

**TITLE :****KNOTS VERSUS ENDOCLIPS FOR STUMP CLOSURE IN  
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## **ABSTRACT**

**Background** : Closure of the appendiceal stump post laparoscopic appendectomy is of great concern. Different techniques are being used, commonly endoclips and knots.

**Aim of work** : Comparing titanium endoclips with intracorporeal polyglactin knots in closure of the appendiceal stump during laparoscopic appendectomy

**Patients and Methods** : Randomized prospective single blind study included 50 patients with acute non complicated appendicitis underwent laparoscopic appendectomy. The stumps were closed using titanium endoclips in 25 patients (group I) and by polyglactin intracorporeal knotting in 25 patients (group II).

**Results** : There are no differences between both methods regarding intra-operative or post operative complications. Moreover, operative time was longer in the knot group but not affecting the outcome.

**Conclusion** : Titanium endoclips are safe for closure of the appendiceal stump with shorter operative time, and easier procedure as well. So it can be a reliable alternative to knot-tying for appendiceal stump closure

## **KEYWORDS**

Laparoscopic appendectomy , Appendiceal stump , Titanium endoclip, knotting , intracorporeal

## **INTRODUCTION**

Laparoscopic appendectomy is increasingly performed by a significant number of surgeons due to its advantages over open surgery. It allows for shorter hospital stay with early return to work, better cosmetic results, less post operative pain and can be of great value in diagnosing the cause of the abdominal pain in query cases especially in females during reproductive period, older patients with suspected malignancy and morbidly obese patients requiring larger incisions.[1,2,3] It also seems to be of a little value in thin adult male patients with a clear diagnosis. [4]

Closure of the appendiceal stump is a crucial point in the procedure as it allows for a smooth post operative recovery and without developing infectious complications.[5]

The appendix stump closure can be performed using pre-knotted loops, linear staplers, ultrasonically activated scalpel, instrument-assisted knotting, bipolar coagulation, slip-knot tying, metal clip and hem-o-lok polymeric clip. However, till now, there is no definite consensus about the best method for the stump closure.[2,5]

### **AIM OF WORK :**

Comparing two techniques of appendiceal stump closure during laparoscopic appendectomy; titanium endoclip and knot tying polyglactin suture, regarding technical feasibility and complications.

## **PATIENTS AND METHODS :**

**Study design:** This was a randomized prospective single blind study study conducted in Cairo University hospitals and Omm El-Mesrieen hospital in the period between October 2012 and October 2014 after approval from the institutional review board and obtaining informed consent from all patients including approval of protocol of treatment.

**Patients :** 50 patients with acute non complicated appendicitis underwent laparoscopic appendectomy. They were divided into two groups according to the technique used to close the appendiceal stump. 25 patients (group I) closed using the titanium endoclip and 25 patients (group II) by using knot-tying (polyglactin) suture.

### **Inclusion criteria:**

Male and female patients, above 18 years, symptomatic acute appendicitis, reasonable good health according to American Society of Anaesthesiologists (ASA) classification (ASA I or II).

### **Exclusion criteria:**

Acute complicated appendicitis (gangrenous, perforated, generalized peritonitis), pregnant female patients, moderate to severe systemic disease (ASAIII and higher), known cirrhosis of the liver, coagulopathy, patients with severe chronic obstructive pulmonary disease, history of abdominal malignancy, morbid obesity, previous lower abdominal or pelvic surgery.

Preoperative patient data were collected. History taking and full clinical examination were done. Routine investigations prior to the surgery were done as CBC, coagulation profile, liver and kidney functions and abdominal U/S. All patients received intravenous antibiotics in form of 3<sup>rd</sup> generation cephalosporin ceftriaxone.

General anesthesia was administered with orotracheal intubation then patient was placed in the supine position in a 15° Trendelenburg position with both arms tucked. The table was tilted lifting its right side. With the operating surgeon standing on the left side of the patient, and the assistant stood on the surgeon's right side. The monitor was on the patient's right side.

### **Surgical technique :**

Pneumoperitoneum pressure of 15mm Hg was established by CO<sub>2</sub>, with Veress needle introduced through the umbilicus. A low flow rate was used initially to avoid gas embolism or vagal stimulation from sudden stretching of the peritoneum, increased tympany in all four quadrants was confirmed.

Positioning of the ports : The 5-mm camera port is inserted through the supra umbilical incision. Placement of the other two working ports was done under vision, at the midline just three fingers above the pubic bone (5-mm) and a 10-mm trocar at the left lower quadrant.

After insertion of the ports, a diagnostic laparoscopy was performed focusing on the pelvis in order to confirm the diagnosis.

The appendix was grasped with endograspers, Harmonic scalpel was used for the mesoappendix dissection.

**For the knot-tying group**, the appendicular base was secured using 2/0 polyglactin (Vicryl Suture Ethicon Ltd, Edinburg, Great Britain) after being encircled with the vicryl by the two working ports. The appendix was then divided between two proximal and one distal knots using endoscopic scissors.

**For the titanium endoclip group**, the appendicular base was divided between two proximal and one distal 9- or 11-mm titanium endoclips (according to stump diameter) ; placed by a laparoscopic clip applier (if we had to use a 11-mm endoclip, we replaced the 10-mm trocar with a 12-mm one).

The operative field was examined for haemostasis. The appendix was retrieved through the left iliac fossa port and withdrawn with the whole port or was placed in an impermeable retrieval bag before its removal. Suction and irrigation was performed using normal saline if the field was contaminated.

Trocars were removed under direct vision ensuring no port site bleeding. The 10-mm port site was closed with 0-Vicryl fascial suture. Skin clips were used to reapproximate the skin. The specimen was sent for pathology for assessing pathological diagnosis

### **Post operative care:**

Patients stayed in the hospital for at least one night after surgery. Patients were given oral fluids once intestinal motility regained the followed by semisolids and soft diet as tolerated then the patients were discharged on the

next morning if afebrile, with audible bowel sounds and were able to tolerate a soft diet and oral analgesia. The skin clips were removed between postoperative days 7 and 10.

### **Outcome Assessment:**

The two groups were assessed regarding:

#### **Operative feasibility :**

Intraoperative findings (acute non complicated appendicitis, adhesions, peritoneal fluid, associated pathology and its management), operative time (from skin incision to wound closure), technical difficulties encountered, intraoperative complications and conversion to open procedure.

#### **Post operative course :**

Postoperative ileus and bowel movement, wound infection, intraperitoneal collection and length of hospital stay.

Data were statistically described in terms of mean  $\pm$  standard deviation ( $\pm$  SD), median and range, or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was done using Student *t* test for independent samples. For comparing categorical data, Chi square ( $\chi^2$ ) test was performed. Exact test was used instead when the expected frequency is less than 5. *p* values less than 0.05 was considered statistically significant. All statistical calculations were done using computer program SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) release 15 for Microsoft Windows (2006).

**RESULTS :**

Laparoscopic appendectomy procedure was performed in 50 patients. Stump closure was done using titanium endoclips (group A, 25 patients) or intra-corporeal knot-tying by vicryl 2/0 (group B, 25 patients).

Group A involved 13 males and 12 females with mean age  $30.96 \pm 8.556$  years, while group B involved 13 females and 12 males with mean age  $26.92 \pm 7.141$  years. No statistically significant differences between both groups regarding age, sex distribution, total leucocytic count or intra-operative findings and histological types of the appendix (p value > 0.05). (Table 1)

Longer operative time was taken to perform the intra-corporeal knots than applying metal clips which had a statistically significant difference between the two groups (p 0.044). No technical difficulties were encountered during the procedure in both groups with no impact on the surgeon's comfort. Also, No laparoscopic procedure was converted to open.

**Table (1) : Basic characteristics and features of the studied cases**

<b>Features</b>	<b>Group A (clip)</b>	<b>Group B (knot)</b>	<b>P value*</b>
No. of cases	25	25	
Male n(%)/Female n(%)	13(52%)/12(48%)	12(48%)/13(52%)	1.000 (NS) **
Age range (mean±SD) (y)	18-46 (30.96±8.556)	18-41 (26.92±7.141)	0.076 (NS) **
TLC range(mean±SD) ( $\times 10^3/\mu\text{l}$ )	6-7 (11.316±3.229)	6.5-17 (11.492±3.097)	0.845 (NS) **
Histological types & operative findings n(%)			
Catarrhal	10 (40%)	14 (56%)	0.325
Suppurative	10 (40%)	7 (28%)	(NS) **
Adhesions	2 (8%)	2 (8%)	
Negative	3 (12%)	2 (8%)	

\* $p < 0.05 = \text{significant}$     \*\*NS = not significant.

Intra-operative complications were encountered in six cases; three cases of each group. One case of them was in group A with bleeding from the mesoappendix (110 cc) that necessitated applying a clip over it while in the rest of cases, there was minimal bleeding from port sites but were less than 30 cc and stopped by cauterization with non-significant p value. (Table 2)

Post operative fever (37.7-38.1°C) occurred in six cases; three in each group. It lasted for less than 24 hours and subsided. Recurrent attacks of

vomiting was happened in one case of group A and was soon spontaneously resolved after starting bowel movement while persistent abdominal pain was encountered in one case from the group B (knot group) due to the presence of pelvic collection which was aspirated under sonographic guidance then the patient was improved and discharged after seven days of admission. Moreover, no cases complicated by wound infection. No statistically significant differences between both groups regarding post operative outcome and complications.

**Table 2 :** Intra-operative and post-operative outcome and complications

Outcomes		Group A (clip)	Group B (knot)	P value*
Intra-operative	Operative time Range(mean±SD) min	35-70 (50±10.508)	45-90 (57.2±13.85)	0.044 (S)**
	Complications n(%)	3 (12%)	3 (12%)	0.549 (NS)***
Post-operative	Fever n(%)	3 (12%)	3 (12%)	0.666 (NS)***
	Bowel complications n(%)	1 (4%)	1 (4%)	0.368 (NS)***
	Hospital stay Range(mean±SD) day	1-2 (1.16±0.374)	1-7 (1.32±1.215)	0.532 (NS)***

\* $p < 0.05$ = significant \*\* S = significant \*\*\*NS = not significant.

## **DISCUSSION :**

Acute appendicitis is one of the commonest causes of acute abdominal pain requiring urgent surgery .[6] It accounts for more than 40% of all emergency laparotomies.[7]

Open appendectomy was considered the gold standard treatment but with the evolution of laparoscopy, it became a good alternative with better results regarding cosmetic appearance, hospital stay and post operative outcome and also a good diagnostic tool for doubtful cases.[8,9]

Being a crucial part in the procedure, closure of appendicular stump has many different techniques as knots, clips and stapling devices.[10,11]

In this study we compared intracorporeal knots with titanium endoclips in securing the appendicular stump, being the most economic and available variants in most of the hospitals with available laparoscopic sets in our hospitals.

This study was conducted on 50 patients with acute non complicated appendicitis, excluding cases with necrotic or gangrenous base that could not be clipped by endoclips thus keeping randomization in cases selection. They were classified randomly into two groups, group A (clip group) and group B (Knot group).

No statistically significant differences were detected between the groups in terms of distribution of age, sex, total leucocytic counts, histological type of the appendix and intra-operative findings.

In the present study, the operative time for the clip group patients was significantly shorter than the knot group which can be explained by the simplicity of clip application and also the technical time consuming knot tying technique using only two working ports.

Similarly, in many other studies, the mean operative time for the endoclip group was shorter than that for the knot-tying group [1,2,7,12], even if was compared with the readily made endoloop [13,14,15]

Also, in a meta-analysis and systematic review done by **Shaikh et al.** on 2015, it was found that, application of endoclips consumed less operative time than endoligatures [16]

In the current study, intra-operative complications were encountered in six patients, three in each group. Bleeding from appendicular artery was observed in one case of the clip group that required application of endoclip to stop bleeding while in the rest of cases, port site bleeding was encountered that stopped by applying the ultrasonic scalpel over them. Also, no cases were converted to open surgery in this study. No statistically significant differences between the two groups regarding intra-operative complications.

In the other similar studies, there was no reported intra-operative complication that was related significantly to the method of appendiceal stump closure. [2,12,13,14,15]

In this study, one patient developed persistent abdominal pain post operatively (4%), in the knot group, U/S showed mild pelvic collection which

was managed by U/S guided aspiration, and was discharged after one week. Another patient developed repeated vomiting (4%) - in the clip group – and was treated conservatively for one day with antiemetics and nil per mouth. Post operative fever was noted in three patients from each group. No statistically significant differences were detected between the groups in terms of postoperative complications ( $P>0.05$ ).

In the similar studies, in spite of the reported post operative complications, there was no significant relation between the occurrence of the complications and the technique used for stump closure. [2,12,13,14,15]

In this study, there was longer hospital stay in the knot group but with no statistical significance. This was consistent with the other similar studies of **Ates et al. (2012)**, **Gonenc et al. (2012)**, **Colak et al. (2013)**, **Delibegović (2012)**, **Akbiyik et al. (2011)** and **Shaikh et al. (2015)**.

Finally, all patients in this study had a very satisfactory cosmetic results.

## **CONCLUSION**

Both knot-tying sutures and titanium endoclips are safe methods for closure of appendiceal stump with satisfactory results despite longer operative time taken during intra-corporeal knotting but with no significant impact on the outcome, so endoclips may be recommended as a reliable alternative in the stump closure after more studies.

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