0,001$ ) comparativement aux patients qui n'ont pas été opérés. La prise en charge non chirurgicale a été associée à un taux élevé de récurrences de l'OIG : 31 % après un suivi médian de 17 mois. Parmi les patients opérés, 60 % ont subi une chirurgie immédiate et 40 % ont subi leur chirurgie après une tentative de prise en charge non chirurgicale. Les patients chez qui la prise en charge non chirurgicale a échoué ont subi leur chirurgie après une période médiane de 2 jours et 89 % en l'espace de 5 jours. Le taux de résection intestinale a été élevé (29 %) chez ceux dont la chirurgie a été retardée. La chirurgie après une intervention non chirurgicale infructueuse a été associée à un taux de mortalité de 14 %, contre 3 % chez les patients immédiatement soumis à la chirurgie. Toutefois, cette différence s'est révélée non significative.

**Conclusion :** Ces données laissent penser que certains patients âgés présentant une OIG attendent peut-être trop longtemps pour leur chirurgie.

Small bowel obstruction (SBO) is a common reason for elderly patients to be admitted to hospital under the care of general surgery. Treatment of SBO may involve immediate surgery, a trial of nonoperative management followed by surgery, or nonoperative management leading to resolution of the obstruction. Decisions regarding the most appropriate treatment approach in older patients with SBO can be challenging for several reasons. Elderly patients with SBO often present late in the course of their illness and report atypical or nonspecific symptoms.<sup>1-3</sup> In addition, their clinical presentation and physical examination may be less reliable.<sup>4-9</sup> Previous research has consistently demonstrated that emergency abdominal surgery in elderly patients is associated with increased morbidity and mortality compared with elective surgery or emergency surgery in younger patients.<sup>10-20</sup> Accordingly, the decision to proceed with surgery must be considered carefully. In contrast, delaying necessary surgery in elderly patients has also been associated with very poor outcomes.<sup>21</sup> These issues make decisions regarding the timing of surgery and duration of nonoperative treatment difficult.

Despite these treatment challenges, very little research has specifically examined the treatment and outcomes of SBO in elderly patients. This is particularly concerning given current demographic trends. It is expected that the elderly population in Canada will double and the number of individuals older than 80 years will triple by 2050.<sup>22</sup> This will likely lead to a substantial increase in the number of elderly patients admitted to hospital with SBO in the future. Therefore, the purpose of this research was to examine the morbidity, mortality and rate of recurrent bowel obstruction associated with the treatment of SBO in elderly patients ( $\geq 70$  years old) at a tertiary care teaching centre.

## METHODS

We prospectively enrolled consecutive patients aged 70 years or older who had an SBO and were admitted to an acute care general surgery service at a tertiary care teaching hospital between Jul. 1, 2011, and Sept. 30, 2012. Patients were included if they had symptoms (abdominal pain, nausea, vomiting, decreased bowel function with or without obstipation) and radiographic findings (plain film or computed tomography [CT]) consistent with an SBO. Patients with obstructing cecal cancers or other large bowel pathology were excluded.

One of us obtained consent from all patients at the time of admission. When patients did not have the capacity to provide consent, either the substitute decision maker or the next of kin provided consent. At the time of admission a comprehensive geriatrics assessment (CGA) was completed for each patient. Patients were asked to describe their functional level 2 weeks before admission to provide a measure of baseline status. If patients could not provide the information it was obtained from their families or care-

givers. Frailty was measured during the CGA using the Canadian Study of Health and Aging Clinical Frailty Scale Score. Each patient was assigned a score of 1-9.<sup>23</sup> Data regarding presentation, investigations, treatment and outcomes were collected through a comprehensive review of the patients' medical records. All patients were contacted by phone 6 months after discharge to determine their vital status (dead v. alive). If patients could not be reached, then we called their predetermined designates. If the designates could not be reached, then we called the family doctor if the patient had provided consent for the investigators to do so. We reviewed the medical records for all patients up until May 30, 2013, (study end date) to determine if patients were readmitted for complications after the index admission or for recurrent SBO.

We determined the etiology of SBO based on physical examination findings, radiologic reports and operative records. Time to return of bowel function was calculated as the time lapse between the surgical consultation and the first documented episode of flatus or stool recorded in the medical record by either the nursing or medical team. Patient comorbidities were categorized using the Charlson Comorbidity Index.<sup>24</sup> This did not take into account patient age. Postoperative morbidity was classified according to the Clavien-Dindo system, which categorizes complications according to a 5-level ordinal scale.<sup>25</sup> Minor complications correspond to grades 1 and 2, major complications to grades 3 and 4, and death corresponds to grade 5 on the Clavien-Dindo scale. Morbidity occurring during the index admission for each patient was recorded. All-cause perioperative and 6-month mortality were also recorded. Perioperative mortality was defined as death during the index admission or within 30 days of surgery.

Approval for the study was obtained from our institutional research ethics board.

## Statistical analysis

Data were entered into a computerized database. We performed all statistical analyses using Graphpad Prism statistical software version 6.0. We performed  $\chi^2$  tests for all analyses of categorical variables, and the Student *t* test was used for statistical analyses of continuous variables. We calculated 95% confidence intervals (CIs) when comparing means. Mann-Whitney nonparametric tests were used to analyze the difference between median values for continuous variables when the assumption of normality was not met. We considered results to be significant at  $p < 0.05$ .

## RESULTS

During the study period 104 patients were admitted with an SBO. The median patient age was 79 years, the median frailty scale score was 5, most patients were women, and the most common etiology of SBO was postoperative adhesions

(Table 1). Overall, 51 patients (49%) were managed non-operatively and 53 patients (51%) underwent surgery.

### Patients managed nonoperatively

In the 51 patients with an SBO who were managed non-operatively, adhesions were responsible for the majority of cases (86%), followed by malignancy (8%) and hernias (6%). Patients who were managed nonoperatively were similar to those who required surgery in terms of age, sex, comorbidities and body mass index (BMI), but were more likely to have undergone prior abdominal surgery and to have been admitted for an SBO in the past (Table 2). The median time to return of bowel function was 1.3 (range < 1–4.4) days, and the median length of stay in hospital was 3 (range < 1–19) days. The in-hospital complication rate was 27%, and the most common complications were delirium, urinary tract infection and atrial fibrillation. Complications were less common and length of stay was shorter among patients treated nonoperatively than among those who underwent surgery (Table 3).

During the index admission 1 patient (2%) managed nonoperatively died of intra-abdominal sepsis. Five additional patients died during the 6 months after discharge, yielding a 6-month mortality of 12%. The deaths that occurred after discharge were due to cancer in 2 patients (40%), stroke in 1 patient (20%), heart failure in 1 patient

(20%) and line sepsis in 1 patient (20%). The readmission rate during the first 6 months after discharge was 39% (20 of 51) in the patients managed nonoperatively. The most common reasons for readmission were recurrent SBO in 11 patients (55%), urinary tract infection in 3 patients (15%) and failure to thrive in 1 patient (5%). The median duration of follow-up after discharge was 17.1 (range 8.2–23.2) months. The rate of readmission for recurrent SBO during the entire follow-up period was 31% (16 of 51), and 25% (4 of 16) of patients required surgery at the time of recurrent SBO. The median time to readmission for recurrent SBO was 2.6 (range 0.13–14.8) months.

### Patients managed surgically

Of the 53 patients who underwent surgery for SBO, adhesions were responsible for the majority of cases (49%), followed by hernias (43%) and malignancy (4%). Thirty-five percent of patients underwent a lysis of adhesions (LOA), 18% had a small bowel resection, 25% had a hernia repair, 13% had a small bowel resection and LOA, and 9% had a hernia repair and small bowel resection. The overall

**Table 1. General characteristics of patients aged 70 years or older presenting with SBO (n = 104)**

Characteristic	Mean (95% CI) or median [range]*
Age, mean (range) yr	79 (70–97)
Sex, % men	43
BMI	25 (24.1–26.2)
LOS, d	6 (< 1–90)
Charlson score	2 (< 1–12)
Frailty scale score, %	
1–3 (well)	22
4 (prefrail)	25
5 (mildly frail)	26
6–8 (moderate/severely frail)	21
9 (palliative)	6
Previous abdominal operation, %	88
Previous SBO, %	29
SBO etiology, %	
Adhesions	67
Malignancy	6
Ventral hernia	12
Groin hernia	9
Stoma hernia	2
Umbilical hernia	2
Inflammatory bowel disease	1
Stricture	1

BMI = body mass index; CI = confidence interval; LOS = length of stay; SBO = small bowel obstruction.  
\*Unless otherwise indicated.

**Table 2. Comparison of baseline characteristics between patients aged 70 years and older with SBO who were managed nonoperatively or operatively**

Characteristic	Group, median (range) or %*	
	Nonoperative, n = 51	Operative, n = 53
Age, yr	79 (70–96)	78 (70–97)
Sex, % male	43	43
BMI, mean (95% CI)	25.7 (24.3–27.1)	24.6 (23.3–26.0)
Charlson score	2 (0–8)	1 (0–12)
Previous abdominal operation	96.1	79.2
Previous SBO	41	17
Patients who received CT	73	74

BMI = body mass index; CI = confidence interval; CT = computed tomography; SBO = small bowel obstruction.  
\*Unless otherwise indicated.

**Table 3. Comparison of outcomes between patients aged 70 years or older with SBO who were managed nonoperatively or operatively**

Variable	Group; median (range) or %		
	Nonoperative, n = 51	Operative, n = 53	p value
In-hospital morbidity			
All complications	27	64	0.002
Major complications	0	21	0.006
Mortality			
In-hospital	2	8	0.18
6-mo	12	8	0.47
LOS	3 (0–19)	10 (2–90)	< 0.001
All-cause 6-mo readmission rate	39	13	0.003
Readmission for SBO	31	15	0.041

LOS = length of stay; SBO = small bowel obstruction.

perioperative mortality was 8%, and the causes of death included line sepsis (25%), intra-abdominal sepsis (25%) and cancer (50%). The overall complication rate was 64%, with respiratory complications being the most common (Table 4). The median duration of follow-up after discharge was 14.4 (range 8.1–22.6) months. The overall rate of recurrent SBO during follow-up was 15%, and the median time to recurrence was 5.4 (range 0.7–14.2) months.

Thirty-two patients (60%) were booked for immediate surgery after the initial assessment by the surgical team. The remaining 21 patients (40%) were admitted for nonoperative management, but required surgery when nonoperative management failed. The imaging performed at the time of presentation for this group of 21 patients included abdominal radiography followed by CT in 76%, CT only in 19% and no imaging in 5%. Only 2 of 21 patients underwent abdominal radiography more than once after admission, and only 1 of 21 patients underwent CT a second time. The decision to proceed to surgery for patients initially treated nonoperatively was made owing to lack of clinical improvement in 67%, worsening findings on clinical examination in 9.5%, elevated white blood cell count ( $\geq 13 \times 10^9/L$ ) in 9.5%, new findings on imaging (high-grade SBO and findings suggestive of ischemic bowel on CT scan) in 4.5% and a combination of these reasons in 9.5%. The median time from the initial general surgery assessment to the decision to operate was 2 (range < 1–13) days; 21% of patients waited more than 3 days, 15% waited more than 4 days and 11% waited more than 5 days. There were no significant differences in the rate of bowel resection, overall complications, readmissions and mortality between patients who were taken for immediate surgery and patients in whom initial nonoperative management failed (Table 5). There was no significant difference in the postoperative median length of stay between the groups (12 d for delayed surgery v. 8 d for immediate surgery,  $p = 0.09$ ).

We compared outcomes between the 18 patients who underwent a small bowel resection at the time of surgery

and the 35 patients who did not require a resection. There was no difference in the rate of complications between these 2 groups (61% after resection v. 66% without resection,  $p = 0.74$ ). While perioperative mortality was 17% in patients who underwent resection versus 3% in those who did not undergo a resection, this difference was not statistically significant ( $p = 0.07$ ).

DISCUSSION

The goal of treatment in patients with SBO is to achieve resolution of the obstruction and minimize morbidity and mortality. Nonoperative treatment is particularly appealing in elderly patients given the increased risk of poor outcomes associated with nonelective surgery in this patient population. In the present study, nonoperative management of SBO was associated with decreased rates of complications and length of stay compared with surgical management. However, nonoperative treatment is not successful in all patients. Overall, 49% of patients in the present study were successfully managed nonoperatively. There is wide variation in the reported rate of successful nonoperative management among patients with SBO, ranging from 43%–76%.<sup>26–34</sup> This likely reflects variation in the etiology of SBO among patients included in previous studies, different clinical thresholds for taking patients with SBO to the operating room and changing practice patterns over the past 3 decades. In the only study that specifically examined treatment of SBO among elderly patients, 19% of patients older than 70 years were treated nonoperatively.<sup>35</sup>

A downfall of nonoperative management is that it is associated with an increased risk of recurrent SBO compared with surgery.<sup>26,29,34,36</sup> In the largest study of recurrent SBO

Table 4. Postoperative complications in patients aged 70 years and older who underwent surgery for SBO (n = 53)

Complication type	Complication rate; no. (%)
Respiratory*	12 (23)
Delirium	6 (11)
Cardiovascular†	6 (11)
Urinary tract infection	6 (11)
Intra-abdominal sepsis	1 (1.9)
Acute renal failure	1 (1.9)
Other‡	3 (5.7)

SBO = small bowel obstruction; TPN = total parenteral nutrition.  
 \*Respiratory failure, pneumonia or pulmonary embolism.  
 †Atrial fibrillation, supraventricular tachycardia or myocardial infarction.  
 ‡Wound dehiscence, requiring TPN or diarrhea.

Table 5. Comparison of outcomes between patients aged 70 years and older with SBO who underwent immediate surgery and delayed surgery after failure of nonoperative management

Variable	Group; no. (%)		p value
	Immediate surgery n = 32	Failed nonoperative management n = 21	
In-hospital morbidity			
All complications	21 (66)	13 (62)	0.78
Major complication	7 (22)	4 (9)	0.80
Mortality			
In-hospital	1 (3)	3 (14)	0.13
6-mo	1 (3)	3 (14)	0.13
All-cause 6-mo readmission rate	5 (16)	2 (10)	0.52
Readmission for SBO	3 (9)	5 (24)	0.24
Surgical procedure			
Surgery with resection	12 (38)	6 (29)	0.50
Surgery without resection	20 (62)	15 (71)	0.50

SBO = small bowel obstruction.

( $n = 32\ 583$ ), Foster and colleagues<sup>34</sup> reported recurrence after 5 years of follow-up in 20% of patients treated nonoperatively compared with 16% of patients treated surgically. Readmission for recurrence happened earlier in the patients managed nonoperatively than in those managed surgically (median 194 v. 354 d). In a study of 309 patients with SBO, the recurrence rate after 10 years of follow-up was 53% among patients treated nonoperatively compared with 29% among those treated surgically.<sup>29</sup> Very little research has specifically examined recurrence after treatment of SBO in elderly patients. In the present study, the recurrence rate after a short duration of follow-up of only 17 months was 31% in patients managed nonoperatively. These data suggest that recurrent SBO after nonoperative treatment may occur earlier and more often in elderly patients than in younger patients. Additional studies with longer follow-up are needed to evaluate the risk and consequences of recurrent SBO in elderly patients. This will help to better define the role for nonoperative management in this patient population.

An additional concern associated with nonoperative management is that delaying surgery may lead to poor outcomes. This is particularly relevant given that it can be very difficult to accurately determine which patients with a SBO have ischemic bowel.<sup>28,32,37,38</sup> Delayed surgery for SBO has been associated with increased morbidity<sup>21,30,39,40</sup> and mortality.<sup>21</sup> However, it is difficult to interpret this literature given that the threshold used to define early versus delayed time periods varied from 24 hours to 4 days. A recent study using data from the National Surgical Quality Improvement Program reported on outcomes for 4163 patients who underwent laparotomy for adhesive SBO.<sup>41</sup> Patients who underwent surgery more than 72 hours after admission experienced a 3-fold increase in mortality and a 2-fold increase in systemic infectious complications compared with patients who underwent surgery sooner. Only 1 study has specifically examined outcomes associated with delayed surgery for SBO in elderly patients. In 56 patients older than 70 years, surgery for SBO performed 48 hours after admission was associated with increased morbidity and length of stay, but not mortality, compared with surgery performed earlier.<sup>42</sup>

Given that the timing of surgery is critical in the management of SBO and that delayed surgery has been associated with poor outcomes, practice guidelines have recommended that conservative management should be attempted for only 3–5 days.<sup>43,44</sup> In the present study the median duration of nonoperative treatment before surgery was 2 days, with 79% of patients undergoing surgery within 3 days and 89% undergoing surgery within 5 days. Despite the fact that almost all of the patients received their operation within the timeframe recommended by current guidelines, our results suggest that some patients may have waited too long. Although there was no difference in the complication rate between those who underwent immediate versus delayed surgery (22% v. 19%, respectively), the mortality was 14%

in the delayed group compared with 3% in the immediate surgery group. While this difference was not statistically significant, it suggests that delaying surgery for SBO for up to 5 days in elderly patients may be associated with increased mortality. In addition, the rate of bowel resection after failed nonoperative management was 29%. This seems high for a group of patients who were being watched in hospital and also suggests that patients may have waited too long for surgery. Had surgery been performed earlier in these patients, resection may not have been required. This is important as bowel resection for SBO has been associated with both increased morbidity<sup>45</sup> and mortality.<sup>34</sup>

### Limitations

There are several limitations associated with this research that should be considered. The major study limitation was the relatively small sample size. This limits the strength of the conclusions that can be made from this study and prevented the use of multivariate analysis. However, this research adds to the literature, as it is one of the few studies that specifically examined SBO in elderly patients. In addition, a heterogeneous population with various etiologies of SBO was included, and the follow-up period was relatively short.

### CONCLUSION

While nonoperative resolution of SBO in elderly patients is ideal, waiting too long to operate may lead to poor outcomes. Our results suggest that older patients with SBO may be waiting too long for surgery. Larger studies are clearly needed to specifically examine the management of SBO in elderly patients to better define the role of nonoperative management and the appropriate duration of nonoperative treatment in this patient population. Until better data are available, caution should be used when deciding to continue with nonoperative management beyond 24–48 hours in older patients with SBO.

**Funding/support:** This research was supported by the Department of Surgery at Dalhousie University, the Nova Scotia Health Research Foundation and the Dalhousie Medical Research Foundation Music-in-Medicine endowment.

**Competing interests:** None declared.

**Contributors:** All authors designed the study. J. Springer, J. Bailey and P. Davis acquired and analyzed the data, which P. Johnson also analyzed. All authors wrote and reviewed the article and approved the final version for publication.

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