# Open mini-incision vs laparoscopic appendectomy

## A retrospective single Centre study

*Ann. Ital. Chir., 2021 92, 1: 1-5*
pii: S0003469X21031900

Salvatore Lo Bianco**, Dario Cavallaro*, Daniele Provenzano**, Antonio Stracqualursi*, Andrea Leonardi*, Guido Basile**, Giuseppe Russo*

**Unit of General Surgery, S. Marta & S. Venera Hospital, Acireale, Azienda Sanitaria Provinciale di Catania (Italy)*
***Department of General Surgery and Medical-Surgical Specialties, University of Catania, Italy*

**Open mini-incision vs laparoscopic appendectomy. A retrospective single Centre study**

INTRODUCTION: *Laparoscopy appendectomy (LA) is the most widely used method for the treatment of acute appendicitis (AA). The interest has shifted towards the mini-incision open method (MOA).*
MATERIALS AND METHODS: *A retrospective study was conducted considering all patients who underwent surgery due to suspected appendicitis from December 2014 to January 2019. The final analysis included 234 patients.*
*The following data were collected: patient age, sex, surgery duration, hospitalization time, wound infections, and mortality.*
RESULTS: *The average time of surgery was 69.89 minutes in the LA group and 62.17 minutes in the MOA group, while the average time of postoperative hospitalization was respectively 5.579 days and 5.143 days. Wound infections occurred in 2 patients in the LA group and in 3 patients in the MOA group.*
CONCLUSION: *Laparoscopic appendectomy has a similar operating time, hospitalization time and wound infections as Mini-incision open appendectomy. Therefore,both techniques are to be considered valid.*

KEY WORDS: Appendicitis, Laparoscopic appendectomy, Appendectomy, Instrumentation, Open approach

## Introduction

Laparoscopy appendectomy (LA) is the most widely used method for the treatment of acute appendicitis (AA). Despite this, the method is not considered as the gold standard. Open appendectomy (OA)is accepted as a standard treatment for AA,with a very low morbidity and mortality rate [1]. The interest has shifted towards the mini-incision open method (MOA) [2]. However, there is no consensus in Literature whether Laparoscopic appendectomy should be chosen as a routine procedure for all acute appendicitis.

The aim of our study is to evaluate if the laparoscopic procedure shows better results compared to mini-incision open method in terms of: operating time, postoperative hospitalization time, mortality, intra-abdominal abscess, wound infection.

## Materials and Methods

A retrospective study was conducted considering all patients who under went surgery due to suspected appendicitis in the General Surgery Department of Santa Marta and Santa Venera Hospital of Acireale, from December 2014 to January 2019.
The analysis included 234 patients who were candidate for surgery due to a suspected appendicitis based on history, clinical trials, blood test results, and medical imaging. The following data were collected: patient age, sex, operating time, hospitalization time, wound infections, and mortality. Among all the patients included, 36 were

*Pervenuto in Redazione Dicembre 2019. Accettato per la pubblicazione Gennaio 2020*
*Correspondence to: Guido Basile, MD PhD, Department of General Surgery and Medical Surgical Specialities, University of Catania (e-mail: gbasile@unict.it)*

excluded: 13 patients for surgical conversion of the procedure, 20 patients for undergoing median laparotomy, 2 patients for under going para-rectal laparotomy, 1 patient for admission to the intensive care. 198 patients were admitted to our study.

This study was approved by the Hospital Ethics Committee. Informed consent was required.

All laparoscopic procedures (LA) were conducted by an experienced laparoscopic surgeon as operatoror first assistant; the procedures were performed according to the standard technique using 3 trocars (Hasson supra-umbilical, 11 mm in left side, 5 mm supra-pubic).

Appendiceal mesentery and the appendiceal artery were cut after bipolar coagulation. Two ENDOLOOPS ligature were placed and tied at the base of the appendix. In case of purulent effusion or an abscess, the area and the minor pelvis of the patients were thoroughly irrigated and a redon drainage was inserted through a lateral trocar.

For the MOA procedures,a mini longitudinal incision (approximately 2.5 cm) at McBurney's point was performed,enabling the visualization of the cecum base. After ligating the appendiceal mesentery and the appendiceal artery, a ligature was placed around the base of the appendix and sub sequently the appendix was removed by cutting. The appendiceal stump was inverted into the cecum using a purse-string suture. If necessary, the peritoneal cavity was irrigated, and the drainage was inserted through a separate incision. All patients received prophylaxis with antibiotics (cefazolin) before surgery.

The results were analyzed using software StatiaticaTM V.10, T- test and Chi-test. The results were considered statistically significant for $P<0.05$.

## Results

Laparoscopic surgery (LA) was performed on 114 patients, whereas the MOA was performed on 84

Table I

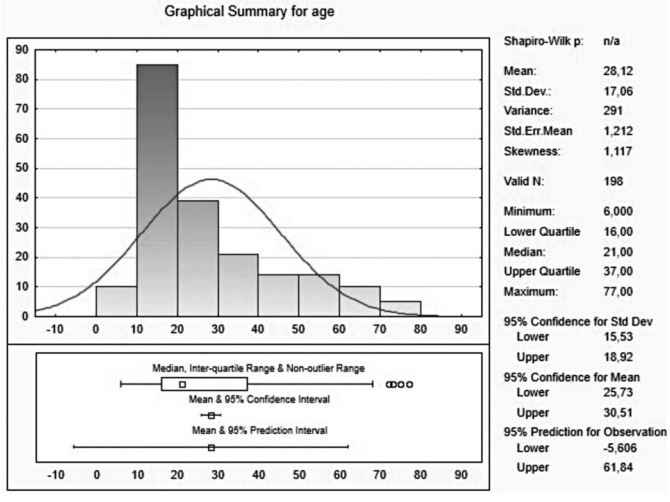


Table II

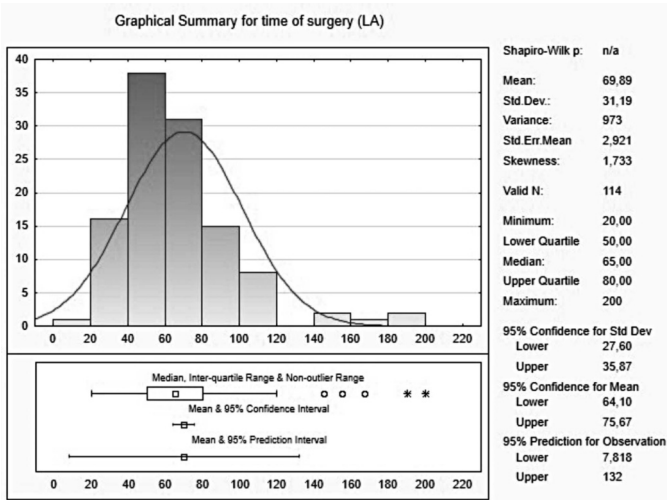


Table III

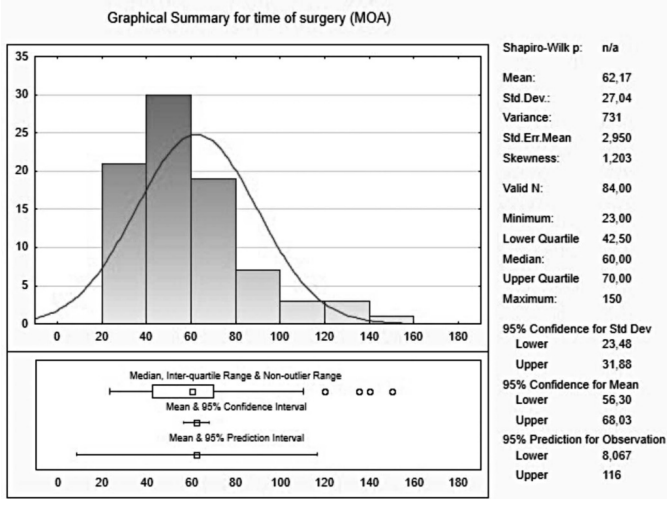


Table IV

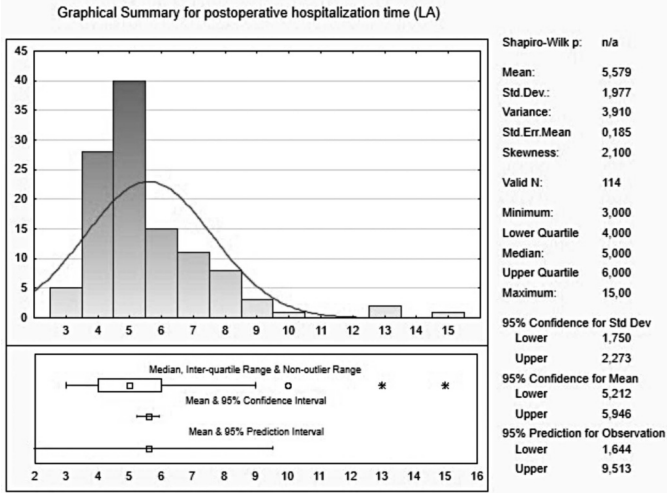

Table V

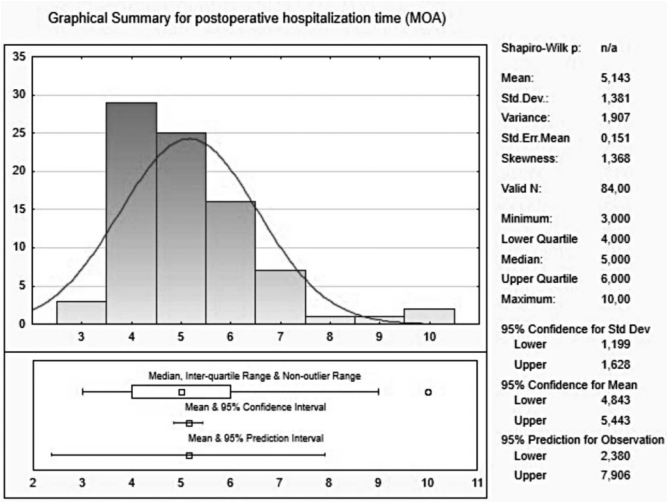


Table VI

| | LA | MOA | P |
|---|---|---|---|
| **Patients (n)** | 114 | 84 | **n/a** |
| **Time of surgery (min)** | 69.89 | 62.17 | **0.07** |
| **Hospitalization time (days)** | 5.579 | 5.143 | **0.08** |
| **Wound infections (n)** | 2 | 3 | **0.43** |
| **Mortality (n)** | 0 | 0 | **n/a** |

patients. The mean age of the patients included in the study was 28.12 years (Table I). The ratio of males to females was 1.041 (Males 101; Females 97). No deaths occurred after surgery in both groups.

The average time of surgery was 69.89 minutes (20 minutes to 200 minutes, SD 31.19 minutes) in the LA group and 62.17 minutes (23 minutes to 150 minutes, SD 27.04 minutes) in the MOA group; the difference was not statistically significant (P= 0.07) (Tables II and III).

The average time of postoperative hospitalization was 5.579 days (3 to 15 days, SD 1.977 days) in the LA group and 5.143 days (3 to 10 days, SD 1.381 days) in the MOA group; the difference was not statistically significant (P = 0.08) (Tables IV and V).

Wound infections occurred in 2 patients of the LA group (1.75 %) and in 3 patients of the MOA group (8.35 %), the difference was not statistically significant (P=0.43) (Tab. VI).

## Discussion

Acute appendicitis is one of the most common cause of abdominal pain requiring urgent surgical approach [3,4]. Although the preoperative diagnosis is still under evaluation, acute appendicular disease must be considered in all patients with abdominal pain [5,6].

For more than a century open appendectomy has been the gold standard for acute appendicitis. The introduction of laparoscopy has profoundly modified surgery, especially for the operating times, hospitalization and patients' comfort; a further benefits is to perform a diagnostic laparoscopy as it offers a large visualization of the abdominal cavity and reduces negative appendectomies [7]. Furthermore, laparoscopic appendectomy can be performed safely in a rural hospital, even for complicated cases [8]. Despite this, appendicular pathology continues to be managed with both approaches, primarily due to use disposable laparoscopic instruments, and concerns about a higher incidence of intra-abdominal abscesses, particularly after perforated appendicitis [8-10]. Therefore, the use of laparoscopic approach remains controversial.

The use of ultrasound is recommended for the study of appendicitis, but carried out by experienced doctors [11].

Svensson et al. show no difference in outcome between open and laparoscopic surgery for acute appendicitis in children as regard complications. The initial assumption that patients treated with laparoscopic surgery had a shorter postoperative stay was not confirmed with a linear regression, which showed that the assumed difference was only due to a trend toward shorter postoperative length of stay over time, regardless of the surgical intervention [12,13].

In our study, the average age is 28.12 years; the incidence based on gender showed no differences (males 101; females 97). No death occurred in both groups. Maybe due to the experience of surgeons, in the laparoscopic approach, total operative time showed no significative statistically difference (69.89 minutes in the LA group, 62.17 minutes in MOA group). 13 patients who initially underwent laparoscopic appendectomy had to be converted to open surgery due to the dense adhesion and the abnormal location.

As a minimally invasive technique, controversies existed for several yearsregarding the superiority of LA over OA [14]. In his prospective study [14] Çiftçi F. shows that there are no differences in surgical outcomes between the two groups and OA is considered the better option due to lower cost [15].

However, lower postoperative pain, diagnostic accuracy, especially in women and the elderly, shorter periods of healing, and better cosmetic results have been considered all advantages for LA over OA.

As a particular category of patients are women, Casarotto in his study analized appendectomy in this gender, determining the postoperative hospital stay, the eventual readmissions within 30 days after discharge, the length of surgical procedures, the costs for the OA and LA, and the rate of negative appendicitis [16]. They concluded that LAs are not associated with a lower complication rate than the OAs and, above all, LAs are more expensive than OAs. For these reasons laparoscopic approach should be used only in case of unclear abdominal pain and not for the treatment of a clear acute and uncomplicated appendicitis.

Another importantevaluation is to compare the costs of laparoscopic versus open appendectomy. For Minutolo et al [17] laparoscopic appendectomy has similar total costs, compared with open appendectomy.
Acute appendicitis in children is common and the optimal treatment modality is still debated, even if recent data suggest that laparoscopic surgery may result in shorter postoperative length of stay without an increased number of complications [12].
S. Olmi et al. believe that LA is effective in any kind of clinical situation, with low traumatic impact and best comfort for the patient. Laparoscopic appendectomy is a safe and effective procedure, as both a diagnostic and therapeutic tool [13,18]. It seems to be more effective than the corresponding open procedure.
According to classic laparoscopic technique, the surgeons are used to perform laparoscopic appendectomy with 3 trocars; after bipolar coagulation of the appendiceal artery and mesentery, two endoloops were placed at the base of appendix [19]. The most frequently used open approach was a Mc Burney incision.
Gozenelli et al. showed that the use of ultrasonic instruments alone to close the appendiceal stump caused an incomplete closure [20].
The appendix has been identified to the cecum. The cases ended with the histological examination of the surgical specimen; the most common histological finding was acute appendicitis with phlegmon.
Despite several studies demonstrate a significantly short hospital stay for the laparoscopic approach due to an early mobilization which facilitates recovery, in our series length of hospital stay and post-operative pain were similar to the MOA group. Wound infection is one of the most common complication during the post-operative time; our study shows no difference findings between the two groups, but the placement of appendix into an endobag before its removal may be the reason of the lower rate of wound infection in laparoscopic group; this advantage might be magnified in obese patients, where a larger open incision would be necessary, with an increased risks of pain and infection. Thirteen laparoscopic procedures required conversion to open, due to the presence of intraoperative complications: abdominal abscesses, tenacious adhesions or suspicious lesions [9]. Finally, laparoscopic appendectomy causes less metabolic and cytokine response than conventional surgery [21].

## Conclusion

In conclusion, laparoscopic appendectomy has a similar operating and hospitalization times as Mini-incision open appendectomy and the differences were not significant. Moreover, the laparoscopic appendectomy has demonstrated a difference in incidence of wound infection compared to the open technique, but the result is not statistically significant.
Therefore, both techniques are considered as a valid choice of treatment. The appropriate technique must be chosen based on the patient's condition (age, constitution, comorbidity, etc.).


## Riassunto

Introduzione: L'appendicectomia laparoscopica (LA) è il metodo più ampiamente usato per il trattamento dell'appendicite acuta (AA). Nonostante ciò, l'interesse si è spostato verso il metodo "open" mini-incisionale (MOA).
Materiali E Metodi: Lo studio retrospettivo è stato condotto prendendo in considerazione tutti i pazienti sottoposti ad intervento chirurgico, per sospetta appendicite, da Dicembre 2014 a Gennaio 2019. L'analisi finale ha incluso 234 pazienti.
Sono stati raccolti i seguenti dati: età del paziente, sesso, durata dell'intervento, durata della degenza, infezioni della ferita e mortalità.
Risultati: Il tempo medio dell'intervento chirurgico è stato di 69,89 minuti nel gruppo LA e di 62,17 minuti nel gruppo MOA, mentre il tempo medio di degenza post-operatoria è stato rispettivamente di 5,579 giorni nel gruppo LA e di 5,143 giorni nel gruppo MOA. Infezioni della ferita si sono verificate in 2 pazienti nel gruppo LA e in 3 pazienti nel gruppo MOA.
Conclusioni: L'appendicectomia laparoscopica ha una durata dell'intervento chirurgico, un tempo di degenza e infezioni della ferita simili all'appendicectomia "open" mini-incisionale. Pertanto, entrambe le tecniche devono essere considerate valide.


## References


1. Mitura K, Dabrowiecki S, Smietanski M, Matyja A: *The experience and awareness of laparoendoscopic procedures among Polish surgeons in everyday clinical practice. WideochirInne* Tech Maloin wazyjne, 2017; 12:13-18.

2. Tzovaras G, Baloyiannis I, Kouritas V, Symeonidis D, Spyridakis M, Poultsidi A, Tepetes K, Zacharoulis D: *Laparoscopic versus open appendectomy in men: A prospective randomized trial.* Surg Endosc, 2010; 24: 2987-2-992;

3. Addiss DG, Shaffer N, Foweler BS, Tauxe R: *The epidemiology of appendicitis and appendicectomy in the United States.* Am J Epidemiology, 1990; 132:910-25.

4. Seem K: *Endoscopic appendectomy.* Endoscopy, 1983; 15:59-64.

5. Bhangu A, Søreide K, Di Saverio S, Assarsson JH, Drake FT: *Acute appendicitis: Modern understanding of pathogenesis, diagnosis, and management*. Lancet, 2015;3 86:1278-87.

6. Di Saverio S, Birindelli A, Kelly MD, Catena F, Weber DG, Sartelli M, et al.: *WSES Jerusalem guidelines for diagnosis and treatment of acute appendicitis*. World J Emerg Surg, 2016;11:34.

7. Grosso G, Biondi A, Marventano S, Mistretta A, Calabrese G,

Basile F: *Major postoperative complications and survival for colon cancer elderly patients*. BMC Surg, 2012; 12 (Suppl 1):S20.

8. Kucuk GO: *Italian Society Of Young Surgeons (SPIGC). Laparoscopic appendectomy in Italy: an appraisal of 26,863 cases.* J Laparoendosc Adv Surg Tech A, 2004; 14:1-8.

9. Shaikh AR, Sangrasi AK, Shaikh GA: *Clinical Outcomes of laparoscopic versus open Appendectomy.* JSLS, 2009; 13:574-80.

10. Agresta F, De Simone P, Leone L, Arezzo A, Biondi A, Bottero L, et al.: *Italian Society Of Young Surgeons (SPIGC). Laparoscopic appendectomy in Italy: An appraisal of 26,863 cases.* J Laparoendosc Adv Surg Tech A, 2004; 14:1-8.

11. Zosimas D, Lykoudis PM, Burke J, Leung P, Strano G, Shatkar V: *Is ultrasound a reliable diagnostic tool for acute appendicitis? A single centre experience*. Ann Ital Chir, 2017; 88:557-61.

12. Svensson JF: *Outcome after introduction of laparoscopic appendectomy in children: A cohort study*. J Pediatr Surg, 2016; 51:449-53.

13. Olmi S, Magnone S, Bertolini A, Croce E: *Laparoscopic versus open appendectomy in acute appendicitis: A randomized prospective study*. Surg Endosc, 2005; 19:1193-95.

14. Ciftci F: *Laparoscopic vs mini-incision open appendectomy*. World J Gastroinest Surg, 2015; 7(10):72.

15. Oravsky M, Bak V, Schnorrer M: *Laparoscopic versus open appendectomy in treatment of acute appendicitis*. Bratisl Lek Listy, 2014; 115:660-62 [PMID: 25573735]

16. Casarotto A, Zarantonello FR, Rebonato M: *Appendectomy in women. Is the laparoscopic approach always better than the "open" approach in uncomplicated appendicitis*? Surg Laparosc Endosc Percutan Tech 2014; 24: 406-409 [PMID: 24910936 DOI: 10.1097/ SLE.0000000000000063]

17. Minutolo V, Licciardello A, Di Stefano B, Arena M, Arena G, Antonacci V: *Outcomes and cost analysis of laparoscopic versus open appendectomy for treatment of acute appendicitis: 4-years experience in a district hospital*. BMC Surg, 2014; 14:14. Published 2014 Mar 19. doi:10.1186/1471-2482-14-14

18. Carbotta G, Del Vecchio A, Prestera A, Laforgia R, Sederino MG, Casamassima G, Minafra M, Fedele S, Balducci G, Palasciano N: *Laparoscopic appendectomy for the treatment of acute appendicitis: A single center experience*. Ann Ital Chir, 2018; 89:278-82.

19. Caglià P, Tracia A, Spataro D, Borzì L, Lucifora B, Tracia L, Amodeo C: *Appendixstumpclosure with endoloop in laparoscopicappendectomy.* Ann Ital Chir, 2014; 85(6):606-09.

20. Gozeneli O, Tatli F, Yucel Y, Ozgonul A, Uzunkoy A: *Can ultrasonic surgical devices be used to close the appendicular stump?* Ann Ital Chir, 2017; 88:562-66.

21. Pişkin E, Özdedeoğlu M, Muhammedoğlu B, Özgün YM, Kuşdemir A: *Comparison of endocrinological and cytokine response to trauma in laparoscopic and conventional appendectomy in patients with acute appendicitis*. Ann Ital Chir, 2019; 90:68-71.