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Adhesive small bowel obstruction in octogenarians: A 6-year retrospective single-center analysis of clinical management and outcomes

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ABSTRACT

Background: Few evidences are available on adhesive bowel obstruction (ASBO)management and outcomes in geriatric patients.
Methods: One-hundred-twenty-eight patients aged 65–79 years were retrospectively compared to 77 patients aged ≥80 years. Aim of this study was to compare ASBO management and in-hospital course between patients aged 65–79 years and those over 80 years.
Results: Upfront surgery in octogenarians related with a higher rate of major complications (23.7%vs4.9%; p = 0.009) and longer hospitalization (8.8vs7.3 days; p = 0.01). No difference according to age was noted in terms of clinical outcomes when the non-operative management (NOM) was employed. Patients aged ≥80 years managed conservatively presented shorter hospitalization (7.3vs8.8 days; p = 0.04), lower rate of intensive care unit (ICU) admission (0vs18.4%; p = 0.005) and cumulative major complications (2.6%vs23.7%; p = 0.007) as compared to ≥80 years old patients treated with upfront surgery. In this same group, NOM failure did not lead to worse outcomes in comparison to upfront surgery.
Conclusions: NOM in≥80 years patients is associated with better in-hospital course. The acceptable clinical outcomes in case of NOM failure further support NOM as first treatment strategy to employ in this same subset of patients.

1. Introduction

The improvement of quality-of-life conditions in Western countries have led to an increase of population's age with a high percentage of people currently aged 65 years and over. In this context, the share of people aged 80 years and over is expected to have a 2.5-fold increase by 2100.[1] This trend portends a concomitant increase of hospitalizations due to both chronic and acute conditions, especially in the emergency department (ED).

Adhesive small bowel obstruction (ASBO) currently represents up to 16% of ED admissions for diseases of surgical interest.[2] It is defined as a small bowel obstruction caused by the peritoneal adhesions resulting from either previous or concomitant abdominal surgeries.

The optimal treatment strategy of ASBO is still matter of debate. Surgery has represented the gold standard of treatment for long time. However, the high rate of perioperative complications[3,4] has led to consider conservative management as a potential alternative. Indeed, the Bologna guidelines[5] advice a non-operative management (NOM) during the first 72 hours from ED admission for all patients with ASBO, independently of age and frailty assessment.

However, as compared to younger patients, the NOM approach in the elderly may lead to opposite outcomes: NOM success would avoid the detrimental consequences resulting from perioperative complications. On the other hand, NOM failure could lead to a significant delay of appropriate treatment, potentially causing a further depletion of physiological reserves. This dilemma is even more significant in case of people aged 80 years and over, due to the higher prevalence of comorbidities and frailty syndrome, resulting in a reduced capability to cope

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with clinical stressing conditions such as ASBO.[6]

Despite the management of ASBO in octogenarians may imply more challenges than in other subsets of patients, no conclusive evidence regarding the potential influence of increasing age on clinical outcomes is currently available. Moreover, due to the increasing aging of the population, it seems appropriate to define geriatric patients as a heterogenous cohort and to analyze the clinical outcomes according to different age subsets within this same population.

Based on these premises, with the aim of giving our contribution to better understand the optimal management of ASBO in this frail subset of patients, we compared the clinical outcomes of upfront surgery and NOM application between patients aged 65–79 years and patients aged 80 years and over.

2. Methods

All records of patients who were admitted to the ED of the Fondazione Policlinico Universitario "Agostino Gemelli" IRCCS of Rome with a diagnosis of ASBO from January 2014 to August 2020 were retrospectively collected. Patients presenting at the ED with evidences of bowel ischemia, strangulation, and/or peritonitis, were excluded from the analysis due to a clear indication to emergent surgical exploration.

Patients aged 65 years and over were then selected for the study and subsequently divided in two groups: patients aged 65–79 years and patients aged 80 years and over. Demographic and clinical data were collected, namely age, sex, and patients' comorbidities (also stratified for Charlson comorbidity index[7]). The two study cohorts were thus compared for clinical presentation and in-hospital course, here including the type of ASBO treatment strategy (NOM vs surgery), intensive care unit (ICU) admission rate, length of hospital stay (LOS), in-hospital mortality and cumulative major complications rate, defined as the composite outcome including death, ICU admission and sepsis onset.

2.1. ASBO definition

ASBO was defined, according to the Bologna guidelines,[8] as an obstruction of the small bowel characterized by abdominal pain and distension, vomiting and constipation.

With regards to ASBO diagnosis and treatment, the Bologna Guidelines[8] point out the following recommendations:

1) In the absence of signs that require emergent surgical exploration (i.e., peritonitis, strangulation, or bowel ischemia), NOM is recommended;
2) A trial of NOM can be continued safely for 72 h;
3) Optimal diagnostic work-up should include a computed tomography (CT) scan with water-soluble oral contrast. In case immediate surgery is not needed, a radiological follow-up with an abdominal X-ray should be performed after 24 h. If the water soluble contrast administered for the CT scan has reached the colon, NOM can be safely continued. In case no contrast is evident in the colon, surgical exploration is suggested.

The work up of our cohort of study consisted of assessing clinical and abdominal surgical history, physical objectivity, blood tests and radiological evaluation, in order to localize the obstruction and identify any complication, such as intestinal ischemia or perforation, which might define immediate surgery as mandatory. Specifically, all patients admitted to the ED with a suspicion of ASBO underwent a CT scan with water-soluble contrast. In those patients who followed a NOM, a radiological follow up was then performed after 24 h with a plain X-ray in order to evaluate the progression of the water-soluble contrast administered for the CT scan.

2.2. Non-operative and operative management for ASBO

NOM was defined in accordance with the Bologna guidelines,[8,9] and started in absence of signs of peritonitis, bowel ischemia and/or strangulation. NOM consisted in withdrawal of enteral feeding, naso-gastric tube placement, parenteral hydroelectrolytic and nutritional support. NOM failure was defined as the persistence of signs and symptoms of ASBO without any improvement after the 72-h period of conservative management, or in case contrast was not seen in the colon at the plain X-ray performed 24 h from the CT scan.[8] In such cases, indication to surgery was given and the patient underwent surgical exploration.

Upfront surgery was defined as surgery performed within 24 h from admission even in the absence of signs of peritonitis, strangulation and/or bowel ischemia, based on surgeon's decision.

2.3. Study outcomes

Primary endpoint of the study was to evaluate LOS, ICU admission rate, in-hospital mortality and incidence of cumulative major complications in the two study populations. Cumulative major complications were defined as the composite outcome including death, ICU admission and sepsis onset. Secondary endpoints were to assess upfront surgery and NOM effectiveness in relation to the above-mentioned variables. A further evaluation of the two treatment strategies was additionally performed exclusively in the subgroup of patients aged 80 years or over, with a particular focus on the clinical course in case of NOM failure.

2.4. Statistical analysis

Categorical variables were statistically compared at univariate analysis using the Chi-square test, while the Mann-Whitney *U* test was used for the comparison of continuous variables.

Categorical variables were presented as numbers and percentages, while continuous variables were presented as median and quartile rank (QR). The significance level was set at 0.05, two sided.

All data were analyzed by SPSSv25®(IBM, IL, USA).

3. Results

During the study period, 777 patients (301 males and 476 females) were admitted to the ED of our Institution with a diagnosis of ASBO. Among these, 285 patients (36.7%) were 65 years old and over. Eighty patients out of 285 (28%) presented signs and/or symptoms of acute peritonitis, requiring immediate surgical treatment, and were therefore excluded from the analysis. Thus, the final study population consisted of 205 patients: 128 (62.4%) younger than 80 years and 77 (37.6%) aged 80 years and over.

Clinico-demographic characteristics and in-hospital course according to age (Table 1).

No significant difference was evidenced between the two study cohorts in terms of comorbidities, except for hypertension, more frequently encountered in patients aged 80 years and over ($p < 0.0001$). Interestingly, all these patients presented a Charlson Comorbidity Index$\geq$3, as compared to 111 out of 128 patients (86.7%) of the cohort of patients aged 65–79 years ($p = 0.001$).

Clinically, patients aged 65–79 years presented abdominal pain at the ED admission more frequently (17–13.3% vs 3–3.9%; $p = 0.03$), while other symptoms had a similar incidence in the two study cohorts.

No difference was noted between the two study groups in terms of employed treatment strategy: similar rates of NOM (52.3%-67 patients and 50.6%-39 patients in the 65–79 years old and $\geq$80 years old cohorts, respectively) and upfront surgery (47.7%-61 patients and 49.4%-38 patients in the 65–79 years old and $\geq$80 years old cohorts, respectively) were evidenced in the two study populations ($p = 0.81$).

In-hospital course was comparable between the two study groups, with similar ICU admission rates ($p = 0.32$), LOS ($p = 0.52$), cumulative

Table 1
Clinico-demographic characteristics and clinical outcomes of the two study cohorts.

Variable	65–79 years old N = 128	≥80 years old N = 77	*p*
Age, *years, median [QR]*	74 [65–79]	84 [80–99]	**< 0.0001**
Sex, *n (%)*			
Male	60 (46.9)	32 (41.6)	0.46
Female	68 (53.1)	45 (58.4)	
Comorbidities, *n (%)*			
Severe Obesity	1 (0.8)	2 (2.6)	0.29
Hypertension	18 (14.1)	33 (42.9)	**<0.0001**
Ischemic heart disease	9 (7)	6 (7.8)	0.84
Previous history of cerebrovascular disease	3 (2.3)	3 (3.9)	0.52
COPD	9 (7)	8 (10.4)	0.40
Diabetes	14 (10.9)	9 (11.7)	0.87
Chronic kidney disease	7 (5.5)	8 (10.4)	0.19
Malignancy	12 (9.4)	10 (13)	0.42
Charlson Comorbidity Index ≥3, *n (%)*	111 (86.7)	77 (100)	**0.001**
ED presentation, *n (%)*			
Abdominal pain	17 (13.3)	3 (3.9)	**0.03**
Vomit	75 (58.6)	49 (63.6)	0.47
Fever	34 (26.6)	14 (18.2)	0.17
Dyspnea	3 (2.3)	3 (3.9)	0.52
Syncope	4 (3.1)	4 (5.2)	0.46
Bleeding	2 (1.6)	1 (1.3)	0.88
Hypotension	4 (3.1)	4 (5.2)	0.46
Type of treatment, *n (%)*			
NOM	67 (52.3)	39 (50.6)	0.81
Upfront surgery	61 (47.7)	38 (49.4)	
Clinical course			
LOS. *days. median [QR]*	7.6 [4.5–11.3]	8 [6–11.8]	0.52
ICU admission, n *(%)*	7 (5.5)	7 (9.1)	0.32
Death, *n (%)*	5 (3.9)	0	0.08
Cumulative major complications[a]. *n (%)*	12 (9.4)	10 (13)	0.42

COPD: Chronic obstructive pulmonary disease; ED: emergency department; NOM: non-operative management; LOS: length of hospital stay; ICU: intensive care unit.
[a] Cumulative major complications include: death, sepsis, ICU admission.

major complications (p = 0.42) and in-hospital mortality (p = 0.08).

3.1. NOM vs upfront surgery outcomes (Table 2)

One-hundred-six patients (51.7%) were treated according to the NOM principles while 99 (48.3%) underwent surgery in the first 72 h from ED admission. No differences in terms of mortality (3.8% vs 1%; p = 0.2), cumulative major complications rate (9.4 vs 12.1%; p = 0.53) and LOS (7.6 [4.5–12.8] vs 7.7 [5.5–11.2]; p = 0.88) were evidenced between the two groups of patients. NOM failure was registered in 31 cases (29.2%). In this subset of patients, LOS resulted considerably longer as compared to patients who were successfully treated conservatively (12.2 [9.1–21.1] vs 6.5 [3.9–9.1] days; p=<0.0001), but no relevant difference was detected in terms of in-hospital mortality (4% vs 3.2%in case of NOM success and failure, respectively; p = 0.85) and cumulative major complications (6.7% vs 16.1% in case of NOM success and failure, respectively; p = 0.13).

A further analysis of clinical outcomes according to age and type of employed treatment was additionally conducted (Table 3). With regards to the upfront surgery cohort, ≥80 years old patients presented a longer LOS (8.8 [6.3–12.5] days vs7.3 [4.6–10.4] days; p = 0.01), with even a higher rate of ICU admission (18.4% vs 4.9%; p = 0.05) and cumulative major complications (23.7% vs 4.9%; p = 0.009). Conversely, no difference was noted between the two groups in terms of in-hospital mortality. Regarding the NOM group, no difference was evidenced, instead, for all the above-mentioned variables. As a whole, NOM failure was evidenced in 31 patients (29.2%): 23 (34.3%) patients of the 65–79 years old group and 8 (20.5%) of the ≥80 years old cohort (p = 0.13).

Table 2
Clinico-demographic characteristics and outcomes in patients undergone NOM vs upfront surgery.

Variable	NOM N = 106	Upfront surgery N = 99	*p*
Age, *n (%)*			
65–79 years old	67 (63.2)	61 (61.6)	0.81
≥80 years old	39 (36.8)	38 (38.4)	
Sex, *n (%)*			
Male	46 (43.4)	46 (46.5)	0.66
Female	60 (56.6)	53 (53.3)	
ED presentation, *n (%)*			
Abdominal pain	5 (4.7)	15 (15.2)	**0.01**
Vomit	62 (58.5)	62 (62.6)	0.54
Fever	22 (20.8)	26 (26.3)	0.35
Dyspnea	4 (3.8)	2 (2)	0.46
Syncope	6 (5.7)	2 (2)	0.18
Bleeding	2 (1.9)	1 (1)	0.60
Hypotension	5 (4.7)	3 (3)	0.53
Charlson Comorbidity Index, *n* (%)			
<3	10 (9.4)	7 (7.1)	0.54
≥3	96 (90.6)	92 (92.9)	
Comorbidities, *n (%)*			
Severe Obesity	2 (1.9)	1 (1)	0.60
Hypertension	25 (23.6)	26 (26.3)	0.66
Ischemic heart disease	8 (7.5)	7 (7.1)	0.90
Previous history of cerebrovascular disease	3 (2.8)	3 (3)	0.93
COPD	10 (9.4)	7 (7.1)	0.54
Hepatopathy	4 (3.8)	0	0.051
Diabetes	11 (10.4)	12 (12.1)	0.69
Chronic kidney disease	12 (11.3)	3 (3)	**0.02**
Malignancy	40 (37.7)	29 (29.3)	0.20
Clinical course			
LOS, *median (QR)*	7.6 (4.5–12.8)	7.7 (5.5–11.2)	0.88
ICU admission. *n (%)*	4 (3.8)	10 (10.1)	0.07
Death, *n (%)*	4 (3.8)	1 (1)	0.20
Cumulative major complications, *n (%)*	10 (9.4)	12 (12.1)	0.53
NOM failure, *n (%)*	31 (29.2)	–	

NOM: non-operative management; ED: emergency department; COPD: chronic obstructive pulmonary disease; LOS: length of hospital stay; ICU: intensive care unit.
[a] Cumulative major complications include: death, sepsis, ICU admission.

3.2. Clinical outcomes in the over 80 years old group

As shown in Table 4, NOM treatment in the ≥80 years old group related to significant advantages in terms of LOS (7.3 [4.6–10.7] vs 8.8 [6.3–12.5] days in the upfront surgery cohort – p = 0.04), ICU admission (0 vs 18.4% in the upfront surgery cohort; p = 0.005) and cumulative major complications (2.6% vs 23.7%; p = 0.007). Moreover, delayed surgery due to NOM failure was not associated to poorer outcomes as compared to those patients who underwent upfront surgery (Table 5).

4. Discussion

Almost 12% of patients presenting with a diagnosis of ASBO are 65 years of age or older and, among them, those aged more than 80 years are rapidly increasing. In our study, up to 9.9% of patients diagnosed with ASBO were aged 80 years and over. This implies the need of a better understanding of ASBO management and clinical course in this increasing frailer portion of the population.

In this last regard, only few reports in the literature specifically focused on the role of age and fraility in defining the more appropriate management in case of ASBO.[10–12] Some authors evidenced a more detrimental clinical course in the geriatric population as compared to younger patients, generally due to the concomitant presence of

Table 3
Univariate analysis of clinical outcomes between the two cohorts of patients undergone upfront surgery or NOM.

	Upfront surgery			NOM		
Variable	65–79 years old N = 61	≥80 years old N = 38	*p*	65–79 years old N = 67	≥80 years old N = 39	*p*
LOS, *days, median [QR]*	7.3 [4.6–10.4]	8.8 [6.3–12.5]	**0.01**	8.5 [4.5–17.4]	7.3 [4.6–10.7]	0.28
In-hospital mortality, *n (%)*	1 (1.6)	0	0.43	4 (6)	0	0.12
ICU admission, *n (%)*	3 (4.9)	7 (18.4)	**0.05**	4 (6)	0	0.12
Cumulative major complications[a], *n (%)*	3 (4.9)	9 (23.7)	**0.009**	9 (13.4)	1 (2.6)	0.06
NOM Failure, *n (%)*				23 (34.3)	8 (20.5)	0.13

NOM: non-operative management; ICU: intensive care unit; LOS: length of hospital stay.
[a] Cumulative major complications include: death, sepsis, ICU admission.

Table 4
NOM vs upfront surgery in ≥80 years old patients.

Variable	NOM N = 39	Upfront surgery N = 38	*p*
LOS, *days, median [QR]*	7.3 [4.6–10.7]	8.8 [6.3–12.5]	**0.04**
Death, *n (%)*	0	0	
ICU admission, n (%)	0	7 (18.4)	**0.005**
Cumulative major complications[a], *n (%)*	1 (2.6)	9 (23.7)	**0.007**

NOM: non-operative management; ICU: intensive care unit; LOS: length of hospital stay.
[a] Cumulative major complications include: death, sepsis, ICU admission.

Table 5
NOM failure vs upfront surgery in ≥80 years old patients.

Variable	NOM failure N = 8	Upfront surgery N = 38	*p*
LOS *days, median [QR]*	11.9 [7.7–20.1]	8.8 [6.3–12.5]	0.18
Death *n, (%)*	0	0	
ICU admission *n, (%)*	0	7 (18.4)	0.19
Cumulative major complications[a] *n, (%)*	1 (12.5)	9 (23.7)	0.49
Ostomy creation, *n (%)*	1 (12.5)	4 (10.5)	0.87
Bowel resection, *n (%)*	1 (12.5)	10 (26.3)	0.40

NOM: non-operative management; LOS: length of hospital stay; ICU: intensive care unit.
[a] Cumulative major complications include: death, sepsis, ICU admission.

comorbidities that can interfere with diagnosis and appropriate treatment.[13–17] In our previous report, we outlined a higher rate of ICU admissions and a more prolonged LOS in patients aged 65 years and over as compared to the younger cohort.[18] Moreover, a recent report of the National Emergency Laparotomy Audit (NELA) documented poorer clinical outcomes in older patients when emergency surgery is performed.[19]

Despite these evidences highlight how challenging may be the management of ASBO in older patients, only few studies regarding differences in terms of clinical presentation and outcomes among geriatric patients according to age has been conducted. In particular, no study in the literature specifically focused on the best treatment management to employ in the subset of patients aged 80 years and over in comparison to other geriatric groups.

We, thus, here reported our experience on ASBO management specifically focusing our attention on over 65-year patients. The main objective was to evaluate the clinical presentation and course as well as to define the best treatment strategy in geriatric patients, with particular focus on octogenarians.

Basing on our results, three main findings should be underlined. First, ≥80 years old patients less frequently presented abdominal symptoms. Secondly, the employment of upfront surgery in ≥80 years old patients led to worse clinical outcomes in comparison to the younger cohort. Third, analyzing exclusively the cohort of ≥80 years old patients, NOM was associated with reduced hospitalization, ICU admission and major adverse events in comparison to the upfront surgery approach. Furthermore, in case of NOM failure, no worse clinical outcomes have been evidenced as compared to upfront surgery for this subset of patients.

Symptoms of ASBO presentation in older patients are still a field of investigation. Most authors reported a later and less pronounced symptomatology in older individuals, with even a less frequent systemic involvement.[20–22] Moreover, in case of acute events, geriatric patients have been demonstrated to show abdominal pain, fever and leukocytosis less frequently than younger patients.[23–25] According to our data, no significant difference was evidenced between our two cohorts of comparison in terms of systemic symptoms. However, a lower rate of abdominal pain was noted in the ≥80 years old population (3.9%) as compared to the 65–79 years old one (13.3%) ($p = 0.03$). This is in line with majority of previous reports and probably linked to a more significant capacity to endure or a greater difficulty for ≥80 years old patients to report symptoms, as well as to a reduced pain perception as compared to younger patients.[26]

Regarding the type of treatment approach to employ, we demonstrated that treating ≥80 years old patients with upfront surgery is burdened by worse outcomes when compared to patients aged less than 80 years, namely longer LOS ($p = 0.01$), higher rate of ICU admission ($p = 0.05$) and major cumulative complications ($p = 0.009$). This becomes even more remarkable after taking into account only patients aged 80 years and over. Specifically, those who underwent NOM experienced better outcomes in terms of LOS ($p = 0.04$), ICU admission ($p = 0.005$) and cumulative major complications ($p = 0.007$) as compared to those who underwent upfront surgery. These data find justification in the frailty of older individuals. For instance, the condition of "polypathology" that generally characterize this subset of patients significantly influences the already compromised physiological reserve, leading to a higher risk of a more detrimental clinical course especially after surgery in an urgent setting.[27–32] As matter of fact, our cohort of ≥80 years old patients presented a slightly higher percentage of comorbidities with a significantly higher rate Charlson comorbidity index ≥3 as compared to the 65–79 years old cohort ($p < 0.0001$).

Of note, although NOM is an appealing treatment option related to better outcomes, its application is not devoid of drawbacks. Specifically, starvation may conflict with the concomitant treatment of comorbidities, since oral medication needs to be reduced or discontinued.[33,34] On the conterpart, the use of alternative routes of administration may show different pharmacokinetics and consequent clinical effects.[35,36] Moreover, avoiding oral feeding and a non-optimal fluid support might add up to the already impaired nutritional status of these patients and pave the way to a higher risk of acute events onset such as acute kidney failure, notably related to worse clinical outcomes in case of ASBO diagnosis.[37] This implies the need for a comprehensive multidisciplinary

geriatric assessment at admission for older patients, aimed to appropriately balance the risks and benefits of the surgical or conservative treatment.[38]

As additional analysis, we evaluated the outcomes of ≥80 years old patients in case of NOM failure as compared to those who underwent upfront surgery with the aim of evaluating the consequences of a failed conservative management. In this regard, no evidence is specifically present in literature. Several authors evidenced more negative effects of delayed surgery in the older population as compared to a patients younger than 65 years.[39,40] In particular, increasing age was associated to a higher rate of mortality in case of delayed surgery.[41] These data are in contrast with our results: we did not evidence any significant variation in terms of LOS ($p = 0.18$), ICU admission ($p = 0.19$), cumulative major complications ($p = 0.49$) and in-hospital mortality (no event per group) in case of NOM failure. Although these promising outcomes in case of NOM failure seem to further advocate for a conservative management for patients aged 80 years and over, the low number of failures imposes caution in drawing conclusions, implying the need for further studies with larger cohorts. Indeed, the single-center analysis we performed significantly limited the sample size of the study population, thus limiting the generality of the results. Moreover, the retrospective design of the study could have led to possible selection biases. On the counterpart, our study population represents, to our knowledge, the largest cohort of patients aged 65 years and over treated for ASBO in a single institution, following guideline-driven treatments. Furthermore, no other study has focused on the comparison of outcomes between early surgery and NOM in patients aged 80 years and over.

5. Conclusions

Despite additional data are needed to better develop this topic, we think that our contribution will help in reaching a consensus in the treatment of older patients affected by ASBO. Here is indeed demonstrated that upfront surgery is associated with worse outcomes in ≥80 years old patients, both when compared to younger patients who underwent early surgery and to patients with comparable age treated conservatively. Furthermore, in case of NOM failure, our data suggest that delayed surgery in ≥80 years old patients is not associated with worse outcomes than early surgical treatment.

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Declaration of competing interest

The authors declare that they have no conflicts of interest.

References

1. Eurostat Statistic Explained. *Index @ Ec.Europa.Eu. Online. Published Online.* 2021.
2. Maung AA, Johnson DC, Piper GL, et al. Evaluation and management of small-bowel obstruction: an Eastern Association for the Surgery of Trauma practice management guideline. *Journal of Trauma and Acute Care Surgery*. 2012;73(5 SUPPL.4):362–369. https://doi.org/10.1097/TA.0b013e31827019de.
3. Scott JW, Olufajo OA, Brat GA, et al. Use of national burden to define operative emergency general surgery. *JAMA Surgery*. 2016;151(6):1–8. https://doi.org/10.1001/jamasurg.2016.0480.
4. NELA Project Team. *The Second Patient Report of the National Emergency Laparotomy Audit (NELA) December 2014 to November 2015 the Second Patient Report of the National Emergency Laparotomy Audit (NELA)*. 2016. November 2015.
5. Di Saverio S, Coccolini F, Galati M, et al. Bologna guidelines for diagnosis and management of adhesive small bowel obstruction (ASBO): 2013 update of the evidence-based guidelines from the world society of emergency surgery ASBO working group. *World J Emerg Surg*. 2013;8(1):1–14. https://doi.org/10.1186/1749-7922-8-42.
6. Evers BM, Townsend CM, Thompson JC. Organ physiology of aging. *Surg Clin*. 1994;74(1):23–39. https://doi.org/10.1016/S0039-6109(16)46226-2.
7. Charlson ME. A new method of classifying prognostic in longitudinal studies : development. *J Chron Dis*. 1987;40(5):373–383.
8. Di Saverio S, Coccolini F, Galati M, et al. Bologna guidelines for diagnosis and management of adhesive small bowel obstruction (ASBO): 2013 update of the evidence-based guidelines from the world society of emergency surgery ASBO working group. *World J Emerg Surg*. 2013;8(1):1–14. https://doi.org/10.1186/1749-7922-8-42.
9. Broek RPG, Krielen P, Di Saverio S, et al. Bologna guidelines for diagnosis and management of adhesive small bowel obstruction (ASBO). *World J Emerg Surg*. 2018;13(1):13–24.
10. Ozturk E, van Iersel M, Stommel MMWJ, Schoon Y, ten Broek RRPG, van Goor H. Small bowel obstruction in the elderly: a plea for comprehensive acute geriatric care. *World J Emerg Surg*. 2018;13(1). https://doi.org/10.1186/s13017-018-0208-z.
11. Krause WR, Webb TP. Geriatric small bowel obstruction: an analysis of treatment and outcomes compared with a younger cohort. *Am J Surg*. 2015;209(2):347–351. https://doi.org/10.1016/j.amjsurg.2014.04.008.
12. Springer JE, Bailey JG, Davis PJB, Johnson PM. Management and outcomes of small bowel obstruction in older adult patients: a prospective cohort study. *Can J Surg*. 2014;57(6):379–384. https://doi.org/10.1503/cjs.029513.
13. Dang C, Aguilera P, Dang A, Salem L. Acute abdominal pain: four classifications can guide assessment and management. *Geriatrics*. 2002;57(3):30–42.
14. Kay L. Abdominal symptoms, visits to the doctor, and medicine consumption among the elderly. A population based study. *Dan Med Bull*. 1994;41(4):466–469.
15. Lyon C, Clark DC. Diagnosis of acute abdominal pain in older patients. *Am Fam Physician*. 2006;74(9):1537–1544.
16. McNamara RM, Rousseau E, Sanders AB. Geriatric emergency medicine: a survey of practicing emergency physicians. *Ann Emerg Med*. 1992;21(7):796–801. https://doi.org/10.1016/S0196-0644(05)81024-8.
17. Vogt DP. The acute abdomen in the geriatric patient. *Cleve Clin J Med*. 1990;57(2):125–130. https://doi.org/10.3949/ccjm.57.2.125.
18. Quero G, Covino M, Laterza V, et al. Adhesive small bowel obstruction in elderly patients: a single-center analysis of treatment strategies and clinical outcomes. *Scand J Gastroenterol*. 2021;56(7):784–790. https://doi.org/10.1080/00365521.2021.1921256.
19. Aitken RM, Partridge JSL, Oliver CM, et al. Older patients undergoing emergency laparotomy: observations from the national emergency laparotomy Audit (NELA) years 1-4. *Age Ageing*. 2020;49(4). https://doi.org/10.1093/ageing/afaa075.
20. Bugliosi TF, Meloy TD, Vukov LF, Foundation M. *A c u t e Abdominal Pain in the Elderly*. 1990:1383–1386. December.
21. Fenyö G. Acute abdominal disease in the elderly. Experience from two series in Stockholm. *Am J Surg*. 1982;143(6):751–754. https://doi.org/10.1016/0002-9610(82)90052-6.
22. Laurell H, Hansson LE, Gunnarsson U. Acute abdominal pain among elderly patients. *Gerontology*. 2006;52(6):339–344. https://doi.org/10.1159/000094982.
23. Quero G, Covino M, Fiorillo C, et al. Acute pancreatitis in elderly patients: a single-center retrospective evaluation of clinical outcomes. *Scand J Gastroenterol*. 2019;54(4):492–498. https://doi.org/10.1080/00365521.2019.1588369.
24. Quero G, Covino M, Ojetti V, et al. Acute pancreatitis in oldest old: a 10-year retrospective analysis of patients referred to the emergency department of a large tertiary hospital. *Eur J Gastroenterol Hepatol*. 2020;32(2):159–165. https://doi.org/10.1097/MEG.0000000000001570.
25. Laurell H, Hansson LE, Gunnarsson U. Acute abdominal pain among elderly patients. *Gerontology*. 2006;52(6):339–344. https://doi.org/10.1159/000094982.
26. Catananti C, Gambassi G. Pain assessment in the elderly. *Surgical Oncology*. 2010;19(3). https://doi.org/10.1016/j.suronc.2009.11.010.
27. Karanikas ID, Liakakos TD, Koundourakis SS, Tzorakis SE, Dendrinos SS. Emergency operations in the management and outcome. *Int Surg*. 1996;81(2):158–162.
28. McIntyre R, Reinbach D, Cuschieri RJ. Emergency abdominal surgery in the elderly. *J R Coll Surg Edinb*. 1997;42(3):173–178.
29. Neary WD, Foy C, Heather BP, Earnshaw JJ. Identifying high-risk patients undergoing urgent and emergency surgery. *Ann R Coll Surg Engl*. 2006;88(2):151–156. https://doi.org/10.1308/003588406X94896.
30. Rosa F, Covino M, Cozza V, et al. Management of acute cholecystitis in elderly patients: a propensity score-matched analysis of surgical vs. medical treatment. *Dig Liver Dis*. 2021;53(12):1620–1626. https://doi.org/10.1016/j.dld.2021.01.011.
31. Quero G, Covino M, Fiorillo C, et al. Acute pancreatitis in elderly patients: a single-center retrospective evaluation of clinical outcomes. *Scand J Gastroenterol*. 2019;54(4):492–498. https://doi.org/10.1080/00365521.2019.1588369.
32. Quero G, Covino M, Ojetti V, et al. Acute pancreatitis in oldest old: a 10-year retrospective analysis of patients referred to the emergency department of a large tertiary hospital. *Eur J Gastroenterol Hepatol*. 2020;32(2):159–165. https://doi.org/10.1097/MEG.0000000000001570.
33. Haider SI, Johnell K, Thorslund M, Fastbom J. Trends in polypharmacy and potential drug-drug interactions across educational groups in elderly patients in Sweden for the period 1992 - 2002. *Int J Clin Pharm Ther*. 2007;45(12):643–653. https://doi.org/10.5414/CPP45643.
34. Hovstadius B, Hovstadius K, Åstrand B, Petersson G. Increasing polypharmacy - an individual-based study of the Swedish population 2005-2008. *BMC Clin Pharmacol*. 2010;10(1):16. https://doi.org/10.1186/1472-6904-10-16.
35. Shader R, Greenblatt D. The use of benzodiazepines in clinical practice. *Br J Clin Pharmacol*. 1981;11(1):5S–9S. https://doi.org/10.1111/j.1365-2125.1981.tb01832.x.
36. Mehvar R, Brocks DR. Stereospecific pharmacokinetics and pharmacodynamics of beta-adrenergic blockers in humans. *J Pharm Pharmaceut Sci*. 2001;4(2):185–200.

37. Lee MJ, Sayers AE, Drake TM, et al. National prospective cohort study of the burden of acute small bowel obstruction. *BJS Open*. 2019;3(3). https://doi.org/10.1002/bjs5.50136.
38. Ozturk E, van Iersel M, Stommel MMWJ, Schoon Y, ten Broek RRPG, van Goor H. Small bowel obstruction in the elderly: a plea for comprehensive acute geriatric care. *World J Emerg Surg*. 2018;13(1). https://doi.org/10.1186/s13017-018-0208-z.
39. Schraufnagel D, Rajaee S, Millham FH. How many sunsets? Timing of surgery in adhesive small bowel obstruction: a study of the Nationwide Inpatient Sample. *Journal of Trauma and Acute Care Surgery*. 2013;74(1):181–189. https://doi.org/10.1097/TA.0b013e31827891a1.
40. Foster NM, McGory ML, Zingmond DS, Ko CY. Small bowel obstruction: a population-based appraisal. *J Am Coll Surg*. 2006;203(2):170–176. https://doi.org/10.1016/j.jamcollsurg.2006.04.020.
41. Peacock O, Bassett MG, Kuryba A, et al. Thirty-day mortality in patients undergoing laparotomy for small bowel obstruction. *Br J Surg*. 2018;105(8). https://doi.org/10.1002/bjs.10812.