



Outcomes of Appendicectomy Among Elderly Patients Over a Five-Year Period

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Abstract

Introduction: Appendicitis in the elderly is a common surgical condition. However, there is a lack of literature about appendicectomy procedures in the elderly.

Methods and Materials: A five-year review of elderly patients undergoing appendicectomy was performed. Patient demographics, pre-operative characteristics, post-operative events and histological results were analyzed.

Results: 173 patients were included. 120 (69.36%) patients had a pre-operative medical comorbidity. The post-operative complication rate was 38.73% (67 patients) with ileus (15 (22.39%) patients) being the most common complication. The 30-day mortality rate was 0.012%. Patients over 76 years of age had statistically significant more post-operative complication rates ($p=0.02$) and longer hospital stays ($p=0.004$).

Conclusion: Atypical presentations for appendicitis in the elderly occur and pre-operative comorbidities are common. Over the age of 76 years, increased post-operative complication rates and longer hospital stays occur.

Keywords: Appendicitis; Appendicectomy; Emergency surgery; Geriatrics

Introduction

Appendicitis is a common abdominal surgical emergency condition and appendicectomy remains a common operation [1-3]. The estimated lifetime risk for appendicitis was reported to be 7% to 8%. In the European Union (EU), the frequency of performed appendicectomy procedures ranges from 49.7 to 170.2 per 100,000 populations. (Eurostat) Despite its common prevalence in a surgical department, the diagnosis of appendicitis can be elusive in the elderly patient (patients over 60 years of age (WHO 2017)) with the overall mortality in the elderly approaching 15%.

Although the peak incidence for appendicitis occurs in the second or third decade of life, with the disease being less common at both extremes of age [1], as the elderly population increases globally, the number of elderly patients requiring appendicectomy would also increase. Thus, with these trends, acute appendicitis will become an increasingly frequent problem in the elderly. Furthermore, the elderly population tends to have multiple medical/surgical comorbidities, which may further result in a potential increase in surgical risks, post-operative complications and delayed post-operative recovery times [2,4]. Although appendicitis remains a common surgical condition, there is a lack of data examining appendicitis in the elderly population. This study aims to analyze the management, patients' presentations, imaging and histopathological reports following appendicectomy in elderly patients presenting with acute appendicitis in a single-centre university teaching hospital.

Methods and Materials

Following approvals from our General Surgical Department and the Data Protection Unit at Mater Dei Hospital (Malta, EU), a 5-year retrospective review of all elderly patients (age more than 60 years (WHO 2017)) who underwent appendicectomy for appendicitis between January 1st, 2015 and December 31st, 2019 was performed. The patients were identified using the department's theatre records and the histology databases. Patient medical records were reviewed to assess patient demographics. Patients' presenting symptoms, initial blood investigations and radiological results, hospital Length of Stay (LOS), type of operation performed, post-operative complications, histopathological results and post-operative colonoscopy results (if performed) were recorded. The data was inputted in a Microsoft Excel 365[®] spreadsheet. Data analysis was performed using the Data Analysis ToolPak for Excel 365[®]. Descriptive statistical analysis with percentages for

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categorical variables and medians for continuous variables were used. Continuous variables were further compared using the two-sample t-test with a p value less than 0.05 were considered significant. Sub-group analysis was performed to assess for outcome differences in different age groups.

Results

A total of 173 patients over the age of 60 years (82 (47.40%) males and 91 (52.60%) females) were enrolled in this retrospective cross-sectional study. The median age was 72 years (range = 61 to 95 years). Female patients were statistically significant older at the time of appendectomy (female median age = 73 years vs. male median age = 71 years ($p=0.014$)). 120 (69.36%) patients had a pre-operative comorbidity with a cardiac comorbidity being the most common ($n=37$ (21.39%)). The presenting symptoms of the patients included in the study are shown in Table 1. 115 (66.47%) patients had Right Iliac Fossa (RIF) pain as part of their presenting symptoms. The initial admission blood investigations in this cohort showed an elevated C-reactive protein (>5 mg/L) in 163 (94.22%) patients, whilst an elevated white cell count ($WCC > 11.4 \times 10^9/L$) and elevated neutrophil count ($>7.20 \times 10^9/L$) were present in 160 (92.49%) patients and 75 (43.35%) patients, respectively. Although 7 (4.05%) patients did not have any pre-operative radiological investigation, Computer Tomography (CT) was performed in 163 (94.22%) patients, Ultrasound (US) imaging was performed in 1 (0.58%) patient and 1 (0.58%) patient underwent both CT and US prior to the appendectomy. The reported findings on imaging are detailed in Table 2. 166 (95.95%) were emergency appendectomy procedures whilst 7 (4.05%) appendectomies were performed as an urgent procedure after patient optimization for surgery. Table 3 shows patient timings from admission to operation. The type of appendectomy operation performed is detailed in Table 4. The median hospital LOS following the appendectomy was 4 days (mean = 7.05 days). The post-operative complication rate was 38.73% (67 patients). Table 5

Table 1: Patient symptoms at presentation.

Patient Symptoms at Presentation	Number of patients (%)
Right Iliac Fossa (RIF) pain	56 (32.37)
Nausea and/or vomiting and RIF pain	35 (20.23)
Non Specific abdominal pain only	32 (18.50)
Non Specific abdominal pain with nausea and/or vomiting;	11 (6.36)
Pyrexia, Nausea and/or vomiting and RIF pain	11 (6.36)
Pyrexia with RIF pain	8 (4.62)
Incidental finding on Radiological Imaging	6 (3.47)
Diarrhea with RIF pain	5 (2.89)
Other symptoms/combination of symptoms	9 (5.20)

Table 2: Radiological findings.

Radiological findings	Number of patients (%)
Simple Appendicitis	117 (67.63)
Complicated Appendicitis (perforation/abscess)	40 (23.12)
No Imaging Performed	7 (4.05)
No Diagnostic Abnormalities	5 (2.89)
Possible Neoplasm	2 (1.16)
Bowel Obstruction	1 (0.58)
Distended Appendix	1 (0.58)

Table 3: Admission to operative time.

Time to Operation	Number of Patients (%)
0 - 24 hours	107 (61.85)
24 - 48 hours	54 (31.21)
48 - 72 hours	10 (5.78)
>72 hours	2 (1.16)

Table 4: Type of operation.

Type of Operation	Number of Patients (%)
Open	82 (47.40)
Laparoscopy	81 (46.82)
Laparoscopic converted to Open	10 (5.78)

Table 5: Post-operative complications.

Clavien-Dindo Complication Grade	Number of Patients (%)
None	106 (61.27)
I	31 (17.92)
II	21 (12.14)
IIIa	6 (3.47)
IIIb	3 (1.73)
IVa	3 (1.73)
IVb	1 (0.58)
V	2 (1.16)

Table 6: Histology of specimen.

Histology	Number of Patients (%)
Appendicitis	158 (91.33)
No diagnostic abnormalities	4 (2.31)
Neuroendocrine tumour	4 (2.31)
Low grade mucinous appendiceal neoplasm	3 (1.73)
Chronic appendicitis	1 (0.58)
Caecal Carcinoma	1 (0.58)
Sessile serrated adenoma of appendix	1 (0.58)
Fibrous obliteration of appendix	1 (0.58)

highlights the Clavien-Dindo post-operative complication grade rates for the cohort. The most common post-operative complications were ileus ($n=15$ (22.39%)) and wound infections ($n=10$ (14.93%)). The 30-day post-operative mortality rate was 0.012% (2 patients). Histological examination of the appendix specimen showed that 9 (5.20%) patients had a neoplasm (Table 6). Follow-up colonoscopy was performed in 20 (11.56%) patients. Adenomatous polyps were present in 7 (4.05%) patients and an incidental carcinoma was found in 1 patient (0.58%). 153 (88.44%) did not undergo a follow-up colonoscopy following the appendectomy. Sub-group analysis (Table 7) of the cohort was performed to analyze whether there are differences with increasing age. Group 1 included patients aged between 60 years and 75-years-old whilst Group 2 included patients older than 76-years old. Statistically significant results were found with female patients being more common ($p=0.01$), more post-operative hospital complication rates ($p=0.02$) and longer hospital stay ($p=0.004$) in patients older than 76 years of age.

Discussion

Appendicitis remains a common surgical problem. The incidence

Table 7: Sub-group analysis.

Characteristic	Group 1	Group 2	p value
	60-75 years old (n=140)	76-95 years old (n=33)	
Male: Female	72:68	9:24	0.01
Laparoscopic: Open Procedure (including conversion to open) (n(%))	61 (43.57): 79 (56.43)	18 (54.55): 15 (45.45)	0.06
Complication during Admission (n(%))	48 (34.29)	18 (54.55)	0.02
30 - Day mortality (n(%))	1 (0.007)	1 (0.03)	0.27
Co-morbidities Present (n(%))	93 (66.43)	26 (78.79)	0.14
Hospital Length of Stay (mean days)	5.98 (1–68)	15.81 (1–68)	0.004
Malignant Histology (n(%))	9 (0.06)	1 (0.03)	0.18

of this emergency condition is reported to be 100 per 100,000 with a higher prevalence in females [3]. As also shown in our study. With an incidence of 5% to 10% of acute appendicitis in the elderly [2,5], our study adds to the limited literature examining appendicitis in the elderly. The authors want to highlight that appendicitis in the elderly occurs and the elderly patient with abdominal pain or non-specific symptoms should not be dismissed. One third of patients present to a surgical department with perforated appendicitis. Complicated appendicitis occurs more commonly in the elderly population [5]. This could result in increase in hospital costs due to the patient comorbidities and post-operative complications. As shown in Table 4, despite laparoscopic appendectomy being considered the most effective surgical treatment when compared to open appendectomy due to its lower incidence of wound infection, shorter hospital LOS, lower incidence of wound infections and better quality of life scores, 82 (47.40%) patients from our cohort underwent open appendectomy. Although the decision to operate either with laparoscopy or the laparotomy approach should remain a clinical decision, the laparoscopic approach should also be considered 'the gold standard' operative treatment in elderly patients with appendicitis [3]. Despite being a common condition, the clinical signs for appendicitis have a poor predicative value with radiological investigations being increasingly used for diagnosis and decreasing the rates of negative laparotomies/laparoscopic procedures [1,4,6-9]. Our study has highlighted that 58 (33.53%) patients did not have RIF pain on admission. 18.5% of patients presented with non-specific abdominal pain making the diagnosis of appendicitis in such a cohort difficult. In our cohort, 163 (94.22%) patients underwent a preoperative CT, with 157 (90.75%) having appendicitis/complicated appendicitis reported by a radiologist. This highlights the high positive predictive rate for appendicitis with CT imaging. Although the increasing availability of Magnetic Resonance Imaging (MRI) none of our patients underwent MRI. Our study noted that 120 (69.36%) patients had a pre-operative co-morbidity. Furthermore, 67 (38.73%) patients had a post-operative complication. Our 30-day post-operative mortality rate was low (n=2 (0.012%). Comparing to other studies, this is lower than reported in the literature [10]. Studies have shown that there is an increased incidence of appendiceal neoplasms in elderly patients and this should be suspected in patients presenting with a longer duration of symptoms and/or with low hemoglobin/hematocrit levels [11]. From our cohort, a follow-up colonoscopy was performed in 20 (11.56%) patients. Adenomatous polyps were present in 7 (4.05%) patients and an incidental carcinoma was found in 1 patient (0.58%). There has been controversy regarding the use of post-operative colonoscopy following appendectomy due to the lack of data on this subject. As noted in recent studies, despite the increasing use of pre-operative CT and laparoscopy, there still is a role for post-operative colonoscopy in

elderly patients to detect colonic pathologies. This study adds more data to the use of post-operative colonoscopy in patients presenting with appendicitis. Every effort was made by the authors to identify the entire patient who underwent an appendectomy and cross – referencing with histology and theatre datasets was performed in order to limit potentially missed data, however one of the limitations of the study was that the authors relied on retrospective data. Furthermore, although a subgroup analysis was performed in order to examine whether outcomes changed with increasing patient age, the groups had a different cohort size. The decision was taken to use 75-years-of-age as a cut off between the two groups to make the two groups size comparable. Although a sub-group analysis with octogenarians would have been ideal, the cohort above the age of 80-years would have been too small making data interpretation difficult and not statistically reliable. Nevertheless, one of the strengths of the study is that Mater Dei Hospital in Malta covers the whole country's population. This makes this study a national study and gives a snapshot of the surgical management of appendicitis in the elderly in an EU country and adds to the limited data in the management of appendicitis in the elderly population.

Conclusion

Elderly patients with appendicitis remain a challenge in view of the patients' typical presentations, the pre-operative comorbidities, and post-operative complications. Our results show that elderly patients with appendicitis undergoing operative management have an increased post-operative complication rate and such patients should be given the highest standards in post-operative management in order to minimize the complication rates following appendectomy. There remains a lack of data on the use of post-operative colonoscopy in such patients. Further studies are required to analyze the management of elderly patients with appendicitis in order to formulate management pathways to minimize elderly patients' morbidity and mortality rates following appendectomies.

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