Routine Interval Appendectomy Is Not Justified After Initial Nonoperative Treatment of Acute Appendicitis

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Background: The role of interval appendectomy (IA) after an episode of acute appendicitis is debated.

Hypothesis: Patients treated nonoperatively for acute appendicitis do not require routine IA.

Design: Retrospective cohort study using discharge abstract data.

Setting: Twelve regional Kaiser Permanente hospitals in Southern California.

Patients: A total of 32,938 patients were hospitalized with acute appendicitis.

Interventions: Appendectomy or nonoperative treatment with or without abscess drainage.

Main Outcome Measures: Hospitalization for recurrent appendicitis or IA.

Results: The type of appendicitis was abscess in 7% of patients, peritonitis in 18%, and no peritonitis or abscess in 75%. Emergency appendectomy was performed in 31,926 (97%) patients. Nonoperative treatment was used initially in 1,012 patients (3%). Of these, 148 (15%) had an IA and the remaining 864 (85%) did not. Thirty-nine patients (5%) recurred after a median follow-up of 4 years. Using Cox regression, sex had a slight influence on recurrent appendicitis (hazard ratio males vs females = 0.52, 95% CI, 0.27-0.99, P = .05). Age, Charlson comorbidity index, type of appendicitis, or percutaneous abscess drainage had no influence on recurrence. Median length of hospital stay was 4 days for the admission for recurrent appendicitis compared with 6 days for the IA admission (P = .006).

Conclusions: Most patients with acute appendicitis undergo appendectomy initially. For those treated nonoperatively, the recurrence rate is low. Routine IA after initial successful nonoperative treatment is not justified and should be abandoned.

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The management of appendicitis has traditionally involved a purely surgical approach. However, in the setting of appendicitis presenting with appendiceal abscess or phlegmon, initial nonoperative management has been shown to be safe and effective. Controversy exists regarding the necessity for an interval appendectomy (IA) following initial nonoperative management of appendicitis. A majority of surgeons endorse IA in children despite a lack of convincing data to support its use.

Interval appendectomy has been traditionally used because of the perceived risk of recurrent appendicitis. The risk of recurrent appendicitis after nonoperative treatment has been reported as 5% to 37%, but most of these studies are small, or have short follow-up periods. Although IA has been shown to have fewer complications than emergency appendectomy in cases of abscesses and phlegmonous appendicitis, the question remains as to whether IA is necessary at all if the risk of recurrent appendicitis is low.

The aim of this study was to determine the risk of recurrent appendicitis following initial nonoperative treatment for appendicitis, and evaluate factors associated with recurrence. Our hypothesis was that the risk of recurrent appendicitis is low and that IA is not routinely indicated. Secondly, we compared the length of hospital stay (LOHS) for patients with recurrent appendicitis and patients undergoing IA.
DATA SOURCES AND STUDY SUBJECTS

This retrospective cohort study used the Southern California Kaiser Permanente Discharge Abstract Database to identify patients hospitalized in 12 acute care hospitals with a diagnosis of appendicitis (International Classification of Diseases, Ninth Revision [ICD-9] codes 540.0, 540.1, 540.9) between January 1, 1992, and December 31, 2004. This study was approved by the Institutional Review Board of Kaiser Permanente Southern California, protocol number 3934.

TREATMENT

Surgical therapy was determined according to the ICD-9 procedure code for appendectomy (ICD-9 code 47.0). Those who had an appendectomy in the initial hospitalization were classified as emergency appendectomy. Patients who were admitted and did not undergo appendectomy in the initial hospitalization were classified as having nonoperative treatment. There were no criteria set a priori for selection of treatment; the decision between initial treatment with appendectomy or observation was made at the surgeon’s discretion. Nonoperative treatment included percutaneous abscess drainage (ICD-9 code 54.91), and the decision to treat an abscess with antibiotics or percutaneous drainage was at the discretion of the treating surgeon and interventional radiologist.

RECURRENT APPENDICITIS AND IA

Recurrences were only evaluated in the patients who were treated nonoperatively during their initial hospitalization. Operative reports were obtained for those patients who underwent an appendectomy after their initial hospitalization to determine whether an appendectomy during a subsequent admission was performed because of recurrent appendicitis or if it was prescheduled as an elective IA.

Table 1. Characteristics of Patients on First Admission With Acute Appendicitis

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>(n = 32 938)</td>
</tr>
<tr>
<td>&lt;20</td>
<td>12 153 (37)</td>
</tr>
<tr>
<td>0-49</td>
<td>15 767 (48)</td>
</tr>
<tr>
<td>50-99</td>
<td>4 718 (15)</td>
</tr>
<tr>
<td>100+</td>
<td>618 (2)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>13 833 (42)</td>
</tr>
<tr>
<td>Male</td>
<td>19 105 (58)</td>
</tr>
<tr>
<td>Charlson comorbidity index</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>30 327 (92)</td>
</tr>
<tr>
<td>1</td>
<td>2177 (7)</td>
</tr>
<tr>
<td>2</td>
<td>434 (1)</td>
</tr>
<tr>
<td>Type of appendicitis</td>
<td></td>
</tr>
<tr>
<td>No abscess or peritonitis</td>
<td>24 717 (75)</td>
</tr>
<tr>
<td>Abscess</td>
<td>2179 (7)</td>
</tr>
<tr>
<td>Peritonitis</td>
<td>5042 (18)</td>
</tr>
<tr>
<td>Initial therapy</td>
<td></td>
</tr>
<tr>
<td>Emergency appendectomy</td>
<td>31 926 (97)</td>
</tr>
<tr>
<td>Nonoperative</td>
<td>1012 (3)</td>
</tr>
<tr>
<td>Subsequent interval appendectomy</td>
<td>148 (15)</td>
</tr>
<tr>
<td>Observation</td>
<td>864 (85)</td>
</tr>
</tbody>
</table>

HOSPITAL STAY

Length of hospital stay was counted in days. Cumulative length of hospital stay was the sum of the first and second hospital admission days.

STATISTICAL ANALYSIS

The data from the Southern California Kaiser Permanente Discharge Abstract Database were exported to SAS version 8 (SAS Institute Inc, Cary, NC) statistical software for subsequent analyses. Associations between predictor variables and recurrent appendicitis were assessed using Cox proportional hazards regression modeling. Variables analyzed for their influence on either outcome were age (in categories <20, 20-49, ≥50 years), sex, Charlson comorbidity index, type of appendicitis (no abscess or peritonitis, abscess, peritonitis), and percutaneous abscess drainage. The strength of associations was expressed as hazard ratios and 95% confidence intervals (CI) for having recurrent appendicitis. The independent effect of predictor variables was found using multiple Cox regression, adjusting for the same variables used in the univariate analysis. Recurrence-free survival time was calculated as the time from admission to hospital until a recurrence, last follow-up, or December 31, 2004, whichever came first. Recurrence-free survival time was estimated using the Kaplan-Meier method and survival curves for the 2 age groups were compared using the log-rank test. Cumulative length of hospital stay and LOHS for each admission was compared between groups using the Wilcoxon rank sum test. Estimates were considered statistically significant if the 95% CI did not overlap 1.0, and if P values were less than .05. All P values reported were 2-tailed.

PATIENT DEMOGRAPHICS

There were 32 938 patients hospitalized with acute appendicitis. Most patients (48%) were between 20 to 49 years of age, and the majority of patients (58%) were men (Table 1). The vast majority of patients (92%) were healthy with a Charlson comorbidity index of 0.

Emergency appendectomy was performed in 97% of the cohort during their initial hospitalization (Table 1). Nonoperative treatment was used initially in the remaining 1012 patients (3%). Of these, 148 (15%) had an IA and the remaining 864 (85%) did not have an IA (Table 1 and 2).

FOLLOW-UP AND RECURRENCE

Patients were observed for a median of 4 years, with a range of 6 months to 12 years. Twenty-six patients were lost to follow-up. After initial nonoperative treatment, 39 (5%) of 864 patients had a recurrence (Table 3 and Figure). Mean time to recurrence was 10±15 months. During the admission for recurrence, appendectomy was performed in 22 patients (57%), cecectomy in 2 (5%), and right hemicolecction in 2 (5%); the remaining 13 patients were treated without operation, and never had another recurrence. In the 148 patients treated with IA, median time to IA after initial diagnosis was 63 days.
Using univariate analysis and multivariable analyses, the only factor associated with recurrence was sex. Males were less likely to recur than females, whereas age, Charlson comorbidity index, type of appendicitis, or percutaneous abscess drainage had no independent influence on recurrence (Table 4).

HOSPITAL STAY

The median cumulative length of hospital stay in the 864 patients treated initially with observation was 6 days. The median LOHS during the first admission for patients in the recurrent appendicitis group was 7 days compared with 6 days in the IA group (P = .06). The median LOHS during the second admission for patients in the recurrent appendicitis group was 4 days compared with 6 days in the IA group (P = .006). The median cumulative length of hospital stay in the 39 patients who recurred was the same as the 148 patients treated with IA, both 12 days (P = .84). Median LOHS for the interval appendectomy admission was 6 days, compared with 3 days for the patients treated with emergency appendectomy (P < .001).

COMMENT

This large, population-based study evaluated the need for IA based on the outcomes of patients initially treated nonoperatively for appendicitis. In the patients who were treated nonoperatively and who did not undergo IA, we found that the risk of recurrent appendicitis was rare (5%). Furthermore, LOHS for the interval appendectomy was longer than it was for a recurrence. Our study incorporated data from 12 regional hospitals and is the largest study to date of patients treated nonoperatively for appendicitis; the low recurrence rate and short LOHS argue against routine IA.

Although most patients with appendicitis are optimally treated with appendectomy, there will be a small proportion with evidence of an abscess or phlegmon who can successfully be treated nonoperatively. Several studies demonstrate that patients experience resolution of their symptoms with the use of intravenous antibiotics alone or in combination with percutaneous drainage of an abscess. Oliak et al performed a retrospective review of 155 patients with appendiceal abscesses. Eighty-eight patients were initially treated nonoperatively and no difference was found in length of hospital stay, time to normalization of white blood cell count and temperature, and time until a regular diet was tolerated compared with the operative group. Brown et al...
Abbreviations: CCI, Charlson comorbidity index; CI, confidence interval.

A hazard ratio of 1 indicates no difference compared with the referent group; a hazard ratio greater than 1 indicates a higher likelihood of recurrence compared with the referent group; and a hazard ratio less than 1 indicates a lower likelihood of recurrence compared with the referent group.

†Referent group.

Proponents of IA also claim that there is little risk associated with this operation, especially when compared with an appendectomy performed for patients with appendiceal abscess or phlegmon.3,13 However, reported complications from IA range from 2% to as high as 23%.3,8,13,14 Although we did not review specific complications in this study, LOHS was used as a marker to measure the severity of the patients’ clinical course and can be a broad indicator of overall morbidity. Interestingly, the LOHS for IA was not only longer than it was for a recurrence, but also longer than it was for patients who were treated with emergency appendectomy. The reason for this is unclear, but we speculate that one possibility may be that IA can be a difficult operation, requiring extensive dissection for an appendix that may not be able to be identified, perhaps which in turn could lead to postoperative ileus.

Our study has some limitations. The results are based on discharge data and our ICD-9 coding of acute appendicitis was not independently validated. There may be unmeasured clinical factors not coded in the database that could predict a recurrence, such as severity on computed tomography, size, or characteristics of abscesses. Many clinical details were not analyzed, such as white blood cell counts, body temperature, time to resuming normal diet, and type and duration of antibiotic treatment, all of which are important factors that may influence LOHS. Although some important variables that were not accounted for may have influenced the risk of recurrence, we believe that the measured outcome event (the recurrence rate) was accurate.

In summary, patients with acute appendicitis treated successfully with nonoperative management have a low
risk of recurrent appendicitis. For the few patients who develop recurrent disease, the hospital stay is shorter than for those treated with IA. We therefore propose that routine IA is not justified following initial nonoperative management of appendicitis.

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REFERENCES


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Underutilization of Digital Rectal Examination When Screening for Prostate Cancer

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Background: Screening for prostate cancer is controversial. American Cancer Society and American Urology Association recommend screening with both digital rectal examination (DRE) and prostate-specific antigen (PSA) testing. Often, PSA testing is not combined with DRE when screening for prostate cancer.

Methods: We collected a list of veteran outpatients who had PSA testing performed between June 1, 1998, and September 30, 1998, from our computerized database. We reviewed their records for documentation of age, race, urinary symptoms, family history of prostate cancer, DRE, and professional training and sex of the health care provider.

Results: Of the 388 records reviewed, DRE was not performed in 311 patients (52.9%). Digital rectal examination was not performed in 276 (53.2%) of 519 patients who had a PSA level less than 4.0 ng/mL; in 202 (38.7%) of 344 patients by male providers and in 109 (44.9%) of 243 patients by female providers (P<.001); and in 231 (61.1%) of 378 patients by doctors of medicine (MDs), 24 (40%) of 60 patients by physician assistants (PAs), and in 56 (37.3%) of 150 patients by nurse practitioners (NPs) (MDs vs PAs, P<.001; MDs vs NPs, P<.001; and NPs vs PAs, P=.42).

Conclusions: Digital rectal examination is underutilized when screening for prostate cancer. This leads to nondetection of some prostate cancers. Although the DRE rate was poor among all health care providers, female providers and physician extenders outperformed male providers and physicians, respectively. (2004;164:313-316)

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