

**LAPAROSCOPIC APPENDECTOMY: HEM-O-LOK VERSUS ENDOLOOP IN STUMP CLOSURE****\*<sup>1</sup>Dr. Purujit Choudhury, <sup>2</sup>Dr. Abhijit Sarma and <sup>3</sup>Dr. Subhanka Sharma**<sup>1</sup>Professor of Surgery, Gauhati Medical College.<sup>2</sup>Associate Professor of Surgery.<sup>3</sup>Registrar of Surgery, Gauhati Medical College.

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**\*Corresponding Author****Dr. Purujit Choudhury**Professor of Surgery, Gauhati  
Medical College.**ABSTRACT**

There are several techniques described to close the appendicular stump during laparoscopic appendectomy. The aim of this study was to investigate the safety and usefulness of the Hem-o-lok clip for the closure of appendicular stump, comparing these data with those concerning the endo-loop. We conducted a retrospective study that compared two groups of patients who underwent laparoscopic appendectomy from 2015 to 2020 at our institution, GMCH. We used the Endoloop to close the stump in the first group (group I) and the Hem-o-lok in the second group (group II). We reviewed patient's data including: complications, operative time, length of stay, costs. There were 121 patients in group I and 138 patients in group II. The mean operative times were 40.5 min in group I and 36.4 min in the group II. No intraoperative complications and no mortality were observed in either group. The mean postoperative length of hospital stay was similar for both groups. There was no rehospitalization after discharge. The complication rate did not reach statistical significance between the groups. The cost of the procedure using the Hem-o-lok has been lower than using the Endoloop. Both the Endoloop and Hem-o-lok are safe for the closure of the appendicular stump. Hem-o-lok appears to be superior than Endoloop in terms of easeness of use and cheapness, maintaining the same safety.

**KEYWORDS:** Appendicitis. Laparoscopic appendectomy Hem-o-lok. Appendicular stump. Endoloop. Clip.**INTRODUCTION**

A cute appendicitis is the most common condition requiring emergency surgery worldwide.

Laparoscopic appendectomy (LA) was first described in 1983 by Semm.<sup>[1]</sup> Currently, it is associated with fewer complications, shorter hospital stay, less intra-abdominal abscess rate, and total costs, compared with open appendectomy. Therefore, this method is recommended as first choice treatment especially in women, the elderly and obese patients.<sup>[2,17]</sup> One of the most important steps of the appendectomy procedure, to avoid serious complications, such as postoperative fistula, peritonitis, and sepsis is closure of the appendix stump.<sup>[3]</sup> The ideal method for appendix stump closure should be safe, accessible, technically simple to use, and cheap. Many different methods have been defined to close the appendix stump, included: staplers, Endoloop (Endoloop Ligature ® Ethicon Endosurgery, Johnson & Johnson, Cincinnati, OH, USA), titanium clips, non absorbable polymer clips (Hem-o-lock®, Weck Surgical Instruments, Teleflex Medical, Durham, NC, USA), extracorporeal sliding knot, intracorporeal ligation, Ligasure.<sup>[4]</sup> Some data suggest that the stapling technique

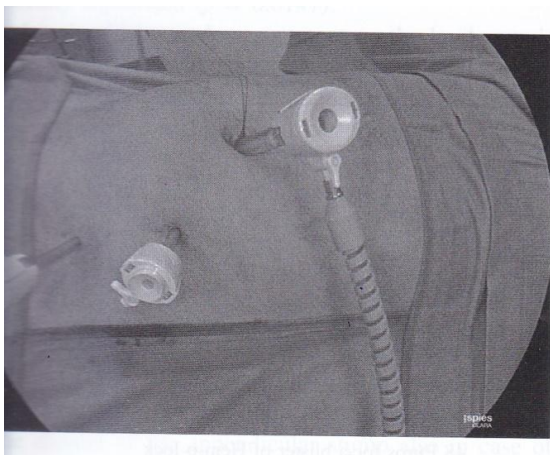
results in the safest closure of the stump even when the appendix base is inflamed and its diameter is too large, but it is also the most expensive method.<sup>[5]</sup> Endoloop use has been proposed by several authors due to its safety in closing the appendix stump and its lower cost as compared to staplers.<sup>[6]</sup> its application requires some technique and a short training period.<sup>[7]</sup> Instead, the most important features of Hem-o-lok are ease of use, with the reduction in operation time, and its cost effectiveness.<sup>[8]</sup> In our center, with more than a thousand laparoscopic procedures per year, we have a wide experience in the use of Hem-o-lok clips to close the cystic duct during the cholecystectomy and the large blood vessels in the other operations. From January 2018, we started to use the Hem-o-lok also for closing the appendix stump, completing, until December 2020, 138 appendectomies with this technique. The aim of this study is to investigate the safety and usefulness of the Hem-o-lok clip for the closure of appendicular stump, comparing these data with those concerning the Endoloop.

**MATERIALS AND METHODS**

Nine difference surgeons have performed 121 appendectomy using Endoloop ligatures (2-0

polydioxanone) from 2015 to 2017 and 138 with Hem-o-lok clips (XL size, gold color applicator) in the time between 2018 and 2020. We obtained informed consent preoperatively from all patients for the use of Hem-o-lok clips as a non standard technique in laparoscopic appendectomy. When the base of appendix was perforated or too large due to the inflammation we used the stapler to close the stump,<sup>[16]</sup> these cases were excluded from our study. The patient's characteristics, operative times, hospital stay and complications were retrospectively analyzed for both groups, and they were confronted. Statistical analysis was performed using SPSS ver. 15.0 (SPSS Inc., Chicago, IL, USA). The t Student test was used to analyze quantitative variables, while the Chisquared test was used for the qualitative ones. Statistical significance was accepted for  $p$  values of  $<0.05$ .

A general anesthesia was performed with the patient in supine position. The surgeons stood in the left side and the monitor in opposite position. An umbilical open laparoscopy was performed and 10 mm trocar was placed; a 12mm Hg pneumoperitoneum was induced. After a check of the pelvis by 5 mm 30-degree camera another two 5mm trocars was placed under direct vision (Fig. 1). An additional trocar was inserted in case of consensual cholecystectomy. The patient was rotated towards the left and Trendelenburg's position was established. The mesoappendix was mobilized and resected with a bipolar device. The proximal base of the appendix was closed using double Hem-o-lok clips (Fig. 2) or double Endoloops (Fig. 3) and then it was transected between these by scissor. In the Endoloop group, the appendiceal stump was invaginated under a tobacco-bag suture. The tobacco-bag suture in the Hem-o-lok group has not been performed since this procedure has never been described in literature and, furthermore, the Hem-o-lok invagination may cause erosion and migration of the same clip. The appendix was then removed through the umbilical port. A retrieval bag was sometimes used for large appendix.



## RESULTS

We have performed 259 laparoscopically appendectomies in the last 6 years (Table 1). The Endoloop group (group I) consisted of 121 patients (35 male, 86 female); mean age 29.9 years; range 14-76 years), while the Hem-o-lok group (group II) consisted of 138 patients (52 male, 86 female : mean age, 32.8 years ; range , 14-90 years).

We have identified 41 phlegmonous appendicitis in the group I against 57 in the group II ( $p = 0.557$ ), while gangrene with pelvic abscess was present in one patient in Endoloop group and four patients in the Hem-o-lok group ( $p = 0.798$ ) ; in the remaining cases for both groups the appendix was affected by simple inflammation (catarrhal). Eleven patients underwent simultaneous cholecystectomy for contextual symptomatic choletithiasis or cholecystitis in the group II. Instead, in the Group I there were one.

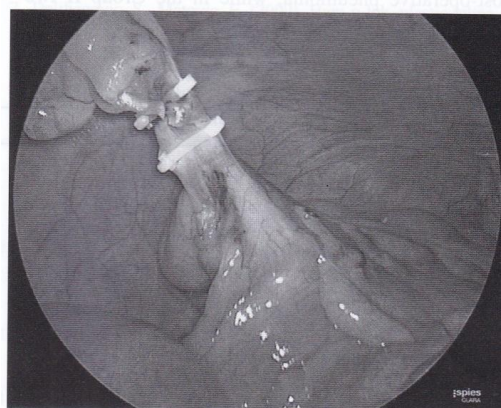


Fig. 3 Closing of the appendicular stump with application of two Endoloops

Simultaneous cholecystectomy and one repair of umbilical hernia. We detected female reproductive system diseases in 20 women in Group I and 26 in Group II (23 vs 30%, respectively,  $p = 0.397$ ).

The mean operative times were 40.5 min in the Endoloop group (range 10-12) and 36.4 min in the Hem-o-lok group (range 15-110) reaching statistical significance ( $p = 0.0319$ ). Excluding case of appendectomy with cholecystectomy or repair of umbilical hernia associated

the mean operative time become 38.9 and 31.3 min. respectively ( $p < 0.0297$ ).

No intraoperative complications and no mortality were observed in either group and no patients required conversions to open appendicectomy.

The mean postoperative hospital stay (LOS) was similar for both groups 1.20 days (Group I) vs 1.23 days (Group II), no statistically significant ( $p = 0.539$ )

There was no re hospitalization after discharge. Regarding the complications in the Group I we had 2 cases of post-operative pneumonia, while in the Group II two umbilical wound infection, resolved with domiciliary oral.

**Table 1: Characteristics of Endoloop and Hem-o-lok group patients.**

	Group I (Endoloop)	Group II (Hem-o-lock)	<i>p</i>
Number of procedures	158	121	
Phlegmonous appendicitis	41	57	0.557
Gangrenous appendicitis	1	4	0.798
Simple (Catarrhal) appendicitis	116	60	
Simultaneous procedures	2	11	
Female reproductive system diseases	20	26	0.697
Operative time	40.5 (10-120) min	36.4 (15-110) min	0.0319
Length of hospital stay	1.20 days	1.23 days	0.539
Complications Costs	2 Pneumonia 184 Euros for two Endoloops	- 2 Umbilical wound infection - 1 SBO 48 Euros for a blister of Heim-o-lock	0.357

Antibiotic therapy and a case of small bowel obstruction (SBO) treated with laparoscopic adhesiolysis that prolonged the patient's hospital stay; complication rate did not reach statistical significance ( $p = 0.357$ ).

In terms of costs, two Endoloop cost 184 Euros while using the emolock costs 48 Euros (this is the cost of a blister with six clips) : total cost for Endoloop group was 22.264 vs 6.624€, reaching statistical difference ( $p = 0.0147$ ).

## DISCUSSION

LA has become the approach of choice by many surgeons in the treatment of acute appendicitis and it is considered the gold-standard for per-menopausal women.<sup>[9,17]</sup> The clinical advantages of LA are: reduced hospital stay, lower incidence of wound infection, faster return to normal work activities, shorter postoperative ileus, less postoperative pain and better cosmetic results.<sup>[10,11]</sup> In addition to these clinical benefits, the laparoscopic approach allows a full exploration of the peritoneal cavity,<sup>[12]</sup> thus representing an important diagnostic tool in case of suspicion of acute appendicitis or concomitant diseases as: pelvic inflammatory disease, endometriosis, ovarian cysts, ectopic pregnancy, cholecystitis, and colonic perforation may mimic appendicitis.<sup>[13]</sup>

The closure of the appendix stump is the most important step of the appendectomy procedure, to avoid serious complications.<sup>[3,16]</sup> Many different methods have been defined to close the appendix stump.<sup>[4]</sup> Despite many studies, there are no universal agreement on any method and no particular method is recommended in the literature.<sup>[4]</sup>

Regarding the use of stapler in LA, it allows simultaneous sealing and division of both the mesoappendix and the appendix base. Some data suggest that the stapling technique results in the safest closure of the stump even when the appendix base is inflamed and its diameter is too large.<sup>[5]</sup> According to the literature, we use stapler only when the appendix base is extremely inflamed or necrotic due to its extremely high costs. So we decided to exclude this method in our study to have a more homogenous sample.

Then we retrospectively analyzed data from two groups of LA, in the first we used the Endoloop and in the second the Hem-o-lok to close the stump appendix.

The Endoloop is a commercial product that is commonly used in LA. It can be made of silk or polyglactin; while applying the Endoloop, the loop snare that is placed to the appendix base is tightened and the appendiceal stump is invaginated under a tobacco-bag. Two Endoloops can be placed separately one over another. It provides stump closure in a similar manner to ligation in open appendectomy.<sup>[4]</sup> However, the laparoscopic suture technique is technically demanding.<sup>[15]</sup>

Hem-o-lok is a nonabsorbable polymer clip and the safety of its use for the ligation of vessels, ureters, and bile ducts has been well documented.<sup>[14]</sup> Recently, some studies have reported the safety of using the Hem-o-lok clip for the closure of appendicular stump ; it should be easy to use and cheap.<sup>[7]</sup>

Analyzing our data, for both groups, there were no complications related to the use of two devices. In fact, only one patient in the Hem-o-lok group was reoperated

for SBO. This is also confirmed by mean postoperative hospital stay that was similar in both groups (1.2 vs 1.23 days;  $p = 0.539$ ). In addition, in our experience the Hem-o-lok has seemed easier to use for all nine surgeons, in fact, the operative time was less in the Hem-o-lok group, especially excluding cases of cholecystectomy or repair of umbilical hernia associated. (38.9 vs 31.3 min;  $p < 0.0297$ ). Finally, the cost of the Hem-o-lok, lower than that Endoloop.

It also should be made a comment on the laparoscopic technique that, in our experience, has allowed to identify gynecological disorders associated to appendicitis, present in 26% of women operated, and performing of 11 simultaneous cholecystectomies without the need to convert, contributing to the short hospitalization of our patients.

## CONCLUSIONS

Our study, as indicated in the literature, showed the clinical advantages of laparoscopic technique for appendectomy. Furthermore, both the Endoloop that Hem-o-lok are safe for the closure of the appendicular stump also in case of phlegmonous and gangrenous appendicitis. The Hem-o-lok appears to be superior to Endoloop in terms of ease of use and cheapness, maintaining the same safety.

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