

## Two Different Methods for Appendiceal Stump Closure: Metal Clip and Hem-o-lok Clip

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### Abstract

**Introduction:** Closure of the appendiceal 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 retrospective clinical study is to emphasize two different methods (metal clip and Hem-o-lok® [Teleflex Medical, Research Triangle Park, NC] clip) for CAS.

**Materials and Methods:** The cases were divided into two subgroups according to the type of CAS. Subgroups were compared with each other according to age, intraabdominal abscess formation, operation duration, and complication rate.

**Results:** No intraoperative complications were seen in either subgroup. There were 22 postoperative complications in the metal clip subgroup (13 intraabdominal abscesses, 9 wound infections) and 8 postoperative complications in the Hem-o-lok clip subgroup (five intraabdominal abscesses, three wound infections). The cost of the closure was \$7 for the metal clip group and \$50 for the Hem-o-lok clip group.

**Conclusions:** The use of Hem-o-lok clips and metal clip for CAS in laparoscopic appendectomy is a feasible, safe, and cost-effective procedure in patients with a mild to moderately inflamed appendix base of less than 10 mm in diameter.

### Introduction

LAPAROSCOPIC APPENDECTOMY (LA) is related to fewer wound infections, faster recovery, and an earlier return to work in comparison with open surgery.<sup>1-4</sup> Closure of the appendiceal stump (CAS) is the most crucial part of appendectomy procedures because most of the complications occur because of a leak of the stump. In laparoscopic procedures, various methods such as endostapling, endoloop or intracorporeal knotting, endoclips, and Hem-o-lok® (Teleflex Medical, Research Triangle Park, NC) clips have been described and are currently in use for LA.<sup>5-8</sup>

The aim of this retrospective clinical study is to evaluate two different methods (metal clip and Hem-o-lok clip) for CAS.

### Materials and Methods

In this retrospective study, 1849 patients who had LA performed following a diagnosis of acute appendicitis in our clinic between January 2008 and October 2012 were evaluated. Complicated cases with the need for open surgery or

those cases in which the stump was closed with sutures were excluded. A Veress needle was inserted into the abdominal cavity by making a perpendicular incision in the umbilicus. The laparoscopic approach was standardized with the use of a 10-mm infraumbilical optic port with an intraabdominal pressure of 10–12 mm Hg. A 30°, 10-mm laparoscope was inserted to visualize the abdominal cavity, with a 10-mm port inserted in the lower left abdomen and a 10-mm port in the lower right abdomen. The mesoappendix was dissected using bipolar coagulation. We placed one metal or Hem-o-lok clip to close the appendix stump. The specimen was removed from the abdomen in a plastic bag (endobag) through the 10-mm port site in all of the cases. If the endobag was broken during the procedure, it was replaced by a new one to prevent any port-site infection intraoperatively. In the presence of collection during operation and abscess without perforation, drains were placed.

The cases were divided into two subgroups according to the type of CAS. Metal clips were used if the stump was larger than 10 mm. Metal or Hem-o-lok clips were used according to the surgeon's intraoperative decision if the stump was smaller than 10 mm. Subgroups were compared with

each other according to age, intraabdominal abscess formation, operation duration, and complication rates.

### Statistical analysis

Statistical analyses were performed using NCSS (Number Cruncher Statistical System) 2007 statistical software (NCSS, Kaysville, UT). Data were evaluated by descriptive statistical methods (mean, standard deviation). For comparison of two independent groups, the *t* test was used; in the comparison of qualitative data, the chi-squared test was used. A *P* value of  $<.05$  was considered statistically significant.

### Results

Among a total number of 1849 cases, 1100 patients with CAS by metal clips and 317 cases with CAS by Hem-o-lok clips were included in the study group. Seventy-six patients with complicated appendicitis (perforated and gangrenous), 344 patients in which the stump was closed with silk sutures, and 12 patients with conversion to the open approach were excluded.

The average age of the patients was 30.6 years in the metal clip group and 30.2 years in the Hem-o-lok clip group. The respective male to female ratio was 598/502 and 169/148 in the two groups. Average duration of the surgery was 45 minutes for the metal clip subgroup and 48 minutes for the Hem-o-lok clip subgroup. The endobag was broken during the procedure in 6 patients in the metal clip group and 4 patients in the Hem-o-lok clip group, but it replaced by a new one intraoperatively. No complication was recorded in these 10 patients.

Drains were used in 21 patients with metal clips and 9 patients with Hem-o-lok clips. No complications were seen in patients with a drain.

No intraoperative complications were seen in both subgroups. There were 22 postoperative complications in the metal clip subgroup (13 intraabdominal abscesses, 9 wound infections) and 8 postoperative complications in the Hem-o-lok clip subgroup (five intraabdominal abscesses, three wound infections). The cost of the closure was \$7 for the metal clip group and \$50 for the Hem-o-lok clip group. Table 1 presents the variables of the two groups.

### Discussion

LA has not yet evolved as the gold standard for the treatment of acute appendicitis, unlike laparoscopic cholecystectomy. 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. It provides a significant reduction in operative time.<sup>1,2</sup>

Although the LA surgical technique has been well established, there are many different techniques within the procedure, including port positioning and the CAS. Kiudelis et al.<sup>9</sup> compared two groups for CAS in their study. The comparison of intracorporeal knotting with invaginating suture versus endoloops did not reveal a statistically significant difference for overall complication rates or average hospital stay; however, the median duration of the surgery was significantly shorter in the endoloop group. In another study, Hue et al.<sup>10</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 close the appendiceal stump.<sup>11,12</sup> On the other hand, there are several recent articles reporting that using the Hem-o-lok clip is a safe method for CAS.<sup>13,14</sup> Another alternative method for closure of the stump is the usage of a metal clip, which is a simple, quick, safe, and cheaper technique.<sup>15</sup>

The price of a cartridge containing 10 titanium endoclips is \$7. CAS with metal endoclips costs less than \$5 per case, whereas it costs \$50 for the Hem-o-lok clip. The difference was statistically significant ( $P < .0001$ ).

In the present study, there was no difference for postoperative complications between the two subgroups. There was no criterion for patient selection if the appendix base was narrower than 10 mm. On the other hand, if the metal clip is not long enough to cover the entire appendix, the appendix is twisted clockwise or counterclockwise, and a second metal clip is applied parallel to the other one in the opposite direction to obtain complete closure. So we think that using a metal clip is more advantageous if the diameter of the appendix base is greater than 10 mm. Hem-o-lok clips have an advantage when the appendix base is inflamed.

Rickert et al.<sup>16</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 metal clip was used in our study without considering the diameter of the appendix base.

In conclusion, 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 a mild to moderately inflamed appendix

TABLE 1. VARIABLES OF THE TWO GROUPS

	<i>Metal clip</i>	<i>Hem-o-lok clip</i>	<i>P</i>
Number of patients	1100	317	
Age (years)	30.60 ± 4.23	30.20 ± 3.67	.127
Gender (F/M)	502 (45.64%)/598 (54.36%)	148 (46.69%)/169 (53.61%)	.789
Operation time (minutes)	45.97 ± 139.25	47.12 ± 15.33	.188
Number of complications			
Intraoperative	0	0	
Postoperative	22 (2%)	8 (2.52%)	.727
Cost (dollars)	7 ± 3.25	50 ± 17.34	.0001

A *P* value of  $<.05$  was considered statistically significant.  
F, female; M, male.

base less than 10 mm in diameter. Our experience suggests that a metal clip is more efficient if the appendix base is greater than 10 mm, instead of a Hem-o-lok clip.

#### Disclosure Statement

No competing financial interests exist.

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