



Research Paper

Comparison of two methods: Clipping and suturing in laparoscopic appendectomy

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ABSTRACT

Objective: Closure of the appendix stump after appendectomy is considered one of the most important parts of laparoscopic appendectomy. Various techniques are used during this surgery, commonly including endoclips and ligatures. Therefore, this study was conducted to compare endoclips with intra-corporeal ligatures in closing the appendix stump during laparoscopic appendectomy.

Methods: This retrospective study was conducted using data from 50 patients with acute appendicitis who underwent uncomplicated laparoscopic appendectomy. The data from patients whose stumps were closed using endoclips in 25 patients (Group I) and with intra-corporeal ligatures in 25 patients (Group II) were extracted and compared regarding the occurrence of intraoperative and postoperative complications.

Results: There were no differences between the two methods in terms of intraoperative and postoperative complications. The duration of surgery in the ligature group was significantly longer than in the clip group ($p = 0.044$). The hospital stay duration was clinically longer in the ligature group, but this difference was not statistically significant ($p > 0.05$).

Conclusion: Endoclips for closing the appendix stump are safer with a shorter operating time and also a simpler method. Therefore, they could be a reliable alternative to the method of closing the appendix stump with ligatures.

Introduction

Acute appendicitis is also one of the most common acute surgical conditions, with one person out of 100,000 in the population affected by acute appendicitis [1]. Accurate and timely diagnosis of acute appendicitis is essential to minimize morbidity. Prompt surgical treatment can reduce the risk of appendiceal perforation [2]. With the occurrence of perforation in appendicitis, the incidence of appendiceal morbidity increases from <1 % in non-perforated cases to 5 % or higher [3].

Today, laparoscopic surgery is recognized as an advanced and reliable method in general surgical fields [4]. In some teaching hospitals, all patients suffering from right iliac fossa pain undergo laparoscopic appendectomy before surgery. There is an increasing tendency towards the use of laparoscopic appendectomy [5]. Some reasons for this are due to lower morbidity, shorter hospital stay, and a shorter recovery period [6].

While laparoscopic surgery is considered the optimal method for

appendectomy, the best technique for closing the base of the appendix remains debatable, with various techniques used to secure the appendiceal stump. Despite numerous studies, there is no global consensus on any specific method recommended in the literature. There are ongoing prospective randomized studies with large sample sizes comparing different methods [7].

When the base of the appendix is severely inflamed or necrotic, the consideration of using a stapler can be made. It is worth mentioning that the use of a stapler and endoloops is more expensive compared to other methods. Considering the specific conditions of our country, the use of more cost-effective alternatives such as suturing and handmade loops will be more suitable. The use of handmade loops is common due to safety, cost-effectiveness, and practicality [8].

While electrocautery and bipolar coagulation are recommended as cost-effective and straightforward methods, clinical studies on these topics are very limited. In general, the safety of these methods should be supported by clinical studies [9].

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So far, data evaluation from articles has shown that all methods have similar reliability. Therefore, methods that are cost-effective and feasible should be considered as the first choice [10].

In laparoscopic appendectomy, there will be no significant difference in the occurrence of intraoperative and postoperative complications between the use of laparoscopic clipping and intracorporeal suturing for closing the base of the appendix. Both techniques will demonstrate similar reliability, safety, and cost-effectiveness, with the choice between the two methods depending on surgeon expertise, equipment availability, and the severity of appendix inflammation.

Nevertheless, the final decision regarding the method used depends on the surgeon's training and experience, equipment availability at that center, costs, and the degree of appendix inflammation [11]. Therefore, this study was designed to examine a comparative analysis between two methods, Laparoscopic clipping, and intracorporeal suturing in laparoscopic appendectomy.

Methods

This study was a retrospective cohort study. In this study, data from 54 patients aged between 12 and 65 years old, who were referred to Shahid Modani, Imam Ali, and Kamali hospitals and underwent laparoscopic appendectomy from the years 2020 to 2022, were evaluated, and a researcher-made checklist was used for data collection. The patients in this period were divided into two groups:

The first group consisted of patients who underwent laparoscopic appendectomy using the clipping laparoscopic method.

The second group consisted of patients who had undergone laparoscopic appendectomy with the intracorporeal suturing method.

Patients who are addicts are excluded from both groups. Ultimately, variables such as age, gender, intra-abdominal abscess formation, duration of surgery, leak anastomosis, and the dosage of postoperative analgesics were compared between the two groups and subjected to statistical analysis.

This study is a retrospective study and the sampling was available. According to the results of the study by Abdalgaliel M. Mohamed and colleagues, the mean (standard deviation) duration of surgery between the two surgical methods, Laparoscopic and Intracorporeal, was found to be 0.42 ± 2.14 and 6.55 ± 2.18 , respectively.

Considering a type I error of 5 % and a test power of 80 %, the sample size of 24 in each group was obtained. To increase the test power by 10 %, the sample size was increased, resulting in a final consideration of 27 samples in each group (total of 54 samples).

Inclusion Criteria: patients with uncomplicated acute appendicitis between the ages of 12 to 65 years presented to the hospital within 48 h of the onset of symptoms and underwent surgery.

Exclusion Criteria: patients with generalized peritonitis, abscesses, underlying diseases such as hypertension, diabetes, immunodeficiency, and cardiovascular or pulmonary conditions.

After gathering and classifying the data, statistical analyses of the data were conducted using SPSS 22 statistical software. Statistical analysis of quantitative variables was performed using the *t*-test, and for qualitative variables, the chi-square test was employed. A *P*-value <0.05 was considered statistically significant.

This study was approved by the Research Ethics Board of Alborz University of Medical Sciences.

Results

In this study, laparoscopic appendectomy was performed on 50 patients. Closing the stump using endoclips (Group A) was performed in 25 patients, and intracorporeal knot (Group B) was carried out in 25 patients using Vicryl 0/2.

Group A consisted of 13 males and 12 females with an average age of 8.556 ± 30.96 years, while Group B comprised 13 females and 12 males with an average age of 7.141 ± 26.92 years.

The histopathological findings did not show a statistical difference between the two groups. In Group A, 10 individuals (40 %) were reported as catarrhal, 10 individuals (40 %) as suppurative, 2 individuals (8 %) with adhesions, and 3 individuals (12 %) reported negative. Group B included 14 individuals (56 %) with catarrhal findings, 7 individuals (28 %) with suppurative findings, 2 individuals (8 %) with adhesions, and 2 individuals (8 %) who reported negative.

There was no statistically significant difference between the two groups concerning age, gender distribution, and types of histological appendix tissues (*p* value >0.05) (Table 1).

A longer duration was spent performing the intra-corporeal knot compared to using clips, which statistically showed a significant difference between the two groups (*p* = 0.044). No technical issues were faced during the surgery duration in either group, with no impact on surgical ease. Additionally, no laparoscopic method was converted to open surgery.

Six intraoperative complications were observed. Three cases from each group; one case in Group A involved bleeding from the meso-appendix (110 cc) requiring clip application, whereas in the other cases, bleeding occurred from the port, which was <30 cc and was stopped by cauterization. This difference between the two groups was not statistically significant.

Postoperative fever (38.1–37.7 degrees Celsius) occurred in six cases. In each group, three individuals experienced this, all of which resolved within <24 h in all instances.

Recurrent vomiting episodes occurred in one case from Group A, which resolved spontaneously after the initiation of bile passage.

While in one case of Group B (knot group), continuous abdominal pain was observed due to the presence of a pelvic collection, which was aspirated under ultrasonography. Subsequently, the patient recovered after seven days of hospitalization and was discharged.

Additionally, there were no cases of wound infection complications. There was no statistically significant difference between the two groups in terms of postoperative outcomes and complications (Table 2).

Discussion

Acute appendicitis is one of the most common causes of acute abdominal pain requiring urgent surgery [12]. It constitutes >40 % of emergency laparotomies [13]. Open appendectomy was considered the gold standard treatment, but with the evolution of laparoscopy, it has become a good alternative with better outcomes in terms of aesthetic appearance, shorter hospital stays, postoperative results, as well as serving as a good diagnostic tool for suspected cases [14].

An important part of this method is closing the appendicular stump, which involves various techniques such as knots, clips, and staplers [15,16].

In this study, patients referred to the hospitals of (XXX), equipped with laparoscopic sets, were compared between the techniques of intracorporeal knot and *endo*-clip for securing the appendiceal stump, which

Table 1
Demographic characteristics of the study.

	Group A (Clip)	Group B (Knot)	P-value
No. of cases	25(50 %)	25(50 %)	
Male n (%)	13(52 %)	12(48 %)	1.000
Female n (%)	12(48 %)	13(52 %)	
Age range (mean ± SD)	18–46 Y/O (30.96 ± 8.556)	18–41 Y/O (26.92 ± 7.141)	0.076
Total leucocyte count ×10 ³ /μl (mean ± SD)	6–7(11.316 ± 3.229)	6.5–17(11.492 ± 3.097)	0.845
Histopathologic finding n (%)	Catarrhal	14(56 %)	0.325
	Suppurative	10 (40 %)	
	Adhesions	2 (8 %)	
	Negative	3 (12 %)	

Table 2
Comparison of the results of two groups of clips and knots.

Outcomes		Group A (clip)	Group B (knot)	P- value
Intra operative	Operating time (min ± SD) min	37–70 (50 ± 10.508)	45–90 (57.2 ± 13.85)	0.044
	Complications n (%)	3(12 %)	3(12 %)	0.549
Post- operative	Fever n (%)	3(12 %)	3(12 %)	0.666
	Bowel complications n (%)	1 (4 %)	1 (4 %)	0.368
	Hospital stay (mean ± SD) range	–2 (1.16 ± 0.374)	1–7 (1.32 ± 1.215)	0.532

are more cost-effective and accessible. It is important to note that to prevent data distortion, the surgeries were performed by a single surgeon.

This study was conducted on 50 patients with uncomplicated acute appendicitis, excluding cases with necrotized or gangrenous bases that were not amenable to clip application. The selection of cases was randomized, but at the same time, there was homogenization in terms of demographic features between the two groups, and overall, there was no statistically significant difference between the two groups.

Among the groups, there were no statistically significant differences in terms of age distribution, gender, total leukocyte count, histological type of the appendix, and intraoperative findings. The discussion will now focus on the study's objectives and findings.

In the present study, the operative time for patients in the clip group was significantly shorter than the knot group, which can be attributed to the simplicity of using clips and the time-saving technique of knot-tying with only two working ports.

Similarly, in many other studies, the average operative time for the endoclip group was shorter than the knot-tying group [11–13], even when compared to pre-tied endoloops.

Furthermore, in a meta-analysis and systematic review conducted by Sheikh et al. in 2015, it was identified that the use of endoclips consumes less operative time compared to endoloops [17].

In the present study, intraoperative complications were observed in six patients, three in each group. A case of bleeding from the appendicular artery was noted in one case in the clip group, requiring the use of an endoclip to control the bleeding, while in the remaining cases, bleeding at the port site was observed and was halted using ultrasonic scalpel.

Moreover, no case in this study required conversion to open surgery. There was no statistically significant difference between the two groups regarding intraoperative complications. In other similar studies, no significant intraoperative complications related to the method of closing the appendix stump have been reported [18].

In this study, one patient developed persistent abdominal pain (4 %) after the surgery. In the knot group, one patient exhibited mild pelvic fluid, managed through guided aspiration and was discharged after a week.

Another patient in the clip group experienced recurrent vomiting (4 %) and was treated conservatively with antiemetic medications and mouth care for one day. Postoperative fever was observed in three patients from each group, and no statistically significant difference was observed between the two groups in terms of postoperative complications.

In similar studies, despite reported postoperative complications, there was no significant association between the occurrence of complications and the method of closing the stump [18,19].

Furthermore, a longer hospital stay was observed in the knot group, but without statistical significance in this study, which is consistent with other similar studies [17,20].

Similar to this study, studies by Ates et al. (2012), Gonenc et al. (2012) [18], Colak et al. (2013) [4], Delibegovic (2012) [5], Akbayir et al. (2011) [19], Sheikh et al. (2015) [17], and the present study

yielded highly satisfactory results.

Conclusion

Both intracorporeal sutures and endoclips are safe methods for closing the appendix stump. Despite the longer operating time during intracorporeal knotting, it provides satisfactory results; however, they do not significantly impact the outcome. Therefore, after further studies, endoclips might be recommended as a reliable alternative for closing the stump.

Human and animal rights

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation Alborz University of Medical Sciences (IR.ABZUMS.REC.1402.030)., and with the Helsinki Declaration of 1975, as revised in 2013.

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Approval of the research protocol

N/A.

Informed consent

Informed consent was obtained from each participant.

Consent for publication

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Availability of data and materials

All relevant data and materials are provided with in manuscript.

CRedit authorship contribution statement

Parham Khoshdani Farahani: Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Conceptualization. **Neda Safaei:** coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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