

POLYMERIC CLIP VERSUS ENDOLOOP FOR STUMP CLOSURE IN LAPAROSCOPIC APPENDICECTOMY-A RANDOMISED CONTROL TRIAL

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ABSTRACT

Objectives:: In laparoscopic appendicectomy, stump closure can be done by various methods such as endoloop, extracorporeal knots, intracorporeal ligatures, and gastrointestinal staplers. Polymeric clip was used in several studies in the closure of appendicular stump because of its lower cost and easy implementation.

The purpose of this study is to investigate the safety, usefulness, and cost-effectiveness of polymeric clips versus endoloop in laparoscopic appendicectomy.

Methods: We conducted a single blinded randomized controlled study on 100 patients of laparoscopic appendicectomy and divided them patients randomly into two groups (50 each) on the basis of technique used for stump closure (polymeric clip and endoloop).

Results: On comparing the two matched groups we found there was a significant reduction in cost (35.36 ± 3.29 vs. 39.56 ± 3.12 , respectively, $*p < 0.05$) and operative time (909.00 ± 63.64 vs. 1164.00 ± 70.54 , respectively, $*p = 0.05$) in the group of polymeric clip as compared to endoloop. Although the post-operative complications and length of hospital stay were comparable in both the groups.

Conclusion: Polymeric clip is not only a cost-effective option for patients but also a time-saving alternative for surgeons, while maintaining equally safe surgical outcomes when compared to endoloops.

Keywords: Polymeric clip, Endo-Loop, Laparoscopic appendicectomy.

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INTRODUCTION

Acute appendicitis is the most common indication for emergency abdominal surgery with a lifetime incidence of 8 – 16%. Laparoscopic appendicectomy is now widely accepted as a treatment of choice for surgical management of acute appendicitis [1].

The proper closure of the stump after appendicectomy is the most crucial step in preventing problems such as appendiceal stump leakage, peritonitis, sepsis, and enterocutaneous fistula that may arise in the post-operative period [2]. Among these stump closure techniques are endoloop, non-absorbable polymeric clips, titanium clips, extracorporeal knots, intracorporeal ligatures, gastrointestinal staplers, ligasure system, harmonic scalpel, and bipolar coagulation [3,4]. The best appendiceal stump closure technique should be accessible, affordable, safe, and easy to use [5] Endoloop is the most commonly employed method of appendiceal stump closure [6]. Its application can be considered technically demanding and may require brief training. The polymeric clip, first introduced in 1999, is a non-absorbable clip with a lock engagement feature and teeth in the jaws that provide good security. These clips are frequently used to ligate the renal hilum vessels during minimally invasive nephrectomy, as well as for other laparoscopic procedures [7].

In recent times, the polymeric clip is implemented in several studies in the closure of appendicular stump due to its lower cost and easy implementation. The purpose of this study is to investigate the safety, usefulness, and cost-effectiveness of polymeric clips in laparoscopic appendicectomy.

METHODS

After obtaining approval from the Institutional Research Ethics Committee, we conducted a single-blinded randomized controlled study, in which, all the patients (n=100) in whom we performed laparoscopic appendicectomy were included. Patients having an unhealthy base of appendix (ruptured/wide/necrosed) were excluded from the study.

After thorough clinical examination and necessary investigations, patients were admitted and randomly assigned into two groups (n=50 in each group), that is, Group A (Polymeric clips) and Group B (Endoloop). Following this, we collected all the relevant data including given treatment in the hospital (intravenous fluids, antibiotics, and analgesics), operation notes/finding, operative timing, intra/post-operative complications, duration of hospital stay, and number of polymeric clip(s)/endoloop(s) used with cost in INR (Indian Rupees). Moreover, after that, we finally assessed the patient on follow-up.

RESULTS

In our study male: female ratio in both the groups was around 3:1 and most of them were young adults within 40 years of age. As far as pathological evaluation is concerned we compared total leucocyte counts (TLC), C-reactive protein (CRP), and diameter of the appendix on ultrasonography/computed tomography scan. On comparing the patient factors (Age, TLC, CRP, diameter of appendix), the result was found to be non-significant as depicted in the table (Table 1).

On comparing the operative factors (operative time, total cost, post-operative pain, and length of hospital stay), there is a significant

Table 1: Comparison of Patient Factors in polymeric group versus endoloop group, that is, Age, TLC, CRP, and Diameter of appendix as per ultrasonography/computed tomography

Patient factors	Polymeric clip (Mean±SD)	Endo-Loop (Mean±SD)	p-value	Result
Age (years)	30.68±12.18	29.00±13.53	0.52	Not Significant
TLC (per mm ³)	17190.00±3387.21	17066.62±2769.37	0.84	Not Significant
CRP (mg/dL)	16.48±3.43	17.26±3.02	0.23	Not Significant
Diameter of appendix (mm)	6.85±0.54	6.85±0.54	1	Not Significant

SD: Standard deviation, TLC: Total leucocyte counts, CRP: C-reactive protein

Table 2: Comparison of means of operative factors in polymeric group versus endoloop group i.e., Operative time (min), total cost (INR), post-operative pain (VAS score), and length of stay (days)

Operative factors	Polymeric clip (Mean±SD)	Endo-loop (Mean±SD)	p-value	Result
Operative time (min)	35.36±3.29	39.56±3.12	0.02	Significant
Total cost (rupees)	909.00±63.64	1164.00±70.54	0.05	Significant
Post-operative pain (VAS Score)	2.02±0.80	2.00±0.83	0.56	Not Significant
Length of hospital stay (days)	2.86±0.61	2.88±0.59	0.87	Not Significant

SD: Standard deviation

difference in operative time and total cost while post-operative pain and length of hospital stay remained non-significant as depicted in the table (Table 2). The mean operative time in the polymeric group was 35.36±3.29 min versus 39.56±3.12 in endoloop group which was significant (*p=0.02). Even the mean cost in INR of polymeric group per case was 909.00±63.64 versus 1164.00±70.54 in endoloop group. There were no intraoperative complications, that is, vascular or bowel injury in either group. Even post-operative complications such as hematoma, surgical site infection (SSI), stump slippage, and pyoperitoneum, were not reported cases in both the groups. However, 10% of total patients in both groups had delayed bowel movements which were managed conservatively.

DISCUSSION

This study was conducted to compare the polymeric clip versus endoloop for stump closure in laparoscopic appendicectomy and examines the effectiveness, safety, and economics of two techniques – polymeric clip and endoloops – that are used to close the appendiceal stump during laparoscopic appendicectomy.

In our study, as far as patient factors are present, we have compared demographic and pathophysiological factors in both groups. The mean age for polymeric clip was 31±12.18 years, and for endoloop, it was 29±13.53 years. The p=0.52 indicates that there is no significant difference in age between the two groups. The gender distribution appears fairly balanced between the two methods, with male patients being the majority in both groups.

On comparing TLC and CRP in both the groups, it was found that both groups had a similar distribution of TLC and CRP, with increased levels suggesting acute inflammation. In polymeric clip group, mean TLC was 18190±3387.21 and for endoloop, it was 17067±2769.37. The p value was not significant between the two group (p=0.84). Similarly, CRP was also found to be comparable with mean CRP for polymeric clip group being 16±3.43 & for endoloop 17±3.02 with p=0.23 (non-significant).

The mean diameter of the appendix for polymeric clip was 6.85±1.58 mm and for endoloop it was 6.97±2.15 mm. The difference in diameter of appendix in both the groups was found to be non-significant with p=0.02. These findings indicate a uniform distribution of appendiceal diameters between the polymeric clip and endoloop methods.

The average cost per case calculated in polymeric clip was found to be Rs. 1350 whereas in the case of endoloop average cost per case was found to be Rs. 1746. Clearly, polymeric clip group appears more cost-effective in our study and there is a significant difference in total cost between the two groups. Wilson *et al.* 2018 [1] conducted a similar

study including a total of 125 patients, with 78 within the endoloop group and 47 in the polymeric clip group. The use of polymeric clip cost £21 compared with £49 for endoloops per operation and concluded that polymeric clips are economical method for securing the appendiceal stump during laparoscopic appendicectomy.

In our study, we also compared intraoperative complications between polymeric clip and endoloop, and none of the patients experienced any vascular or bowel injuries during the procedures. This indicates a high level of safety for both surgical methods, with no reported complications related to these specific intraoperative risks. Similarly, a study by Varghese *et al.* 2018 [3] included 20 patients, 13 men and 7 women. They compared safety of endoloop versus polymeric clip and they also did not encounter any intraoperative complications.

The mean operative time in our study for polymeric clip was 35±3.29 min and for endo-loop, it was 41±3.12 min. The p=0.02 indicates that there is a significant difference in operative time between the two groups, with the group of polymeric clip taking significantly less time. The decreased operative time can be contributed to ease of application in polymeric clip device. Furthermore, as a laparoscopic surgeon, we are more used to endoclips as compared to endoloops in other procedures. As far as post-operative pain score is concerned, there was no significant difference in post-operative pain levels between the two groups. For hematoma, SSI, and slippage, there were no reported cases in either polymeric clip or endoloop groups. About 10% of patients in both polymeric clip and endoloop groups experienced post-operative ileus as a complication. The findings in our study indicate that the incidence of post-operative complications is equally low in both procedures. Ureyen *et al.* 2020 [8] conducted a similar study in which there was no significant difference between the groups concerning pre-operative and post-operative complications (p>0.05).

The mean length of hospital stay for polymeric clip was 3±0.61 days, and for endoloop, it was 3±0.59 days. The p=0.87 indicates that there is no significant difference in the length of hospital stay between the two groups.

CONCLUSION

The findings of this study demonstrate that polymeric clip is not only a cost-effective option for patients but also a time-saving alternative for surgeons while maintaining equally safe surgical outcomes when compared to endoloops. These results highlight the potential benefits of using polymeric clip in surgical procedures, providing both economic advantages for patients and efficiency for healthcare providers. Further research and exploration in this area may help validate and expand upon these findings, ultimately contributing to improved practices and outcomes in the field of surgery.

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