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Outcomes of complicated appendicitis: Is conservative management as smooth as it seems?

Katelyn A. Young, Nina M. Neuhaus, Marcus Fluck, Joseph A. Blansfield, Marie A. Hunsinger, Mohsen M. Shabahang, Denise M. Torres, Kenneth A. Widom, Jeffrey L. Wild*

Department of General Surgery, Geisinger Medical Center, 100 N. Academy Avenue, Danville, PA, USA

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ABSTRACT

Background: This study characterized the failure rate of non-operative management (NOM) for complicated appendicitis (CA; perforation, abscess, phlegmon), and compared outcomes among patients undergoing acute appendectomy (AA), elective interval appendectomy (EIA), and unplanned appendectomy after failing to improve with NOM.

Methods: Adults treated at one facility between 2007 and 2014 were retrospectively studied.

Results: Ninety-five patients presented with CA. Sixty individuals underwent AA. The remaining 35 patients initially underwent NOM: 14 underwent EIA, nine (25.7%) failed NOM, 12 never underwent surgery.

All patients failing NOM had an open operation with most (55.6%) requiring bowel resection. AA and EIA were comparable in surgical approach, bowel resection and post-operative readmission. However, AA demonstrated a lower incidence of bowel resection (3.3% vs 17.1%, $P = 0.048$) when compared to all patients initially undergoing NOM.

Conclusions: Due to the high incidence of failed NOM and the morbidity associated with failure, AA may be appropriate for CA.

Summary: Complicated appendicitis can be initially managed with an operative or non-operative approach. This study found that due to the high incidence of failed non-operative management and the increased morbidity associated with failure, immediate surgical management is an appropriate treatment option to consider for complicated appendicitis.

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1. Introduction

Appendicitis is among the most common intra-abdominal surgical emergencies, presenting with an annual incidence of approximately 250,000 cases in the United States alone.¹ The majority of patients present with acute inflammation without perforation,² and the standard of care for uncomplicated appendicitis is

an acute appendectomy (AA).³

In contrast, the management of patients whose appendicitis is complicated by perforation, phlegmon, or abscess remains controversial. AA in this population is curative but associated with increased complexity due to the heightened inflammatory state and distorted local anatomy. For this reason, the World Society of Emergency Surgery's consensus statement on the management of complicated appendicitis recognizes that AA is a safe treatment option if performed by an experienced surgeon.³ Indeed, the only randomized control trial performed in adults⁴ agreed with several retrospective reports describing the safety and feasibility of immediate definitive source control.^{5–7} While bowel resection may be required, the trial reported an overall morbidity rate of less than 20%,⁴ which is consistent with previous reports.^{8–10}

Stable patients with complicated appendicitis can also be managed non-operatively with antibiotics and, if appropriate,

* Corresponding author. Section of Trauma and Emergency General Surgery, Department of General Surgery, Geisinger Medical Center, 100 N. Academy Avenue, MC 21-68 Danville, PA 17822, USA.

E-mail addresses: kayoung1@geisinger.edu (K.A. Young), nmneuhaus@geisinger.edu (N.M. Neuhaus), mfluck1@geisinger.edu (M. Fluck), jblansfield1@geisinger.edu (J.A. Blansfield), mahunsinger@geisinger.edu (M.A. Hunsinger), mmshabahang@geisinger.edu (M.M. Shabahang), dmtorres@geisinger.edu (D.M. Torres), kawidom@geisinger.edu (K.A. Widom), jlwild@geisinger.edu (J.L. Wild).

percutaneous drainage.³ A recent meta-analysis of 17 non-randomized studies suggested that patients who were successfully treated with non-operative management experienced decreased overall morbidity compared to AA.¹¹ There is an ongoing debate, however, regarding whether such conservative measures should be followed by elective interval appendectomy (EIA). Traditionally, EIA has been performed to prevent recurrence and to rule out the possibility of malignancy.^{12–14} Nonetheless, a meta-analysis of 61 studies concluded that EIA may not be necessary for patients who respond to non-operative management as the pooled risk of recurrent appendicitis was less than 10% and the incidence of malignancy was less than 2%.¹⁵

Despite these meta-analyses and the consensus of the World Society of Emergency Surgery, which ultimately supports the use of non-operative management,³ clinical practice continues to include both operative and non-operative treatment strategies. One limitation in evaluating the current literature is the lack of consensus in defining what constitutes failed non-operative management. For this reason, there is considerable variability in the stated effectiveness of non-operative measures, with some studies reporting failure rates as high as 55.6%.¹⁶ Furthermore, there is a paucity of literature characterizing the presentation and outcomes of patients who do not respond to non-operative treatment in the inpatient or outpatient setting. The present study hypothesized that non-operative management would fail to fully treat all patients and that failure would be associated with adverse outcomes compared to immediate surgical management. To investigate this hypothesis, this study aimed to characterize the failure rate of non-operative management and compare outcomes for complicated appendicitis among patients treated with AA, patients undergoing EIA and patients undergoing an unplanned appendectomy after failing to respond to non-operative management.

2. Materials and methods

This was a retrospective study approved by the Institutional Review Board of Geisinger Health System. Data for all adult patients (age ≥ 18 years) who presented to a single tertiary care center (Geisinger Medical Center, Danville, PA) with appendicitis between January 1, 2007 and July 1, 2014 were reviewed. Patients were included if there was evidence of complicated appendicitis on the first computed tomography (CT) scan during the initial presentation. Complicated appendicitis was defined as the presence of appendiceal abscess, phlegmon, or extraluminal air, per the final report issued by the board-certified attending radiologist at the time of image acquisition.

All patients were classified by the initial intent to treat. All treatment decisions were made at the attending surgeon's discretion as there is no institutional guideline for the management of complicated appendicitis. Regardless of the management approach, follow-up office visits approximately two weeks after discharge are standard practice with the need for additional visits determined on an individual basis.

2.1. Operative management: AA

Patients managed with urgent operative intervention were classified as the AA group. While pre-operative antibiotics were administered, these patients were never started on a trial of non-operative management.

2.2. Non-operative management: failed non-operative management

The first subgroup of patients initially managed non-operatively

failed to improve with non-operative management. While there were no criteria set a priori for the definition of failure, clinical parameters for decision making included vital signs, physical examination and laboratory markers (white blood cell count, lactate, creatinine.) In the inpatient setting, failure was defined as any patient who did not show clinical or radiological improvement after at least 24 h of non-operative management using intravenous antibiotics and, if indicated, percutaneous drains.

Patients failing non-operative management in the outpatient setting had an unplanned hospitalization for unresolved appendicitis or inflammatory collections, which required unplanned appendectomy.

2.3. Non-operative management: EIA

The second subgroup of patients initially managed non-operatively showed clinical improvement with non-operative management and did not have recurrent appendicitis before EIA, which was performed at least six weeks after discharge. Patients were not symptomatic of appendicitis at the time of EIA.

There is no institutional guideline for the use or timing of EIA and as such the decision was made according to the patient's preference and the surgeon's discretion. Patients in whom malignancy was found during follow-up colonoscopy underwent laparoscopic bowel resection with appendectomy performed by a board-certified surgeon specializing in colorectal surgery.

2.4. Non-operative management: no surgery

The third subgroup of patients who were managed non-operatively never underwent appendectomy. This group consisted of patients with severe comorbidities that posed an anesthesiologic risk that precluded operative intervention. This group also consisted of patients who were suitable for surgery but responded to non-operative management, and the decision to forgo EIA was made according to the patient's preference or the surgeon's discretion during follow-up office visits.

The primary outcome for this study was the incidence of failed non-operative management. The need for major bowel resection, defined as right hemicolectomy or ileocecectomy for non-malignant pathology, served as the secondary outcome for this study. Additional data relating to demographics, presentation, clinical course and operative outcomes were collected from the institutional electronic health record. Readmission for an abdominal source within 90 days of discharge following appendectomy was also evaluated. To compare outcomes by the initial intent to treat (operative versus non-operative management), outcomes of AA were compared to all patients who were initially managed non-operatively. Furthermore, to understand the effect of failing non-operative management, outcomes among patients who failed non-operative management were compared to patients who underwent AA.

Results are reported as frequency or mean with standard deviation unless otherwise specified. Univariate analysis of categorical variables was performed using the chi-square or Fisher's exact test. Continuous variables were evaluated using the student's t-test. All analyses were performed using SAS software, Version 9.4 (Copyright 2013 SAS Institute Inc. Cary, NC). All statistical tests were two-sided and $P < 0.05$ was considered to be statistically significant.

3. Results

During the study period, 533 patients were diagnosed with acute appendicitis, and 95 of these cases (17.8%) met radiological criteria for complicated appendicitis (Fig. 1). Sixty patients (63.2% of

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