

Can Interval Appendectomy be Justified Following Conservative Treatment of Perforated Acute Appendicitis?¹

Joannele Z. Lugo, M.D.,* Dimitrios V. Avgerinos, M.D.,* Amanda J. Lefkowitz, B.A.,* Matthew E. Seigerman,*
Ismail S. Zahir, M.D.,† Andrew Y. Lo, M.D.,* Burton Surick, M.D.,* and I. Michael Leitman, M.D.*²

*Department of Surgery, Beth Israel Medical Center, Albert Einstein College of Medicine, New York, New York; and †Department of Pathology, Beth Israel Medical Center, Albert Einstein College of Medicine, New York, New York

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Background. There continues to be controversy about the necessity of interval appendectomy for delayed presentation of acute appendicitis. While recent studies suggest that the risk of recurrent disease is small, the risk of interval appendectomy is also small and does provide histologic identification and usually definitive treatment of the right lower quadrant inflammatory process.

Methods. A retrospective analysis of medical records gathered from 2002 to 2007 at a major teaching hospital of 986 adult patients over the age of 13 with appendicitis were analyzed. Forty-six patients (5%) were found to have right lower quadrant abscess or phlegmon, and were managed with intravenous antibiotics. Some patients also underwent percutaneous drainage. These patients were then readmitted 6 to 26 wk later for an elective laparoscopic interval appendectomy.

Results. There were 19 males and 27 females with an average age of 43 y. Ninety-four percent of the appendectomies were completed laparoscopically; 16% of patients were found to have a normal or obliterated appendix on pathologic evaluation and likely did not benefit from interval appendectomy. On the other hand, 84% of patients had persistent acute appendicitis, chronic appendicitis, evidence of inflammatory bowel disease, or neoplasm identified, and likely benefited from surgical appendectomy.

Conclusions. Interval appendectomy provides diagnostic and therapeutic benefit to patients who present

with a right lower quadrant abdominal inflammatory focus, and should be carefully considered in all adult patients. © 2010 Elsevier Inc. All rights reserved.

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INTRODUCTION

Nonoperative management of acute appendicitis with abscess formation or phlegmon is becoming widely accepted among surgeons. Inflammation associated with abscess formation or phlegmon may make an appendectomy at the time of presentation technically more difficult, leading to injury of adjacent loops of small bowel [1]. A right hemicolectomy or ileocecal resection is often the result. Because of the associated morbidity that results from operating under such circumstances, more and more surgeons are opting to treat conservatively in the face of abscess or phlegmon and return weeks to months later to perform an interval appendectomy [2].

Recent studies have questioned the usefulness of interval appendectomy after conservative management of acute appendicitis. Many have come to the conclusion that the risk of recurrent appendicitis is low and that there is no role for interval surgery, while others still advocate interval surgery as part of management [1, 3–6].

In order to form an abscess or phlegmon, the appendix must be perforated. In such cases, it is likely that the appendiceal lumen fibroses or remains obliterated after conservative management, which makes the possibility of recurrent appendicitis very low.

Laparoscopic appendectomy is not without risks and complications. Although complication rate is low, it

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² To whom correspondence and reprint requests should be addressed at Department of Surgery, Israel Medical Center, 10 Union Square East, Suite 2M, New York, NY 10003. E-mail: MLeitman@chpnet.org.

exists. The risk of complications from interval appendectomy coupled with the presumed low risk of recurrence after conservative management of acute appendicitis prompted us to look at our own pathologic specimens to see if our prediction of fibrosis and obliteration was actually correct. The initial hypothesis was that a high percentage of the pathologic specimens would have an obliterated appendiceal lumen supporting conservative management of acute appendicitis in these cases without interval surgery.

METHODS

After obtaining approval from the Institutional Review Board of our hospital, all adult patients (more than 18 y of age) who underwent interval appendectomy at Beth Israel Medical Center between 2002 and 2007 were included in the study. The diagnosis of perforated appendicitis with phlegmon or abscess formation was confirmed by computed tomography (CT) scan 6 wk to 6 mo prior to the scheduled appendectomy.

The radiology reports of the CT scans at the time of presentation were reviewed to confirm the diagnoses of perforated or phlegmonous appendicitis as well as to look for other pertinent pathology, such as presence of an appendicolith. The pathology reports from the original submitted specimens were reviewed for luminal status, presence of appendicolith, or presence of neoplasm.

The original specimens were then reviewed again by the pathology department to specifically look to see if the lumen of the submitted appendices were normal or obliterated.

RESULTS

Forty-six patients met the selection criteria; 19 male, 27 female, with a mean age of 43 y. This accounted for 4.8% of the patients admitted with appendicitis during the study period. CT guided percutaneous drainage was performed in 26 patients (56%). Patients remained in the hospital for an average of 4.6 d for intravenous antibiotics and other treatment. Interval appendectomy was performed an average of 56 d following hospital discharge. All appendectomies were approached laparoscopically and two, required conversion to an open procedure due to adhesions or the need to secure the cecal closure with suture. One patient required outpatient treatment for a superficial wound infection. There were no other complications. All laparoscopic appendectomies were performed in an ambulatory surgical setting.

Results from the original pathology reports are listed in Table 1. Histologic analysis demonstrated acute inflammation (44%), chronic inflammation (15%), acute appendicitis with perforation (13%), obliterated appendix (9%), normal appendix (7%), inflammatory bowel disease (4%), mucinous cystadenoma (4%), and endometriosis (4%).

Appendicoliths were found in 18 patients (39%). Four patients (9%) developed recurrent abdominal pain following discharge after conservative management. His-

tologic analysis following appendectomy in these patients showed chronic appendicitis with appendicolith (two patients), mucinous cystadenoma, and acute appendicitis with appendicolith.

DISCUSSION

Patients who present with missed appendicitis present a technical and decision making challenge for the surgeon. This accounts for 3%–6% of patients who present with acute appendicitis [1, 8]. Many studies have investigated the role for interval appendectomy after conservative treatment for acute appendicitis. There has been data suggesting a need for interval appendectomy [3, 7] as well as suggesting that interval appendectomy is unnecessary [8–11]. Kaminski *et al.* indicated that about 85% of patients will never have recurrent appendicitis following their acute presentation and nonsurgical treatment [12]. Dixon *et al.* reported a similar incidence of recurrent appendicitis and found that subsequent attacks were less frequent with subsequent observation and less severe, based upon white blood cell count, temperature, length of hospital stay, suggesting that interval appendectomy could be deferred, avoided, or performed only in patients with recurrent appendicitis [13]. Lai *et al.* also reported that most recurrent episodes of appendicitis occur in the first 6 months [10].

The risk of recurrence appears to be much higher if an appendicolith is present [6, 7]. Some advocate performing interval appendectomy in adults as soon as possible to reduce the risk of postoperative morbidity, and the progression of pathologic processes [14]. Clearly, even outpatient laparoscopic interval appendectomy is easily performed in the majority of patients [15], and while percutaneous drainage followed by interval appendectomy may be associated with some morbidity and cost, it appears to compare favorably with early surgery in complicated appendicitis. Keckler *et al.* [16] also report a 94% laparoscopic appendectomy

TABLE 1
Pathologic Diagnosis of Patients Undergoing Interval Appendectomy

| Pathologic diagnosis | Number patients | % |
|-------------------------------------|-----------------|----|
| Acute inflammation | 20 | 44 |
| Chronic inflammation | 7 | 15 |
| Acute inflammation with perforation | 6 | 13 |
| Obliterated appendix | 4 | 9 |
| Normal appendix | 3 | 7 |
| Inflammatory bowel disease | 2 | 4 |
| Mucinous cystadenoma | 2 | 4 |
| Endometriosis | 2 | 4 |



FIG. 1. Low power H and E stain: Appendix, transverse section demonstrating appendicolith. (Color version of figure is available online.)

rate but an average 1.4 d hospital stay following surgery.

The present study shows that 9% of patients will develop recurrent right lower quadrant abdominal pain early in their course following discharge from conservative management of missed appendicitis. In addition, our review demonstrates that pathologic findings of clinical and potentially clinical significance will be discovered by interval appendectomy (acute appendicitis, chronic appendicitis, neoplasm, inflammatory bowel disease, or an appendicolith (Fig. 1), suggesting that interval appendectomy would likely benefited these patients. Interval laparoscopic appendectomy is safe and may generally be performed on an ambulatory setting.

On the other hand, 16% of patients demonstrated either a normal appendix or an obliterated appendix suggesting these patients did not benefit from appendectomy (Figs. 2 and 3). Without additional testing, it

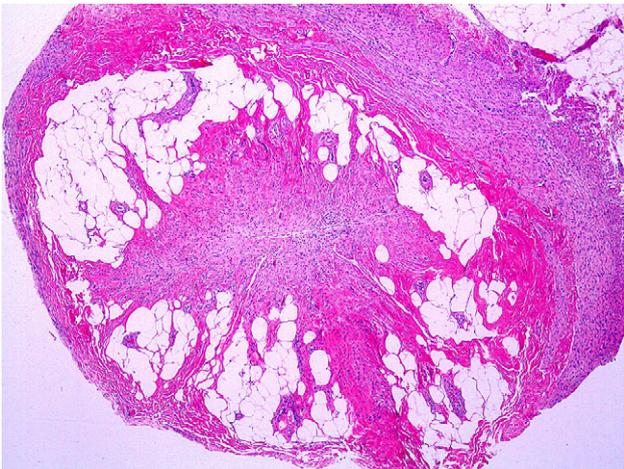


FIG. 2. Low power H and E stain: Appendix, transverse section. Lumen is completely obliterated with fibro-adipose connective tissue. There are no luminal epithelial elements or lymphoid aggregates. (Color version of figure is available online.)

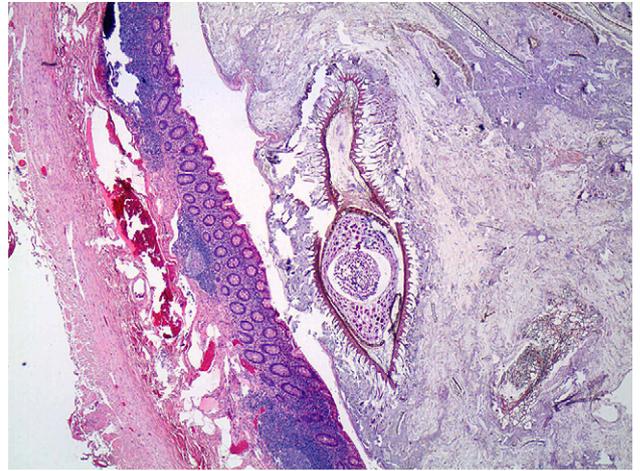


FIG. 3. High power H and E stain: Appendix, transverse section. Lumen is completely obliterated with fibro-adipose connective tissue. This demonstrates fibrous obliteration of the lumen. (Color version of figure is available online.)

would be difficult to determine from the preoperative evaluation which of the present series of patients had fibrous obliteration of appendiceal lumen, and might avoid interval appendectomy.

Therefore, predicting the pathology on the resected appendix is not usually possible. Therefore, a policy of observing every patient following nonoperative treatment for acute appendicitis might not be wise, as clinically significant disease may not be adequately treated.

Patients with appendicoliths are most likely to benefit from interval appendectomy as this becomes a nidus for future infection [17]. While inflammatory bowel disease or neoplasm are not common causes of acute appendicitis, knowing the precise etiology of the acute appendicitis episode is essential for appropriate treatment of patients with disease of the appendix and nearby ileum and cecum [18].

An individualized approach to each patient following resolution of perforated appendicitis is advised. This may require additional diagnostic testing (such as contrast enema, colonoscopy, or small bowel series) in patients being observed, to exclude the presence of an appendicolith, inflammatory bowel disease, or appendiceal tumors. A cost-benefit analysis would then be necessary to determine the utility of this additional testing in lieu of interval appendectomy.

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