Indications for Emergency Abdominal Surgeries in Older Patients: 7-Year Experience of a Single Centre

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Abstract

The majority of patients undergoing emergency laparotomy are older adults that carry the highest mortality. More research into the development of targeted interventions is required. Therefore, the aim of the study was to analyse the indications for emergency abdominal surgery in patients aged ≥ 65 admitted to the Department of General Surgery. The study included consecutive patients aged ≥ 65 who underwent emergency abdominal surgery within 48 h after admission at one institution. In 2010–2017, 986 patients were enrolled in the study (female 57%, male 43%). Patients were divided into three age groups, 65–70, 71–84 and ≥ 85 , with 255 patients (25.9%), 562 patients (57.0%) and 169 patients (17.1%) in each group, respectively. In the first and second age groups, the most common indications for surgery were acute cholecystitis, non-malignant ileus, colorectal cancer complications and acute appendicitis. In the oldest patients, the most common indications were complications of colorectal cancer, acute cholecystitis, non-malignant ileus and complications of diverticulosis. In the women, the biggest differences in indications between age groups were colorectal cancer ($p = 0.025$) and peptic ulcer disease complications ($p = 0.005$); in the men, the biggest difference was seen for complicated diverticulitis ($p = 0.001$). The most frequent comorbidities were heart diseases (81.0%), followed by endocrine (33.6%) and vascular diseases (22.7%). The three most common indications for emergency surgery in older patients at our institution were acute cholecystitis, colorectal cancer complications and non-malignant bowel obstruction, affecting 59.5% of this group of patients. Elective surgery and endoscopic screening have the potential to prevent major part of these acute diseases. However, further prospective research is necessary on this field, particularly among frail, older patients.

Keywords Acute abdomen · Abdominal surgery · Emergency surgery · Geriatric patients · Older patients

Introduction

A general improvement in living conditions and healthcare quality has led to global increases in average life expectancy, with an associated increase in the elderly population [1]. According to the available literature, patients ≥ 65 years make up 15–21% of patients admitted to the Emergency Department (ED), and rising [2, 3]. While 10% of all consultations in the ED are caused by abdominal pain, 20–25% of these are geriatric patients, 22% of whom require emergency surgery [4, 5]. In the elderly population, several factors hamper the diagnostic process and delay implementation of appropriate treatment,

including difficulties in gathering relevant past medical history, atypical presentation of clinical symptoms and presence of comorbidities. Importantly, an early decision for surgery, when necessary, is one of the most important prognostic factors [3, 5–8]. Diagnostic delays and suboptimal treatment lead to a high percentage of postoperative complications (exceeding 50%) and a high in-hospital mortality rate (11–37%) [9–11]. The literature evaluating the indication for emergency surgery in larger population of older, consecutive patients is scarce. Therefore, the aim of this study was to analyse indications for emergency abdominal surgeries among consecutive patients aged ≥ 65 admitted to the Department of General Surgery.

Methods

The study sample comprised of consecutive patients aged ≥ 65 who underwent emergency abdominal surgery within 48 h

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after admission to the Department of Surgery. Data from 2010 to 2011 were obtained retrospectively from medical records and perioperative reports. Other information, in 2012–2017, was collected prospectively. The Ethics Committee of the Jagiellonian University approved the study.

Emergency surgical conditions were classified into the following 12 categories: acute cholecystitis, colorectal cancer complications (bowel obstruction, bleeding, perforation), non-malignant obstruction (strangulated hernia, volvulus, adhesion, gallstone ileus), acute appendicitis, complicated diverticulitis (perforation, bleeding requiring surgical intervention), peptic ulcer disease complications (perforation, bleeding requiring surgical intervention), acute intestinal ischemia, pancreatic cancer complications (biliary obstruction, bowel obstruction), gastric cancer complications (perforation, pylorus obstruction, bleeding), peritoneal carcinomatosis, other malignant (retroperitoneal sarcoma, ovarian or bladder cancer causing bowel obstruction) and other non-malignant (trauma/intra-abdominal abscesses requiring surgical intervention).

Included patients were divided into the following three age groups: 65–70, 71–84 and ≥ 85 . Patients were also divided into two groups according to gender. Patients not requiring laparoscopy or laparotomy (undergoing minor procedures) were excluded from the analysis.

Statistical Analysis

Statistical analysis was performed using STATISTICA StatSoft® 13.0 software. Frequencies (n) with percentages (%) are given for qualitative variables. The Shapiro–Wilk test was used to confirm the normality of the distribution of quantitative variables. Medians were used to describe the central tendency of the quantitative variables, and the minimum and maximum values were given. Pearson's chi-squared test was used to compare nominal variables. The results were considered statistically significant for $p < 0.05$.

Results

In 2010–2017, we enrolled 986 patients aged 65 or more who underwent emergency abdominal surgery. We identified 255 (25.9%), 562 (57.0%) and 169 (17.1%) patients in the 65–70, 71–84 and ≥ 85 age groups, respectively, and the median age was 76 (65–102). There were 562 women (57%) and 424 men (43%). There were significantly more women and significant differences in all the age groups ($p = 0.004$). The demographic data for individual age groups of patients are presented in Table 1.

Table 1 also presents a detailed analysis of surgical indications. The most common indications were acute cholecystitis (24.3%), colorectal cancer complications (17.9%) and non-malignant bowel obstruction (17.3%).

Acute cholecystitis was the most common cause of hospitalisation in the both 65–70 (25.1%) and 71–84 (25.8%) age groups. In the oldest patients (≥ 85), the most frequent indication was colorectal cancer complications. In the first two age groups, the four most common indications were identical: acute cholecystitis, non-malignant bowel obstruction, complications of colorectal cancer and acute appendicitis. In the oldest patients (≥ 85), the order of the most common indication was different: colorectal cancer complications, acute cholecystitis, non-malignant obstruction and complicated diverticulitis.

The frequencies of particular diseases differed significantly between the age groups. Acute appendicitis represented 14.9% of all diagnoses among the youngest patients, while in patients aged 71–84 and ≥ 85 , it was 7.3% and 5.9%, respectively ($p = 0.001$). Colorectal cancer complications were the most frequent in the group of the oldest patients at 24.3%, while in patients aged 71–84 and 65–70, it represented 17.3% and 14.9%, respectively ($p = 0.041$). Diverticulosis complications in the first, second and third age groups were reported with frequencies of 3.1%, 6.4% and 9.5%, respectively ($p = 0.025$). Complications of peptic ulcer disease were 2.8%, 6.4% and 8.9%, respectively ($p = 0.023$). Table 2 and Figs. 1 and 2 present analysis of subgroups based on gender.

In the women, the most common indications for emergency surgery were acute cholecystitis (22.4%), non-malignant bowel obstruction (20.5%) and colorectal cancer complications (15.5%). Acute cholecystitis was the most common diagnosis in patients aged 65–70 (21.6%) and in 71–84 (25.9%). However, among the oldest patients, acute cholecystitis was only the third most frequent reason for hospitalisation (13.9%) ($p = 0.030$). The incidence of colon cancer complications increased among women with age, in subsequent age groups 11.9%, 14.1% and 23.5% (the most frequent reason for hospitalisation in the patients aged ≥ 85) ($p = 0.025$). The same tendency was observed for the diagnosis of peptic ulcer disease complications, 2.2%, 5.8% and 12.2%, respectively ($p = 0.005$). Diagnosis of acute appendicitis in consecutive age groups had a decreasing share in the total number of diagnoses, 17.2%, 8.0% and 3.5%, respectively ($p = 0.001$).

In the men, the most common indications for emergency surgery were acute cholecystitis (26.9%), colorectal cancer complications (21.0%) and non-malignant bowel obstruction (13.2%). In the 65–70 and 71–84 age groups, the most common indications did not differ significantly. Only in case of complicated diverticulitis, the prevalence increased significantly with age, with patients aged ≥ 85 having a significantly higher prevalence 1.7%, 2.8% and 13.0%, respectively ($p = 0.001$).

Table 3 presents the prevalence of the comorbidities in the study population. In heart diseases (history of myocardial infarction, ischemic heart disease, chronic heart failure, valvular heart disease) 81.0% was the most common comorbidity,

Table 1 Demographic data and indication for emergency surgery in the elderly patients

	All patients	Age group			<i>p</i> value
		65–70	71–84	≥ 85	
Number of patients (%)	986	255 (25.9)	562 (57.0)	169 (17.1)	-
Women (%)	562 (57.0)	134 (23.8)	313 (55.7)	115 (20.5)	0.004
Men (%)	424 (43.0)	121 (28.6)	249 (58.7)	54 (12.7)	
Median age (range)	76 (65–102)	67 (65–70)	77 (71–84)	88 (85–102)	-
Indications for surgery					
Acute cholecystitis	240 (24.3%)	64 (25.1%)	145 (25.8%)	31 (18.3%)	0.133
Colorectal cancer complications	176 (17.9%)	38 (14.9%)	97 (17.2%)	41 (24.3%)	0.041
Non-malignant bowel obstruction	171 (17.3%)	43 (16.9%)	97 (17.3%)	31 (18.3%)	0.922
Acute appendicitis	89 (9.0%)	38 (14.9%)	41 (7.3%)	10 (5.9%)	0.001
Diverticulosis complications	60 (6.1%)	8 (3.1%)	36 (6.4%)	16 (9.5%)	0.025
Peptic ulcer disease complications	58 (5.9%)	7 (2.8%)	36 (6.4%)	15 (8.9%)	0.023
Other non-malignant*	57 (5.8%)	12 (4.7%)	39 (6.9%)	6 (3.6%)	0.176
Acute intestinal ischemia	35 (3.6%)	6 (2.4%)	22 (3.9%)	7 (4.1%)	0.482
Other malignant [#]	33 (3.4%)	16 (6.3%)	15 (2.7%)	2 (1.2%)	0.007
Pancreatic cancer complications	27 (2.7%)	10 (3.9%)	14 (2.5%)	3 (1.8%)	0.357
Gastric cancer complications	21 (2.1%)	8 (3.1%)	10 (1.8%)	3 (1.8%)	0.433
Peritoneal carcinomatosis	19 (1.9%)	5 (2.0%)	10 (1.8%)	4 (2.4%)	0.887

*#Other non-malignant (trauma/intra-abdominal abscesses requiring surgical intervention), other malignant (retroperitoneal sarcoma, ovarian or bladder cancer causing ileus)

followed by the endocrine diseases (diabetes mellitus, hyperthyroidism, hypothyroidism), 33.6%, vascular diseases (history of cerebrovascular accident, peripheral arterial disease, intermittent claudication, aortic aneurysm), 22.7%, gastrological diseases (active peptic ulcer disease, chronic hepatitis), 18.8%, neurologic diseases (hemiplegia, epilepsy, multiple sclerosis, neuromuscular diseases or neurodegenerative disorders), 17.1% and psychiatric diseases (dementia, depression, psychotic, bipolar or anxiety disorders), 6.2%. Significant differences in age groups were observed for heart diseases and neurologic diseases. The prevalence increased with age, 64.9%, 84.2%, 88.2% for heart diseases ($p < 0.001$) and 12.6%, 17.1%, 24.3% for neurological disorders ($p = 0.007$), respectively. Concerning gender, endocrine comorbidities were observed more frequent among females than males, 37% vs. 29%, $p = 0.008$.

Discussion

The elderly population is growing both in Poland and throughout Europe. Today, people aged ≥ 65 constitutes 15% of the European population [12]. This is reflected in the slowly rising average age, which is currently 41.9 in Europe and 29.2 globally [13]. Due in part to rising life expectancies, the number of older patients admitted to hospitals is also increasing.

The literature confirms our observation that more women are admitted to the hospital than men [3, 6, 7, 14]. Fenyö et al.

have shown that females accounted for almost two thirds of patients with an acute abdomen [9]. In our study, the percentage was 57% and the difference was statistically significant. Only Huang et al reported a higher percentage of males among older patients [15]. Previous studies have shown that the male–female ratio decreases with age, probably reflecting women's longer life expectancy [14].

Authors analysing surgical indications in the elderly admitted to the emergency department have identified the most common causes of acute abdominal pain to be gallbladder disease and biliary tract disorders [3–6, 8, 16]. We found the three most common indications for surgery in patients ≥ 65 to be acute cholecystitis, colorectal cancer complications and non-malignant bowel obstruction, representing 59.5% of all patients. Minor differences in results between studies may be derived from the application of different inclusion criteria and the different characteristics of research populations [3–5].

Laurell et al. and Rosenthal et al. showed that acute cholecystitis was the most common cause of acute abdomen in elderly patients (≥ 65), which is consistent with our results [7, 17]. Generally, the incidence of cholelithiasis increases with age, reaching 33% among people aged 70 [18]. Factors predisposing gallstone formation include altered bile acid production, high cholesterol bile saturation and reduced gallbladder sensitivity to cholecystokinin. Moreover, no gender differences in incidence were seen (female 22.4% vs. male 26.9%), not the case in younger patients [18]. However, importantly, acute cholecystitis can be prevented in this population by

Table 2 Indications for emergency surgery in female and male older patients (analysis in the three age groups)

	Female	Age			<i>p</i> value
		Male	65–70	71–84	≥ 85
Acute cholecystitis	126 (22.4%)	29 (21.6%)	81 (25.9%)	16 (13.9%)	0.030
	114 (26.9%)	35 (28.9%)	64 (25.7%)	15 (27.8%)	0.796
Non-malignant bowel obstruction	115 (20.5%)	28 (20.9%)	61 (19.5%)	26 (22.6%)	0.770
	56 (13.2%)	15 (12.4%)	36 (14.5%)	5 (9.3%)	0.565
Colorectal cancer complications	87 (15.5%)	16 (11.9%)	44 (14.1%)	27 (23.5%)	0.025
	89 (21.0%)	22 (18.2%)	53 (21.3%)	14 (26.0%)	0.501
Acute appendicitis	52 (9.25%)	23 (17.2%)	25 (8.0%)	4 (3.5%)	0.001
	37 (8.7%)	15 (12.4%)	16 (6.4%)	6 (11.1%)	0.130
Complicated diverticulitis	44 (7.8%)	6 (4.5%)	29 (9.3%)	9 (7.8%)	0.225
	16 (3.8%)	2 (1.7%)	7 (2.8%)	7 (13.0%)	0.001
Peptic ulcer disease complications	35 (6.2%)	3 (2.2%)	18 (5.8%)	14 (12.2%)	0.005
	23 (5.4%)	4 (3.3%)	18 (7.2%)	1 (1.9%)	0.137
Other non-malignant*	28 (5.0%)	6 (4.5%)	18 (5.8%)	4 (3.5%)	0.603
	29 (6.8%)	6 (5.0%)	21 (8.4%)	2 (3.7%)	0.287
Acute intestinal ischemia	22 (3.9%)	3 (2.2%)	14 (4.5%)	5 (4.4%)	0.518
	13 (3.1%)	3 (2.5%)	8 (3.2%)	2 (3.7%)	0.890
Other malignant [#]	20 (3.6%)	11 (8.2%)	7 (2.2%)	2 (1.7%)	0.004
	13 (3.1%)	5 (4.1%)	8 (3.2%)	0 (0.0%)	0.335
Peritoneal carcinomatosis	14 (2.5%)	4 (3.0%)	6 (1.9%)	4 (3.5%)	0.600
	5 (1.2%)	1 (0.8%)	4 (1.6%)	0 (0.0%)	0.559
Pancreatic cancer complications	13 (2.3%)	3 (2.2%)	8 (2.6%)	2 (1.7%)	0.881
	14 (3.3%)	7 (5.8%)	6 (2.4%)	1 (1.9%)	0.191
Gastric cancer complications	6 (1.1%)	2 (1.5%)	2 (0.6%)	2 (1.7%)	0.531
	15 (3.5%)	6 (5.0%)	8 (3.2%)	1 (1.9%)	0.537

Bold values denote statistical significance at the $p < 0.05$ level

*#other non-malignant (trauma/intra-abdominal abscesses requiring surgical intervention/necrotic acute pancreatitis/diagnostic laparotomy), other malignant (retroperitoneal sarcoma, ovarian or bladder cancer causing ileus)

elective surgery. Many surgeons hesitate to operate on older patients with symptomatic cholelithiasis. However, we have shown in our previous study that elective laparoscopic cholecystectomy, in experienced hands, is safe, even in frail older patients, and can be performed with minor morbidity and no mortality [19].

The second and third most common indication for acute surgery were colorectal cancer complications (consisting mostly of tumour induced bowel obstruction) and non-malignant bowel obstruction due to hernia strangulation and volvulus and adhesions. Causes of small intestinal obstruction differ between young and older patients. Typically, younger

Fig. 1 Prevalence of selected diseases indicated for emergency abdominal surgery in women (analysis of three age groups)

Fig. 2 Prevalence of selected indications for emergency abdominal surgery in men (analysis of three age groups)

patients are more likely to have symptomatic adhesions, whereas both groups experience strangulated hernia and volvulus. Meanwhile, colorectal cancer, diverticulitis and volvulus are primarily responsible for large intestinal obstruction and are diagnosed mostly in older individuals [20]. It should be noted that these causes are preventable by regular colonoscopic screening and elective hernia surgery.

In the general population, acute appendicitis is the most common indication for emergency abdominal surgery, and the third most common in the elderly [21]. In our population, acute appendicitis was the fourth most common reason for surgery. With increased age, we observed decreasing percentages of patients undergoing surgery due to appendicitis. However, attention should be paid to the general increase in appendicitis incidence in the elderly [21].

Age correlates positively with diverticulitis incidence. Eighty per cent of people over 85 have diverticulosis. It is estimated that at some point in their lives, about 20% of them will experience diverticulitis and another 20% suffer from complications [22]. Our study found that in the oldest individuals (≥ 85) diverticulosis complications led to emergency abdominal surgery more often than in younger geriatric patients.

Peptic ulcer disease is a disorder often underdiagnosed among older people. In about half of patients over 60, the first symptom of peptic ulcer disease is a life-threatening complication, most often gastrointestinal perforation [23]. In our research, this was the sixth most common indication for emergency abdominal surgery. We also observed that its occurrence was significantly higher in older patients. Comparing historical data with more recent reports, decreased incidence of peptic ulcer disease complications is evident, probably due to progress in pharmacotherapy and increased physician awareness. Nevertheless, it is still an important reason for acute abdomen, especially in the oldest patients.

Concerning gender, Gardner et al. found that in patients aged > 70 , there were no significant gender differences in the frequencies of several surgical diseases, although a higher postoperative mortality rate was seen in men ($p < 0.001$) [16]. Our study showed that in women, the most prominent differences between the age groups were found in the frequencies of colorectal cancer and peptic ulcer disease complications. The frequency of colorectal cancer complications increased by 2% for the 70–84 vs. ≥ 65 age group and by 9% for the ≥ 85 vs. 70–84 age groups. Peptic ulcer disease complications similarly

Table 3 Prevalence of the comorbidities in the study population

	Overall sample ($n = 986$) %	Age			p value	Sex		p value
		65–70 %	71–84 %	≥ 85 %		Female %	Male %	
Comorbidities								
Heart diseases	81.0	69.4	84.2	88.2	< 0.01	82.8	78.8	0.12
Endocrine diseases	33.6	31.0	34.2	35.5	0.57	37.0	29.0	0.01
Vascular diseases	22.7	19.6	23.7	24.3	0.38	23.1	22.2	0.72
Gastrological diseases	18.8	16.0	18.9	20.4	0.52	19.8	17.5	0.36
Psychiatric diseases	6.2	4.31	6.23	8.88	0.16	6.6	5.7	0.55
Neurologic diseases	17.1	12.6	17.1	24.3	0.01	15.1	19.8	0.05

increased by 3.5% and 6%, respectively. In men, the biggest differences between age groups were diverticulosis complications, which increased by 11% and 10%, respectively.

One of the most essential factors preventing postoperative fatal outcomes is early and correct diagnosis. As it was mentioned before, in the older population, several factors hamper the diagnostic process and delay implementation of appropriate treatment, including difficulties in gathering relevant past medical history, atypical presentation of clinical symptoms and presence of comorbidities [5–8]. Therefore, obtaining computer tomography scans early can accelerate the diagnosis process and as consequence lead to improved surgical outcomes [24].

Moreover, comorbidity is common in older cancer patients and deserves special consideration. There is no consensus on how should the comorbidity burden be measured [25]. Even though many comorbidity indices were developed so far, no unified, widely used instrument exists. Patients with comorbidities have worse outcomes comparing with those with no such conditions. Although data regarding their significance is insufficient and in many cases conflicting [26, 27], not every comorbidity type may also have clinical significance, which is a topic of our ongoing study. Moreover, comorbidities cannot be optimised in the emergency setting. Therefore, acute surgeries pose a risk factor for the older patients, including significantly higher morbidity and mortality rate in comparison with the elective operations [28]. Introduction of frailty screening and other geriatric surgery concepts may be an option for further outcome improvement. However, at present, there is not enough data to draw reliable conclusion.

Conclusions

The three most common indications for emergency surgery in older patients at our institution were acute cholecystitis, colorectal cancer complications and non-malignant bowel obstruction, affecting 59.5% of this group of patients. Elective surgery and endoscopic screening have the potential to prevented great part of these acute diseases. However, further prospective research is necessary on this field, particularly among frail, older patients.

Authors' Contributions Study concepts: Weronika Lebowa, Urszula Skorus, Jakub Kenig

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Compliance with Ethical Standards

Conflict of Interest All authors of the manuscript certify that Weronika Lebowa, Urszula Skorus, Kamil Rapacz, Jakub Kenig do not have commercial associations (e.g., consultancies, stock ownership, equity interests, patent-licencing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article.

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