Comparison between endoloop and linear mechanical stapler for the appendicular stump closure

Comparación entre ligadura con lazo hemostático y engrapadora mecánica lineal para el cierre de base apendicular

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Abstract

Introduction: In the last decades, the approach by minimally invasive surgery of abdominal pathologies is growing due to its evident benefits; the appendicular cases being the main surgical emergency, with different methods of closing the appendicular base. In this article, we compared the appendicular base closure with linear stapler and endoloop, to analyze the frequency of complications such as abscess, dehiscence and seroma. **Method:** A prospective, observational and descriptive study was conducted, with a total of 703 procedures, using 567 endoloop patients and 136 linear stapler, operated by the same surgeon and surgical team, with a completed learning curve. **Results:** The complications referred in the present study were patients with abscess ($n = 5$), dehiscence ($n = 3$) and seroma ($n = 3$). According to the phases of the appendiceal pathology: phase 1 or congestive appendix did not present complications; phase 2 or suppurative was reported one case of surgical wound dehiscence in the use of endoloop; in phase 3 or necrotic, one case of seroma was reported in a patient treated with endoloop; while in phase 4 or perforated there is a significant difference in the case of abscesses, reporting five in the use of endoloop and none in the case of a linear stapler. **Conclusions:** In our study there is no statistically significant difference between the use of linear stapler or endoloop in the early appendicular phases; being of significant utility in Phase 4 the use of linear stapler for the incidence of abscesses.

KEY WORDS: Endoloop. Mechanical lineal stapler. Appendicitis. Appendicular stump.

Resumen

Introducción: En las últimas décadas es creciente el abordaje por mínima invasión de patologías abdominales debido a sus beneficios evidentes. El cuadro apendicular es la principal emergencia quirúrgica, con diferentes métodos del cierre de la base apendicular. En este artículo comparamos dicho cierre con engrapadora lineal o ligadura con lazo hemostático, para analizar la frecuencia de complicaciones como absceso, dehiscencia y seroma. **Método:** Se realizó un estudio prospectivo, observacional y descriptivo, con un total de 703 procedimientos, empleando en 567 pacientes ligadura con lazo hemostático y en 136 engrapadora lineal, operados por los mismos cirujano y equipo quirúrgico, con curva de aprendizaje concluida. **Resultados:** Las complicaciones referidas en el presente estudio son absceso ($n = 5$), dehiscencia ($n = 3$) y seroma ($n = 3$). De acuerdo con las fases de la patología apendicular: fase 1 o apéndice congestivo, no presentaron complicaciones; fase 2

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o supurativo, se reportó un caso de dehiscencia de herida quirúrgica con el uso de ligadura con lazo hemostático; fase 3 o necrótico, se reportó un caso de seroma en un paciente tratado con ligadura con lazo hemostático; y fase 4 o perforado, se encuentra diferencia significativa en el caso de abscesos, reportando cinco con el uso de ligadura con lazo hemostático y ninguno con engrapadora lineal. Conclusiones: En nuestro estudio no existe diferencia estadísticamente significativa entre el uso de engrapadora lineal o ligadura con lazo hemostático en las fases apendiculares 1-3; en la fase 4 es de utilidad significativa el uso de engrapadora lineal ante la incidencia de abscesos.

PALABRAS CLAVE: Ligadura con lazo hemostático. Engrapadora mecánica lineal. Apendicitis. Base apendicular.

Introduction

Over the past few decades, the use of minimally-invasive approaches to abdominal pathologies has been growing, especially in acute gynecological, vesicular and appendicular conditions, where offering a speedy recovery, decreasing postoperative pain and reducing the frequency of surgical site infections has been achieved in comparison with traditional open surgery¹⁻⁴.

Acute appendicitis is the most common abdominal surgical emergency, and its current resolution approach is preferred using laparoscopic appendectomy, with different methods for appendicular stump closure, out of which the most commonly used are hemostatic loop ligation (endoloop), sutures, endoclips and linear staplers. An ideal closure should be resistant to traction, avoid infections or contamination, and elicit minimal local reaction by the tissue where it is placed⁵. In this article, we compare two basic appendicular stump closure methods, linear stapler and endoloop, with the purpose to determine if there is difference between the rate of complications such as abscess, dehiscence and seroma. Ligation with endoloop is usually more economic than with linear stapler, which also requires a trocar incision that may require from 12 to 15 mm, with the benefit of allowing a quick and efficacious closure of the appendicular stump, even in situations of appendicular perforation⁶⁻⁹. Regarding the duration of a laparoscopic surgery using linear stapler, it is 50 to 62 minutes, while the time reported with the use of endoloop is 47 to 75.4 minutes¹⁰.

Method

A prospective, descriptive observational study was carried out, with 703 patients undergoing appendectomies by the laparoscopic route during the period of January 2014 to December 2017, at different private hospitals, operated by the same surgeon with a completed learning curve. This protocol was approved by

the Hospital Ángeles Clínica Londres ethics and research committee, and authorization was requested to each patient by means of informed consent, where he/she could accept or refuse to be included in the study. In total, 703 procedures were included, out of which, in 567, ligation with endoloop was used and, in 136, linear stapler, with all procedures being performed by the same surgeon and surgical team, who had completed their learning curve. The electronic record-obtained database was collected in Microsoft Excel 2016, and for statistical analysis, Fisher's exact test was used in the R program, with statistical significance being set at a p-value < 0.05.

Results

Seven-hundred and three patients who underwent laparoscopic appendectomy were included; in 567, endoloop was used for appendicular stump closure (80.65%), whereas in 136 (19.34%), mechanical stapler was used.

The incidence of complications was studied and analyzed: abscess (n = 5), dehiscence (n = 3) and seroma (n = 3). The patients were grouped according to the appendicular condition phase (phases 1 to 4). Phase 1 corresponds to a congestive appendix; phase 2, suppurative; phase 3, necrotic; and phase 4, perforated. Once divided by phases, the number of patients who were operated with endoloop or stapler was recorded in order to compare and determine whether there is significant difference in the incidence of complications.

Within appendicular phase 1, none of the above-mentioned complications was found. In phase 2, one dehiscence was found. In phase 3, there was one case of seroma with the use of endoloop, but there is no statistically significant difference. In phase 4, there is significant difference for the incidence of abscesses, since five abscesses occurred when using endoloop and none when linear stapler was used; for the remaining complications there is no significant difference with the use of either surgical technique (Table 1).

Table 1. Comparison of the incidence of complications in appendicular stump closure

Phase	Complication	Endoloop	Stapler	p
1	Abscess	0	0	> 0.05
	Dehiscence	0	0	> 0.05
2	Abscess	0	0	> 0.05
	Dehiscence	1	0	> 0.05
3	Abscess	0	0	> 0.05
	Dehiscence	0	0	> 0.05
	Seroma	1	0	> 0.05
4	Abscess	5	0	0.00178
	Dehiscence	1	1	0.0518
	Seroma	2	0	0.08688

Discussion

Among the 703 patients who underwent this procedure, there were only 11 complications (1.56%), out of which 10 (1.42%) occurred with the use of endoloop and one (0.14%) corresponded to the linear stapler. Among these complications, there were 5 abscesses (0.71%), 3 cases of dehiscence (0.42%) and 3 of seroma (0.42%). According to Hilko Swank et al.⁴, the prevalence of intra-abdominal abscesses after laparoscopic appendectomy is 4.2%, and that of wound infection is 0.5%.

When the statistical analysis was performed, we found the following: in phases 1, 2 and 3, p-value was < 0.05, and thus we cannot conclude that one closure method is better than the other; in phase 4, the same is observed for complications such as seroma and abscess, but for dehiscence, a p-value < 0.05 is observed, and it can be therefore concluded that, at this phase, the stapler causes less abscesses than endoloop.

Laparoscopic surgery has been shown to offer numerous benefits for the resolution of several pathologies, such as appendicitis, but controversy persists on the method for appendicular stump closure.

In 2017, Van Rossem et al.¹¹ carried out a comparison between endoloop and stapler for the resolution of appendicitis by the laparoscopic route in 1,369 patients, with the purpose to analyze a possible relationship between the closure method and infectious complications, and concluded that the type of closure did not influence on complications, but appendicitis severity did. Sahm et al.¹² assessed the effectiveness of the use of endoloop for appendicular closure in comparison with linear stapler, and found that endoloop ligation has no significant difference in terms of resulting complications. Miyano et al.¹³ carried out a similar study, and concluded that there was no

significant difference in laparoscopic appendectomy complications between the use stapler or endoloop. Safavi et al.¹⁴ observed that the use of endoloop is preferable, since there is no significant difference with the stapler in terms of complications, but there is in the cost-benefit ratio and, in addition, they stated that such complications may be due to the quality of the appendicular stump rather than to the closure technique. In contrast, Escolino et al.¹⁵ concluded that, although the use of stapler is more expensive than endoloop ligation, it should be used in complicated appendicitis with perforation or necrosis, since it was associated with a lower incidence of abscesses.

As for cost-benefit, in Switzerland, Beldi et al.^{16,17} demonstrated that the use of stapler costs € 248 more than the use of endoloop. Kazemier et al.¹⁸ report that, in the European Union, the use of stapler increases the cost by € 300 in comparison with endoloop ligation. Miyano et al.¹³ refer that, in the USA, average operating cost using endoloop is USD \$ 890, while using the stapler it is USD \$ 1,300. Mehdorn et al.¹⁰ report that, in Germany, the use of the stapler is € 235 more expensive than the use of endoloop.

In this article, we assess two methods, linear stapler and hemostatic loop ligation (endoloop). The linear stapler leaves metal staples on the stump and may cause future adhesions in the abdominal cavity or pseudopolyp formation in the cecum. As for ligation with endoloop, there is evidence that it reduces safety when used in a perforated appendix⁴. A crucial part of the procedure with this method is ligation manual fixation, with the possibility of insufficient closure and risk of appendicular stump abscess⁵. Endoloop is 6 to 12 times more economic than the use of linear stapler⁶.

Conclusions

In our study there is no statistically significant difference between the use of linear stapler or endoloop in appendicular phases 1, 2 and 3. The same behavior is not observed in phase 4, particularly with regard to abscess, which shows a higher incidence with the use of endoloop. Owing to of this, we consider that the use of linear stapler might be adequate and timely for appendicular stump closure at phase 4.

Conflicts of interests

The authors declare that they have no conflicts of interest.

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