

Research article

## Mini-laparoscopic versus laparoscopic approach to appendectomy

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### Abstract

**Background:** The purpose of this clinical study is to evaluate the feasibility of using 2-mm laparoscopic instruments to perform an appendectomy in patients with clinically suspected acute appendicitis and compare the outcome of this mini-laparoscopic or "needlescopic" approach to the conventional laparoscopic appendectomy.

**Methods:** Two groups of patients undergoing appendectomy over 24 months were studied. In the first group, needlescopic appendectomy was performed in 15 patients by surgeons specializing in advanced laparoscopy. These patients were compared with the second or control group that included 21 consecutive patients who underwent laparoscopic appendectomy. We compared the patients' demographic data, operative findings, complications, postoperative pain medicine requirements, length of hospital stay, and recovery variables. Differences were considered statistically significant at a p-value < 0.05.

**Results:** Patient demographics, history of previous abdominal surgery, and operative findings were similar in both groups. There was no conversion to open appendectomy in either group. No postoperative morbidity or mortality occurred in either group. The needlescopic group had a significantly shorter mean operative time ( $p = 0.02$ ), reduced postoperative narcotics requirements ( $p = 0.05$ ), shorter hospital stay ( $p = 0.04$ ), and quicker return to work ( $p = 0.03$ ) when compared with the laparoscopic group.

**Conclusions:** We conclude that the needlescopic technique is a safe and effective approach to appendectomy. When performed by experienced laparoscopic surgeons, the needlescopic technique results in significantly shorter postoperative convalescence and a prompt recovery.

### Background

Mini-laparoscopy is an emerging area of minimally invasive surgery that involves the use of miniature (2-mm diameter) laparoscopic instruments. The premise of mini-laparoscopy is that smaller instruments cause less ab-

dominal wall trauma and, consequently, minimize pain and the stress response to surgery [1]. Previous clinical studies have proved the feasibility of the mini-laparoscopic or needlescopic approach to certain laparoscopic procedures including cholecystectomy, antireflux sur-

gery, and adrenalectomy [2–5]. These reports have documented the safety of mini-laparoscopy and its advantage in leading to rapid recovery, shorter hospital stay, and excellent cosmesis.

Laparoscopic appendectomy has incited considerable controversy since its evolution. However, a number of clinical trials have supported the belief that laparoscopic appendectomy decreases hospital stay and shortens recovery time when compared with open appendectomy [6–8]. Mini-laparoscopic appendectomy is the natural extension to the application of these smaller instruments to the diagnosis and treatment of acute appendicitis. Despite the growing interest in needlescopic appendectomy, published series are currently lacking, and studies have been recommended to validate or refute the potential advantages of this technique [1]. The objective of this retrospective clinical study is to examine the safety and efficacy of needlescopic appendectomy and compare its outcome with that of the conventional laparoscopic approach.

### Methods

The study included patients older than age 18 years with the diagnosis of acute appendicitis. Patients were considered a candidate for appendectomy according to the standard indications for surgery and based on clinical evaluation, laboratory values, and diagnostic imaging. Patients with bleeding diathesis were excluded from the study. No definitive criteria were established to exclude patients from the mini-laparoscopic group; however, three patients, one with extreme morbid obesity and two with preoperatively documented abscesses, were denied the mini-laparoscopic approach. Experienced laparoscopic surgeons were available for each procedure, but surgeons with a dedicated laparoscopic practice were the only physicians performing the mini-laparoscopic appendectomies.

Two groups of patients were included in the study over the 24-month period. The medical records of patients entered into the study during the initial 10 months were reviewed retrospectively. For the subsequent 14 months, data were collected prospectively. The following were evaluated in each group: age, gender, body mass index, history of previous abdominal surgery, operative observations, operative time, complications, postoperative narcotics requirements, length of hospital stay, and length of time required for the patient to return to work or normal activity.

### The mini-laparoscopic technique

The patient was positioned supine on a multi-positional operating table with the arms tucked. General anesthesia was induced, and a Foley catheter and orogastric tube

were inserted. Intravenous antibiotics were administered as per the surgeon's preference.

The primary surgeon stood on the patient's left side with the assistant on the right. Initial entry into the abdomen was made via an open approach at the umbilicus. Typically, a 12-mm port was inserted at this location. The insufflation pressure was automatically regulated and maintained at 12 to 15 mmHg. Two millimeter trocars were inserted: [1] laterally in the right mid-abdomen, and [2] supra-pubically.

The abdomen was thoroughly explored, and the appendix was identified. Tilting the operating table to the patient's left and in a head-down position facilitated visualization of the right iliac fossa. The operation was performed with 2-mm instruments and a 10-mm scope. The appendix was freed from its inflammatory attachments. If needed, the cecum was mobilized to free a retrocecal appendix. As needed, the appendix was elevated by applying a 2-mm EndoLoop (Ethicon, Sommerville, NJ, USA) to the tip. This helped to visualize the appendiceal mesentery, which was transected with a stapler inserted through the umbilical port while visualization was maintained with a 2-mm scope. The linear cutting stapler was also used to divide the base of the appendix. The resected appendix was placed in an extraction sac and removed through the 12-mm port. The abdominal cavity was copiously irrigated, and the fluid was suctioned before completion of the procedure. Throughout the operation, when a clip, stapler, entrapment bag, or an irrigation/suction device was introduced into the abdomen, the 12-mm port was used and the 10-mm scope was temporarily exchanged for a 2-mm scope.

The conventional laparoscopic technique used three ports (two 5-mm and one 10-mm port). The needlescopic technique was considered converted if one or more of the 2-mm ports were converted to a 5-mm port.

### Statistical methods

Statistical analysis was performed using Wilcoxon rank sum tests or student's t test for continuous or ordered discrete variables and Fisher's exact test for categorical variables. A  $p$ -value  $< 0.05$  was considered significant.

### Results

Study patients consisted of 15 consecutive patients undergoing needlescopic appendectomy and 21 consecutive patients undergoing conventional laparoscopic appendectomy over 24 months. Both groups were similar in age, gender, body mass index, and history of previous abdominal surgery (Table 1). There was no conversion to open appendectomy in either group and no conversion

**Table 1: Patient demographics in the needlescopic and laparoscopic appendectomy groups**

	Needlescopic Appendectomy n = 15	Laparoscopic Appendectomy n = 21
Male/female	6/9	10/11
Mean age (years)	39 (range, 18–60)	40 (range, 18–63)
Mean BMI*	26 kg/m <sup>2</sup>	25 kg/m <sup>2</sup>
Mean number of previous abdominal operations	0.3 (range, 0–2)	0.2 (range, 0–2)

\*BMI = Body Mass Index

**Table 2: Gross pathological findings of the appendices removed in the needlescopic and laparoscopic appendectomy groups**

	Needlescopic Appendectomy n = 15	Laparoscopic Appendectomy n = 21	P-Value
Normal	2 (5%)	4 (19%)	P = 0.25
Inflamed	10 (75%)	12 (57.1%)	P = 0.21
Perforated	3 (20%)	5 (23.8%)*	P = 0.18

\*2 patients had perforated appendix with abscess formation

from a needlescopic to a conventional laparoscopic technique.

The gross intraoperative pathological findings were not statistically different when comparing the two groups (Table 2). The mean operative time was 55 minutes (range, 45–65 minutes) for the needlescopic group and 74 minutes (range, 38–120 minutes) for the laparoscopic group, statistically significantly less ( $p = 0.02$ ) operative time for the needlescopic group.

No intra- or post-operative complications occurred with either technique. The mean in-hospital use of narcotic analgesia as measured in MSO<sub>4</sub> equivalent was 11 mg in the patients who underwent needlescopic appendectomy compared with 34 mg in the laparoscopic group ( $p = 0.05$ ). Other variables of postoperative recovery (length

of hospital stay and time from operation to return to work or normal activity) were statistically significantly less in patients who underwent needlescopic appendectomy (Table 3).

### Conclusions

In our experience, needlescopic appendectomy is a safe and feasible procedure. It appears to diminish the consequences of the comparatively more invasive conventional laparoscopic appendectomy. This is reflected in the significantly reduced need for postoperative pain medications and an overall quicker recovery. Continued improvement in imaging and instrumentation is expected to further refine this technique and increase its utility.

### Competing Interests

None declared.

**Table 3: Variables of postoperative recovery for needlescopic and laparoscopic appendectomy groups**

	Needlescopic Appendectomy n = 15	Laparoscopic Appendectomy n = 21	P-Value
Mean length of hospital stay (days)	1.3 (range, 1–4)	3.2 (range, 1–7)	P = 0.04 *
Mean days to return to work or normal activities	8 (range, 5–14)	17 (range, 7–21)	P = 0.03 *

\*P-value < 0.05 considered statistically significant

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