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Short Communication

Reducing the Cost of Laparoscopic Appendectomy

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Abstract

Introduction: Different systems for closing and sealing off the appendiceal stump and the mesoappendix can be used when performing appendectomies laparoscopically. The object of this study was to evaluate procedure costs attaching to the different systems used.

Methods: This was a prospective, non-randomized study of 20 laparoscopic appendectomies using endoloops and endoclips instead of endostaplers to close off the appendix and mesoappendix. Postoperative complications, length of hospital stay, and reintervention rate were recorded. Consumable supplies used were tallied and the cost calculated. The results were compared to those for an earlier series of laparoscopic appendectomies performed using endostaplers.

Results: No differences were observed for procedure times, safety of the surgery, or postoperative complications. There was, however, a very significant difference in the cost of the procedure. The total cost using an endostapler was €562, with loops-clips €32, i.e., a savings of €530 per appendectomy.

Conclusions: Laparoscopic appendectomy using ligatures and clips to close off the appendix and the mesoappendix is a safe, reliable, and highly efficient method that brings considerable cost savings.

Keywords: Laparoscopic appendectomy; Costs; Endoclip; Endoloop; Endostapler

Introduction

Acute appendicitis is one of the most frequent causes of emergency abdominal surgery at a General Surgery Unit. There has for years been consensus that laparoscopic appendectomy is the procedure of choice, because it improves the quality of outcomes during the postoperative period and shortens hospitalization times [1]. Nevertheless, the direct costs of laparoscopic procedures are significantly higher than those of open appendectomies.

The direct costs of laparoscopic appendectomies depend on the laparoscopic trocars and instruments used and, in particular, the methods used for hemostasis of the vessels in the mesoappendix and the devices used to close off the appendiceal stump. The first two are standard for any minimally invasive approach, but the staplers and the various systems of hemostasis available are all safe but vary considerably in economic cost [2].

At our hospital, both the appendiceal stump and the mesoappendix have for years been resected and stapled using an endostapler [3,4], consuming between two and three reloads per procedure. As mentioned above, there are other, alternative methods that are equally safe yet are more economical, e.g., endoloops (appendiceal stump) and endoclips (mesoappendix and appendiceal stump).

The object of this study was to compare the economic cost of the procedure based on the appendectomy system employed, i.e., an endostapler or an alternative system.

Methods

A prospective, non-randomized study was performed, comparing the economic cost depending on the devices used to close and seal off the appendiceal stump and the mesoappendix during laparoscopic appendectomy [5].

In September 2017, the General Surgery Unit carried out a "pilot study" performing laparoscopic appendectomies using endoloops and/or endoclips instead of endostaplers for ligation and hemostasis of the appendix and mesoappendix.

Polyglactin endoloops are inserted through the tip of the appendix to the base to tie off the base of the appendix. Endoclips are made from a high-strength, non-absorbable polymer and are designed with a system of closure by locking their arms together; the clips are placed at the base of the appendix or are used to close off and resect the mesoappendix. The applicator used for placement is inventoriable and suitable for insertion through a 10 mm trocar (Figure 1) [6-9].

Twenty laparoscopic appendectomies performed using this ligation and hemostasis systems were included in this study (Figure 2). Postoperative complications, conversion rates, length of hospital stay,

Figure 1: Endoclip cartridge and applicator.

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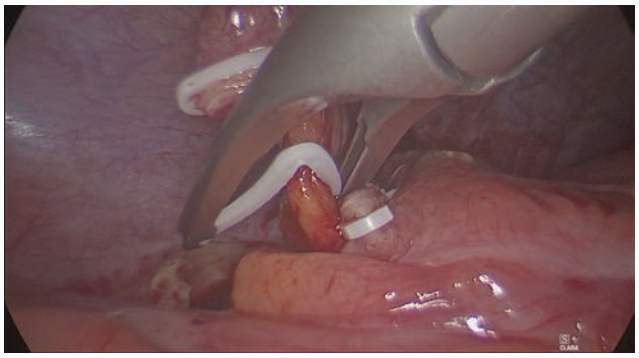

Figure 2: Endoclips sealing off the mesoappendix and appendiceal stump.

and reintervention rate were recorded. In addition, the consumables used were tallied and their cost calculated.

The results were compared to those for a series of 20 laparoscopic appendectomies performed using endostaplers for both the appendiceal stump and the mesoappendix in the preceding weeks. The use of laparoscopic clip applicators by surgeons to control bleeding along the stapling line was also recorded and the consumables tallied.

The prices used to calculate the costs were taken from the bids in the supply tenders for laparoscopic and stapling material now current at our hospital (VAT not included). The price of an endostapler was €224, and the price of each reload (intestinal or vascular tissue) was €134. The price for an endoloop was €12. The price for a pack of 6 endoclips was €4. As previously mentioned, an inventoriable applicator is used in placing the endoclips, and it is provided by the surgical supply company and so has no effect on the final procedure price.

In the statistical assessment, the quantitative variables were calculated as mean values with standard deviation, and variables were compared using Student's t-test.

IRB approval and written consent are not required for this study.

Results

Mean appendectomy time was 65 minutes, 63 minutes for the endostapler group and 66 minutes for the non-endostapler group. Differences were not significant. The mean hospital stay was 2.2 days (2.1 for the endostapler group, 2.2 for the other group), and again the difference was not statistically significant. No re-admissions or intra-abdominal complications were recorded. There were no conversions to open surgery, and no endostapler use was required by the endoclip/endoloop group.

As was to be expected, there was a highly significant difference ($p<0.001$) in procedure cost: the total endostapler procedure cost was €562, and the endoloop-endoclip procedure cost was €32, that is, a savings of €530 per appendectomy. Table 1 set out the mean consumption and cost per laparoscopic appendectomy using endostaplers and Table 2 the mean consumption and cost per laparoscopic appendectomy using endoloops-endoclips.

There was no significant variation in the number of appendectomies performed at our hospital each year. In 2015 there were 128 procedures, in 2016 there were 132, and in 2017 there were 130 (mean value: 130/year). The annual savings would have been €68,978 per year, with the same clinical outcomes and patient safety (Table 3).

Table 1: Mean consumption and cost (VAT not included) per laparoscopic appendectomy using endostaplers.

Device	Quantity	Unit Price	Cost
Endostapler	1	€224	€224
Reloads	2.3	€134	€308
Endoloops	0	0	0
Endoclips	0	0	0
Laparoscopic applicator	0.5	€60	€30
Total			€562

Table 2: Mean consumption and cost (VAT not included) per laparoscopic appendectomy using endoclips-endoloops.

Device	Quantity	Unit Price	Cost
Endostapler	0	0	0
Reloads	0	0	0
Endoloops	0.4 (× 2)	€12	€9.60
Endoclips	1	€4	€4
Laparoscopic applicator	0.3	€60	€18
Total			€31.60

Table 3: Overall per-procedure cost of laparoscopic appendectomies per year.

	Per Procedure	Per Year (130)
Using endostaplers	€562	€73,086
Using endoclips	€32	€4,108
Overall Savings	€530	€68,978

Discussion

Today, laparoscopic appendectomy is a fully accepted surgical procedure, despite the fact that the direct costs attached are significantly higher than those for open surgery.

When laparoscopic appendectomies first began to be performed, surgical procedure times increased significantly compared to those for open surgery, because of the learning curve. Because of their ease of use and speed, endostaplers were used at first both to close off and resect the mesoappendix and for the appendiceal stump.

The gradual increase in the cost of the technology has led us to look for more economical alternatives for a very commonly performed procedure, with a view to lowering costs and helping to keep the health care system viable. In this study we quantified the cost reduction achieved for appendectomies performed using endoloops and/or endoclips and did not observe any significant differences in procedure times, safety, or postoperative complication rates.

Replacing endostaplers with endoclips and endoloops did not increase procedure times, because the devices are easy for surgeons to use and easy for operating room staff to handle. Furthermore, endoclips and endoloops produce a better seal and better hemostasis than mechanical staples, which often result in bleeding along the staple line that surgeons need to contain by means of electrocauterization, manual suturing, or laparoscopic clips that increase both the consumables used and procedure times and thus increase procedure costs.

The availability of one or another system for closing off the mesoappendix and the appendix depends on the availability of material under the procurement Service's tendering process. Operating room support team training is optimal for any of these techniques, both for assembling endostaplers and for inserting endoclips in their applicators.

There is, however, a very sizeable difference in the per-procedure economic cost when using one or the other closure device. Given that laparoscopic appendectomies are one of the most frequent surgical procedures performed by a General Surgery Unit (GSU), multiplying

the procedure cost reduction achieved using endoloops and endoclips by the number of procedures carried out in a year results in considerable savings, and these should therefore be the method of choice used at public hospitals, with selective use of endostaplers (a large appendix or a perforated base).

Endoclips were even more economical than endoloops, though the difference was not as appreciable. Furthermore, using an endoloop for the appendicular stump needs to be combined with endoclips to seal off the mesoappendix.

There are several endoclip sizes. We used the 10 mm size (gold pack) for both the appendiceal stump and the mesoappendix, with an applicator the same size. A combination of 5 mm endoclips (purple pack) with a 5 mm applicator to seal off the mesoappendix and 10 mm endoclips to seal off the appendiceal stump can be used [9,10].

The results reported here can be further improved using an appendectomy kit containing the rest of the necessary consumable surgical supplies, such as surgical drapes, needles, scalpels, disposable material, etc. Our hospital's procurement service has plans to purchase this material shortly. In this study, we estimated the savings that could result based on the price of each item separately compared with the price for the kit as a whole. At the present time, the total price of all the surgical consumables purchased separately is €215. By comparison, the maximum price estimated for the kit is €185/kit. This would add a savings of a further €30 per procedure, i.e., €3,900/year.

Based on the above, we conclude that laparoscopic appendectomy using ligatures and clips to close off the appendix and the mesoappendix is a safe, reliable, and highly efficient method that affords our hospital annual savings of €68,978, and this amount will be increased by further savings of €3,900/year when the appendectomy kit comes into use [11].

This study was made possible thanks to the multidisciplinary teamwork of the surgery service, the surgical ward, and the procurement service to lower the costs of laparoscopic appendectomy, increase the efficiency of our decision making and procedures, and, ultimately improve the quality of care.

References

1. Ferrer M, Belda R. Instrumentation handbook for laparoscopic surgery. In Aran Ediciones SA, editors. Chapter 9. Laparoscopic appendectomy. 2011.
2. Strzatka M, Matyja M, Rembiasz K. Comparison of the results of laparoscopic appendectomies with application of different techniques for closure of appendicular stump. World J Emerg Surg. 2016;11:4.
3. Ramírez CFJ, Acosta PLE, Arizpe BD. Apendicectomía laparoscópica con endograpadora. Experiencia de una serie de casos. Rev Mex Cir Endoscop. 2016;17(3):123-7.
4. Elía M, Echazarreta-Gallego E, Cordoba-Diaz d Laspra E, Allue-Cabanuz M, Gascon-Dominguez M, Millan-Gallizo G, et al. Tratamiento de la base apendicular por laparoscopia mediante el uso de endograpadoras: análisis de resultados. Rev Chil Cir. 2017;69(2):135-8.
5. Galatioto C, Guadagni S, Zocco G, Mazzilo M, Bagnato C, Lippolis PV, et al. Mesoappendix and appendix stump treatment in laparoscopic appendectomy: A retrospective study in 1084 patients. Ann Ital Chir. 2013;84(3):269-74.
6. Cebrián C, Gomez FA, Granell SC, Vega MN, Lopez A, Alvarez MV, et al. Apendicectomía laparoscópica con endolazo: resultados de nuestra experiencia. Cir Pediatr. 2011;24:98-101.
7. Hanssen A, Plotnikov S, Dubois R. Uso de clips poliméricos (Hem-o-lock®) para el cierre del muñón apendicular, como alternativa en apendicectomía laparoscópica. Rev Venez Cir. 2006;59(2):55-9.
8. Cuaresma R, Benavides M, Buela E, Bignon H, Martinez-Ferro M. Uso de clips Hem-o-lock® en apendicectomía laparoscópica de pacientes pediátricos. Cir Pediatr. 2009;22:103-5.
9. Rakic M, Jukic M, Pogorelic Z, Mrklic I, Klicek R, Druzijanic N, et al. Analysis of endoloops and endostaples for closing the appendiceal stump during laparoscopic appendectomy. Surg Today. 2014;44(9):1716-22.
10. Van Rossem CC, van Geloven AA, Schreinemacher M, Bemelman WA. Endoloops or endostapler use in laparoscopic appendicectomy for acute uncomplicated and complicated appendicitis, Surg Endosc. 2017;31:178-84.
11. Mannu GS, Sudul MK, Bettencourt-Silva JH, Cumber E, Li FF, Clark AB, et al. Closure methods of the appendix stump for complications during laparoscopic appendectomy. Cochrane Database Syst Rev. 2017;11(11):CD006437.