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Early versus delayed appendectomy: A comparison of outcomes

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ABSTRACT

Background: The optimal timing for performing appendectomy in adults remains controversial.
Method: A one-year retrospective review of adult patients with acute appendicitis who underwent appendectomy. The cohort was divided by time-to-intervention into two groups: patients who underwent appendectomy within 8 h (group 1), and those who had surgery after 8 h (group 2). Outcome measures including perioperative morbidity and mortality, post-operative length of stay, and the 30-day readmission rate were compared between the two groups.
Results: A total of 116 patients who underwent appendectomy met the inclusion criteria: 75 patients (65%) in group 1, and 41 (35%) in group 2. There were no differences between group 1 & 2 in perioperative complications (6.7% vs. 9.8%, $P = 0.483$), postoperative length of stay (median [IQR]; 19.5 [11.5–40.5] vs. 20.0 [11.25–58.5] hours, $P = 0.632$), or 30-day readmission rate (2.7% vs. 4.9%, $P = 0.543$). There were no deaths in either group.
Conclusion: Delayed appendectomy performed more than 8 h was not associated with increased perioperative complications, postoperative length of stay, 30-day readmission rate, or mortality.
Summary: This is a retrospective analysis of patients presenting with acute appendicitis. Outcome measures including mortality and morbidity (complications), 30-day readmission rate, and postoperative length of stay were compared in patients who underwent early appendectomy (within 8 h from time of arrival, to emergency department, to skin incision), and those who underwent delayed appendectomy (after 8 h). No reported mortality. No differences were observed between the two groups regarding complications, 30-day readmission rates, or postoperative length of stay.

1. Introduction

Appendicitis remains one of the most common causes of acute abdomen, and, traditionally, immediate appendectomy has been the gold-standard treatment. The concern with delay in surgical management is that the progression of appendicitis, over time, will likely result in perforation with subsequent increased risk of morbidity and mortality. Current research, however, has been inconclusive in this regard.

A retrospective review of over 1000 patients treated for acute appendicitis found that delayed appendectomy was unsafe and led to increased rates of complications in patients with intervention delayed more than 48 h. The risk of progressive pathology was 13 times higher in the group in which appendectomy was delayed for longer than 71 h.[1] A subsequent review of over 4000 patients treated for acute appendicitis found that appendectomy delayed 6 h or more was associated with a significant increase risk of surgical site infection.[2] One study found that appendectomy delayed more than 12 h led to increased complication risk, and delays greater than 24 h led to increased incidence of gangrenous appendicitis.[3]

In contrast, a large retrospective study from the American College of Surgeons National Quality Improvement Program (NSQIP) database found that appendectomy delayed more than 12 h was associated with increased operative time and postoperative stay, but not morbidity or mortality.[4] A retrospective study found that length of postoperative stay, complication rate, and readmission rate were not significantly affected when appendectomy was delayed more than 8 h after initial presentation.[5]

The aim of this study was to compare the outcomes including morbidity, mortality, postoperative length of stay, and 30-day

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readmission rate in patients with acute appendicitis who underwent appendectomy within 8 h of arrival to the emergency department, and those who had surgery after 8 h. Our hypothesis was that a delay in performing appendectomy was associated with adverse outcomes.

2. Methods and materials

After institutional review board approval, a retrospective review of all patients with the diagnosis of acute appendicitis at a single university-affiliated community hospital from March 2015 to March 2016 was performed. Patients with a diagnosis of appendicitis were identified based on ICD-9 codes (540, 540.0, 540.1, 540.9) and ICD-10 codes (K35, K35.3, K35.3, K35.8).

All patients undergoing appendectomy during the study period who met the inclusion criteria were included in the analysis. Inclusion criteria for the subjects were (1) patients between the age of 18–90 years at time of appendectomy, (2) patients diagnosed with appendicitis by ultrasound, computed tomography (CT) scan, magnetic resonance image (MRI), or by clinical suspicion, and (3) patients who underwent appendectomy during the same hospitalization in which they were diagnosed. Exclusion criteria were (1) patients discharged from the hospital before undergoing appendectomy (i.e. interval appendectomy, patients leaving against medical advice), and (2) pregnant patients who were diagnosed with acute appendicitis.

The study population was divided into two groups by time-to-intervention: the early appendectomy (group 1) included patients who underwent surgery within 8 h, and the delayed appendectomy (group 2) included patients who had surgery after 8 h. The two study groups were then then compared for differences in the underlying characteristics including demographic, clinical, radiographic and perioperative data. Outcome measures included mortality and morbidity, postoperative length of stay, and 30-day readmission rate.

Data was collected manually via patient chart review within the electronic medical record. Statistical analysis was performed using SAS Enterprise Guide 7.1. Statistical significance was considered for $P < 0.05$. Categorical variables are presented as frequencies and percentages, and continuous variables were reported as means and standard deviation (SD) or, if the data were skewed, as medians and interquartile ranges (IQR). Categorical data were tested using the Pearson χ^2 test. Differences in means between groups were compared using the unpaired Student *t*-test or Mann-Whitney rank sum test.

3. Results

During the one-year study period, a total of 116 patients met the inclusion criteria for the study population. Seventy-five patients (65%) underwent appendectomy within 8 h of arrival to the ED, and 41 patients (35%) after 8 h. The overall mean (SD) age was 42.2 (17.5) years. Male patients accounted for 54% (n = 63) of the population. The median (IQR) time from onset of abdominal pain to arrival to the ED was 24 (12–48) hours. The median (IQR) time from arrival to ED to skin incision was 6 (3.3–10) hours.

Table 1 presents detailed overall patient characteristics and comparison between the two study groups. There was no

Table 1
Overall patient demographic, clinical and radiologic data and comparison between early appendectomy (group 1) and delayed appendectomy (group 2).

	Overall (n = 116)	Early Appendectomy (Group 1) (≤8 h, n = 75)	Delayed Appendectomy (Group 2) (>8 h, n = 41)	*p*-value
Background Demographics				
Age in years, mean (SD)	42.2 (17.5)	42.6 (18)	41.4 (16.7)	0.585
Gender (Male/Female)	63/53	39/36	24/17	0.561
Body Mass Index (Kg/m^2), mean (SD)	28.9 (6.7)	29 (6.7)	28.5 (7)	0.796
Prior abdominal surgeries, n (%)	41 (35)	23 (30.7)	18 (44)	0.1622
Medical Comorbidities				
CAD, n (%)	3 (2.6)	1 (1.3)	2 (4.9)	0.285
CVA, n (%)	2 (1.7)	1 (1.3)	1 (2.4)	0.667
CHF, n (%)	3 (2.6)	1 (1.3)	2 (4.9)	0.285
COPD, n (%)	4 (3.4)	1 (1.3)	3 (7.3)	0.126
Diabetes, n (%)	11 (9.5)	6 (8)	5 (12.2)	0.516
Chronic Kidney Disease, n (%)	3 (2.6)	2 (2.7)	1 (2.4)	0.941
Clinical and Imaging Data				
Timing from onset of abdominal pain to arrival to ED in hours, median (IQR)	24 (12–48)	24 (12–48)	24 (15–48)	0.314
Symptoms associated with abdominal pain				
Fever, n (%)	14 (12.1)	10 (13.3)	4 (9.8)	0.768
Nausea, n (%)	65 (56)	41 (54.7)	24 (58.5)	0.701
Anorexia, n (%)	24 (21)	18 (24)	6 (14.6)	0.338
Diarrhea, n (%)	11 (9.5)	9 (12)	2 (4.9)	0.323
Physical Examination/labs				
Temperature in Celsius, mean (SD)	36.9 (0.6)	36.9 (0.6)	36.9 (0.6)	0.911
Localized peritonitis, n (%)	112 (96.6)	73 (97.3)	39 (95.1)	0.688
Diffuse peritonitis, n (%)	4 (3.4)	2 (2.7)	2 (4.9)	0.534
White blood count (x10^9/L), mean (SD)	13.9 (4.5)	13.8 (4.2)	13.5 (5.1)	0.513
Radiologic Data				
Abdomen and Pelvis CT Scan, n (%)	108 (93)	68 (91)	40 (97.5)	0.163
CT scan Findings				
Peri-appendiceal inflammation, n (%)	102 ((94)	67 (98.5)	35 (87.5)	0.560
Fecolith, n (%)	38 (35)	27 (40)	11 (27.5)	0.408
Phlegmon/Abscess, n (%)	4 (3.7)	1 (1.5)	3 (7.5)	0.126
Pneumoperitoneum, n (%)	4 (3.7)	1 (1.5)	3 (7.5)	0.661
Ultrasound, n (%)	15 (13)	9 (12)	6 (5.2)	0.687
MRI, n (%)	1 (0.9)	1 (1.3)	0 (0)	1.000

CAD = coronary artery disease, CVA = cerebrovascular accident, CHF = congestive heart failure, COPD = chronic obstructive pulmonary disease, ED = Emergency Department, CT = computerized tomography, MRI = magnetic resonance Image.

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