

Surgical treatment of acute appendicitis in older patients

Authors' Contribution:
A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

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ABSTRACT:

Introduction: Acute appendicitis (AA) is the most common indication for emergency surgery and it occurs more often in children and young adults than in patients of advanced age. AA in older patients is a challenging surgical problem because of its atypical presentation. This study was performed to determine whether the age of a patient impacts the outcomes and whether laparoscopic appendectomy (LA) is a feasible method for treatment of patients > 65 years.

Material and methods: We performed a retrospective study of 355 patients with AA who were admitted to the Department of General, Minimally Invasive and Elderly Surgery in Olsztyn from 2014 to 2017. The patients were divided into three age groups: 18 to 40, 41 to 65 and >65 years. The histopathological diagnoses were divided into three types: simple AA, phlegmonous AA, and gangrenous AA. Results. LA was performed in 96% of young adults and in 67% of older patients. The patients older than 65 years had higher preoperative white blood cell counts, higher C-reactive protein (CRP) levels and had a longer length of stay (LOS) than younger patients ($P = 0.05$, $P = 0.03$, and $P = 0.03$, respectively). We found a positive correlation among the CRP levels, open appendectomy (OA), and gangrenous appendicitis.

Conclusions: Patients older than 65 years more frequently underwent OA than LA, had higher preoperative CRP levels and had a longer LOS than younger patients. Higher CRP levels were associated with a greater risk of gangrenous appendicitis. LA is a safe and feasible treatment method for patients older than 65 years.

KEYWORDS:

acute appendicitis, older patients, elderly patients, laparoscopic appendectomy

INTRODUCTION

Acute appendicitis (AA) is the most common indication for emergency surgery [1]. The lifetime risk of AA is approximately 7% to 8%, and AA more frequently occurs in male than female patients (68.8–88.0 vs. 55.3 per 100 000 people, respectively) [2, 3]. The incidence of AA is also higher in children and young adults than in patients of advanced age (5%–10%) [2, 3]. Laparoscopic appendectomy (LA) is currently the gold-standard treatment for AA [4].

Progress in medicine and technology has resulted in an increased age of the general population. The most recent epidemiologic studies have shown that 11% of the worldwide population are older than 60 years, whereas by 2050 this rate will have increased to almost 30% [5]. The increase in aging is a challenge for physicians and management with surgical treatment.

Older age is associated with increased risk factors and higher morbidity and mortality rates due to comorbidities, such as diabetes mellitus, hypertension, and frailty syndrome [6–9]. AA in older patients is also a challenging surgical problem because of its atypical presentation and delayed diagnosis [9, 10]. Laboratory tests, such as the white blood cell (WBC) count and C-reactive protein (CRP) level are commonly used to confirm the diagnosis of AA [11, 12].

AIM

This study was performed to determine whether there is a relationship between the age of a patient and the results of preoperative laboratory tests or the management or histopathological diagnosis of AA. We evaluated whether LA is a feasible method for treatment of patients older than 65 years.

MATERIALS AND METHODS

We performed a retrospective study of 355 patients with AA who were admitted to the Department from 2014 to 2017. The patients were divided into three age groups: 18 to 40, 41 to 65, and >65 years. Data for each patient were gathered during hospitalization. We analyzed the type of procedure [LA or open appendectomy (OA)], preoperative CRP level, WBC count, length of hospital stay (LOS), histopathological diagnoses, reoperations, and readmissions. The histopathological diagnoses were divided into three types: simple AA, phlegmonous AA, and gangrenous AA.

Statistical analyses were performed using Microsoft Excel 2013 (Microsoft Corp., Redmond, WA, USA) and GraphPad Prism 7 (GraphPad Software, San Diego, CA, USA). The data are presented as mean, minimum, maximum and standard deviation. An independent-samples t-test was used for continuous variables. Analysis of variance, ANOVA test, was used to compare variables within age groups. The P value below 0.05 was considered statistically significant.

RESULTS

LA was the most common approach to AA. This procedure was performed in 96% of young adults and in 67% of older patients (Tab. I). OA was performed more often in patients aged >65 years than in younger patients (Tab. I). The most common reason of conversion was periappendicular infiltration.

Patients aged >65 years had higher CRP levels than younger patients ($P < 0.05$). Patients aged 41 to 65 years who underwent OA had significantly higher CRP levels than those who underwent LA

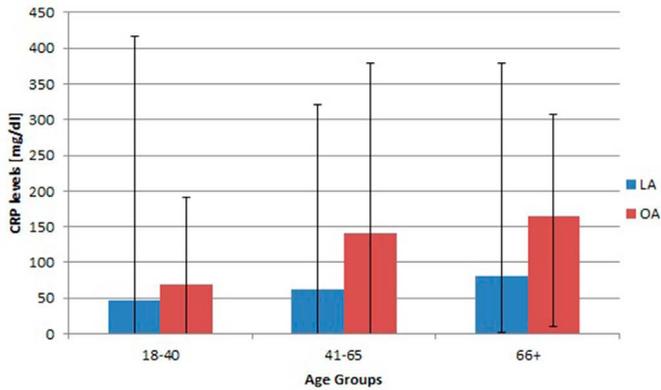


Fig. 1. Preoperative CRP level [mg/dl].

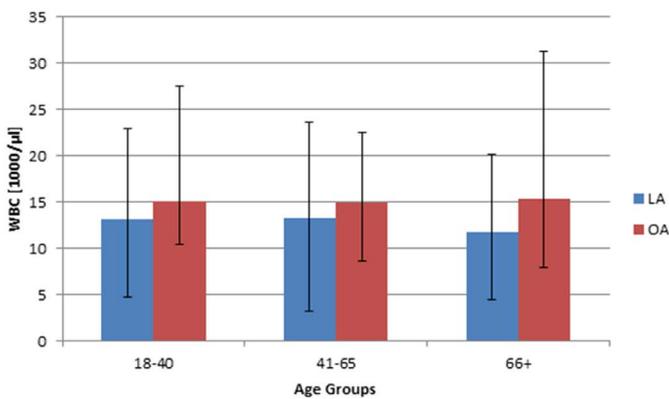


Fig. 2. Preoperative WBC level [1000/µg].

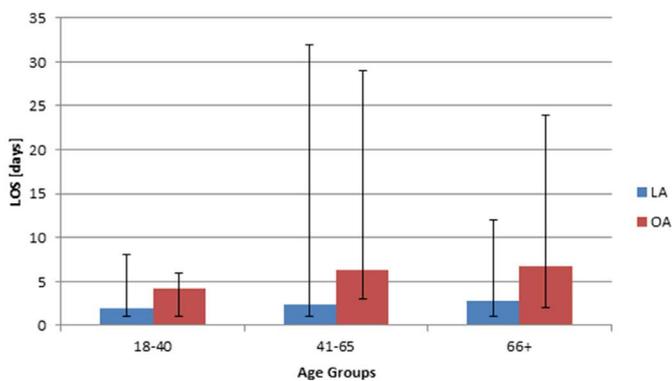


Fig. 3. LOS [days].

($P = 0.01$). The same trend was noted in the older groups, although the differences were not statistically significant (Fig. 1).

Patients aged >65 years had higher WBC counts than younger patients ($P = 0.03$). There was no significant difference in the other analyzed data, although OA was associated with a higher WBC count (Fig. 2).

Patients aged >65 years had a longer LOS than younger patients ($P = 0.03$). Patients aged 18 to 40 and 41 to 65 years who underwent OA had a significantly longer LOS than those who underwent LA ($P = 0.01$ and $P = 0.01$, respectively) (Fig. 3).

Patients with a postoperative diagnosis of gangrenous AA had significantly higher CRP levels, higher WBC counts and longer LOS

Tab. I. Patients' characteristics.

	18–40 YEARS	41–65 YEARS	65+ YEARS
Female	90 (45.7)	15 (55.6)	15 (55.6)
Male	107 (54.3)	12 (44.4)	12 (44.4)
LA	189 (96)	18 (67)	18 (67)
OA	Primary	4 (14.7)	4 (14.7)
	Conversion	2 (1)	5 (18.3)

Data are presented as n (%).

Tab. II. Association of CRP level, WBC count, and LOS with histopathological diagnosis in the three age groups.

	SIMPLE AA (N = 140)	PHLEGMONOUS AA (N = 178)	GANGRENOUS AA (N = 32)	P
CRP, mg/dL	49.44±73.55	56.00±70.00	151.26±114.81	<0.05
18-40 y	44.88±71.96	42.18±57.34	116.69±142.25	0.01
41-65 y	49.85±63.74	70.88±77.92	161.91±101.49	<0.05
>65 y	126.88±141.71	73.11±87.77	188.02±88.43	0.07
WBC, 1000/µL	12.06±4.40	14.90±12.67	14.71±5.12	0.03
18-40 y	11.8±4.34	14.28±4.37	15.13±5.52	<0.05
41-65 y	12.84±4.41	14±4.26	13.56±3.59	0.37
>65 y	9.6±4.93	22.35±40.36	16.81±7.47	0.07
LOS, days	2.49±3.03	2.14±1.79	3.9±4.10	<0.05
18-40 y	2.02±1.31	1.89±1.43	2.45±1.92	0.66
41-65 y	3.36±4.86	2.13±1.82	3.67±1.4	0.07
>65 y	3.20±2.95	3.56±2.83	6.5±8.87	0.4

Values are presented as mean±standard deviation.

than patients with simple and phlegmonous AA (Tab. II.). Five patients required readmission. Four of them underwent LA (aged 20, 35, 64, and 68 years, respectively). One underwent OA (aged 33 years). None of the patients required reoperation.

DISCUSSION

We analyzed the characteristics of AA, preoperative laboratory test results, and clinical outcomes in three age groups. Our study shows that patients older than 65 years more frequently underwent OA than LA, had higher preoperative CRP levels and longer LOS than younger patients. Additionally, we found a positive correlation among CRP levels, OA, and gangrenous appendicitis. More than a half of the analyzed patients were younger than 40 years (55.5%), while only 7.6% of the patients were older than 65 years, which is consistent with the worldwide epidemiology of AA [13]. Our evaluation of the preoperative WBC counts and CRP levels showed that the WBC count did not differ either among different age groups or between LA and OA; however, the CRP levels were significantly higher in older patients and in patients who underwent OA. Similar findings have been reported in the literature [9, 10, 13–15]. Cohen-Arazi et al. reported that the atypical clinical presentation in older patients can delay the diagnosis [10].

Older patients often have multiple diseases including diabetes mellitus, neurological disorders, or fragility syndrome, which can minimize the symptoms of AA or cause a rapid onset of inflammation [6–10]. Moreover, the epidemiology shows higher incidence of AA in younger age, therefore even the surgeons, who

make the decisions about the operation, delay the diagnosis and surgery [9, 10, 16].

Our study shows that OA was more often performed in older than in younger patients. One-third of patients aged >65 years underwent OA, while only 4% of patients <40 years underwent OA. We analyzed the reasons for performing OA. Although we found no significant correlation between the choice of the procedure and the preoperative WBC counts or CRP levels, we observed a tendency to choose OA in older patients with high inflammatory parameters, which is also consistent with the results of other studies [14, 15]. The most common reason for conversion according to our surgical protocols was extensive inflammatory infiltration in the peritoneum, although only 20% of histopathological diagnoses were gangrenous AA. OA was the first-choice procedure in 44.4% of patients aged >65 years. The surgical decision regarding the procedure was associated with the surgeons' experience and learning curve. Surgeons who had been taught LA from the beginning of their career chose LA as the first-choice procedure and were less likely to convert to OA. In contrast, surgeons who started their education with OA were more likely to choose OA.

Advanced age also resulted in a longer LOS. We found that the prolonged hospitalization was associated with the patients' general condition, the surgeons' decision to manage the patients for a longer period of time in hospital and various social reasons. Moreover, older patients more frequently underwent OA, which was another reason

for a longer LOS [17]. Previous studies have shown that higher CRP levels reflect an increased occurrence of gangrenous appendicitis and a longer LOS, which is consistent with our findings [17, 18].

According to a clinical prospective randomized trial performed by Mantoglu et al., LA is an effective treatment method for AA. It leads to faster postoperative recovery and less pain [18, 19]. Nevertheless, we found no difference in the prevalence of complications between patients who underwent LA versus OA. Previous studies have shown that LA reduces mortality and morbidity [20, 21, 22]. Our analysis showed that younger patients undergoing OA had a significantly longer LOS than those who underwent LA. Limitations of this study include its retrospective design and lack of long-term follow-up. All data regarding postoperative complications and readmissions were obtained using hospital software only. Some patients may have chosen another department; therefore, this information may be insufficient. Nevertheless, our results match the data reported worldwide.

CONCLUSIONS

Patients older than 65 years more frequently underwent OA than LA, had higher preoperative CRP levels and a longer LOS than younger patients. The choice to perform OA was associated with surgeons' experience and habits. Additionally, higher CRP levels were associated with a greater risk of gangrenous appendicitis. LA is a safe and feasible treatment method for patients older than 65 years.

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