



Laparoscopic appendectomy: comparison between different techniques for the closure of the appendicular stump

Cristina Frattini^{1,2}, Sherman Kwan³, Arianna Birindelli¹, Gregorio Tugnoli¹, Salomone Di Saverio^{1,4}

¹Emergency and Trauma Surgery Unit, Maggiore Hospital Regional Emergency Surgery and Trauma Center, Bologna Local Health District, Bologna, Italy; ²General Surgery Department, University of Pavia, San Matteo Hospital, Pavia, Italy; ³Royal Perth Hospital, Perth, Western Australia, Australia; ⁴Department of General and Colorectal Surgery, Cambridge University Hospitals NHS Foundation Trust, Addenbrooke's Hospital, Cambridge Biomedical Campus, Hills Road, Cambridge, UK

Correspondence to: Dr. Salomone Di Saverio, MD, FACS, FRCS. Hills Rd, Cambridge CB2 0QQ, UK.

Email: salo75@inwind.it; salomone.disaverio@gmail.com.

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Laparoscopic appendectomy is now a widely accepted surgical approach to acute appendicitis. Compared to the open approach, laparoscopy confers numerous advantages, such as less postoperative pain, shorter hospital stay, faster recovery and lower wound infection rates. Even if laparoscopy was associated with longer operative times and higher operative costs, in experienced hands it is more beneficial and cost-effective than open surgery for complicated appendicitis. Nonetheless, it remains the first choice for surgical treatment and is especially indicated in obese patients, older patients and patients with relevant comorbidities (1).

Closure of the appendicular stump has been the subject of numerous studies due to the range of techniques available: endoligature (including preformed suture loops (endo-loops) and intracorporeal knot-tying sutures), bipolar coagulation, endoscopic linear cutting staplers, radiofrequency, ultrasonic vibrations, metal clips or polymer clips (2). Two key points must be taken into consideration when choosing which method has to be adopted: patient safety and economic cost. The former point includes the effects of prolonged anaesthesia due to extension of operative time, iatrogenic injury, and reoperations for inadequate closure (e.g., malfunction of staplers, loop failure, clip dislodgement), while the latter refers to hardware costs per intervention and the costs of lengthier procedures (mainly reduced time for other operations), prolonged hospital stay, and

cost of reoperations and follow-up (3). Although there are numerous papers comparing the costs and clinical outcomes of these methods, this paper is noteworthy as it compares four main procedures to close the appendicular stump in a randomized clinical four-arm trial.

Different types of endoligature can be employed for the closure of the appendicular stump and include endoloop, an intracorporeal knot or Roeder loop. The type chosen depends on surgeon preference. Regarding the choice of one ligature versus two ligatures, studies found no significant differences in the incidence of postoperative complications between the two options; however, the evidence provided by these works was of low quality, with no randomised trial amongst them. Delibegović and Mehmedovic opted for a single Vicryl loop ligature on the base, and one on the distal part which is then removed with the appendix.

Closure with an endoloop is economical; however intracorporeal knot-tying requires extensive laparoscopic training for securing the knot and to excise the appendix without inadvertent fecal contamination of the tips of instruments or of the surrounding viscera. Moreover, surgical times are longer using endoloops (2,4-6). Longer times using endoloops was also observed in this study which found significantly longer loop application times and overall operation times in the endoloop arm.

Several papers have described the use of polymeric non-absorbable (e.g., Hem-o-lok) and titanium clips as safe,

cheaper than staplers, characterized by a better learning curve and a shorter operating time compared to endoloops. Usually, the maximum diameter of the appendiceal stump that can be closed by clips is 10 mm which is insufficient to securely encircle a bulging appendix (7,8). However, studies evaluating titanium double-shanked (DS) clips that are made with double “jaws”, demonstrated that these clips can safely close appendiceal stump with a diameter of up to 20 mm. Another advantage of the DS-clip is that its closing mechanism closes the distal end first, then gradually approximates between both extremities, thereby diminishing the effect of “pushing out” the tissue. On the other hand, one drawback for DS-clips is that like a stapler, the applicator for the clips requires a 12.5-mm trocar which then necessitates closure of the fascial layers to prevent trocar hernias (9-11). Delibegović and Mehmedovic only describe DS-clips that can close stumps up to 10 mm in diameter and concluded that Hem-o-lok clips, with their larger opening, are more useful in enlarged appendixes, while in fact the double “jaws” titanium clips are certainly more effective on inflamed, swollen appendix bases. However, they also highlight an important advantage of Hem-o-lok clips; the ability to be removed and re-placed in a more desirable location which is not possible with any type of DS-clip. This manoeuvre does require a specialised tool to remove the clip and re-placement then requires re-introduction of the applicator with the clip reloaded.

Endoscopic staplers are well known to reduce operative time and require less experience to operate successfully. From the technical point of view, they need a 10- to 12-mm port. Delibegović and Mehmedovic highlighted the substantially higher cost of stapling devices as its biggest disadvantage. There was also no morbidity in any of the study arms and that hospital stay was comparable amongst all methods. The data does reflect trends in other published studies which have shown a shorter time of operation and time of application for staplers as well as less surgical training required to use the device.

All techniques have their own benefits and drawbacks in terms of costs, gradient of learning curve and surgical times. Where the operating surgeon has the prerequisite skill, there is currently no evidence of any clinical advantage between endostaplers and endoligature. Further clinical trials are needed to improve the evidence guiding the use of the various types of clips (12,13).

Delibegović and Mehmedovic present findings are in accordance with contemporary literature on appendicular stump closure in a laparoscopic appendectomy. They have

compared four different techniques in a single, randomised trial which was not performed previously (14). This study emphasises the necessity for further randomized clinical trials to examine the clinical profile and economical cost of clips which were suggested as having the most benefit for further evaluation and could become the method of choice in securing the base of the appendix.

The current state of the art is that any method can be employed, with the surgeons choosing based on their own experience, expertise and in the context of resources available.

In our opinion, a cost evaluation may be useful, and the differences between various healthcare systems should be considered to better evaluate which method is most effective and appropriate. As countries with high operating room costs might benefit more from surgical tools which reduce operation length, countries with low operating room costs, instead, would have to cut down on instrument costs.

Recent series have demonstrated that routine use of endostaplers and other expensive and high-tech devices is often not justified, even in complicated and difficult cases, and use of endoloops or of intracorporeal sutures is safe and feasible (15) either during traditional laparoscopy or in single incision laparoscopic surgery (SILS) appendectomy (16).

Since all methods for closing the appendicular stump are equally safe, the future of research on laparoscopic appendectomy should be focused on the identification of the better method according to the resources of the specific health care system.

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