Minilaparoscopic Appendectomy for Acute Appendicitis
Nicola Di Lorenzo, MD, Antonio Manzelli, MD, Giorgio Coscarella, MD, Maurizio Pietrantuono, MD, Tomasz Marek Jarzembowski, MD, Piero Marco Fisichella, MD, Achille Lucio Gaspari, MD

ABSTRACT
Background: Minilaparoscopic appendectomy for appendicitis is not a well-established procedure. This approach provides less abdominal wall trauma, fewer complications, and excellent cosmetic results. Our aim was to show the feasibility and safety of the minilaparoscopic approach.

Methods: Minilaparoscopic appendectomy was performed in 37 patients. Two 2.2-mm trocars were used to manipulate a 2.2-mm, 0-degree laparoscope and for grasper access. A 5-mm trocar was used for the ultrasonic scalpel.

Results: No deaths occurred. In 3 patients (8%), appendectomy was aborted due to pathology of the ovary. Conversion to the open approach occurred in 2.7% of patients. The average operating time was 34 minutes (range, 15 to 80), and the median length of hospital stay was 1.2 day (range, 1 to 5).

Conclusions: The minilaparoscopic approach a) has the same advantages as the conventional laparoscopic approach in terms of better diagnostic accuracy and safety; b) a low incidence of complications; and c) yields excellent cosmetic results.

Key Words: Minilaparoscopy, Appendicitis.

INTRODUCTION
The role of minilaparoscopic appendectomy for acute appendicitis is not well established. Prospective studies have shown the superiority of laparoscopic appendectomy in the treatment of acute appendicitis.1–4 However, this technique has not yet gained widespread acceptance because of its longer operative time and lower cost effectiveness when compared with the open approach. Moreover, although recent retrospective studies have shown that laparoscopic appendectomy is associated with a significantly shorter hospital stay,5–7 other reports demonstrate no significant difference in hospital stay when the laparoscopic and the open approach were compared.8

The minilaparoscopic approach is associated with less abdominal wall trauma, a lower infection rate at the trocar site and abdominal wall hernia, and produces excellent cosmetic results. In this study, our goal was to confirm the safety and show the feasibility of the minilaparoscopic approach for the treatment of acute appendicitis.

METHODS
Between May 1999 and June 2001, a minilaparoscopic appendectomy was attempted in 37 patients with a preoperative diagnosis of acute appendicitis and without a previous history of abdominal surgeries.

All patients underwent general anesthesia. Preoperative administration of antibiotics consisted of third-generation cephalosporin. The pneumoperitoneum was created by insertion of a Veress needle through a small incision in the umbilicus. The abdominal cavity was inflated with CO₂ until intraabdominal pressure reached 14 mm Hg. A 2.2-mm trocar was placed laterally to the left rectus abdominis muscle and served to manipulate a 2.2-mm, 0-degree laparoscope. Another 5-mm trocar was placed just below the umbilical crease and was used for the ultrasonic scalpel. A third 2.2-mm trocar was placed suprapubically in the midline and was used for grasper access.

Exploration of the right lower abdominal cavity identified either an inflamed appendix or ruled out appendiceal pathology. In the presence of appendiceal pathology, the appendix was held with an atraumatic grasper and dis-
operative pain management consisted of 2 doses of 10 mg ketorolac tromethamine (10 mg IV) was administered as needed for pain control. All patients were discharged with written instructions regarding diet, physical activity, use of oral nonsteroidal anti-inflammatory drugs (NSAIDs) for pain control, and follow-up clinic visits were scheduled for 1 week, 1 month, and 6 months postoperatively.

RESULTS

The study population consisted of 37 patients, of which 7 were males and 30 were females. The average age of the patients was 26 years (range, 7 to 48). Minilaparoscopic appendectomy was initially attempted in 37 patients; however, it was only completed in 31 (84%). In 2 patients (5.3%), the procedure was completed with the conventional laparoscopic approach, because both patients had a perforated appendix. Both patients were operated on with larger trocars and instruments because this made it safer to manipulate and resect the appendix and to wash the abdominal cavity. In 1 patient (2.7%), the procedure was converted to an open approach through a midline incision due to diffuse fecal peritonitis as a consequence of a ruptured appendix. In 3 patients (8%), an appendectomy was not performed because of pathology confined to the ovary. No deaths have occurred. One wound infection occurred at the umbilical trocar site, which was treated conservatively. During the extraction of the specimen through the 2.2-mm umbilical trocar, the specimen bag ruptured and the inflamed appendix contaminated the abdominal wall.

Of the 31 patients, four patients (13%) had a normal appendix, 26 patients (84%) had acute appendicitis, and 1 patient (3%) had a perforated appendix. The average operating time was 34 minutes (range, 15 to 80), and the median length of stay was 1.2 days (range, 1 to 5). Postoperative pain management consisted of 2 doses of 10 mg of ketorolac tromethamine given intravenously. In all patients, wounds resulting from trocar placement healed well.

DISCUSSION

Previous studies have confirmed the superiority of laparoscopic appendectomy in the treatment of acute appendicitis. It is associated with decreased postoperative pain, a shorter length of hospitalization, a faster return to normal activity, an early resumption of dietary intake, and fast resolution of postoperative ileus. However, this technique has not yet gained widespread acceptance because of its longer operative time and higher cost compared with the open approach. In a prospective, randomized study of 50 patients, Minné et al showed that the laparoscopic approach did not offer any improved benefits compared with the open approach for the routine patient with acute appendicitis. Nevertheless, we believe that the laparoscopic approach allows good exploration of the abdominal cavity and may be helpful in ruling out different pathological states. In our experience, minilaparoscopic exploration of the abdominal cavity diagnosed pathology of the ovary in 8% of patients. In addition, the laparoscopic approach to acute appendicitis is safer in fertile women. It has been shown that 80% of women who underwent an open appendectomy, compared with 10% of women treated with laparoscopic appendectomy, may develop adhesions that in fact may be responsible for the infertility or chronic abdominal pain, or both.

Based on our experience, the procedure was completed with the conventional laparoscopic approach in 2 patients (5.3%) because of a perforated appendix. We have learned that it was safer to insert bigger trocars and instruments to manipulate and resect the appendix, and also wash the abdominal cavity. We believe that converting to conventional laparoscopy was not a technical regression because the outcome did not differ from the outcome in those who underwent the minilaparoscopic appendectomy. Our conversion rate is similar to that described by most authors.

It is generally true that the cost of laparoscopic appendectomy is higher than that of open appendectomy. Although shorter hospitalization, less pain medications, and better patient compliance are well-established benefits associated with laparoscopic treatment, the financial burden associated with it in the long-term is also well established. Sterile use of finger cut gloves instead of sterile specimen containers and use of nondisposable trocars and instruments may contribute greatly to the reduction in cost.
ultrasonic scalpel is an essential tool that possesses great advantages. It can be used multiple times; it is versatile and can be used for other minimally invasive procedures, thus lowering its overall cost. It minimizes the use of clips and sutures, therefore reducing operating time.

The benefits of the laparoscopic approach in terms of better diagnostic accuracy and safety, especially for women of childbearing age, outweighs the disadvantage of a longer average operative time of about 17 minutes.\(^5\),\(^17\) In terms of advantages associated with the use of the minilaparoscopic approach, a reduction in abdominal wall trauma and a decrease in the number of complications, such as infection of the trocar site and abdominal wall hernia have been reported elsewhere.\(^18\)--\(^20\) Moreover, the smaller dimension of the trocars accounts for approximately a 70% reduction in postoperative pain, compared with that for the conventional laparoscopic approach.\(^21\)

We have not observed abdominal wall hernia after the minilaparoscopic appendectomy. One patient, however, developed a wound infection at the umbilical trocar site that resulted from direct contact of the inflamed appendix with the abdominal wall after rupture of the finger bag. To avoid such a complication in the future, we modified the technique by extracting the bag though the 5-mm suprapubic incision, and since then no similar complications have occurred. Postoperative pain was controlled well with small doses of intravenous analgesics. The wounds from trocar placement healed well, and the general condition of all patients was excellent at 6-month follow-up.

**CONCLUSION**

This study shows that the minilaparoscopic approach has the same advantages as the conventional approach in terms of better diagnostic accuracy and safety, especially for women of childbearing age. In addition, it has a very low incidence of complications.

**References:**

1. Attwood SEA, Hill ADK, Murphy PG, Thornton J, Stephens RB. A prospective randomized trial of laparoscopic versus open appendectomy. *Surgery.* 1992;112:497–501.

2. Hansen JB, Smithers BM, Schache D, Wall DR, Miller BJ, Menzies BL. Laparoscopic versus open appendectomy: prospective randomized trial. *World J Surg.* 1996;20:17–21.

3. Marzouk M, Khater M, Elsadek M, Abdelmoghny A. Laparoscopic versus open appendectomy: a prospective comparative study of 227 patients. *Surg Endosc.* 2003;17(5):721–724.

4. Piskun G, Kozik D, Rajpal S, Shahian G, Fogler R. Comparison of laparoscopic, open, and converted appendectomy for perforated appendicitis. *Surg Endosc.* 2001;15(7):660–662.

5. Long KH, Bannon MP, Zietlow SP, et al. Laparoscopic Appendectomy Interest Group. A prospective randomized comparison of laparoscopic appendectomy with open appendectomy: clinical and economic analyses. *Surgery.* 2001;129(4):390–400.

6. Ozmen MM, Zulfikaroglu B, Tanik A, Kale IT. Laparoscopic versus open appendectomy: prospective randomized trial. *Surg Laparosc Endosc Percutan Tech.* 1999;9(3):187–189.

7. Roy A, Parker SJ. Single-blind randomized clinical trial of laparoscopic versus open appendicectomy in children. *Br J Surg.* 2001;88:510–514.

8. Wullstein C, Barkhausen S, Gross E. Results of laparoscopic vs. conventional appendicectomy in complicated appendicitis. *Dis Colon Rectum.* 2001;44:1700–1705.

9. Garbutt JM, Soper NJ, Shannon WD, Botero A, Littenberg B. Meta-analysis of randomized controlled trials comparing laparoscopic and open appendectomy. *Surg Laparosc Endosc.* 1999;9(1):17–26.

10. Grandjean JP, Arefiev A. Laparoscopic appendectomy. Review based on an homogeneous series of 906 cases [in French]. *Ann Chir.* 1999;53(4):280–284.

11. Tate JJT, Dawson JW, Chung SCS, Lau WY, Li AKC. Laparoscopic versus open appendectomy: prospective randomised trial. *Lancet.* 1993;342:633–637.

12. Serralta A, Planells M, Bueno J, Rodero D. A simple scoring system to reduce intraabdominal septic complications after laparoscopic appendectomy. *Surg Endosc.* 2000;14(11):1028–1030.

13. Minne L, Varner D, Burnell A, Ratzer E, Clark J, Haun W. Laparoscopic vs open appendectomy. Prospective randomized study of outcomes. *Arch Surg.* 1997;132(7):708–711; discussion 712.

14. Moberg AC, Ahlberg G, Leijonmarck CE, et al. Diagnostic laparoscopy in 1043 patients with suspected acute appendicitis. *Eur J Surg.* 1998;164(11):833–840; discussion 841.

15. Hellberg A, Rudberg C, Enochsson L, et al. Conversion from laparoscopic to open appendicectomy: a possible drawback of the laparoscopic technique? *Eur J Surg.* 2001;167(3):209–213.

16. Matthews BD, Mostafa G, Harold KL, Kercher KW, Reardon PR, Heniford BT Minilaparoscopic appendectomy. *Surg Laparosc Endosc Percutan Tech.* 2001;11(6):351–355.

17. Larsson PG, Henriksson G, Olsson M, et al. Laparoscopy reduces unnecessary appendicectomies and improves diagnosis in fertile women. A randomized study. *Surg Endosc.* 2001;15(2):200–202.

18. Lippert H, Koch A, Marusch F, Wolff S, Gastinger I. Open vs. laparoscopic appendectomy [review; in German]. *Chirurg.* 2002;73(8):791–798.
19. Liu CD, McFadden DW. Laparoscopic port sites do not require fascial closure when nonbladed trocars are used. *Am Surg.* 2000;66(9):853–854.

20. Ortega AE, Hunter JG, Peters JH, Swanstrom LL, Schirmer B. The Laparoscopic Appendectomy Group. A prospective randomized comparison of laparoscopic appendectomy with open appendectomy. *Am J Surg.* 1995;169:208–213.

21. Cueto J, Valencia-Reyes MS, Vazquez-Frias JA, Castaneda-Leeder P, Nevarez-Bernal R, Weber-Sanchez A. Technical modifications for laparoscopic appendectomy and other pelvic procedures using micro instruments. *Surg Laparosc Endosc Percutan Tech.* 2000;10(4):211–214.