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Electrical Sealing by a Ligasure Versus Mechanical Closure of Appendicular Stump in Laparoscopic Appendectomy

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Abstract

Background: Closure of appendicular stump consider an important step in laparoscopic appendectomy by ligatures and clips or by using energy source, such as ligasure.

Aim of the work: The aim of this study is to evaluate the effect of sealing of appendicular stump by a ligasure in comparison to closure by ligature or clips as regard outcome and complications.

Patients and methods: On 60 patients with uncomplicated acute or chronic appendicitis, a prospective study will be carried out. The patients were obtained from the surgical department of Al-azhar University Hospitals and Cairo specialized hospital. All patients will get a thorough physical examination, laboratory testing and a pelvic-abdominal ultrasound. Thirty patients will undergo laparoscopic appendectomy employing ligasure, while another thirty patients will receive the using ligature or clips. Patients will be monitored for six months. Detailed analysis of intraoperative findings (operational time and issues), hospital stay, and postoperative complications.

Results: A follow up of the patient's data over 6 months, we discovered no differences between mechanical closure and ligasure sealing (intraoperative problems or postoperative complications). However, when compared to using a ligature or clips, revealed that using ligasure saved about 13 min of overall operating time.

Conclusion: Evaluation of using ligasure or mechanical closure to secure the appendicular stump showed that both methods have a similar reliability and complication rate. But here using of ligasure show save time intra-operatively, easy to apply and the simplicity of techniques but high cost.

Keywords: Appendicular stump, Electrical sealing, Lap appendectomy, Ligasure, Mechanical closure

1. Introduction

Acute appendicitis is the most frequent acute pathological abdominal illness needing immediate surgery. The laparoscopic appendectomy (LA) has become more popular and is advised as the first course of treatment, particularly for female, obese, and elderly patients.¹

LA can also give surgeons a greater field view and identification of other abdominal organs that can have different pathologies that could mimic the symptoms of acute appendicitis.²

The most crucial step in preventing major complications such postoperative fistula, peritonitis, and sepsis is closing the appendicular stump.³ Due to this circumstance, surgeons are looking for alternative treatments for LA. The best technique for closing an appendix stump should be affordable, practical, safe, and easy to apply technically.⁴

Extracorporeal sliding knots, intracorporeal ligations, endo-loops, nonabsorbable polymer clips (Hem-o-lock clips), hand-made loops, and Ligasure usage, and bipolar cautery division are some of the techniques utilised in LA to seal appendicular

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stumps. According to studies, each of these techniques is secure and practicable.⁵

In this study, there was a comparative study was carried out to show and confirm that is no difference between using ligasure device as a source of sealing and other mechanical closure by ligature or clips for appendicular stump. The aim of this study is to assess effect of energy source sealing of appendicular stump by using of ligasure device in comparison to mechanical closure by ligature or clips as regard outcome and complications.

2. Patients and methods

Between November 2021 and July 2022, this prospective study was conducted at Cairo Specialized Hospital and the surgical division of Al-Azhar University Hospitals. The Al-Azhar University Ethics Board gave the study their approval. There were 60 patients who had either a simple acute appendicitis or a chronic appendicitis diagnosis. Subsequently divided into two groups, one with thirty patients utilising ligature and clips to mechanically close the appendicular stump and the other with thirty patients using a ligasure device to seal the stump. The postoperative leakage, fistula, postoperative pain, hospital stay, operating time, postoperative bleeding, and postoperative infection were all compared for both groups.

2.1. Inclusion criteria

Inclusion criteria for trial participants comprised uncomplicated acute appendicitis or chronic appendicitis, no contraindication to laparoscopy, no known inflammatory bowel illness, and age greater than fourteen (crohn,s disease or ulcerative colitis).

2.2. Exclusion criteria

Excluded patients were found to have complex appendicitis (appendicular mass, abscess, etc.). A laparoscope was also not administered to patients who had the following conditions: cirrhosis with ascites, abdominal distention, and coagulation disorders; cardiac patients; shock upon arrival; a large ventral hernia; and a previous history of laparotomies for small intestinal blockage. General anaesthesia should be avoided in cases of severe heart and/or lung disease, mental incompetence that prevents the patient from giving informed permission, and inflammatory bowel disease. All patients had thorough preoperative histories taken, which included details like name, age, sex, place of residence, work title, marital status, any uncommon

habits that might have a medical meaning, a look at the main complaint, and any unusual habits. A thorough current history revealed the following symptoms: right lower abdominal pain or periumbilical pain that had previously shifted to the right lower abdomen; nausea and/or vomiting; a fever of more than 38 °C; a history of prior operations and their postoperative results; chronic diseases (such as cardiac diseases, Diabetes Mellitus, etc.); drug allergy & intake; and blood transfusion. As part of preoperative clinical exams, our patients had general assessments for vital signs and other systems to determine whether they were suitable for anaesthesia and surgery. Upon closer inspection, the right iliac fossa area exhibits guarding, sensitivity, and rebound soreness. The average patient age was at least fourteen.

Laboratory To rule out any intra-abdominal co-pathology, all patients had regular testing, including pelvi-abdominal ultrasound a complete blood count, urea, creatinine, blood sugar, INR, and chest plain X-ray studies in cases of prior smoking, bronchial asthma, or clinical symptoms of chest issues (Fig. 1).

On the day of operation or the day before, patients were admitted. Before the operation, the abdomen is prepared and then the hair is shaved. A single dosage of a broad-spectrum antibiotic used during anaesthetic induction Endotracheal intubation and general anaesthesia were both employed. All patients were positioned supine with their heads somewhat cocked to the left and their bodies fixed in breeding operations.

Operative field was sterilized by povidone-iodine and towed up in normal manner. Insufflation of abdomen and insertion of ports, sealing of appendicular artery and divided by ligasure device then appendix sealed without dividing by ligasure device at three different levels starting form base of appendix finally dividing between first two sealed line towards the base and third one towards tip of appendix in case of mechanical closure appendicular artery and stump closed by ligature or hemo-clips (Fig. 2).

3. Results

A total number of 60 patients with simple acute appendicitis or chronic appendicitis was enrolled. The age of studied cases ranged from 17 to 51 years with a mean was 31.97 ± 8.94 years. There were 22 (36.7%) males and 38 (63.3%) females. The studied patients were randomized and divided into two groups (group A: containing 30 patients using ligature and clips for a mechanical closure of

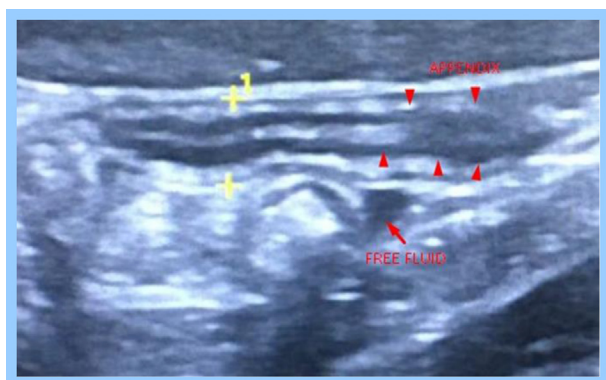


Fig. 1. Shows swollen inflamed appendix and rim of free fluid, consistent with acute appendicitis.

appendicular stump and group B containing 30 patients using ligasure device for sealing appendicular stump).

Demographic characteristics of the study population in both the groups were given in Table 1. Both the groups were comparable in terms of age, gender, residence and comorbidities. The mean age in group A was 34.13 ± 8.86 years with range being 17–50 years and in group B, mean age was 29.80 ± 8.62 years with range being 17–51 years. No significant difference was found between the two studied groups regarding demographic data including age, gender, residence and comorbidities ($P > 0.05$).

Regarding diagnosis, most cases in both groups had acute appendicitis (93.3% and 90% in group A & group B respectively) with no significant difference between them ($P > 0.05$) as shown in (Table 2).

Table 3. A comparison of the two research groups' demographics In group A, the mean operating time

Table 1. Demographic characteristics in the two the study groups.

	Group A (n = 30) n (%)	Group B (n = 30) n (%)	P- value
Age (years)			
Mean \pm SD	34.13 ± 8.86	29.80 ± 8.62	0.060 ^a
Range	17.0–50.0	17.0–51.0	
Gender			
Male	10 (33.3%)	12 (40.0%)	0.592 ^b
Female	20 (66.7%)	18 (60.0%)	
Residence			
Great Cairo	26 (86.7%)	24 (80.0%)	0.060 ^b
Lower Egypt	1 (3.3%)	2 (6.7%)	
Middle Egypt	3 (10.0%)	0 (0.0%)	
Upper Egypt	0 (0.0%)	4 (13.3%)	
Comorbidities			
No	22 (73.3%)	27 (90.0%)	0.226 ^b
DM	4 (13.3%)	2 (6.7%)	
HTN	4 (13.3%)	1 (3.3%)	

^a Student T U test.

^b Chi-Square Test.

was 54.55.57 while in group B, it was 44.64.68. In comparison to group A, which used ligature and clips for a mechanical closure of the appendicular stump, there was a considerable reduction in the length of the procedure in group B employing the

Table 2. Diagnosis in the two the study groups.

	Group A (n = 30) n (%)	Group B (n = 30) n (%)	P- value
Diagnosis			
Acute appendicitis	28 (93.3%)	27 (90.0%)	1.00 ^a
Chronic appendicitis	2 (6.7%)	3 (10.0%)	

^a Fischer Exact Test.

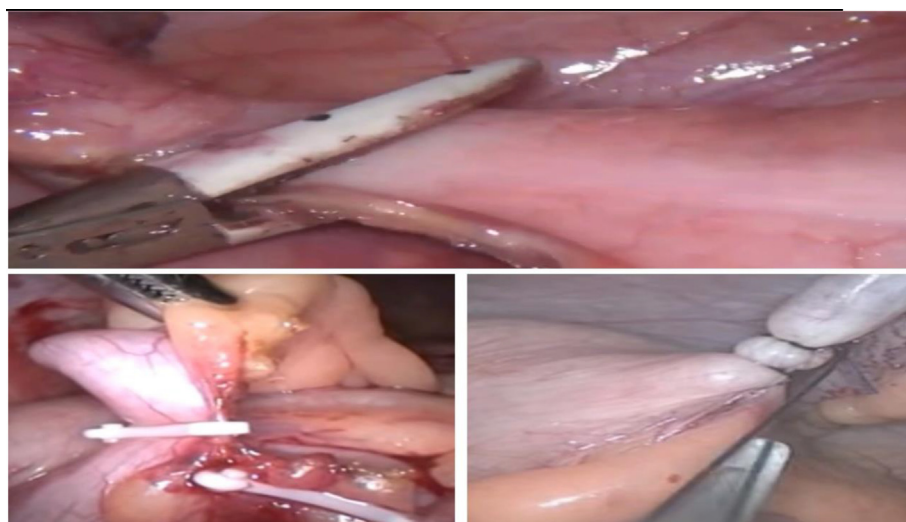


Fig. 2. Shows appendicular stump sealing by ligasure device versus hemo-clips and ligature.

Table 3. Operative data in the two studied groups.

	Group A (n = 30) n (%)	Group B (n = 30) n (%)	P value
Operative time (min.)			
Mean \pm SD	54.5 \pm 5.57	44.6 \pm 4.68	<0.001 ^{c,a}
Range	45.0–65.0	35.0–51.0	
Hospital stay (years)			
1 day	29 (96.7%)	30 (100.0%)	1.00 ^b
3 days	1 (3.3%)	0 (0.0%)	
Mean \pm SD	1.07 \pm 0.37	1.0 \pm 0.0	0.321 ^a
Range	1.0–3.0	1.0–1.0	

^a Student T U test.^b Fischer Exact Test.^c Highly significant.

ligasure device (P 0.001) Fig. 3. All patients in both groups stayed in the hospital for one day, with the exception of one case in group A that stayed for three days, as shown in the table, therefore there were no discernible differences between them regarding hospital stays (3).

Regarding complications, there were one case in group A had postoperative bleeding with no significant differences were found when comparing groups ($P > 0.05$). None of cases developed post-operative leakage or fistula. However, there was significant decrease of the time required for returning to work in group B compared to group A ($P < 0.001$) as the median time was 7.1 days in group A and 6.33 days in group B as shown in (Table 4 and Fig. 4).

To record the clinical information, a report form was used. The SPSS (Statistical Package for Social

Table 4. Postoperative outcome in the two studied groups.

	Group A (n = 30) n (%)	Group B (n = 30) n (%)	P value
Post-op leakage			
No	30 (100.0%)	30 (100.0%)	NA
Yes	0 (0.0%)	0 (0.0%)	
Postop bleeding			
No	29 (96.7%)	30 (100.0%)	1.00 ^b
Yes	1 (3.3%)	0 (0.0%)	
Fistula			
No	30 (100.0%)	30 (100.0%)	NA
Yes	0 (0.0%)	0 (0.0%)	
Return to work (days)			
Mean \pm SD	7.10 \pm 0.61	6.33 \pm 0.76	<0.001 ^{c,a}
Median (IQR)	7.0 (7.0–7.0)	6.5 (6.0–7.0)	
Range	6.0–10.0	5.0–7.0	

^a Mann–Whitney U test.^b Fischer Exact Test.^c Highly significant.

Science) version 20 computer programme was used to tabulate and analyse these data to create:

3.1. Descriptive data

For the data, frequency and distribution for the qualitative data and mean and standard deviation (SD) for the quantitative data were generated as descriptive statistics.

3.2. Analytical statistics

One of the following tests was used to determine the significance of the difference in the statistical

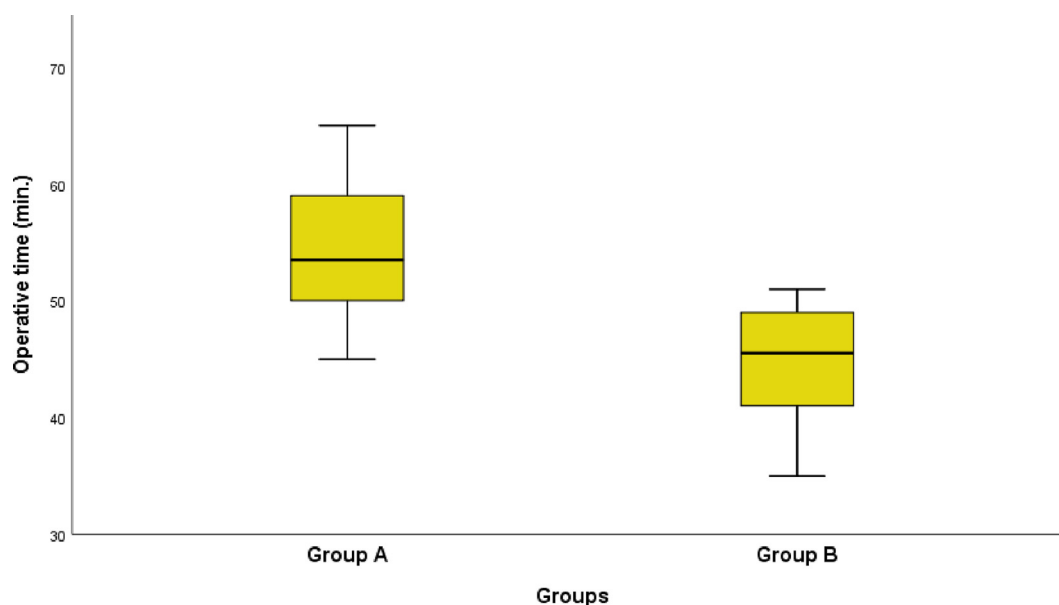


Fig. 3. Boxplot showing difference between the study groups regarding operative time.

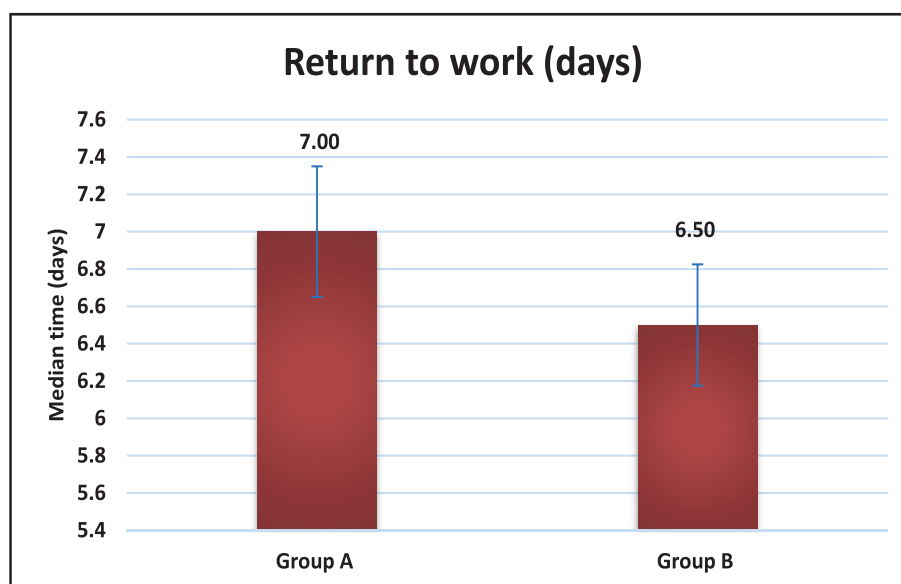


Fig. 4. Difference between the study groups regarding time for Return to work.

comparison between the several groups after the Shapiro–Wilk test of normality had established their non-normalcy. Two groups of quantitative data with parametric and non-parametric means were compared using the Student's *t* test and the Mann–Whitney *U* test, respectively. Using the Mann–Whitney's test, the statistical significance of the difference between two research groups in a nonparametric variable was evaluated (*U* test). The Fisher Exact Test and the Chi–Square Test (χ^2 -value) were used to compare categorical data among groups (FET). In all analyses, a *P* value of 0.05 or less was regarded as statistically significant, whereas a *P* value of 0.05 or higher was regarded as statistically insignificant.

4. Discussion

Acute appendicitis is the most frequent acute pathological abdominal illness needing immediate surgery. LA has become more prevalent and is advised as the first course of treatment, particularly for women, obese individuals, and older people.¹

In our study in comparison to many others.^{6–8} When comparing the use of any mechanical device versus a ligasure sealing technique for closure of the appendicular stump during LA, we found no significant differences in our primary outcomes of total complications, intraoperative complications, and post-operative complications.

Among surgeons, acceptance of LA is growing.⁴ Regarding early postoperative measures like postoperative pain and bowel function recovery, LA has

been demonstrated to be superior to open appendectomy and is also associated with a lower wound infection rate.⁹

Closing the appendicular stump is an essential part of a LA because it is the source of the majority of postoperative issues. The development of potentially lethal diseases such as sepsis, postoperative peritonitis, leakage, and fistulas is one of these consequences. One of the solutions is to mechanically close the appendicular stump using ligasure sealing, according to studies.^{6,10} In these studies, ligasures were used to seal the appendicular stump. There was no noticeable difference between the mechanical closure approach and the use of ligasure sealing when we compared the effectiveness of mechanical closure by ligature or clips against ligasure sealing between two laparoscopic procedures utilised for appendicular stump closure.¹¹

By and large, 13 min across all examinations. (The mean employable time was 54.5 ± 5.57 in bunch An and 44.6 ± 4.68 in bunch B. There was critical decrease in employable time in bunch B utilizing ligasure gadget contrasted with bunch An in which ligature and clasps for a mechanical conclusion of attached stump ($P < 0.001$).^{15,16} Between the two gatherings, there were no considerable contrasts in the intraoperative and postoperative difficulties. While picking which method to use in routine clinical practice, the money saving advantage examination is the main element to consider on the grounds that issues are consistently a chance. We accept that specialists ought to be more specific, utilizing a modest ligature to close the attached

stump and possibly utilizing ligasure gadgets when totally essential.¹² All through our examination, there was no recorded casualty. This is in accordance with by far most of prior research examinations that were led on a similar subject. In an examination of a sizable regulatory data set, it was determined that the by and large detailed mortality of appendectomy is exceptionally low, affirming that appendectomy is a protected strategy no matter what the procedure utilized when there is no peritonitis.¹³

The two gatherings' intricacy rates were tantamount. This is equivalent to most of surveys, meta-investigations, and randomized research. In our review, the length of emergency clinic stay was no different for the two gatherings, and there was no way to see a contrast between them.¹⁴

4.1. Conclusion

The use of ligasure devices and mechanical closure of the appendicular stump are two potential techniques to preserve the appendicular stump during LA with comparable complication rates.

In the majority of patients, mechanical closure can be used to safely secure the appendicular stump, and in a small minority of individuals, a ligasure device should be used selectively. Mechanical closure is also the most economical way to secure the appendicular stump. Based on our research, we advise using ligasure devices to secure the appendicular stump in situations of acute or chronic appendicitis, which also raises cost but shortens the length of an operation.

Conflict of interest

None declared.

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