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**Original Research Article**

# Ligation versus clipping of the appendicular stump in laparoscopic appendectomy: an ongoing predicament

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## ABSTRACT

**Background:** Appendectomy being one of the common surgical emergencies performed either laparoscopically or by open approach. As laparoscopy is replacing open appendectomies with rapid pace, closure of appendix stump base remains a debatable aspect of surgery.
**Methods:** All the patients fulfilling inclusion criteria of acute appendicitis undergoing laparoscopic appendectomy. Stump of the appendix after appendectomy was closed either by ligation or Titanium clip.
**Results:** Both the groups were comparable in terms of demographic details. Operating time in the clip group was much less averaging 35.62±8.3 (25-70 mins.) as compared to ligation group which was 46.32±7.8 (35-90 mins.) and which was statistically significant. Illeus being most common post operative complications observed in both the group and was non-significant. One patient in ligation group developed fistula which led to the prolonged hospital stay and readmission but was managed conservatively. Both the groups were comparable in terms of length of hospital stay.
**Conclusions:** Closure of appendicular stump using titanium clip is an easy, cheap, readily available and reliable option.

**Keywords:** Appendicular base, Clipping, Laparoscopic appendectomy, Ligation

## INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies encountered in surgical and emergency department requiring admission and surgery.[1] Most common presenting complaint being right iliac fossa pain; but several diseases, such as pelvic, inflammatory disease, endometriosis, ovarian cysts, ectopic pregnancy, acute cholecystitis and colonic perforation may mimic acute appendicitis, so proper imaging is mandatory in diagnosis of acute appendicitis.[2] After the first laparoscopic appendectomy done by gynecologist, Kurt Semm in 1982 procedure of surgery remains more or less the same; except improvement in the visual aspect and more precise instruments.[3] While laparoscopic appendectomy surgery is considered the optimal method for appendectomy, the best techniques for closing the base of appendix remains debatable, with various technique used to secure the appendiceal stump. Despite numerous studies, there is no global consensus on any specific method recommended in the literature. Modality of closure of the appendicular stump depends on condition of the base of appendix, available resources and surgical skills.

Different available options being, use of stapler, Endo loops, intracorporeal suturing and clipping.[4] There is no clear-cut consensus regarding when to use which method for closer; at one end, using a stapler is a costly affair and at another end, cheap and cost-effective ligation method is available, but it requires surgical expertise.[5] Therefore, this study was designed to compare between two methods

of appendicular stump closure using laparoscopic clipping and intracorporeal suturing in laparoscopic appendectomy.

## METHODS

This study was conducted in the Department of general surgery in a tertiary care centre, SRMS-IMS, Bareilly, UP, India from June 2023 to June 2025.

This was prospective randomized study. Randomization was done on the basis of computer-generated software for randomization. After the ethical clearance, patients were enrolled for the study. This study was conducted on 60 patients diagnosed with acute appendicitis who fulfilled the inclusion criteria. Sample size was not determined prior to conduction of study, as it was time bound study, hence all the patients who fulfilled the inclusion criteria in the study period (02 years) and got surgical (Laparoscopic Appendectomy) treatment they all were included.

### *Inclusion criteria*

All cases of acute appendicitis subjected to laparoscopic appendectomy falling in the age group between 12 to 70 years.

### *Exclusion criteria*

Patients in whom laparoscopic appendectomy has to be converted to open procedure. Appendicular mass was diagnosed preoperatively either clinically or by radiological means. The patient was randomly allocated in two groups.

A ligation group where appendicular stump after laparoscopic appendectomy, was closed by intra corporeal ligation using non-absorbable silk suture. A clip group where appendicular stump after laparoscopic appendectomy was closed by the application of titanium clips.

### *Technique of laparoscopic appendectomy*

That patient, who fulfilled the inclusion criteria were subjected to laparoscopic appendectomy. Type of anaesthesia depend on patient fitness either for general anaesthesia or spinal anaesthesia. The patient was placed in supine with 15° Trendelenburg position (head low) with right side up tilt and both the hand tucked by the side.

Monitor was placed on the right side near the pelvis of the patient. Operating Surgeon stood on the left side of the patient and the camera person on the right-hand side of the operating surgeon, near the head end of the patient. After painting and draping, pneumoperitoneum was created using veress needle. Intra-abdominal pressure was set to be 14 mm hg. First 10 mm camera port was placed in the umbilical region, depending on the size of abdomen. Second 5 mm working port was placed in between camera port and pubic symphysis. After insertion of the ports, a quick diagnostic laparoscopy was performed on the routine basis to confirm our diagnosis and to look for any other alternative pathology; at the same time position of the appendix and base of the appendix is identified and thereafter 10 mm port is placed according to the base of appendix in the right illiac fossa

The surgeon left hand holds the Babcock grasper to retract the appendix, so that mesoappendix is exposed. With the help of Maryland forceps in the right-hand window is created in the mesoappendix near the base of appendix and appendicular artery is either clipped or ligated. Once artery has been taken care of, base of the appendix is either clipped or ligated.

After transection of the appendix remaining stump, mucosa was cauterized. The appendix was pulled out from the right illiac fossa port site. Retrieval of the specimen in the retrieval bag and irrigation was optional depending on the contamination. Drain was placed at the operating site always as a safer option. Ports were removed under direct vision and closed with polyamide suture 2-0.

### *Data collection*

All the data was recorded, tabulated and statistics was applied using SPSS software version 22.

## RESULTS

In this study, 60, patient of appendectomy was operated, 30 in each group. Ligation group consisted of 13 male and 17 female patients ranging in the age group of 12 to 40 years with mean age being 27+7.11 years (Table 1). Clip group consisted of 15 male and 15 female patients ranging from 14 years to 42 years with mean age of 25.3+8.11 years (Table 1).

In intraoperative findings in ligation group thirteen patient had pus/ infective collection present at the time of surgery rest seventeen had either normal, looking or inflamed appendix. All those thirteen patients had oedematous base (Table 2). In clip group nineteen, patient had normal looking/ inflamed, appendix without any collection, rest eleven had pus / infective collection either in the right illiac fossa or pelvis and had oedematous base (Table 2).

Operating time was more in ligation group, because of intra corporeal knotting / suturing of the base, ranging from 35 minutes to 90 minutes. As compared to clip group where operating time was curtailed by using clip in the meso appendix and base of the appendix, ranging from 25 to 70 minutes (Table 2). In ligation group patient, one patient had pelvic collection in post-operative period which was managed conservatively on antibiotics

but lead to increased hospital stay in that patient and re-admission (Table 3, 4). In clip group, none of the patient developed any complication. In both the groups, post operative illeus was the major complication which led to the apprehension to the patient and ultimately prolonged hospitalization (Table 3). Histopathological analysis of ligation group reported 13 patients had gangrenous appendix, three had normal appendix, whereas seven had catarrhal and seven had suppurative as histopathology report. In clip group, four patients had normal, eleven had gangrenous, eight had catarrhal and seven had suppurative histopathology (Table 5).

**Table 1: Demographic details.**

| | | Ligation group (n=30) | Clip group (n=30) | P value | Significant/ not significant |
|---|---|---|---|---|---|
| **Age** | Mean±SD | 27.0±7.11 | 25.3±8.11 | 0.39 | Not significant |
| | Range | 12-40 | 14-42 | | |
| **Sex** | Male | 13 (43.33%) | 15 (50%) | 0.82 | Not significant |
| | Female | 17 (56.66%) | 15 (50%) | | |

**Table 2: Intra operative findings.**

| | | Ligation group (n=30) | Clip group (n=30) | P value | Significant/ not significant |
|---|---|---|---|---|---|
| **Diagnostic Laparoscopic findings** | Acute inflammation | 17 (56.66%) | 19 (63.33%) | 0.84 | Not significant |
| | Pus collection | 13 (43.33%) | 11 (36.66%) | | |
| **Condition of the base** | Normal | 15 (50 %) | 17 (56.66%) | 0.83 | Not significant |
| | Oedematous | 15 (50%) | 13 (43.33 %) | | |
| **Operating time (mins)** | Mean±SD | 46.32±7.8 | 35.62±8.3 | 0.0001 | Significant |
| | Range | 35-90 | 25-70 | | |

**Table 3: Complications.**

| | | Ligation group (n=30) | Clip group (n=30) | P value | Significant/ not significant |
|---|---|---|---|---|---|
| **Illeus** | Present | 25 | 25 | 1 | Not significant |
| | Absent | 05 | 05 | | |
| **Bowel injury** | Present | 0 | 0 | 0 | Not significant |
| | Absent | 30 | 30 | | |
| **Pelvic abscess** | Present | 01 | 0 | 0.5 | Not significant |
| | Absent | 29 | 30 | | |
| **Port site infection** | Present | 02 | 01 | 0.75 | Not significant |
| | Absent | 28 | 29 | | |
| **Fistula formation** | Present | 01 | 0 | 0.5 | Not significant |
| | Absent | 29 | 30 | | |
| **Readmission** | Present | 01 | 0 | 0.58 | Not significant |
| | Absent | 29 | 30 | | |

**Table 4: Hospital stays.**

| | | Ligation group (n=30) | Clip group (n=30) | P value | Significant/ not significant |
|---|---|---|---|---|---|
| **Hospital stay (hours)** | Mean±SD | 48±9.3 | 50±8.3 | 0.38 | Not significant |
| | Range | 26-120 | 28-96 | | |

**Table 5: Histopathology report.**

| | Ligation group (n=30) | Clip group (n=30) | P value | Significant/not significant |
|---|---|---|---|---|
| **Normal** | 03 | 04 | 0.83 | Not significant |
| **Suppurative** | 07 | 07 | 1 | Not significant |
| **Catarrhal** | 07 | 08 | 0.8 | Not significant |
| **Gangrenous** | 13 | 11 | 0.8 | Not significant |

## DISCUSSION

Open appendectomy used to be the gold standard treatment for appendicitis in the past, but with the advent of laparoscopic surgery, it has significantly replaced it as has better outcomes in terms of aesthetic, lesser hospitalization and less post-operative complications.[6-8] Success lies in timely interval, meticulous dissection and using armamentarium judiciously. In appendectomy Meticulous closer of appendix base had an impact on the post operative results. For the appendicular stump closure various techniques are available such as knots (intracorporeal/ extracorporeal/ loops), clips (titanium/ hemlocks) and staplers.[9] In this study, we compared intracorporeal knotting with clipping using titanium clips. All the surgeries were conducted in the same institute at a stretch of two years period with the single experienced laparoscopic surgeon. Among both the groups, there were no statistically significant difference in terms of age, sex intra -operative findings and histopathological findings. In the present study, the operating time was more for ligation group patients because of intracorporeal suturing/knotting of appendicular artery and appendicular base, while it was significantly less in clip group because of simplicity of clip usage.

Similar results were observed from the previous studies.[5,10] Although we have not used endo loops in our studies, but it is authors assumption that although endo loops are lesser time consuming, but still, they will be more time consuming as compare to clip application. Further, more in a meta-analysis and systematic review conducted by Shaikh et al in 2015, it was found that endo loops take more time as compare to endo clips.[11] In terms of complications, there were no complication in the clip group, whereas one patient in ligation group had post operative pelvic collection, which ultimately led to fistula formation, which lead to re-admission, but was managed conservatively as controlled fistula and complete recovery took place in two weeks. No need of pus aspiration /re-exploration. Rest, both the group had illeus as a major complication, but it subsides by its own.

In term of length of hospital, stay, although patient was eligible for discharge in 24 hours of surgery from Surgeon point of view, but none of the patient opted because of various reasons like post-operative pain, not passed stool and flatus, long distance from medical facilities and some religious taboo/ believes. Although reasons were more or less, same in both the groups there was lesser mean hospital stay in clip group, but it came out to be statistically insignificant. These results were in coherence with previous studies conducted by various authors Cloak et al, Sheikh et al and Gonene et al.[11-13]

There seems to be small sample size, to draw a significant scientific conclusion, thus more robust data is required in future, so as to arrive at a consolidated statement.

## CONCLUSION

Closure of appendicular stump using titanium clip is an easy, cheap, readily available and reliable option. This option will be of great help for those who are new in this laparoscopic field and are lagging in terms of expertise. It might be considered as an alternative or bail out procedure for experts when appendicular stump is not amenable for knotting.

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