

Laparoscopy for Questionable Appendicitis

Can it Reduce the Negative Appendectomy Rate?

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Laparoscopy has been performed in 32 patients in whom the diagnosis of appendicitis was suspected, but in whom clinical findings were equivocal and insufficient to establish the diagnosis. These patients represented 13.6% of the total group of patients admitted with questionable appendicitis during this period. Fifty per cent of these 32 patients had unusual clinical features, such as a prolonged history of symptoms, significant intercurrent disease, prior treatment with antibiotics or steroids, etc. At laparoscopy, the diagnosis of acute appendicitis was made in 17 patients. Another disease was diagnosed in 8 patients, and 7 were judged to have no pathologic abnormalities. There were two false negative examinations and one false positive, but no ruptured appendices resulted. Twelve patients (37.5%) were spared operation by laparoscopy. The negative appendectomy rate was decreased from 10 to 1%.

FOR MANY YEARS it has been accepted that there is an inherent error rate of 5–15% in the diagnosis of appendicitis. Improved diagnostic methods have not substantially altered this rate of error.^{1,2} Indeed, it has often been stated that if a surgeon does not have a negative appendectomy rate of 10% he is operating on too few patients, thereby exposing some of them to the increased risk of the complications of rupture. To our knowledge, this thesis has never been put to test, however.

In most cases, the patient with a negative appendectomy is one in whom the diagnosis was somewhat in doubt preoperatively because of equivocal physical findings. Operation is advised to settle the diagnosis on the assumption that the hazard of missing appendicitis is greater than that of an unnecessary abdominal exploration.

Although a "negative" appendectomy carries very little mortality risk to the patient, the postoperative morbidity is not inconsequential. At a minimum, several days in the hospital are required. There is a measurable incidence of wound infections and other complications

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of laparotomy. We have sought to determine whether laparoscopy could eliminate unnecessary operations in this group of patients.

Methods

Patients were selected for laparoscopy if they had a clinical course constant with acute appendicitis but lacked confirmatory physical findings. All had been admitted to the hospital with appendicitis as a primary diagnostic concern, and all were observed for a period of time, usually overnight, sometimes for several days. If, during the period of observation, symptoms progressed and peritoneal signs developed, appendectomy was carried out without laparoscopy. Conversely, if symptoms subsided or another diagnosis was established, neither operation nor laparoscopy was performed. Laparoscopy was reserved for those individuals who showed neither signs of improvement nor of deterioration. In the past, these patients would have been subjected to laparotomy.

The technique of laparoscopy in children has been previously described.³⁻⁷ In this group of patients, general anesthesia was used in every case, and carbon dioxide was the distending gas. The Storz pediatric laparoscopy equipment was used via a trocar placed through an incision in the umbilicus. A probe was introduced through a small right lower quadrant stab wound for manipulation of intra-abdominal viscera to permit adequate examination.

The diagnosis of acute appendicitis was made if the appendix was seen to be inflamed, if it was covered with adherent omentum, or if it was not possible to see the appendix because of inflammatory adhesions or edema in the pericecal region. If the appendix was

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seen and judged to be normal, laparoscopic examination of the pelvic organs, the intestinal tract, gallbladder, liver, duodenum and stomach was carried out in search of another explanation for the physical findings.

If acute appendicitis was diagnosed by laparoscopy, appendectomy was carried out immediately following the procedure under the same general anesthetic. If a nonsurgical diagnosis was established, or the examination was negative, the patient was discharged from the hospital when he became asymptomatic.

Clinical Material

In a four year period ending February 4, 1979, 234 patients were admitted to the Boston Floating Hospital because of a question of appendicitis. Of this group, 115 (49.1%) spontaneously improved or another diagnosis was established. They were discharged from the hospital without operation or laparoscopy. In 87 patients (37.2%), physical findings at the time of admission or after a period of observation led to a diagnosis of acute appendicitis. These patients had appendectomy performed. In all but one, an acutely inflamed appendix was found and removed.

In the remaining 32 patients (13.6%) clinical and laboratory findings were inadequate to establish the diagnosis of acute appendicitis, and laparoscopy was performed. All of these patients had abdominal pain, but they lacked guarding or other evidence of peritoneal inflammation. Sixteen (50%) of these patients had complicating factors in their history which made diagnosis difficult. Eleven had symptoms for three days or more, and yet lacked clear-cut abdominal findings. Ten had other significant complicating diseases such as leukemia, the nephrotic syndrome, dermatomyositis, thalassemia, or jaundice. Several were receiving steroid therapy. Others had recently taken antibiotics. Other clinical information is given in Table 1. All but two patients underwent a period of in-hospital observation of six hours or more. Eight were watched for two days or more. Many had histories which were atypical for appendicitis:

T.B. was a 6-year-old boy who developed abdominal pain after being "dropped" into a swimming pool three days prior to his admission to the hospital. Persistence of pain led to hospitalization because of a question of intra-abdominal injury. Physical examination revealed mild right lower quadrant tenderness without objective peritoneal signs. Rectal examination was normal. Rectal temperature was 38 C. In the ensuing 48 hours of observation in the hospital his temperature rose to 40 C but he denied abdominal pain, and physical examination revealed only mild tenderness. Roentgen examination of the abdomen showed ileus. At laparoscopy the appendix was found to be covered with omental adhesions. Appendectomy was performed, and an acutely inflamed (unruptured) appendix was removed. He made a prompt recovery.

TABLE 1. Unusual Clinical Findings on Admission in 32 Patients

	Appendicitis	Not Appendicitis	Total (%)
Symptoms for 3 days or more	6	5	11 (34)
T < 38 C per rectum	10	8	18 (56)
WBC < 10,000	5	9	14 (44)
Other disease	5	5	10 (31)

M.W. was a fourteen-year-old girl who was admitted with a ten-day history of right lower quadrant pain, fever, and anorexia. Physical examination revealed tenderness in the right lower quadrant with slight guarding. WBC was 6,300. The pain persisted overnight and she underwent laparoscopy. A twisted paraovarian cyst was found on the right side and removed through the laparoscope (Fig. 1). Postoperatively the pain was gone, and she has had no recurrence of pain in the ensuing 18 months.

G.K. This thirteen-year-old boy was admitted to the hospital with a one-day history of periumbilical abdominal pain, anorexia, and vomiting with temperature to 39 C. He was under treatment with corticosteroids for the nephrotic syndrome. Physical examination revealed tenderness in both right and left lower quadrants. WBC was 6,600. Because of the fear that steroid administration was masking an inflammatory process, laparoscopy was performed. The appendix appeared normal, as did the other abdominal organs. The pain subsided over the next 24 hours.

Results

The appendix was seen in 27 of the 32 patients (Table 2). In 12 patients, the appendix was judged to be acutely inflamed and appendectomy was performed. In five patients the appendix could not be visualized, three because of overlying adherent omentum. All five were operated on and all were found to have an inflamed appendix. Thus the diagnosis of acute appendicitis was made in 17 patients. One of these, a 4-year-old girl with dermatomyositis on high dose steroid and antibiotic therapy, was thought to have appendicitis at laparoscopy because of inflammatory exudate around the appendix. She proved to have an unsuspected perforated peptic ulcer. In the other 16 patients, pathologic examination confirmed the diagnosis of acute appendicitis. None were ruptured.

In seven patients no abnormalities were noted at laparoscopy. Six improved and were discharged from the hospital. One developed progressive signs of peritoneal irritation, and 24 hours after laparoscopy he underwent laparotomy. An acutely inflamed appendix (unruptured) was removed. This patient, early in our experience, had appendicitis of the very tip of the appendix which had been incompletely visualized because of its retrocecal position. The importance of seeing the entire appendix at laparoscopy is emphasized by this error.

In eight patients, another pathologic condition was diagnosed. Five had gynecologic disorders: mittel-

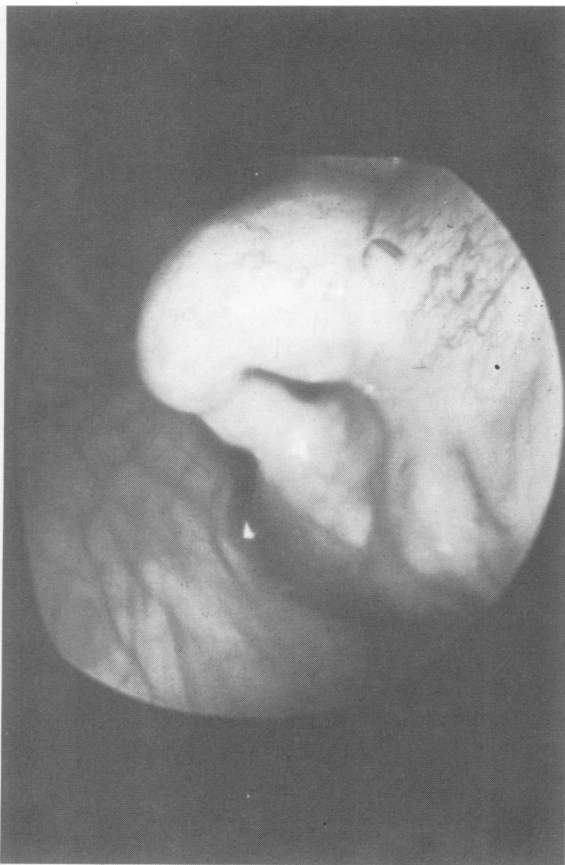


FIG. 1. Paraovarian cyst as seen through the laparoscope. It was amputated and removed through a separate stab wound under laparoscopic control.

schmerz (2), salpingitis, ruptured ovarian cyst, and torsion of a paraovarian cyst (which was removed by means of the laparoscope). One patient with Ewing's sarcoma had an abscess in an unsuspected tumor recurrence in the pelvis. Two patients had acute leukemia. In one, leukemic infiltrates on the cecum and peritoneum were noted at laparoscopy. No operation was performed, and he subsequently recovered. In the other patient, diffuse erythema of the appendix, cecum and terminal ileum was noted at laparoscopy without in-

TABLE 2. Findings at Laparoscopy

Inflamed appendix	12
Appendix not seen	5*
Normal	7†
Other diseases	8
leukemic infiltrates	2†
mittelschmerz	2
tumor abscess	1
torsion paraovarian cyst	1
ruptured ovarian cyst	1
salpingitis	1

* All of these patients had appendicitis.

† One in each of these groups later proved to have appendicitis.

flammatory adhesions or exudate (his peripheral WBC was 1,000). No operation was performed, but right lower quadrant tenderness worsened, and two days later appendectomy was performed. A mildly inflamed, unruptured appendix was removed.

Thus, there were three errors in this group: one false positive (the patient with the perforated ulcer), and two false negatives (one incompletely visualized, and the other the patient with leukemia). Diagnosis was thus delayed in two patients. There were no complications from laparoscopy.

Twelve of the 32 patients undergoing laparoscopy were spared operation (38%). Unnecessary operation was thus avoided in 10% (12/119) of the entire group (87 appendicitis plus 32 laparoscopy). One patient who was operated on for appendicitis without laparoscopy was found to have a normal appendix. (The patient later passed a right ureteral stone.) Therefore, laparoscopy appears to have reduced the negative appendectomy rate from 10 to 1% in this group of patients.

Discussion

Laparoscopy has been used extensively in adult gynecologic practice, where it has been found to be effective and safe. Well over a million laparoscopies have been performed in the past several years. It is now the preferred method for sterilization. Laparoscopy has also been used for the diagnosis of a variety of abdominal conditions in adults—suspected neoplasm, liver disease, trauma, etc.⁸⁻¹²

The use of laparoscopy in children has lagged behind that in adults, in part because pediatric instruments only became available about five or six years ago. Several series have demonstrated the variety of applications of laparoscopy in the pediatric age group and demonstrated its safety.^{3,5-7,13}

There has been little progress in the diagnosis of appendicitis in the past several decades.¹ In part, this is because of the variable nature of the disease. In most patients, appendicitis is progressive—signs and symptoms worsen with time, and the need for operation becomes obvious. A significant minority have a far less fulminant form of the disease, however, and constitute a significant diagnostic challenge to the physician.

When other medical conditions are present, or the patient has received antibiotics or steroids, diagnosis becomes even more difficult. Judiciously utilized, laparoscopy can resolve these dilemmas and shorten hospital stay. In retrospect, perhaps it should have been employed earlier in several of the patients in this series.

Barium enema has been advocated as a method of diagnosing appendicitis in the equivocal case.¹⁴⁻¹⁵ In

our experience, it has occasionally been helpful. A negative barium enema may be misleading, however,¹⁷ and, more importantly, a barium enema will seldom help in the diagnosis of nonintestinal causes of lower abdominal pain (25% in this series). In contrast, laparoscopy will usually reveal the pathologic process. In fact, it permits a far *better* evaluation of intraperitoneal organs than is possible through an appendectomy incision.

In addition to errors in interpretation (3 in this series), laparoscopy for questionable appendicitis has two additional potential errors. A small percentage of patients have a retrocecal appendix which cannot be visualized by laparoscopy. If the criterion of nonvisualizability is used for determining the need for laparotomy, some uninflamed retrocecal appendices will be found. Secondly, every surgeon has had the experience of removing what appeared to be a normal appendix, only to have the pathologist tell him that it showed signs of active inflammation. At laparoscopy, these will be interpreted as normal.

There were two patients in this series in whom the diagnosis of appendicitis was missed. In both, persistent and progressive signs led to appendectomy, which was performed prior to rupture. The findings at laparoscopy, like those from any diagnostic study, must be interpreted in the context of the patient's clinical condition. Continued observation until signs have subsided is clearly mandatory.

Laparoscopy is cost effective. If laparotomy is avoided, the operating room fee is reduced, and the hospital stay is markedly shortened (Table 3). Conversely, if laparoscopy leads to laparotomy, an additional operating room expense is incurred. However, with appropriate patient selection, the savings accrued from sparing some individuals the need for laparotomy more than compensates for this additional expense, so there is a net savings overall. More importantly, however, a significant fraction of individuals will be spared laparotomy and its potential complications and discomfort.

Laparoscopy is a safe and useful adjunct in the management of patients with questionable appendicitis. With careful attention to patient selection, laparoscopy has the potential to reduce the negative appendectomy rate to 1–2% without increasing the risk to the patient.

TABLE 3. *Laparoscopy vs. Appendectomy Cost Comparison*

	Operating Room	Hospital Room	Total
Appendectomy only (3 days hosp.)	560	540	1100
Appendectomy plus laparoscopy (3 days hosp.)	740	540	1280
Laparoscopy only (1 day hosp.)	340	180	520

Numbers indicate dollars.

By doing so, it will spare a significant number of patients the need for laparotomy. Further evaluation of its role in the management of these patients is indicated.

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