

## Comparison between the use of Titanium Clips and Monopolar Diathermy for Closure of the Mesoappendix in Laproscopic Appendectomy in terms of Operative Time and Cost

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### ABSTRACT

**Objective:** To compare the use of Titanium clips and Monopolar diathermy for laparoscopic appendectomy mesoappendix closure in terms of operative time and cost.

**Study Design:** Quasi-experiment study.

**Place and Duration of Study:** Department of Surgery, Combined Military Hospital, Nowshera Pakistan, from Jul 2021 to Jun 2022.

**Methodology:** A total of 70 patients who were diagnosed with acute appendicitis and were admitted for laparoscopic appendectomy were randomly divided into two groups via the lottery method. In Group-A, the closure of the mesoappendix was done using Titanium clips, and in Group-B, the ligation of the mesoappendix was done using Monopolar diathermy. Patient outcomes in terms of operative time and procedure cost were assessed.

**Results:** Out of 70 patients, 49(70.0%) were males and 21(30.0%) were females, aged 18 to 60 years, with a mean age of 37.57±7.71 years. The overall mean weight of the patients was 65.29±12.14 kg; height was 1.71±0.12 metres; and BMI was 24.96±5.23 kg/m<sup>2</sup>, respectively. Prolonged operative time was observed in 16(45.71%) patients in Group-A, compared to 7(20.0%) in Group-B (*p*-value 0.022). In Group-A, the total cost of the operation was Rs. 32,000, whereas in Group-B, it was Rs. 30,000 (*p*-value=0.001).

**Conclusion:** This study concluded that Monopolar diathermy for the closure of the mesoappendix is better in terms of operating time and cost as compared to the use of Titanium clips.

**Keywords:** Cost, Laparoscopic Appendectomy, Operative Time

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### INTRODUCTION

Acute appendicitis is one of the most common causes of acute abdominal pain, leading patients to attend emergency departments. It is associated with significant morbidity and a burden on the healthcare system.<sup>1</sup> The incidence of acute appendicitis varies significantly across the globe, with a lifetime risk of 2% in Africa, 8% in Europe, and 9% in the USA. In developed countries, the annual risk is calculated to be 5.7 to 50 per 100,000 individuals, with peak incidence between 10 and 30 years of age<sup>2,3</sup>.

Appendectomy is one of the most frequently performed surgical procedures. It is a relatively safe procedure, with a case fatality rate of 2.1–2.4 reported in some studies.<sup>4,5</sup> The mortality and morbidity associated with appendectomy have drastically decreased with the advent of minimally

invasive surgery, or laparoscopy, in 1983.<sup>6</sup> Since then, this procedure has gained widespread acceptance and is now considered the gold standard for non-complicated appendicitis due to its advantages over an open procedure, such as a shorter hospital stay, less pain, early post-operative recovery, and a better cosmetic outcome.<sup>7</sup> A conventional laparoscopic appendectomy was done using three trochars. However, innovation and evolution led to the development of single-port laparoscopic appendectomy, which aims to minimise abdominal wall trauma and achieve a better and earlier therapeutic outcome.<sup>8,9</sup> Even with all the benefits, laparoscopic procedures still have a longer operating time and a slightly higher risk of an intra-abdominal abscess forming. These risks are affected by the mesoappendix closure technique.<sup>10</sup>

Closing the mesoappendix and appendicular stump is considered a critical step in the appendectomy procedure because it prevents infectious complications. However, which is the best

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method to close the mesoappendix is still debatable. Keeping this in mind, we have conducted a study that compares the outcomes of using Titanium clips and Monopolar diathermy for the closure of the mesoappendix in our clinical setting.

**METHODOLOGY**

The quasi-experiment study at the Department of surgery at Combined Military Hospital, Nowshera Pakistan, was conducted from July 2021 to June 2022 after Ethical Committee Approval was sought (letter no. ref A/23).

**Inclusion Criteria:** The study included patients of either gender, aged 18-60 who presented signs and symptoms of acute appendicitis and were admitted for laparoscopic appendectomy.

**Exclusion Criteria:** Patients with a perforated appendix showing signs of peritonitis, a right iliac fossa mass or abscess, who were pregnant or had previous abdominal surgeries, or who had known diseases at the same time as ovarian cystectomy, Meckel's diverticulum, or colonic tumours that could change the outcome, were not included.

The procedure was explained to all patients, and informed written consent was obtained. All the patients who fulfilled inclusion criteria were randomly divided into two equal groups in a ratio of 1:1 by the lottery method (Figure).

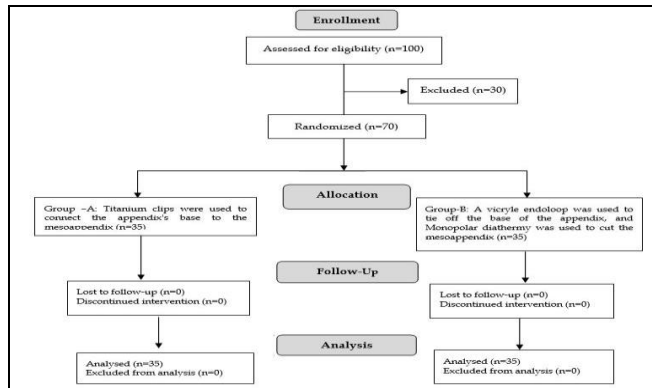


Figure: Patient Flow Diagram (n=70)

Prophylactic antibiotics were given to all patients. A laparoscopic appendectomy was performed using the standard three-port technique. With both arms tucked, the patient was placed supine in the 150 Trendelenburg position. The pneumoperitoneum was created using the closed technique. Once the swollen appendix was discovered, Titanium clips were used to connect the appendix's base to the mesoappendix in

Group-A patients. For patients in Group-B, a vicryle endoloop was used to tie off the base of the appendix, and Monopolar diathermy was used to cut the mesoappendix.

Patient demographic data were recorded. Outcomes in terms of procedure cost and operating time were recorded separately for each patient. The total cost of the procedure for laparoscopic appendectomy was calculated to be Rs 30,000; the additional cost of Titanium clips was estimated to be Rs 2000, which was added to the total cost. Monopolar diathermy was free of charge, so no additional charges were added. If the operating time increased beyond 60 minutes, it was labeled as prolonged operating time.

Data was entered and analysed using Statistical Package for Social Sciences version 24 (SPSS v. 24). Categorical variables were presented as frequencies and percentages. Continuous variables were presented as Means±standard deviation. Pearson's chi-square test was used to determine the associations between categorical variables. The p-value of ≤0.05 was considered statistically significant.

**RESULTS**

Out of 70 patients who underwent laparoscopic appendectomy, 49(70.0%) were males and 21(30.0%) were females, with a male-to-female ratio of 2.3:1. The age range was between 18 and 60 years, of which 39(55.71%) patients were between 18 and 40 years old, with a mean age of 37.57±7.71 years. The overall mean weight of the patients was 65.29±12.14 kg; height was 1.71±0.12 metres; and BMI was 24.96±5.23 kg/m<sup>2</sup>, respectively. Table-I shows the baseline characteristics of the patients. In 16(45.71%) patients whose meso-appendix was closed with a Titanium clip and in 7(20.0%) patients whose meso-appendix was ligated with Monopolar diathermy, the surgery took longer than 60 minutes (p-value=0.022).

Table-I: Baseline Characteristics of the Patients (n=70)

Characteristics	Value
<b>Gender n (%age)</b>	
Male	49(70.0%)
Female	21(30.0%)
Age (years±SD)	37.57±7.71
Weight (Kg±SD)	65.29±12.14
Height (meters±SD)	1.71±0.12
BMI (Kg/m <sup>2</sup> ±SD)	24.96±5.23

In 35 cases (100%) where the meso-appendix was closed with a Titanium clip and in 35 cases (100% of the cases where the meso-appendix was ligated with Monopolar diathermy), the cost was more than

Rs.32,000 (Table-II). Table III shows the operative time association in both groups with respect to age and gender.

**Table-II: Comparison of Outcome in Study Groups (n=70)**

Outcome	Group-A (n=35)	Group-B (n=35)	p-value
<b>Operative time</b>			
<60 min	19(54.29%)	28(80.0%)	0.022
>60min	16(45.71%)	07(20.0%)	
<b>Cost</b>			
>Rs.32000	35(100%)	00(0%)	0.0001
<Rs. 30000	00 (0%)	35(100.0%)	

value=0.022). Cost was observed in 26 patients (74.29%) following mesoappendix closure with a Titanium clip, and in 00 patients (0.0%) following mesoappendix ligation with Monopolar diathermy (p-value=0.0001).

A study in Iraq that looked at different ways to close the appendicular stump and mesoappendix showed that there were big differences between the two Groups of people who had laparoscopic appendectomy in terms of complications during and after the surgery, as well as the length and cost of the

**Table-III: Association of Prolonged Operative Time with Respect to Age and Gender (n=70)**

Variables	Group A (n=35)		Group B (n=35)		p-value	
	operative time		operative time			
	>60min	<60min	>60min	<60min		
Age Groups (Years)	18-40	10 (50%)	10(50%)	05(26%)	14(73.6%)	0.129
	41-60	06(40%)	09(60%)	02(12.5%)	14(87.5%)	0.080
Gender	Male	11(44%)	14(56%)	04(16.6%)	20(83.3%)	0.038
	Female	05(50%)	05(50%)	03(27.27%)	08(72.7%)	0.284

## DISCUSSION

Laparoscopic appendectomy is now recommended as the treatment of choice for women, the elderly, and obese patients. Closure of the mesoappendix and appendicular stump is an important and critical step that is associated with major post-operative complications.<sup>11-12</sup> In the literature, different methods for ligation of mesoappendices have been described and studied. Some of the methods available for ligating the appendix's base are expensive, while others are technically demanding, including clipping and ligation.<sup>14,15</sup> Different types of clips are available that can be used safely. The most commonly used are Titanium clips and absorbable polymer clips. However, one disadvantage of clips is that they cannot be used in cases of intense inflammation of the appendix's base. Which method has a better prognostic value is still debatable.<sup>16-18</sup> However, the ideal method of mesoappendix closure should be simple, cost-effective, and easily accessible.

The main goal of our study was to find out if using different mesoappendix closure methods, such as Titanium clips and Monopolar diathermy, made a difference in how well patients did and how much the surgery cost and how long it took. In our study, the length of the surgery was longer in 16 patients (45.71%) who had the mesoappendix closed with a Titanium clip and in 7 patients (20.0%) who had the mesoappendix ligated with Monopolar diathermy (p-

procedure. In one Group, mesoappendix closure was done with Monopolar diathermy, while in the other Group, Titanium clips were used for mesoappendix closure<sup>19</sup>. Their findings showed that patients whose mesoappendix ligation was performed with Monopolar diathermy had a shorter operation duration, a lower cost, and a lower incidence of intraoperative bleeding.

A similar study was carried out in a tertiary care hospital in Rawalpindi Pakistan, in which they compared Monopolar diathermy and harmonic scalpel for closure of the mesoappendix in laparoscopic appendectomy<sup>20</sup>. They conclude that both techniques are equally effective for closing the mesoappendix. There was no statistical difference in terms of procedure time or blood loss in both Groups.

In a country like Pakistan, where most of the patients are of low socioeconomic status, using Monopolar diathermy for the closure of the mesoappendix would reduce the overall cost of the procedure. All efforts were made to ensure that the data collected was reliable; however, we did not take into account the effect of mesoappendix closure on primary outcomes like intraoperative and postoperative complications, which would further strengthen our findings.

## LIMITATIONS OF STUDY

In cases of complicated appendicitis, we had to convert to an open appendectomy due to the fragile base of the appendix to ensure safe stump closure.

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We extend our gratitude to all of the patients and their families.

### CONCLUSION

This study concluded that Monopolar diathermy for the closure of the mesoappendix is better in terms of operating time and cost as compared to the use of Titanium clips.

**Conflict of Interest:** None.

### Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

SA, TMF: Conception, Study design, Data Collection, drafting manuscript and approval of final version to be published

MH, MY: Design of Study, data analysis, critical review and approval of final version to be published.

GJ & TM: Data analysis and interpretation, critical review and approval of final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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