

## DIFFERENCES IN THE CLINICAL COURSE OF ACUTE APPENDICITIS IN THE ELDERLY IN COMPARISON TO YOUNGER POPULATION

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Acute appendicitis (AA) still remains the most common acute surgical abdominal emergency. Although 90% of cases occur in children and young adults, the incidence in the elderly amounts up to 10% and is constantly rising.

**The aim of the study** was to assess the differences between clinical presentation in the elderly patients with AA compared to the younger patients. Additional aim was to assess the correlation between in-hospital time delays and patients' outcomes.

**Material and methods.** We conducted a retrospective analysis of medical data of 274 patients admitted to 3<sup>rd</sup> Department of General Surgery in Cracow between January 2011 and December 2013 due to AA. The elderly group comprised 23 patients aged 65 and above and the non-elderly group consisted of 251 patients.

**Results.** The groups did not differ in symptoms and their duration, type of surgery and its duration. However, time from admission to ED to the beginning of the procedure was significantly lower in the elderly group (575.56 vs 858.9 min;  $p=0.03$ ). The elderly had longer hospital stay (6.08 vs 4.69 days;  $p=0.004$ ). In the elderly group the perforation rate was close to reaching statistical significance (26.1% vs 12.4%;  $p=0.06$ ). No mortality was noted in both groups and morbidity was slightly higher in elderly group (17.4% vs 10%;  $p=0.26$ ).

**Conclusions.** There was no difference in the clinical presentation between elderly and non-elderly patients group. However, elderly patients presented with a more progressed inflammation of the appendix. The hospital stay was longer in the elderly group, without any mortality and with higher rate of morbidity in this group. The length of the preoperative phase was significantly shorter, confirming the awareness of importance of time in the elderly patients with acute abdomen.

**Key words:** acute appendicitis, elderly, symptoms

Acute appendicitis (AA) still remains the most common acute surgical abdominal emergency with the lifetime incidence of 7% in general population. Although 90% of cases occur in children and young adults (peak 10-30 years) and up to 10% in the elderly over 60 years, the incidence of the disease in the latter group seems to be rising due to recent increase in the life expectancy (1, 2). Acute appendicitis in late adulthood

is connected with considerably higher complication rate and mortality due to delayed presentation to emergency room or surgical department and often primarily uncertain diagnosis that leads to extensive diagnostic protocol (3, 4). Perforation and septic progression occur more commonly in the elderly compared to younger age groups (4). Although there are several trials revealing that short postadmission delays up to 24

hours do not influence the unfavorable outcomes in AA, some studies confirm that in-hospital delay is a major contributor to pathological outcomes in older patients (3, 5, 6). Therefore an experienced surgeon should evaluate older patients with suspected AA within a narrow time margin and before additional diagnostic procedures are implemented (3).

The aim of the study was to assess the differences between clinical presentation and decision making in the elderly patients with AA compared to the younger patients. Additional aim was to assess the correlation between in-hospital time delays and patients' outcomes in AA.

## MATERIAL AND METHODS

A retrospective analysis was performed using medical records of patients treated in the 3<sup>rd</sup> Department of General Surgery Jagiellonian University Medical College from January 2011 to December 2013. Patients admitted with suspicion of AA were included to the study. Apart from general analysis of all patients, a group of those aged 65 and more years was separated due to presumed differences in presentation of the disease and outcomes in this group. Except from basic epidemiologic data, the database consisted of an exact list of patients' symptoms and their duration, the results of laboratory tests and radiological examinations, a type of surgery, an intraoperative diagnose and complications which occurred during the hospitalization. Assessed symptoms were: migration of pain, anorexia, nausea or vomiting, tenderness, rebound tenderness. We also evaluated Alvarado score, which includes eight diagnostic criteria: pain migration, anorexia, nausea or vomiting, tenderness in right lower quadrant (RLQ), rebound pain, temperature above 37.3 Celsius degrees, leukocytosis, shift to the left, and modified Alvarado score, which comprises nausea or vomiting, RLQ tenderness, indirect signs of positivity (Rovsing sign, pain in rectal examination), leukocytosis and ultrasound examination (7). Moreover, we meticulously assessed the timing before the surgical procedure counted as time period between the admission to Emergency Department (ED) and the admission to the surgery department, time

period between the admission to the surgery department and the beginning of the surgery and time period between the admission to ED and the beginning of the surgery. What is more, correlation between time delay and patients' outcomes was analyzed.

## Missing data

Due to the lack of essential data in patients' history 3% of the records were removed from the database.

## RESULTS

Between January 2011 and December 2013 282 patients were included into the study. Of these, 274 patients with complete data were included into the study. Mean age was 35.9 ( $\pm 16.8$ ) years and 153 (36.5%) were female. Mean age in women was 36.5 ( $\pm 17.3$ ) and in men 33,2 ( $\pm 15,6$ ). 23 (8.39%) patients were 65 years old or older and comprised group of elderly in our study. Other 251 patients were included into non-elderly group. Basic demographic characteristics are shown in tab. 1.

The groups did not differ in average duration of symptoms, time from admission to ED to admission to the surgical department and time from admission to the surgical department to the beginning of surgery. However, time from admission to ED to the beginning of the procedure was significantly lower in the elderly group [575.56 ( $\pm 385.8$ ) vs 858.9 ( $\pm 875.3$ );  $p=0.03$ ]. There was no substantial difference between the groups regarding symptoms that the patients complained on. No differences between the groups were found also in Alvarado score [6.39 ( $\pm 1.71$ ) vs 6.8 ( $\pm 1.7$ );  $p=0.14$ ], as well as modified Alva-

Table 1. Demographic characteristics of the study population

	Global population (n=274)	Elderly (n=23)	Non-elderly (n=251)
Age (years)	35,9 ( $\pm 16,8$ )	71,6 ( $\pm 7,4$ )	32,37 ( $\pm 12,6$ )
Women	n=153; 36,5 ( $\pm 17,3$ )	n=16; 71,8 ( $\pm 7,08$ )	n=137; 32,6 ( $\pm 13,2$ )
Men	n=121; 33,2 ( $\pm 15,6$ )	n=7 72,6 ( $\pm 8,84$ )	n=114 30,5 ( $\pm 11,11$ )

rado score [5.56 ( $\pm 1.8$ ) vs 5.9 ( $\pm 1.9$ );  $p=0.43$ ]. Comorbidities, defined as concomitant but unrelated to the primary diagnosis pathology or disease process, were significantly more commonly present in the elderly group than in non-elderly: 22 (95.7%) vs 77 (30.7%);  $p=0.001$ . The preoperative data is presented in tab. 2.

The analysis of intraoperative data (tab. 3) revealed no difference in the duration of the procedure between the groups. Although it did not reach statistical significance, an open procedure was more frequently performed in the elderly: 17 (73.9%) vs 105 (41.8%);  $p=0.087$ . Moreover, in this group the histopathological diagnosis of specimen was significantly less often non-inflammatory, catharalis or phlegmonous appendicitis. There was an insignificantly higher percentage of elderly patients

with gangrenous appendicitis and perforation. However, it must be noted that the perforation rate was close to reaching statistical significance 6 (26.1%) vs 31 (12.4%);  $p=0.06$ .

The length of hospital stay was significantly longer in the elderly patients 6.08 ( $\pm 5.04$ ) vs 4.69 ( $\pm 3.4$ );  $p=0.004$ . In terms of postoperative complications, either surgical or medical, there was no significant difference between the groups, although there were more surgical complications in the elderly group [4 (17.4%) vs 25 (10%);  $p=0.34$ ]. Mortality rate in our population was 0%. Postoperative data is shown in tab. 4.

The overall complication rate in whole population was correlated neither with time from admission to ED to admission to the surgical department ( $p=0.95$ ) and time from admission to the surgical department to the

Table 2. Pre-operative data regarding time relations and clinical presentations in the global population and in the elderly vs non-elderly group

	Global population (n=274)	Elderly (n=23)	Non-elderly (n=251)	p
Duration of symptoms (hours)	45,7 ( $\pm 37,5$ )	47,13 ( $\pm 28,7$ )	45,5 ( $\pm 38,2$ )	0,48
Time ED: SUR (minutes)	549,7 ( $\pm 779,1$ )	383,7 ( $\pm 346,3$ )	566,8 ( $\pm 807$ )	0,14
Time ED: OP (minutes)	832,2 ( $\pm 847,8$ )	575,56 ( $\pm 385,8$ )	858,9 ( $\pm 875,3$ )	0,03
Time SUR: OP (minutes)	273,2 ( $\pm 264$ )	191,8 ( $\pm 110,9$ )	280,7 ( $\pm 272,8$ )	0,2
Migration of pain	154 (56,2%)	10 (43,5%)	144 (57,4%)	0,33
Anorexia	75 (27,4%)	11 (47,8%)	64 (25,5%)	0,37
Nausea or vomiting	169 (61,7%)	15 (65,2%)	143 (57%)	0,77
Tenderness	252 (92%)	21 (91,3%)	231 (92%)	0,99
Rebound tenderness	234 (85,4%)	21 (91,3%)	213 (84,9%)	0,8
Alvarado score	6,8 ( $\pm 1,75$ )	6,39 ( $\pm 1,71$ )	6,8 ( $\pm 1,7$ )	0,14
Modified Alvarado score	5,87 ( $\pm 1,97$ )	5,56 ( $\pm 1,8$ )	5,9 ( $\pm 1,9$ )	0,43
Presence of comorbidities	99 (36,1%)	22 (95,7%)	77 (30,7%)	0,001

ER – admission to the Emergency Department, SUR – admission to the surgical department, OP – beginning of the surgical procedure

Table 3. Intraoperative data in the global population and in the elderly vs non-elderly group

	Global population (n=274)	Elderly (n=23)	Non-elderly (n=251)	p
Type of operation				
Open	122 (44,5%)	17 (73,9%)	105 (41,8%)	0,087
Laparoscopic	130 (47,4%)	5 (21,7%)	125 (49,8%)	
Conversion	16 (5,8%)	0	16 (6,4%)	
Duration of the procedure	79 ( $\pm 28,9$ )	78,3 ( $\pm 41,9$ )	79 ( $\pm 27,54$ )	0,38
Diagnosis				
Non-inflammatory	5 (1,8%)	0	5 (2%)	$p=0,0001$
Appendicitis catharalis	2 (0,7%)	0	2 (0,7%)	$p=0,0001$
Appendicitis phlegmonosa	168 (61,3%)	9 (39,1%)	159 (63,3%)	$p=0,02$
Appendicitis gangrenosa	59 (21,5%)	8 (34,8%)	51 (20,3%)	$p=0,1$
Perforation	37 (13,5%)	6 (26,1%)	31 (12,4%)	$p=0,06$

Table 4. Postoperative data

	Global population (n=274)	Elderly (n=23)	Non-elderly (n=251)	p
Duration of hospitalization (days)	5,16 ( $\pm 6,83$ )	6,08 ( $\pm 5,04$ )	4,69 ( $\pm 3,4$ )	p=0,004
Total complications rate	31 (11,3%)	4 (17,4%)	27 (10,8%)	p=0,34
Surgical complications	29 (10,6%)	4 (17,4%)	25 (10%)	p=0,26
Medical complications	2 (0,7%)	0	2 (0,8%)	p=0,68
Mortality	0	0	0	

beginning of the surgery ( $p=0.69$ ), nor with the time from admission to ED to the beginning of the surgery ( $p=0.47$ ). Observed surgical complications in the elderly group comprised hematoma of the wound (3 patients) and wound dehiscence (1 patient). In the non-elderly encountered surgical complications were wound infections, hematoma of the wound, wound dehiscence, partial and total bowel obstruction, intra abdominal abscesses. Whereas medical complications were diagnosed only among the non-elderly patients including exanthema and anxiety disorder.

## DISCUSSION

In our population patients aged 65 and older were the minority, but the percentage of elderly was consistent with data in the literature (1, 2). Although the elderly group was relatively small, there were some important differences between the groups that reached statistical significances, which shows that diagnostic process and the course of appendicitis in these patients is indeed different. Tough in our study the two groups did not differ in symptoms or their duration, the literature reports presence of atypical and sometimes misleading symptoms in the elderly suffering from AA (2, 4, 8). Older patients had significantly more comorbidities, which is an obvious observation, but may be the cause of diverse approach and management offered to these patients.

Interestingly, even though time from ED to surgical department and from surgical department to the beginning of the procedure was not significantly different, overall time from ED to the beginning of the procedure was. Apparently surgeons decide earlier to operate on the elderly than on the younger patients, which might be caused by a suspicion of more serious disease or worse general condition due to comorbidities. Gurleyik et al. found out that the

perforation rate is increasing with age of patients in those above 50 years-old reaching its peak in octagenarians (4). Other studies report that incidence of perforation among the elderly is higher than in non-elderly and varies between 28-90% (1, 4). In the research of Lee et al. the incidence of perforation amounted to 26.2% and was not substantially higher in the older group (8). These findings are similar to ours, since the incidence of perforation in the elderly in our population was 26.1% and it almost reached statistical significance ( $p=0.06$ ). The rationale behind the correlation between age and perforation rate is considered to be ischemic changes due to atherosclerosis, thinner, fibrotic appendix wall and fatty infiltration. These factors lead to predisposition of the appendix wall to perforate with even mild intraluminal pressure increase (8).

Duration of the hospital stay was significantly longer in the older population, which is understandable taking into consideration many comorbidities that affect aged individuals and lower capability of wound healing. Some authors consider longer hospital stay is associated with higher complication rate in the elderly, but in our study there was no difference between the groups in complication rate, so above mentioned factors might be more important in our population (2, 8). Although it did not reach statistical significance, the surgical complications rate was higher in our population among the elderly, comprising in our research exclusively complications affecting the wound site. In researched time period in our department there was no deaths related to AA. Other authors report the mortality rate between 2.3% – 10% and connect it with higher complication rate among elderly, especially with perforation rate and septic complications compounded by comorbidities (2, 8).

In addition to comparison of the outcomes according to age, we investigated correlation

between complication rate and in-hospital time delays. There are two studies to be found, which had similar findings to ours, that delayed appendectomy is safe and feasible procedure and is not associated with higher complication or mortality rate (5, 6). Nevertheless, von Titte et al. report that the delay in diagnosis was related to perforation, postoperative complication and hospital length of stay (9). Population in this study was though small and comprised 4 patients, whereas before mentioned studies had huge populations of almost 500 and more than 2400 patients (5, 6, 9). This results show that this problem is more complicated and it largely depends on population and medical centre.

## CONCLUSIONS

In our study population there was surprisingly no difference in duration of symptoms before and in the clinical presentation at the moment of admission to the hospital between elderly and non-elderly patients group. However, elderly patients presented with a higher rate of gangrenous and perforated appendicitis. The hospital stay was longer in the elderly group, without any mortality and with higher rate of morbidity in this group. The length of the preoperative diagnostic and preparation phase after hospital admission was significantly shorter, confirming the awareness of importance of time in the elderly patients with acute abdomen.

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