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### RESEARCH ARTICLE

#### APPENDICULAR STUMP CLOSURE USING HEM-O-LOK® CLIPS IN LAPAROSCOPIC APPENDECTOMY.

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#### Abstract

**Background:** Closure of the appendicular stump (CAS) is the most crucial part of appendectomy procedures because most of the complications occur by a leak of the stump. The aim of this clinical study is to evaluate Hem-o-lok® clip size XL [Teleflex Medical, Research Triangle Park, NC] for CAS regards operative time, complications and cost.

**Methods:** This is a prospective study of 20 patients had history of acute appendicitis operated upon by laparoscopic appendectomy using Hem-o-lok® clip for CAS in the Upper Gastrointestinal Surgery Unit, Alexandria Main University Hospital. Operative time, complication rate and cost were recorded.

**Results:** mean Operative time was  $49.8 \pm 11.04$ . No intraoperative complications were seen. There were no postoperative leak or intraabdominal collections. Only one patient had postoperative wound infection. The mean cost of the closure was \$50 for the Hem-o-lok clip group.

**Conclusions:** The use of Hem-o-lok clips for CAS in laparoscopic appendectomy is a feasible, safe, but cost-effective procedure in patients with a non-gangrenous appendix base regardless of the diameter.

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#### Introduction:-

Laparoscopic appendectomy (LA) has fewer wound infections, faster recovery, and an earlier return to work in comparison with open surgery.<sup>(1)</sup> Closure of the appendicular stump in laparoscopic appendectomy is the most critical part of the procedure. Inadequate closure can lead to intra-abdominal surgical site infection or life-threatening complications such as fistulas, peritonitis and sepsis. Various methods such as ligation using extracorporeal sliding knots, intracorporeal knotting, endostapling, endoloop or endoclips have been described and are currently in use for CAS in laparoscopic appendectomy (LA).<sup>(2)</sup> The use of Hem-o-lok clips, which are non-absorbable, polymer structures for ligation of vessels, ureters, and bile ducts, has been documented in many surgical procedures. Design of the applier eliminates possible fall out of the clip. There are variable sizes of the clip the largest of which is XL. The XL size clip was used (external clip length 17.33 mm, internal length 13.58 mm) for the closure of appendicular stump Fig.(1).<sup>(3)</sup>

**Aim of the work:-**

The aim of this prospective clinical study is to evaluate Hem-o-lok® clip size XL [Teleflex Medical, Research Triangle Park, NC] for CAS as regards operative time, complications rate and cost.

**Materials and Methods:-**

This prospective study was performed on 20 patients admitted to Alexandria University hospital with acute appendicitis candidates for LA and Hem-o-lok clip was used for CAS. There were no exclusion criteria besides the intraoperative finding of a gangrenous base.

All patients underwent three Trocar LA. Access to the peritoneum begins with a 12mm umbilical port. Two additional ports are placed under vision in the suprapubic region 5mm and left lower quadrant 10mm. In cases where a 5mm lens was available; a 5mm port was used in the left lower quadrant trocar. The mesoappendix was dissected using either monopolar electrocautery. we placed one Hem-o-lok clip for appendicular stump closure. Fig. (2,3)

Postoperatively, all the patients were assessed postoperatively as regards the length of postoperative hospital stay. Postoperative complications such as leak from appendicular stump, wound infection, port site hernia, incisional hernia, fecal fistula, intra-abdominal abscess. Follow up of all patients was performed using abdominal ultrasonography and white cell count on day 7 post operative to exclude leak from the appendix stump and intraabdominal abscesses. Upon suspicion of leak from appendicular stump, CT enterocolonography is ordered.

**Results:-**

The average age of patients was 27.5 years. The male/female ratio was 7/13. Average duration of the surgery was  $49.8 \pm 11.04$ . Among 20 patients included in our study, 4 patients (20%) presented with perforated appendix and the other 16 patients (80%) had acute appendicitis without perforation.

Drains were used in 3 patients to ensure proper intra-abdominal collection drainage. No intra-operative complications recorded.

Our results showed no postoperative intra-abdominal collection nor leak from appendicular stump. The only postoperative complication we faced was a single patient with wound infection. the cost of closure was \$50 for the Hem-o-lok clip since only a single clip is sufficient. Table (1)

**Table 1:-** Variables of Studied patients

Number of patients	20
Age	$27.4 \pm 7.9$
Gender (male/female)	7/13
number of cases of perforated appendix	4
Operative time	$49.8 \pm 11.04$
Diameter of appendix base	$9.55 \pm 1.57$
Post-operative complications	1 (wound infection)
Cost of closure	$50.0 \pm 0.0$



Fig. (1)



Fig. (2)

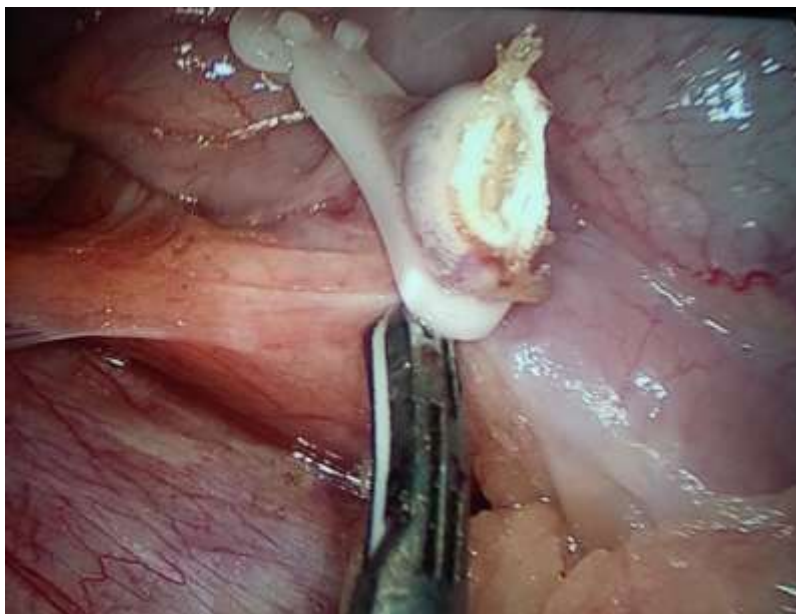


Fig. (3)

**Discussion:-**

Unlike laparoscopic cholecystectomy, Laparoscopic appendectomy has not yet evolved as the gold standard for the treatment of acute appendicitis.<sup>(4)</sup> The main reason is the difficulties encountered during the closure of the stump. CAS with endoclips is simple and does not necessitate special laparoscopic experience and so provides a significant reduction in operative time.<sup>(1)</sup>

Although the LA surgical technique has been well established, there are many different techniques within the procedure, including port positioning and the CAS.

Rickert et al.<sup>(5)</sup> reported that using a titanium clip is safe in comparison with other commercially available clips because of its size, which allows the closure of an appendix base greater than 10 mm. In contrast, a Hem-o-lok clip was used in our study without considering the diameter of the appendix base.

In another study, Hue et al.<sup>(6)</sup> compared the Hem-o-lok clip and the endoloop for CAS. Their results revealed that the use of the Hem-o-lok clip for CAS in LA is a feasible, safe, fast, and cost-effective procedure in patients with a mild to moderately inflamed appendix base of less than 10 mm in diameter. The most important point in LA is to choose the safest method for CAS. In previous studies, most surgeons have used either a stapler or an endoloop to CAS.<sup>(7)</sup>

On the other hand, there are several recent articles reporting that using the Hem-o-lok clip is a safe method for CAS. Another alternative method for CAS is the usage of a metal clip, which is a simple, quick, safe, and cheaper technique.

Bozkurt et al.<sup>(8)</sup> compared both clips in CAS and concluded that the use of a Hem-o-lok clip and a metal clip for CAS in LA is a feasible, safe, and cost-effective procedure in patients with an inflamed appendix base less than 10 mm in diameter and metal clip is more efficient if the appendix base is greater than 10 mm, instead of a Hem-o-lok clip.

We had no restrictions in using the Hem-o-lok clip in such cases and we had no difficulty clipping an appendix base more than 10mm in diameter. we had a mean diameter of  $9.55 \pm 1.57$ mm with 8 cases (40%) having a base diameter 10-13mm.

Bozkurt et al showed that metal clip costs 7\$ while hem-o-lok clip costs 50\$ showing a statistically significant difference in cost of CAS.<sup>(8)</sup>

Our findings are consistent with their results. The Hem-o-lok clip costs 50\$ and only a single clip was used per case.

**Conclusions:-**

Hem-o-lok clip is safe effective but cost-effective method in closure of appendicular stump regardless of the base diameter.

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