Appendix stump closure with endoloop in laparoscopic appendectomy

Ann. Ital. Chir., 2014 85: 606-609
pii: S0003469X14022854

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AIM: *To address the question of the appendix stump closure in laparoscopic appendectomy and evaluate the incidence of intraoperative and postoperative complications after application of endoloops.*
MATERIAL OF STUDY: *Data included age and gender, ASA score, co-morbid illness, prior abdominal surgery, clinical presentation, operative time, conversion rate and reasons for conversion, postoperative morbidity and mortality rates, pathologic diagnosis, and length of hospital stay.*
RESULTS: *Laparoscopic appendectomy with stump closure using endoloops was performed in 35 consecutive patients. Postoperative complications occurred in three patients. The mean postoperative hospital stay was 2 days. The perioperative mortality rate was 0%.*
DISCUSSION: *The treatment of appendiceal stump closure in laparoscopic appendectomy represents the main technical aspect and it is an important step for its potentially serious postoperative complications due from an inappropriate management. Endostapling, hem-o-lok clips and intracorporeal knotting are the most commonly recommended methods. All alternatives have advantages and disadvantages against the different clinical stages of acute appendicitis, and it should be noted that the different forms of appendiceal stump closure have never been assessed in prospective randomized studies.*
CONCLUSIONS: *From our experience we can confirm that the endoloop can be safely used and should be the preferred modality in treating the appendiceal stump, especially for low-grade appendicitis. Alternative methods should be used in case of phlegmonous or gangrenous appendicitis, perityphlitic abscess or simultaneous operation for Meckel's diverticulum. Knowledge about and appropriate use of all of them are important for a safe and more cost-effective procedure.*

KEY WORDS: Appendiceal stump closure, Laparoscopic appendectomy

Introduction

Acute appendicitis is the most common inflammatory disease of the abdominal cavity with about 8% of the population in industrialized countries requiring removal of the appendix over the course of their lifetime [1,2]. Mc Burney first described the surgical treatment of acute appendicitis using the classic right lower quadrant incision in 1894 [3], which has been the standard treatment for acute appendicitis for more than a century. During the initial period of the mini-invasive era, laparoscopic surgery for appendicitis has greatly improved and has gained acceptance over the past 15 years. The velocity of technical change and the visible advantages of the laparoscopic procedure led to the application of these operations into daily clinical practice. In 1983, Semm performed the first laparoscopic appendectomy and ever since then, more than half of appendectomy are nowadays performed laparoscopically [4,5]. The efficiency and superiority of laparoscopic approach compared to the

Pervenuto in Redazione Maggio 2014. Accettato per la pubblicazione Maggio Giugno 2014.
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open technique has been the subject of much debate [6-9], even if several studies and systematic reviews have demonstrated at least the equivalence of the operative approach between laparoscopic and open appendectomy [10-12]. We have also to consider the meta-analyses of prospective randomized trials underlining that laparoscopic appendectomy reduced wound infection rates, time to normal activities and represent a diagnostic advantage in fertile women and obese patients [10,13-15]. Moreover, laparoscopy has the advantages of using small incisions to obtain good quality visualization and access to the abdominal cavity with a postoperative pain reduction and decreased amounts of analgesics administration [4,16]. On the other hand, the disadvantages of the laparoscopic procedure are the need for training in laparoscopic surgery, a marginally higher intra-abdominal abscess rate in phlegmonous or gangrenous appendicitis and the higher operating costs [17,18]. Both latter factors are inevitably influenced by the technique of appendiceal stump closure. Various methods, such as endostapling, ligature with extracorporeal sliding knots or endoloop or intracorporeal knotting, and endoclip, have been described and are currently in use for laparoscopic appendectomy [19-21]. All alternatives have advantages and disadvantages against the different clinical stages of acute appendicitis, and it should be noted that the different forms of appendiceal stump closure have never been assessed in prospective randomized studies. The guiding principles for the appendiceal stump closure are the need for secure, inert closure of the appendiceal base without injury to the appendiceal stump or cecum, with minimal risks of complication attributable to the closure technique. Knowledge about and appropriate use of all alternatives are important for a safe and more cost-effective procedure.

Material and Methods

To address the question of the appendix stump closure in laparoscopic appendectomy, we conducted a retrospective study evaluating the medical records of 35 consecutive patients who underwent laparoscopic appendectomy at the Department of Surgery, Transplantation and Advanced Technologie-Surgery Oncology Unit, University Hospital of Catania (Italy). Data included age and gender, ASA score, co-morbid illness, prior abdominal surgery, clinical presentation, operative time, conversion rate and reasons for conversion, postoperative morbidity and mortality rates, pathologic diagnosis, and length of hospital stay. The 35 patients recruited for the study gave all the informed consent. Preoperatively all patients underwent laboratory analysis and ultrasonography of the abdomen. In all patients laparoscopic appendectomy was planned because of suspected appendicitis. The all operations were performed by the same surgical team and done by a board certified surgeon or by a surgical trainee under supervision of the former. The surgeon and an assistant stood on the left side, and the monitor was on the right side of the patient. All of the operations were performed under general anesthesia. The position of the patient was 15-degree Trendelenburg and a mild left tilt. The bladder was previously decompressed with Foley catheter. Laparoscopic appendectomy was performed using a standard three-trocars technique with disposable instruments. The laparoscopic approach was standardized with a 10-mm umbilical trocar, a 5-mm trocar in the lower left and 10-mm in the lower right abdomen. An open technique was used in all cases to introduce the umbilical cannula and to achieve the pneumoperitoneum, as previously described by our group [22]. After pneumoperitoneum is established and the abdominal cavity was inspected. In case of macroscopic non-inflamed appendix and no other obvious abdominal pathology explaining right lower quadrant pain, our policy is to still remove the appendix in order to rule out other causes of pain. Adhesiolysis and/or the dissection of the mesoappendix was accomplished using monopolar or bipolar coagulation. All the operations of the recruited patients were performed using two endoloops on the appendiceal stump. An additional loop was placed 10 mm distally. The appendix was then divided with laparoscopic scissors between the loops. We disinfected the appendiceal stump with polyvidone-iodine. The specimen was evacuated with the lower right abdomen trocar in order to avoid any contamination of the abdominal wall. Patients undergoing incidental appendectomy in operations for other indications, open appendectomy or patients with a high risk of inadequate closure of the appendiceal stump using endoloops were excluded. The patients received an intravenous antibiotic prophylaxis one hour before the operation and a therapeutic dose was administered during the hospitalization. Postoperative follow-up was performed at 1, 2, and 4 weeks.

Results

Laparoscopic appendectomy with stump closure using endoloops was performed in 35 consecutive patients. Mean age of all patients was 24.5 years (range 15-63 years). The ratio of men to women was 9:26 respectively, with no significant difference in average age between the two genders. Comorbid conditions included hypertension in 1 patient, peripheral vascular disease and diabetes mellitus in 2 patients. Thirty-two patients had no co-morbid disease. The patients were evaluated according to the ASA classification. Thirty-two patients were classified as class I and three were classified as class II. The average operative time was 40.30 minutes. No conversion to open appendectomy was necessary. Clinical findings showed no macroscopic signs of inflammation in 7 patients. Hystopathological diagnosis was confirmed

to be acute appendicitis in 25 patients with perityphlitic abscess in 2 of this patients. Other pathological findings such as chronic appendicitis was find in 10 patients. Postoperative complications occurred in three patients. Two of the complications were directly related to the surgical procedure itself including one patient with a postoperative bleeding from a trocar-site requiring reoperation and one wound infection occurred, which resolved under antibiotic therapy. All of these complications occurred in the patients with acute appendicitis or a perityphlitic abscess. One patient experienced a prolonged postoperative ileus, which resolved under conservative treatment (nasogastric tube and bowel stimulation). The mean postoperative hospital stay was 2 days. A few patients required more than 48 hours postoperative hospitalization. The perioperative mortality rate was 0%.

Discussion

Acute appendicitis is the most common intra-abdominal condition requiring emergency surgery and the appendectomy represents its treatment [1]. The treatment of appendiceal stump closure in laparoscopic appendectomy represents the main technical aspect and it is an important step for its potentially serious postoperative complications due from an inappropriate management. The development of life-threatening events such as stercoral fistulas, postoperative peritonitis, and sepsis are in fact feared and unwanted. Endostapling is the most commonly recommended method for securing the appendiceal stump and offers a reliable stump closure for all forms of appendicitis [23,24]. The benefits of a mechanical endostapler include decreased stercoral fistula rates and possible treatment of complicated forms of appendicitis with necrosis at the insertion of the appendix into the cecum. Reports also revealed shorter procedure times, lower rates of wound infection and postoperative ileus in favour of the stapler device [25]. Disadvantages include costs, technical problems and rare cases of intestinal obstruction related to suture line adherence. Several surgeons support use of hem-o-lok clips related with a shorter time of laparoscopic procedure and lower cost, moreover the application of this device can be done by almost every surgeon without any previous training while the application of the endoloop requires dexterity and some training [20]. Other studies performs an analysis of intracorporeal knotting with invaginating suture versus endoloops in appendiceal stump closure. The results show that there were no significant differences between the two groups in overall intraoperative and postoperative complications rate and in hospital stay. The total cost of this procedure is cheaper than the endoloop technique but the median duration of the operation was significantly shorter when the endoloop was used [26]. However, the superiority of endostapling and other techniques for the appendiceal stump closure in patients with uncomplicated appendicitis has yet not been demonstrated. For this reason, it would be appropriate to use alternative methods, particularly for cases with uncomplicated appendicitis. In accordance with other Authors [19,27-30] we currently use endoloop for closing the appendiceal stump, which represents the our standard technique when the base of the appendix is healthy. This technique is cheaper than the stapler closure and the overall perioperative complication rates and hospital stay are comparable. In addiction the costs can further decrease when the appendicular base is minimally inflamed, as it could be safely controlled by a single endoloop. From the analysis of the literature and from our experience we can then confirm that the endoloop can be safely used and should be the preferred modality in treating the appendiceal stump, especially for low-grade appendicitis. Alternative methods should be used in case of phlegmonous or gangrenous appendicitis, perityphlitic abscess or simultaneous operation for Meckel's diverticulum.

Riassunto

L'appendicite acuta rappresenta la più comune patologia infiammatoria della cavità adddominale. Mc Burney ne ha per primo descritto il trattamento chirurgico utilizzando la classica incisione nel quadrante addominale inferiore destro. Tale approccio è stato considerato il trattamento standard della patologia appendicolare per più di un secolo, fino all'inizio dell'era video laparoscopica. I rapidi cambiamenti tecnici e gli innegabili vantaggi della procedura videolaparoscopica ha portato ad una ampia diffusione della metodica in ambito clinico. La chiusura del moncone appendicolare, durante l'appendicectomia video laparoscopica, rappresenta uno degli aspetti tecnici fondamentali della procedura per le gravi potenziali complicanze che possono derivare da un suo non appropriato trattamento. Gravi complicanze sono infatti rappresentate da deiscenza, fistole stercoracee e peritonite. La chiusura con endostapler, hem-o-look e legatura intracorporea rappresentano le metodiche più comunemente utilizzate. Tutte le alternative descritte presentano vantaggi e svantaggi e vanno rapportate ai diversi stadi clinici della patologia appendicolare. Va inoltre notato che le differenti metodiche di trattamento del moncone appendicolare non sono state testate in studi randomizzati. In base alla nostra esperienza si può affermare che il trattamento del moncone appendicolare con endoloop può essere utilizzato con sicurezza e dovrebbe essere considerata la metodica di scelta anche in relazione al rapporto costo-beneficio. Metodi alternativi di chiusura del moncone appendicolare andrebbero utilizzati in caso di appendicite flemmonosa o gangrenosa, ascesso peritiflitico e/o contemporaneo trattamento di diverticolo di Meckel.

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