

## Laparoscopic appendectomy for complicated acute appendicitis

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**SUMMARY:** Laparoscopic appendectomy for complicated acute appendicitis.

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*The role of laparoscopic appendectomy in complicated appendicitis is still not widely accepted. The authors report their retrospective study performed to evaluate the effectiveness of the laparoscopic approach in the management of complicated appendicitis.*

*From January 2003 to October 2008, 552 patients underwent appendectomy in our surgical department. Among these, 358 were not complicated appendicitis while 194 were complicated. Of the 194 cases of complicated appendicitis, 121 patients underwent laparoscopic appendectomy while the remaining 73 cases were treated by conventional open surgery. The average length of hospital stay was 5.7 days, with a range from 4 to 13 days. Post-operative complications were observed in a total 11 patients (9.1%), including 3 cases of intra abdominal abscess (2.5%), 2 cases of umbilical wound infection (1.6%) and 6 cases of prolonged ileus (4.9%).*

*Our experience suggests that the laparoscopic procedure is a valid, safe and feasible option to manage acute complicated appendicitis.*

**RIASSUNTO:** Appendicectomia laparoscopica per appendicite acuta complicata.

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*Il ruolo dell'appendicectomia laparoscopica in corso di appendicite acuta complicata non è ancora ben definito. Gli Autori riportano il loro studio retrospettivo condotto per valutare l'efficacia della metodica laparoscopica nella gestione dell'appendicite acuta complicata.*

*Da gennaio 2003 a ottobre 2008, nel nostro Dipartimento abbiamo eseguito 552 interventi di appendicectomia, di cui 358 per appendiciti non complicate e 194 per forme complicate; di quest'ultime, 121 sono state condotte laparoscopicamente. Il tempo medio di degenza è stato di 5.7 giorni, con range 4-13, e le complicanze post-operatorie si sono verificate in 11 pazienti (9.1%) di cui 3 casi di ascesso intra-addominale (2.5%), 2 casi di infezione della ferita ombelicale (1.6%) e 6 casi di ileo paralitico (4.9%).*

*Gli Autori ritengono l'appendicectomia laparoscopica una procedura valida, fattibile e sicura anche in corso di appendicite acuta complicata.*

**KEY WORDS:** Acute appendicitis - Complications - Appendectomy - Laparoscopy.  
Appendicite acuta - Complicanze - Appendicectomia - Laparoscopia.

### Introduction

Acute appendicitis represents the most common surgical emergency in the USA, and appendectomy is one of the most frequent surgical interventions in pediatrics and during pregnancy (1).

Since the first laparoscopic appendectomy, reported by Semm in 1983 (3), a large number of meta-analytic and prospective randomized trials have widely proven the

benefit of the laparoscopic approach, as opposed to open appendectomy, for patients with uncomplicated appendicitis. However, the role of laparoscopic appendectomy in the presence of complicated appendicitis is not yet globally shared.

Our study reviews and retrospectively analyzes the results of laparoscopic appendectomy for complicated appendicitis performed in our institute since 2003. The purpose of this study is to show the safety, feasibility and benefits of this mini-invasive procedure.

### Patients and methods

From January 2003 to October 2008, 552 patients underwent appendectomy in our surgical department. Among these; 358 were not complicated appendicitis while 194 were complicated; out of the

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194 cases of complicated appendicitis, 121 patients underwent laparoscopic appendectomy while the remaining 73 cases were treated by conventional open surgery (Tab. 1).

The surgical approach (either open or laparoscopic) was chosen exclusively on a case-by-case basis by the surgeon on duty. Most often, the conventional open method was adopted by our colleagues with lower laparoscopic experience. Complicated appendicitis was defined as gangrenous or perforated inflammation with or without purulent peritoneal collection.

All patients with appendicitis underwent a health check, clinical blood count test, abdominal ultrasounds, and when requested a CT abdominal scan (exclusively in adult patients to exclude other differential pathologies). Third generation cephalosporin was given intravenously one hour prior to surgery. A urinary bladder catheter was always inserted after anaesthetic induction of the patient and was removed before the reawakening.

All laparoscopic appendectomies were performed using the three-trocar procedure. The pneumo-peritoneum was always achieved by an open technique introducing the 10-mm Asson trocar in the upper border of the umbilicus. After peritoneal exploration, obtained with the laparoscope inserted through the umbilical port, the instruments were inserted through a 10-mm trocar positioned in the lower left abdomen and through a 5-mm supra-pubic trocar. The appendix was completely mobilized with its mesentery from surrounding visceral adhesions and pericecal collection using a bipolar forceps. The mesoappendix was ligated each time with an absorbable endoloop in order to better achieve haemostasis. The appendectomy was performed after an absorbable endoloop ligation of the appendiceal base and sometimes a blue cartridge endoGIA was used (mainly during significant gangrenous appendicitis). The exposed appendiceal mucosa was electrocauterized when possible. In cases of a probable unsafe endoloop ligation the appendiceal ligated base was sunk with a continuous 3-0 absorbable suture. The appendix was always removed through the umbilical port utilizing an endobag (avoiding abdominal wall contamination). In all cases we carefully cleaned the peritoneal cavity and in particular the right pericecal side by irrigating with a normal saline solution (in order to remove every residual septic material). A 7mm drain tube was always placed in the pericecal position after its introduction through the 5-mm supra pubic trocar. The 10-mm port of the lower left abdominal side was always closed with a fascial absorbable stitch and the umbilical port was closed in the same manner. The skin was closed with staples. Antibiotic therapy was administered after surgery for 5 days (a few of the patients required a longer treatment).

## Results

In our study 121 laparoscopic appendectomies for complicated appendicitis were retrospectively reviewed. The average patient age was 35.6 years, with a range from 11 to 83 years; 52 of the patients were female and 69 of the patients were male.

The average operative time was 67 minutes, with a range from 46 to 113 minutes. In 46 cases the appendix was perforated and in 75 cases it was gangrenous. In 58 cases the peritonitis was not purulent and among these 32 cases were local and 26 cases were diffuse peritonitis; of the remnant 63 cases, we found a local purulent collection in 42 cases and in 21 cases the collection was pelvic.

Open surgery was not employed in any of the cases,

TABLE 1 - NUMBER OF APPENDECTOMY SINCE 2003.

Acute appendicitis	Appendectomy	
	Open	Laparoscopic
Complicated (C)	194	121
Not Complicated (NC)	358	225

but in 5 of the 121 cases (4.1%) we performed an ileocecal resection with ileo-colic extracorporeal hand made anastomosis. In these cases the gangrenous inflammation involved the large right bowel.

The average length of hospital stay was 5.7 days, with a range from 4 to 13 days. Post-operative complications were observed in a total of 11 patients (9.1%), including 3 cases of intraabdominal abscess (2.5%), 2 cases of umbilical wound infection (1.6%), and 6 cases of prolonged ileus (4.9%) (Tab. 2). One patient suffering from an intra-abdominal abscess needed an abdominal percutaneous drainage and two patients underwent a second laparoscopic cleaning and drainage. There was no mortality rate in our series.

## Discussion

In recent years the incidence rate of appendicitis has drastically decreased as a result of better diagnostic accuracy of radiological procedures (which consent differential diagnosis with other pathologies) and, above all, thanks to antibiotic therapy (which can heal light appendicitis without requiring surgical intervention). Meanwhile, the complicated appendicitis rate has actually escalated due to the increasing trend to avoid surgery at the first light event by trying to heal with antibiotics therapy. However, if the antibiotic therapy does not prove effective, the appendicitis is likely to develop into complicated forms such as gangrenous, perforated and abscess (2).

Since the first laparoscopic appendectomy, reported

TABLE 2 - DEMOGRAPHICS, RESULTS AND POST-OPERATIVE COMPLICATIONS IN 121 APPENDECTOMIES FOR COMPLICATED APPENDICITIS.

Parameter	
Age, years (range)	35.6 (11-83)
Gender (male/female)	69/52
Mean operative time, minutes (range)	67 (46-113)
Mean length of hospital stay, days (range)	5,7 (4-13)
Umbilical wound infection, n (%)	2 (1,6%)
Intraabdominal abscess, n (%)	3 (2,5%)
Prolonged ileus > 48 hours, n (%)	6 (4,9%)

by Semm in 1983 (3), a large number of meta-analytic and prospective randomized trials have largely proven the benefit of the laparoscopic approach (as opposed to open appendectomy) for patients with uncomplicated appendicitis. The benefits include a shorter length of hospital stay, a lower wound infection rate, less post-operative pain, a faster return to normal daily activities, and a better aesthetic result (4).

As for the management of complicated appendicitis (defined as gangrenous or perforated inflammation with or without purulent peritoneal collection) the role of the laparoscopic approach is still controversial. In literature only scarce retrospective analyses have been reported and are often quite debatable. The prevalent procedure is to perform an explorative laparoscopy and, upon discovery of complicated appendicitis, the technique is changed to open appendectomy (5). According to the Cochrane data base review published in 2004 (6), laparoscopic appendectomy for complicated appendicitis is responsible for longer operative times, higher costs and above all a greater intraabdominal abscess rate compared to open appendectomy. The review defines the laparoscopic procedure as advantageous mainly in expert centers and for obese and young female patients. For this reason the minimally invasive procedure is not yet globally accepted as the gold standard approach for complicated appendicitis.

In our department we started employing laparoscopic surgery in 1992, initially for cholecystectomy and later for other abdominal pathologies. The laparoscopic approach is now utilized in 72% of the cases in which abdominal surgery is required (Tab. 3). In 2003, as a result of our accumulated and ever increasing experience, we collectively approved the laparoscopic procedure as the gold standard for complicated appendicitis.

In our retrospective analysis we found an intraabdominal postoperative abscess rate of 2.5%, not altogether dissimilar from the literature data (7). The incidence of

intraabdominal complications increased in complicated appendicitis but without any statistical difference among laparoscopic (4.1%) and open (4.9%) appendectomy (8). We believe that laparoscopic peritoneal cleaning in complicated appendicitis is complete, adequate and provides better results in comparison to open surgery which is often performed through a mini laparotomy. In all cases we employed a 7-mm drain tube positioned in the pericecal site and routinely removed on the third postoperative day. We contend that this procedure supports a better recovery. Pokala et al. reported, for laparoscopic complicated appendectomy, an intraabdominal postoperative abscess rate of 14% versus 0% obtained in open surgery. However, it's important to note that none of the 43 patients in their laparoscopic group had drains (9). While the authors report a wound infection rate of 5.3% (10), infection in the umbilical wound represents a manageable complication. In regards to our 2 cases of umbilical wound infection (1.6%), we suggest that this complication can be avoided by using an endobag to remove the appendix, by carefully cleaning the site port with Iodopovidone 10% solution at the conclusion of the intervention, and by closing the umbilical gap with two absorbable stitches as suggested by So et al. (10).

Some studies have shown that there is no difference in the resumption of the diet after laparoscopic or open appendectomy (11, 12). Meanwhile, other reviews contend that the difference in the resumption of the diet is related to the severity and complications of the appendicitis but generally faster after laparoscopic procedure (13). We reported 6 cases of prolonged ileus over 48 hours, all were patients with peritoneal abscess and all were resolved within 96 hours.

The incidence of histologically normal appendix in patients with clinical signs and symptoms of acute appendicitis ranges from 8 to 41% (14, 15). For this reason we contend that the laparoscopic procedure is the better approach in cases of suspected acute appendicitis, above all in young females and obese patients, but also in children and the elderly. Laparoscopy not only allows diagnosis but it also allows the management of other differential benign and malignant pathologies.

In our experience we have found endometriosis, pelvic inflammatory disease, adnexal torsion, Crohn's disease, solitary cecal diverticulitis, omental infarction, Meckel's diverticulitis, cecal and appendiceal neoplasm.

## Conclusion

Laparoscopic appendectomy for complicated appendicitis can be particularly challenging. Our study suggests that the laparoscopic procedure is a safe and feasible option but should be performed by expert laparoscopic surgeons in order to truly appreciate the benefits.

TABLE 3 - OUR LAPAROSCOPIC EXPERIENCE IN THE LAST 24 MONTHS.

Surgery	Laparoscopy, n
Gastrectomy/rafia	55
Colorectal resection	231
Splenectomy	18
Appendectomy	149
Cholecystectomy	432
Pancreatectomy	19
Adrenalectomy	7
Gastric banding/sleeve gastrectomy	44
Alloplastic hernia repair	58
Hepatectomy	14
Total laparoscopies	1027 (72%)
Total abdominal interventions	1417

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