Should the Macroscopically Normal Appendix be Removed During Laparoscopy for Acute Right Iliac Fossa Pain When No Other Explanatory Pathology is Found?

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**Background:** Acute appendicitis remains the most common surgical emergency and although diagnosis should be made on clinical grounds, sometimes this can be difficult. Laparoscopy has gained increasing favour as a method of both investigating right iliac fossa pain and treating the finding of appendicitis. The aim of this study was to determine the accuracy of intraoperative diagnosis of appendicitis.

**Patients and Methods:** Records of all patients who underwent laparoscopy for possible appendicitis at the Norfolk and Norwich University Hospital over a 1-year period were reviewed. Notes of those patients who underwent an open appendicectomy were also reviewed for comparison. Intraoperative findings were recorded, as were the subsequent pathologic findings.

**Results:** Over the 1-year period from September 2005 to September 2006, 355 operations for suspected appendicitis were performed. In 277 (78%) cases, these were performed laparoscopically. Seventy-three out of 78 open appendicectomies were confirmed as appendicitis. Only 1 of these was not macroscopically evident to the surgeon. The appendix was removed in 259 of the 277 laparoscopic procedures. Correct intraoperative diagnosis was made in 217 (84%) of removed appendixes, 12 (29%) of the appendices thought to be macroscopically normal and removed were found to be appendicitis after histologic examination. Eighteen patients undergoing the laparoscopic procedure had their appendix left in situ due to normal appearance; none had represented at 6 months postsurgery.

**Conclusions:** Laparoscopy may aid in the diagnosis of acute right iliac fossa pain. However, intraoperative diagnosis is not easy with almost one-third of apparently normal appendices being inflamed histologically. We would therefore advocate the removal of a normal looking appendix in the absence of other explanatory pathology.

**Key Words:** laparoscopy, appendicitis, appendicectomy, intraoperative assessment

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Acute appendicitis remains the most common presenting surgical emergency.\(^1\) Clinical findings are the mainstay for diagnosis, often supported by blood results such as a raised white cell count or raised C-reactive protein. However, significantly high negative appendicectomy rates are still common place\(^5\). Other noninvasive diagnostic tools such as ultrasonography and computed tomography have also been advocated to aid diagnosis.\(^2\)–\(^4\)

Diagnostic laparoscopy has also been used in patients presenting with acute onset right iliac fossa pain where the clinical diagnosis remains equivocal.\(^5\) Indeed, it may be more readily accessible or available than ultrasound or computed tomography, allowing a more rapid diagnosis to be made. However, during laparoscopy, the question remains regarding whether or not a macroscopically normal appendix should be removed, in the absence of any other explanatory pathology. It has been previously proposed that this is the most appropriate decision to take in an otherwise normal laparoscopy.\(^5\)–\(^6\) It has been stated that removal of a normal looking appendix confers no disadvantage with respect to morbidity or mortality. Indeed, an early or “microscopic” appendicitis may not be apparent on macroscopic examination intraoperatively,\(^8\)–\(^9\) and risks a relaparoscopy or laparotomy if transmural appendiceal inflammation ensues. However, other studies have found that removal of a “normal” appendix was associated with increased morbidity such as increased lifetime risk of small bowel obstruction.\(^10\)–\(^13\)

At the authors’ center, the decision on whether or not to remove a macroscopically normal appendix is left to the discretion of the operating surgical team, as is the decision on whether to perform the procedure laparoscopically or open. This study aims to identify how accurate diagnosis was in those patients who had their appendix removed, and to determine whether there were any further implications in those patients who had an apparently normal looking appendix left in situ.

**PATIENTS AND METHODS**

Patients were identified using the operative records stored electronically on the ORSOS (Operating Room Scheduling Office system) for the period September 2005 to September 2006 inclusive. The database was searched for the terms “appendicectomy” and “emergency.” The histopathology results of specimens taken from this cohort of patients were reviewed from the integrated communications environment system, or case notes if no results were available to determine whether a microscopic appendicitis existed. Concurrently it was possible to determine whether any other appendiceal pathology, not apparent intraoperatively, was present. Operative notes were reviewed to determine whether the appendix appeared macroscopically
normal to the operating surgeon, and in the laparoscopic cases, whether or not it was removed. In our institution, there is currently no department policy to remove a normal looking appendix at laparoscopy in the absence of any other pathology. The decision is left to the operating surgeon. (In all open cases, as dictated by tradition, the appendix was removed).

Appendectomy specimens in this center are prepared according to a hospital-defined protocol, involving immediate fixing in formalin before transport to the pathology laboratory. Specimens are sectioned at the tip, body, and base and are examined by a senior pathologist. Details of macroscopic and microscopic findings are issued in the final report. Acute appendicitis is defined histologically as a transmural inflammation. Those specimens showing peri-appendiceal inflammation or serositis were not included in this study.

RESULTS

Over the 1-year period from September 2005 to September 2006, 355 operations for suspected appendicitis were performed (Table 1). In 277 (78%) cases, this was carried out laparoscopically and in 78 (22%) an open approach was used (Table 2).

Open Appendicectomies

Of the 78 patients undergoing open appendicectomy, 72 (92%) appendices were macroscopically inflamed and appendicitis was confirmed histologically in all of these. Of the remaining 6 cases, in which the appendix was felt to look macroscopically normal, only 1 was confirmed as having a microscopic appendicitis.

Laparoscopic Appendicectomies

Of the 277 laparoscopic procedures, the appendix was removed in 259 (94%). The remaining 18 cases in which the appendix was left in situ could then be divided into 2 even groups. In the first group of 9 patients (50%), this was due to the disclosure of an alternative explanatory pathology for the acute right iliac fossa pain (Table 3). The remaining 9 patients (50%) had their appendix left in situ as it was felt that it appeared macroscopically normal, despite the absence of any other intra-abdominal pathology.

Of the 259 patients who had their appendix removed, the appendix was thought to be macroscopically inflamed in 217 patients (84%). Again, all of these specimens were confirmed as appendicitis histologically. In the remaining 42 patients (16%) in this cohort, it was felt that the appendix was macroscopically normal, but a decision was made to remove the appendix anyway. Twelve (29%) of these 42 macroscopically normal appendices were subsequently found to have acute appendicitis at a microscopic level.

DISCUSSION

There has been an increasing trend over recent years toward laparoscopic management of suspected acute appendicitis. Indeed, it has long been suggested that laparoscopy in women of child-bearing age, in which the differential diagnosis is wider, should be the "gold standard"14; a suggestion more recently extended to include men.15 The laparoscopic approach has also been advocated in the morbidly obese.16 Once the remit of consultants only, it is now becoming increasingly available to surgical trainees. Laparoscopy has the advantage of allowing a thorough visualization and assessment of the abdomen, an ability to treat, and shorter postoperative recovery.

However, the clarity of image and magnification provided by laparoscopy (more recently enhanced by the use of "high definition" equipment) has also meant that there has also been an increasing trend to leave a normal looking appendix in situ. In contrast, in the traditional open procedure, appendicectomy is always performed.

Our results show that intraoperative assessment of the appendix during laparoscopy is not reliable. Twenty-nine percent of appendices which were thought to be macroscopically normal were found to be inflamed on subsequent histologic examination. Eighteen out of 259 cases (6%) undergoing laparoscopic investigation had their appendix left in situ. In 9 of these cases, this was justified by the finding of an alternative diagnosis thought to be sufficient to be a cause of symptoms. However, in the remaining 9, the appendix was left in situ despite no alternative diagnosis being made and no findings which may have explained the patients’ symptoms. At 6 months, none of these patients had represented with similar symptoms or had required any further surgery. This could be used as an argument against incidental removal of a normal looking appendix. This study dealt with acutely presenting right iliac fossa pain, and removal of the appendix at the time of operation serves to exclude this if the patient returns. Champault et al17

<p>| TABLE 1. Demographics of Patients Treated With Open Appendicectomy and Those Undergoing Laparoscopy |</p>
<table>
<thead>
<tr>
<th>Demographics</th>
<th>Open (n = 78)</th>
<th>Laparoscopy (n = 277)</th>
</tr>
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<tbody>
<tr>
<td>Mean age (range)</td>
<td>40.9 (16-92)</td>
<td>37.4 (12-93)</td>
</tr>
<tr>
<td>No. male patients (mean age)</td>
<td>66 (38.4)</td>
<td>118 (35.5)</td>
</tr>
<tr>
<td>No. female patients (mean age)</td>
<td>12 (54.5)</td>
<td>159 (38.7)</td>
</tr>
<tr>
<td>Primary surgeon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consultant</td>
<td>3</td>
<td>23*</td>
</tr>
<tr>
<td>Registrar</td>
<td>72</td>
<td>244</td>
</tr>
<tr>
<td>Senior house officer</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>
*Two appendices were thought to be normal looking in the consultant operated group—1 was histologically found to be appendicitis.

<p>| TABLE 2. Numbers of Appendices Removed Using Open and Laparoscopic Techniques and Their Appearance Intraoperatively |</p>
<table>
<thead>
<tr>
<th>Macroscopic Appearance</th>
<th>Open</th>
<th>Laparoscopic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Abnormal</td>
</tr>
<tr>
<td>Male</td>
<td>5</td>
<td>61</td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
<td>11</td>
</tr>
</tbody>
</table>

for the acute right iliac fossa pain (Table 3). The remaining 9 patients (50%) had their appendix left in situ as it was felt that it appeared macroscopically normal, despite the absence of any other intra-abdominal pathology.

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suggest that the accuracy of laparoscopy in diagnosing appendicitis is 92%, (in this study it was 229/259—88%), supporting the fact that some degree of error remains even with direct visualization. Chiarugi et al18 found that 58% of their seemingly normal appendices had pathologic changes. However, in their data, none of the macroscopically assessed appendices were subsequently found to have microscopic inflammation. Singhal and Jadhav19 found that in 55% of the female patients, appendices that appeared macroscopically normal were subsequently found to have a variety of diagnoses including fibro-obliterative changes, luminal inflammation, serositis, lymphoid hyperplasia, fecoliths, and a pin worm. Further, Roberts et al20 suggested that 33% of all patients (including both laparoscopic and open procedures) who had a normal appendix removed were subsequently found to have histologic evidence of inflammation. Roberts et al20 believe that some degree of error remains even with direct visualization. Chiarugi et al18 found that 58% of their seemingly normal appendices had pathologic changes. However, in their data, none of the macroscopically assessed appendices were subsequently found to have microscopic inflammation. Singhal and Jadhav19 found that in 55% of the female patients, appendices that appeared macroscopically normal were subsequently found to have a variety of diagnoses including fibro-obliterative changes, luminal inflammation, serositis, lymphoid hyperplasia, fecoliths, and a pin worm. Further, Roberts et al20 suggested that 33% of all patients (including both laparoscopic and open procedures) who had a normal appendix removed were subsequently found to have histologic evidence of inflammation.

Teh et al21 argue that leaving an appendix that is apparently normal significantly lengthens the operative time, and increases the risk of wound infection. However, once identified, surely a “normal” appendix is quite straightforward to remove and should not add significant time to the operation.22 In addition, there is no evidence to suggest that laparoscopic removal of the appendix leads to an increased incidence of port-site infections.

Laparoscopy is an important diagnostic technique to reveal intra-abdominal pathology. Furthermore, it can provide a route for treatment, allowing a short hospital stay and swift return to normal activities.23,24 Patient care should not be compromised as surgeons strive to achieve low negative appendicectomy rates. We would advocate the removal of the appendix in those patients undergoing laparoscopy for right iliac fossa pain in the absence of other explanatory pathology.

REFERENCES