Best Evidence Topic

Comparison between Endoloop ligature and Hem-o-lok clip (Polymer ligation) for appendiceal stump closure during laparoscopic appendicectomy

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ABSTRACT

A best evidence topic has been constructed using a described protocol. The three-part question addressed was: In patients undergoing laparoscopic appendicectomy is Hem-o-lok clip safer than Endoloop ligature for closure of appendiceal stump?

The search has been devised and 6 studies were deemed to be suitable to answer the question. The outcome assessed was the safety and cost effectiveness of Hem-o-lok clip (Polymer ligation) versus Endoloop ligature for appendiceal stump closure during laparoscopic appendicectomy. We concluded that Hem-o-lok clip is a safe and feasible tool for appendiceal stump closure. It’s also a cost-effective way and could be a cheaper option compared to other measures.

1. Introduction

This BET was constructed using a framework outlined by the International Journal of Surgery [1]. A BET provides evidence-based answers to common clinical questions, using a systematic approach of reviewing the literature.

2. Clinical scenario

In performing laparoscopic appendicectomy, which technique is the best for appendiceal stump closure? Is it Endoloop ligature or Hem-o-lok clip? Are there any downsides for using either one of them? Therefore, we decided to conduct a systematic review to look for an evidence-based answer to these questions.

3. Three-part question

In [patients undergoing laparoscopic appendicectomy] is [Hem-o-lok clip] [Polymer clip] safer than [Endoloop ligature] for [closure of appendiceal stump]?

4. Search strategy

The search was conducted as following:

Embase 1974 to 2021 and MEDLINE® 1946 to November 2021 using the OVID interface.

[Laparoscopic appendicectomy OR appendicectomy] AND [Hem-o-lok clip OR Polymer clip OR Polymeric clip] AND [closure of appendiceal stump] AND [Intraoperative complications OR Postoperative complications OR Leak OR abscess].

The search was limited to English language and human studies.

5. Search outcome

250 articles were found. Out of these 6 deemed to be suitable and met the criteria of our search after removing the duplicate and excluding the irrelevant articles. We only included articles which compared these two methods for appendiceal stump closure and excluded studies which compared other methods.

Exclusion criteria:

1 Conference abstracts
2 Studies not comparing both techniques

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| Author, date of publication, journal and country | Study type and level of evidence | Patient group and study period | Exclusion Criteria | Post operative Follow up | Outcomes | Key results | Additional comments |
|-----------------------------------------------|---------------------------------|--------------------------------|-------------------|-------------------------|----------|-------------|---------------------|
| Delibegovic et al. [5], 2012, Journal of Laparoscopic Endoscopy & Advanced Surgical Techniques, Bosnia and Herzegovina | Randomized clinical trial (RCT), level II | The study included 90 patients who were randomly assigned into 3 groups: a. Appendix base secured using endoloop b. Appendix base secured using stapler c. Appendix base secured using one Hem-o-lok clip | Not mentioned | Not mentioned | To compare safety, intraoperative timing and cost effectiveness | The use of one Hem-o-lok clip is as safe as an endoloop and/or stapler; however, the time of the laparoscopic procedure using the Hem-o-lok was shorter in comparison with the use of an endoloop, with the cost of the procedure being the lowest | High level of evidence, reasonable sample size, single centre, no power calculation, no mention of the randomization technique, no blinding, follow up period was not mentioned, risk of bias |
| Hue et al. [1], 2013, Journal of the Korean Surgical Society, Korea | Randomized clinical trial (RCT), level II | The study included 105 patients who were classified into two groups: a. The endoloop group consisted of 66 patients b. the Hem-o-lok group consisted of 39 patients | In some cases, Hem-o-lok clip was not used due to an enlarged appendix base and severe inflammation of the appendix base; in these patients, the endoloop was used | All patients were followed for a month postoperatively | to investigate the safety and usefulness of the Hem-o-lok clip for the closure of appendicular stumps and its limitations | The use of Hem-o-lok clips for the closure of appendicular stumps in laparoscopic appendectomy is a feasible, safe, fast and cost-effective procedure in patients with a mildly to moderately inflamed appendix base of less than 10 mm in diameter | High level of evidence, reasonable sample size, single centre, no power calculation, no mention of the randomization technique, no blinding, risk of bias |
| Colak et al. [4], 2013, Surgical Laparoscopy Endoscopy & Percutaneous Techniques Journal, Turkey | Randomized clinical trial (RCT), level II | The study included 53 patients. a. 26 in hem-o-lok group b. 27 in endoloop group | Exclusion criteria were (1) the patients under 16 years of age, (2) the patients with previous major abdominal operations, (3) the patients with pregnancy, (4) the patients who refused to consent for the study, and (5) the patients who converted to open appendicectomy Hem-o-lok clips or endoloop ligatures were used in uncomplicated appendectomy without inflammation of the base of the appendix while endostaplers were applied in complicated cases | patients were invited to attend outpatient clinics at the first and fourth week postoperatively | To evaluate the clinical outcomes of hem-o-lok ligation system in laparoscopic appendix stump closure by comparing it to the endoloop ligation | The mean operation time was shorter in hem-o-lok group than endoloop group. However, the difference was not significant. Other surgical findings were similar | High level of evidence, clearly mentioned the randomization procedure and the follow up time, small sample size, single centre, no blinding, risk of bias |
| Soll et al. [3], 2016, Journal of Langenbeck’s Archives of Surgery, Switzerland | Retrospective observational study, Level III | The outcome of 813 consecutive patients, operated between 2009 and 2013 receiving laparoscopic appendectomy either with hem-o-lok or endoloop for acute appendicitis, was analysed. Hem-o-lok clips were used in 54% (n = 435) and endoloop sutures were applied in 46% (n = 378) of the patients | The aim of the study was to compare the hem-o-lok ligation system with endoloop suture to close the appendiceal stump with regard to postoperative intra-abdominal abscesses | 30 Days | Closure of the appendicular stump using the nonabsorbable hem-o-lok ligation system did result in a reduced rate of intra-abdominal surgical abscesses as compared to the application of endoloops | Large sample size, multivariate analysis, single centre, risk of bias cannot be excluded |
| Sadat-Safavi et al. [6], 2016, Journal of Research in | Randomized clinical trial (RCT), level II | The study included 76 patients who were randomly classified into two groups: a. The patients who were in the endoloop group b. The patients who were in the hem-o-lok group | The exclusion criteria included the following: 1. Patients who were in the hem-o-lok group; 2. Patients who were in the endoloop group | Not mentioned | To Compare the effect of stump closure by endoclips versus hem-o-lok ligation system | The effect of stump closure by endoloop versus endoclips is not effective | High level of evidence, reasonable sample size, single centre, (continued on next page) |
### Table 1 (continued)

| Author, date of publication, journal and country | Study type and level of evidence | Patient group and study period | Exclusion Criteria | Post operative Follow up | Outcomes | Key results | Additional comments |
|------------------------------------------------|---------------------------------|--------------------------------|-------------------|--------------------------|---------|------------|---------------------|
| Medical Sciences, Iran                         | Retrospective observational study, Level III | The study included 259 patients for which: a. 121 patients in Group A where endoloop suture used to close the appendiceal stump b. 138 patients in group B where Hem-o-lok was used The study was conducted between 2010 and 2015 | When the base of appendix was perforated or too large due to the inflammation stapler was used to close the stump Not mentioned | The patients who underwent lap. Appendicectomies different for complications, but the duration of surgery was shorter in endoclips method | no power calculation, no mention of the randomization technique, no blinding, follow up period was not mentioned, risk of bias |

#### 3. Absence of full-text articles

#### 4. Low evidence papers

#### 6. Result

(Please refer to the Table 1).

#### 7. Discussion

During laparoscopic appendicectomy, the base of the appendix is usually secured by an Endoloop ligature [8] or stapler [9]. A non-absorbable Hem-o-lok clip (Weck Closure Systems, Research Triangle Park, Durham, NC, USA) was shown as an alternative technique which can be cheaper and quicker [10].

In 2012, Delibeovic et al. [2] devised a prospective randomized clinical trial to compare safety, intraoperative timing and cost effectiveness between different methods. 90 patients with acute appendicitis were randomly divided into three groups: In the first group, the base of the appendix was secured using one Endoloop ligature, in the second group using a 45-mm stapler, and in the third group using only one nonabsorbable Hem-o-lok clip. They concluded that the use of one Hem-o-lok clip is as safe as an Endoloop and/or stapler; however, the time of the laparoscopic procedure using the Hem-o-lok was shorter in comparison with the use of an Endoloop, with the cost of the procedure being the lowest.

Hue et al. [3] conducted a prospective randomized clinical trial in the period between May 2010 to August 2011. 105 patients who underwent laparoscopic appendicectomy were included. Endoloop was used in 66 patients and Hem-o-lok in 39. The aim of the study was to investigate the safety and usefulness of the Hem-o-lok clip for the closure of appendicular stump and its limitations. They concluded that the use of Hem-o-lok clips for the closure of appendicular stumps in laparoscopic appendicectomy is a feasible, safe, fast and cost-effective procedure in patients with a mildly to moderately inflamed appendix base of less than 10 mm in diameter.

In 2013, Colak et al. [4] devised another prospective randomized clinical trial where they randomly allocated 53 patients into either Hem-o-lok or Endoloop groups. 26 patients were in the Hem-o-lok group and 27 in the Endoloop group. The aim of the study was to evaluate the clinical outcomes of Hem-o-lok ligation system in laparoscopic appendiceal stump closure by comparing it to the Endoloop ligature. They concluded that the mean operation time was shorter in the Hem-o-lok group than the Endoloop group; however, the difference was not significant. Other surgical findings were similar. The closure of the appendicular stump with polymeric nonabsorbable clips in laparoscopic appendicectomy may be a cheaper and simpler alternative to other widely used methods.

In 2016, Soll et al. [5] looked at the results of 813 patients who underwent laparoscopic appendicectomy in their retrospective observational study. In 435 patients Hem-o-lok was used to close the appendiceal stump while Endoloop suture was used in 378. The aim of the study was to identify the incidence of intra-abdominal abscesses after the application of Hem-o-lok clips and compare them with Endoloop ligatures. They concluded that the closure of the appendiceal stump using the non-absorbable Hem-o-lok ligation system did result in a reduced rate of intra-abdominal surgical abscesses as compared to the application of Endoloop.

In the same year, Sadat-Safavi et al. [6] conducted a randomized
clinical trial which compared the two methods of closing the appendiceal stump in terms of the length of operating time, postsurgical complications, and the duration of hospitalization. They included 76 patients who were randomly classified into two groups. 38 patients in Hem-o-lok appendiceal stump closure group and 38 patients in Endoloop group. They concluded that the effect of stump closure with Endoloop versus endoclips is not different for complications, but the duration of surgery was shorter in the endoclip method.

Lastly, Lucchi et al. [7] toward the end of 2016 published a retrospective observational study which included 259 patients. The aim of the 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 Endoloop. Endoloop suture appendiceal stump closure was used in 121 patients while Hem-o-lok was used in 138. They concluded that both the Endoloop and Hem-o-lok are safe for the closure of the appendicular stump. However, Hem-o-lok appears to be superior to Endoloop in terms of ease of use and cheapness while maintaining the same safety.

The observed limitation to all of the abovementioned studies is the risk of bias. Moreover, in cases where the appendicular base is inflamed, friable or too wide most of the articles have either excluded them or have not used Hem-o-lok (have used either endoloop or stapler).

8. Clinical bottom line

Four randomized clinical trials and two retrospective studies proved that Hem-o-lock is safe and feasible tool for appendiceal stump closure. It’s also a cost-effective way and could be a cheaper option compared to other measures.

Ethical approval

Not applicable.

Sources of funding

None.

Author contributions

SA: devised the idea of the study, conducted literature search and wrote the paper.
TS: assisted in literature search and collecting the data.
MO: assisted in literature search and writing the paper.
RI: assisted in literature search editing and writing the paper.

Trial registry number

1. Name of the registry: Not applicable
2. Unique Identifying number or registration ID: Not applicable
3. Hyperlink to your specific registration (must be publicly accessible and will be checked):

Guarantor

Sabry Abounozha (SA), Tamer Saafan (TS), Munzir Obaid (MO), Rashid Ibrahim (RI).

Consent

Not Applicable.

Declaration of competing interest

None.

References

[1] O.A. Khan, et al., Towards Evidence-Based Medicine in Surgical Practice: Best BETs, Elsevier, 2011.
[2] S.J.J.o.L. Delibegović, A.S. Techniques, The Use of a Single Hem-O-Lok Clip in Securing the Base of the Appendix during Laparoscopic Appendectomy, vol. 22, 2012, pp. 85–87.
[3] C.S. Hue, et al., The Usefulness and Safety of Hem-O-Lok Clips for the Closure of Appendicular Stump during Laparoscopic Appendectomy, vol. 84, 2013, pp. 27–32.
[4] E. Colak, et al., A Comparison of Nonabsorbable Polymeric Clips and Endoloop Ligatures for the Closure of the Appendicular Stump in Laparoscopic Appendectomy: a Prospective, Randomized Study, vol. 23, 2013, pp. 255–258.
[5] C. Soll, et al., Appendiceal Stump Closure Using Polymeric Clips Reduces Intra-abdominal Abscesses, vol. 401, 2016, pp. 661–666.
[6] S.A. Sadat-Safavi, et al., Comparison the Effect of Stump Closure by Endoclips versus Endoloop on the Duration of Surgery and Complications in Patients under Laparoscopic Appendectomy: A Randomized Clinical Trial, 2016, p. 21.
[7] A. Lucchi, et al., Laparoscopic Appendectomy: Hem-O-Lok versus Endoloop in Stump Closure, vol. 69, 2017, pp. 61–65.
[8] E.A. Neugebauer, et al., The EAES clinical practice guidelines on laparoscopic cholecystectomy, appendectomy, and hernia repair, in: EAES Guidelines for Endoscopic Surgery, vol. 2006, Springer, 1994, pp. 265–289.
[9] M. Wagner, et al., Laparoscopic stapler appendectomy, 10, 1996, pp. 885–899.
[10] A. Hanssen, S. Plotnikov, R.J.J. o, t.S.o.L.S. Dubois, Laparoscopic Appendectomy Using a Polymetric Clip to Close the Appendicular Stump, vol. 11, 2007, p. 59.