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Is laparoscopic appendectomy going to be standard procedure for acute appendicitis; a 5-year single center experience with 1,788 patients

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Abstract

Purpose To evaluate whether laparoscopic appendectomy can be the gold standard for acute appendicitis regarding the applicability and cost effectivity.

Materials and methods The study included patients who were operated by laparoscopically for acute appendicitis between January 2008 and September 2012. Patients' sex, ages, hospitalization time, the type for closure of the appendiceal stump, complication rate, surgery time and other parameters were recorded.

Results 1,788 patients with acute appendicitis on laparoscopic evaluation constituted the study population. Average age of the patient group was 30.1 ± 2.3 years old. Average hospitalization time was 1.2 ± 1.1 days. Metal clips were used in 1,100 (61.5 %) patients, intracorporeal knotting was performed in the remaining. Total complication rate was 3.8 %.

Conclusion By the using of metal clips and increased experience; laparoscopy may be gold standard for acute appendicitis.

Keywords Laparoscopic appendectomy · Acute appendicitis

Introduction

Appendectomy is probably the most common surgical intervention performed by general surgeons [1]. In the past,

open appendectomy was the indispensable surgical option for acute appendicitis. Semm introduced the laparoscopic appendectomy as a second surgical option at 1983 and the technique has been gaining popularity through the years [2].

Laparoscopy has several advantages over open technique such as shorter hospitalization period, less post-operative pain, earlier recovery of intestinal motility, less adhesions and less tissue trauma [3, 4]. On the other hand, factors such as higher additional costs, accessibility problems in emergency conditions and less surgical experience preclude the technique to be the standard surgical option as cholecystectomy [5].

The aim of this study is to evaluate whether laparoscopic appendectomy can be the standard therapy for acute appendicitis regarding the applicability and cost effectivity.

Materials and methods

The study included patients who were admitted to our emergency department for acute abdominal pain and operated laparoscopically for acute appendicitis between January 2008 and September 2012. The cases that were found to have complicated appendicitis by laparoscopic evaluation or without acute appendicitis were excluded.

A Veress needle was inserted into the abdominal cavity by making a perpendicular incision in the infraumbilical region. The laparoscopic approach was standardized with the use of a 10 mm infraumbilical optic trocar and intra-abdominal pressure of 10–12 mmHg. A 30°, 10 mm laparoscope was inserted to visualize the abdominal cavity, a 10 mm trocar in the lower left abdomen, and a 10 mm trocar in the lower right abdomen were also used. The mesoappendix was dissected using bipolar coagulation. We

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placed one metal or hem-o-lock clip or intracorporeal knotting to the appendiceal base according to the performing surgeon's choice. An additional loop or the second polyglactin ligature was placed 10 mm distally for cutting base. A drain was used when perforation and infected occurred.

First generation cephalosporin (cefazoline sodium 1 g iv) was used as preoperative antibiotic prophylaxis and diclofenac sodium (75 mg/3 ml im) was used for postoperative analgesic.

Patients' sex, ages, hospitalization time, the type for closure of the appendiceal stump, complication rate, operative time and other parameters were recorded.

Results

1,788 patients (Female/male: 877/911) with acute appendicitis on laparoscopic evaluation constituted the study population. Seventy-six complicated cases were excluded because different operative techniques were performed for these patients and 176 patients with normal appendicitis were excluded.

Average age of the patient group was 30.1 ± 2.3 years old. Average hospitalization time was 1.2 ± 1.1 days. Metal clips were used in 1,100 (61.5 %) patients, hem-o-lock clips were used in 317 (17.7 %) patients and intracorporeal knotting was used in 344 (19.2 %) patients for closure of the appendiceal stump (Table 1). Twenty-six patients (1.5 %) was converted to open because of difficulties in dissection.

Total complication rate was 3.8 % (69 patients). Complications seen in the study group were as following: Intraabdominal abscess in 20 patients (1.1 %), surgical site infection in 16 patients (0.89 %) intraabdominal fluid collection in six patients (0.3 %) which drainage was needed, extended abdominal pain in six patients (0.3 %) (without any etiological finding), post-operative dyspnea in two patients (0.1 %), stump appendicitis in one patient (0.05 %) whom was second polyglactin ligature was placed over than 10 mm distally (surgical treatment at 4th month), ileus accompanying surgical site infection in one patient (0.05 %). Nineteen patients with intraabdominal abscess were treated with radiologically guided drainage, the remaining patient

was treated surgically. Ceftriaxone + metronidazole combination was used in these patients after drainage. The remaining complications were treated with conservative methods and local wound care.

The time interval between preoperative anesthesia induction and postoperative extubation was defined as the surgery time. Average surgery time was 54 ± 22 min.

Twenty female patients (1.1 %) in the study group were pregnant. Gynecological problems were present in 44 patients (pelvic inflammatory diseases, ovarian torsion salphengitis) (5.2 %), one patient had gossypiboma (0.05 %) and another patient (0.05 %) had epiploica torsion and ischemia.

Discussion

Open appendectomy is the standard surgical intervention for acute appendicitis more than a century. However, the frequency of laparoscopic appendectomy increases in the last 20 years [6].

The technique gradually becomes the first option for women, obese and elder patients and for clinically non-diagnostic cases [7]. Although laparoscopic appendectomy has several drawbacks such as higher costs and time needed for learning the skill compared to open technique; factors like shortening of hospitalization time, decreased surgical site infections, decreased analgesic need and minimal tissue damage promote the advance of laparoscopic appendectomy [8].

Direct exploration of the abdominal viscera is a major advantage of laparoscopy to utilized in female patients, especially in the differential diagnosis between appendicitis and gynecological emergencies. Among the female patients with preliminary diagnosis of acute appendicitis, 5 % of them have gynecological problems. In these cases laparoscopy allows direct diagnosis of the gynecological problem and treatment of appendicitis, which is applicable even in pregnancy [9, 10].

In our study, all the patients, male or female, had undergone laparoscopic appendectomy. Among the excluded 176 cases that were found to have other diagnoses according to the laparoscopic exploration, 126 were women and 50 were men. In other words, laparoscopic exploration precluded unnecessary laparotomy in these patients.

One of the major advantages of open appendectomy is the costs. Endo-loop and laparoscopic stapler used for appendix stump closure during laparoscopic appendectomy raise the cost of surgery [11, 12]. The cost of a cartridge containing 10 titanium endoclips is \$7. The closure of appendiceal stump with metal endoclips costs less than \$5 per case, whereas the cost of an endostapler and an

Table 1 Patients distribution

Female/male	877/911
Age	30.1 (15–81)
Hospitalization time	1.2 (1–6)
Metal clips/hem-o-lock clips/ intracorporeal knotting	1,100 (61.5 %)/317 (17.7 %)/ 344 (19.2 %)

endoloop is \$360 and \$50 respectively [13]. Metal clips were used in 1,100 patients in the presented study. 2/0 silk sutures were used as intra-corporeal ligation without any additional cost. Appendiceal stump closure is critical to avoid post-operative complications. Complications such as fistula formation and post-operative peritonitis is closely related with stump closure. Metal clips or hem-o-lock clips used in our series did not create such a complication. Previous studies state that the wound infection rates are lower with laparoscopy; however intraabdominal abscess risk is higher than open appendectomy [14, 15]. In the present study, we did not encounter such an increase in abscess formation, but exclusion of complicated cases may lead to a bias and this issue is one of the drawbacks of this study.

Duration of the operation is another criticized aspect of laparoscopic appendectomy. According to a meta-analysis of Ohani et al. (39 major articles including 5,896 cases), duration of laparoscopic appendectomy was longer than the open approach [16]. In contrary to literature, the duration of laparoscopy was similar to open appendectomy in our study. This result may be attributed to increased experience. In addition, use of metal clip shortens the duration of operation [16].

In conclusion; beneath the well known advantages, laparoscopy also provides opportunity to explore the patients with suspicion of acute appendicitis and to diagnose and or even treat the additional or alternative problems. Use of metal clips and experience in laparoscopy are major factors to overcome the most prominent drawbacks of laparoscopic appendectomy, such as costs and operation time. Regarding these facts we could say that laparoscopic appendectomy is going to be the standard procedure for acute appendicitis.

Conflict of interest Mehmet Abdussamet Bozkurt, Mustafa Gökhan Ünsal, Selin Kapan, Murat Gönenc, Mahmut Doğan, Mustafa Uygur Kalaycı, and Halil Aliş declare that they have no conflict of interest.

Compliance with ethics guidelines All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki declaration of 1975, as revised in 2008 (5). Informed consent was obtained from all patients for being included in the study.

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