ORIGINAL ARTICLE

Comparison of intracorporeal knotting and endoloop for stump closure in laparoscopic appendectomy

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ABSTRACT

BACKGROUND: Several appendiceal stump closure tecniques such as intracorporoeal-knotting, endoloop, stapler and clips are used during laparoscopic appendectomy. This study aimed to compare intracorporoeal-knotting and endoloop tecniques used to close appendiceal stump in laparoscopic appendectomy.

METHODS: This study included patients who underwent laparoscopic appendectomy with preliminary diagnosis of acute appendicitis in General Surgery Department of Adana Numune Training and Research Hospital between June 2009 and July 2013. The demographics, appendiceal stump closure tecniques, operation time, complications, and length of hospital stays of the patients were compared.

RESULTS: A total of one hundred and twenty-six patients underwent laparoscopic appendectomy (Female: 81, Male: 45). Intracorporeal-knotting (Group 1) was performed in sixty-five patients; whereas, endoloop (Group 2) was performed in sixty-one patients in order to close appendiceal stump. The operation time was longer in Group 1 compared to Group 2 (62.0±10.67 min., 56.80±11.94 min., p=0.01). The length of hospital stays were nonsignificant between the groups. Four patients were complicated by superficial surgical site infection in both groups.

CONCLUSION: In the present study, the operation time was found to be longer for intracorporeal knotting tecnique compared to endoloop tecnique; however, there was no significant difference regarding the length of hospital stay and complications. Performing intracorporeal-knotting technique is suggested since it is cheaper than endoloops and it may also improve hand manipulations of the surgeons who intend to advanced laparoscopy.

Key words: Acute appendicitis; appendiceal stump; endoloop; intracorporeal knotting; laparoscopic appendectomy.

INTRODUCTION

Although open appendectomy (OA) is one of the first learned procedures in general surgery assistant training period, laparoscopic appendectomy (LA) is not routinely performed as it is not a gold standard like laparoscopic cholecystectomy. LA has been performed in general surgical practice for over 30 years in western countries. However, although LA is shown once again in several western studies as the first surgical option that shortens hospital stay compared to OA, decreases the pain after surgery, and accelerates the early recovery especially in women and overweight patients, debates are still ongoing in this era.[1,2]

In laparoscopic appendectomy, there are several methods to close the appendix stump. Closing the stump with an intracorporeal knotting (IK), endoloop (EL), endostapler or polymer clips etc. are the most frequently used surgical techniques.[3–5] Usage of these different techniques on different clinical stages of acute appendicitis, advantages and disadvantages have been reported in terms of both execution and expenditure.[6–10] In this study, we aimed to compare the clinical results of the EL and IK techniques which we used to close the appendix stump, in patients with acute appendicitis. To our knowledge, this is the first study comparing intracorporoeal-knotting and

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endoloop tecniques used to close appendiceal stump in laparoscopic appendectomy.

MATERIALS AND METHODS

Patients, who underwent laparoscopic appendectomy with the prediagnosis of acute appendicitis in Adana Numune Training and Research Hospital, General Surgery Department between June 2009 and July 2013, were taken into this study. Instituonal ethical committee approved the study. Patients who were under eighteen years of age, patients with a perforated appendicitis and generalized peritonitis, cases those required conversion to open appendectomy during laparoscopy and patients not diagnosed with acute appendicitis after surgery in histopathologic evaluation were excluded from the study. Also, patients with pregnancy, American Society of Anesthesiologists III and IV patients were excluded from the study population. All operations were performed by a single surgeon (IB). Written consent was taken from all patients before surgery. All patients received 1 g cefazoline preoperatively.

Patients were divided into two groups as IK knotting group (Group 1) and EL group (Group 2). A 10 mm telescope was inserted to all patients above the umblicus with a 10 mm trocar with open procedure and two more trocars were inserted left lateral area under the umblicus. Mesentery of the appendix was cut with either Ligasure (Covidien, Boulder, CO) or with an ultrasonic dissector (31 ACE 36 E harmonic scalpel, Ethicon Endo-Surgery, Inc.). Vicryl™-0 Ethicon was used in Group 1 patients for the closure of the stump. After the closure of the stumps in this group with a double manual knotting, appendectomy was completed and specimen was taken out from the abdomen. Vicryl-Endoloop 0 (Ethicon Endo-surgery) was used in Group 2 patients. After appendix stump was closed with EL, proximal end was cut by clipping and specimen was taken out from the abdomen. Operation time, length of hospital stay (LOS) after surgery and complications were obtained from patient records.

Statistical Analysis

In data analysis, IBM Statistical Packaged Software for Social Sciences (IBM SPSS; SPSS, Inc., Chicago, IL, USA) version 20.0 was used. For continuous data, mean (standard deviation, SD) was used and for non-relevant to normal distribution, median (min-max) was used, and categorical data were showed with percentages (%). Demographics of patients, whose appendix stump was closed with IK and EL techniques depending on Gaussian distribution, were evaluated with Student's t-test or Mann–Whitney U test in in continuous data, whereas categorical data were tested with Chi-square. $P<0.05$ was considered statistical significant.

RESULTS

During the study period, laparoscopic appendectomy was performed to a total of one hundred and twenty-sixpatients consisting of 81 females (64.3%) and 45 males (35.7%). Demographics of the patients, surgery findings and follow-up data after surgery are shown in Table 1. Patients' mean age was 32.33±10.97 years. For closure of the the appendix stump, IK knotting (Group 1) was used in sixty-five patients and EL was used in 61 patients (Group 2). Operation time of patients in Group 1 was statistically longer than of Group 2 ($p<0.05$). No significant difference was found between the groups in terms of LOS ($p>0.05$). Superficial infections - not requiring drainage or intervention - on the trocar sites were seen in four patients from each group.

DISCUSSION

In several studies, in comparison with open appendectomy, LA has been found to fasten early recovery after surgery,

Table 1. The demoghrapics of the patients underwent laparoscopic appendectomy

Parameters	Group 1 (Intracorporeal knotting) (n=65)	Grup 2 (Endoloop) (n=61)	Univariate p
Age	33.24±11.16 (18.0–66.0)	31.36±10.76 (19.0–62.0)	0.33
Gender (Male/Female)	23/42 (35.4/64.6)	22/39 (36.1/63.9)	0,54
Operation time (min.)	62.0±10.67 (30.0–95.0)	56.80±11.94 (15.0–105.0)	0.01
Length of hospital stay (day)	1.00 (1.0–6.0)	1.00 (1.0–4.0)	0.89
Total cost (TL)	675	768	0.04

Data were given mean±SD/median (min.-max.). SD: Standard deviation.
İK: Intracorporeal knotting; EL: Endoloop.
Total cost was calculated after adding EL and Vicryl prices for groups.

shorten early return to daily life and work.[1,2,6] However, although 30 years have passed over the first LA surgery description,[11] discussions on the recommended technique on appendix stump closure are still ongoing today. According to the current literature, most frequent methods of stump closure are with endostaplers (ES), EL and clips.[3–6,12] In the first years of LA, EL was frequently used in stump closure; whereas, it is known that ES is safer and commonly used in recent years.[13] However, in numerous prospective studies and meta-analysis, it is stated that these three methods don't show any significant superiorities to each other in terms of operation time, preoperative and postoperative complication rates and hospital stay durations.[10,12]

In this study, when we compared the IK knotting technique in terms of operation time, complication and hospital stay, we only found that mean operation time was 6–7 min. longer in Group 1 than in Group 2. Our findings in both groups are co mpatible with theliterature.[4,12,14] Bowel injury, bleeding, stump leakage and intra-abdominal abscess after LA are the most frequent complications.[2] However, in our study no major complications were seen in any of the patients.

Laparoscopic appendectomy cost changes according to the surgical materials used, such as ES, EL, endoclip and trocar.[2] However, it is suggested that the optimal technique to use in LA appendix stump closure should be reliable and cost effective as it was stated in previous studies15. In our study, cost of a single EL (Vicryl-Endoloop 0; Ethicon Endo-surgery) was 28€, suture (Vicryl™-0 Ethicon) cost was 1.85€.

In a study by Gönenç et al.,[14] it was suggested to surgeons who would perform the IK knotting technique to close the appendix stump in LA to do it with an experienced surgeon on the first[10–15] cases. Also, it is stated that IK knotting technique will contribute to the training of surgeons in the beginning of advanced laparoscopic surgery. On the contrary to western countries, considering that laboratories don't exist in our country for surgeons to improve the advanced laparoscopic surgery training, we suggest applying this technique in institutions where surgery training is being given.

This retrospective study has several limitations. First of all, our study was not a prospective randomized trial. However, patients in the groups were divided homogeneously to be compared with each other. Secondly, the study population was small due to the patients with complicated appendicitis, and LAs done by other surgeons weren't included with the purpose of standardization.

Conclusion

In our study, we found that operation time in IK knotting technique used to close the appendix stump was longer than the EL technique; however, no significant difference was found in terms of hospital stay and complications. We suggest using IK knotting technique for closing the appendix stump since it is cost-effective and it improves hand manipulation of surgeons who will begin advanced laparoscopy.

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ORİJİNAL ÇALIŞMA - *ÖZET*

Laparoskopik appendektomide intrakorporal düğüm ve endoloop ile güdük kapama yöntemlerinin karşılaştırılması

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AMAÇ: Laparoskopik apendektomi sırasında apendiks güdüğünü kapatmak için intrakorporal düğüm, endoloop, stapler ve klips gibi çeşitli yöntemler kullanılmaktadır. Bu çalışmada laparoskopik apendektomide apendiks güdüğünü kapatmak için kullanılan intrakorporal düğüm ve endoloop yöntemlerinin karşılaştırılması amaçlandı.

GEREÇ VE YÖNTEM: Bu çalışmaya Adana Numune Eğitim ve Araştırma Hastanesi Genel Cerrahi Kliniği'nde Haziran 2009 ile Temmuz 2013 tarihleri arasında akut apandisit ön tanısı ile laparoskopik apendektomi yapılan hastalar dahil edildi. Hastaların demografik özellikleri, apendiks güdüğünü kapatma tekniği, ameliyat süresi, komplikasyon ve yatış süreleri olarak karşılaştırıldı.

BULGULAR: Seksen biri kadın, 45'i erkek olmak üzere toplam 126 hastaya laparoskopik apendektomi yapıldı. Altmış beş hastada apendiks güdüğünü kapamak amacıyla intrakorporal düğüm (Grup 1), 61 hastada ise endoloop (Grup 2) kullanıldı. Grup 1'deki hastaların ameliyat süresi Grup 2'ye göre daha uzun idi (62.0±10.67 dk, 56.80±11.94 dk, p=0.01). Gruplar arası hastanede kalış süreleri arasında fark saptanmadı. Her iki grupta dörder hastada yüzeyel cerrahi alan enfeksiyonu görüldü.

TARTIŞMA: Bu çalışmada intrakorporal düğüm tekniğinde ameliyat süresinin endoloop tekniğine göre daha uzun olduğu, ancak hastanede yatış süresi ve komplikasyon açısından birbirinden anlamlı bir fark bulunmadığı tespit edilmiştir. İntrakorporal düğüm tekniğinin endolooptan daha ucuz olduğu ve ileri laparoskopik cerrahiye başlayacak olan cerrahlar için el manüpülasyonunu geliştirdiğinden dolayı tercih edilmesini önermekteyiz.

Anahtar sözcükler: Akut apandisit; apendiks güdüğü; endoloop; intrakorporal düğüm; laparoskopik apendektomi.

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