

Laparoscopic appendectomy in the pediatric age group: comparative study between LigaSure and monopolar diathermy

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Background Various techniques such as endoloops, endoscopic linear cutting staplers, electrothermal vessel-sealing system (LigaSure), Harmonic scalpel, clips, and bipolar coagulation have been used for the division of the mesoappendix during laparoscopic appendectomy. This study was conducted to evaluate the potential benefits and limitation of LigaSure and electrocautery in laparoscopic appendectomy (LA).

Patients and methods Forty patients with clinical diagnosis of acute appendicitis admitted to the Pediatric Surgery Unit at the Alexandria University Children's Hospital between September 2008 and September 2010 were included in this study. The patients were assigned to two groups according to the mesoappendix dissection device: LigaSure and monopolar diathermy (MD) groups. The primary outcome measures (operating time, conversion rate, length of hospital stay, bleeding during dissection, port site infection, and readmissions) were compared.

Results LA was performed in 40 patients with acute appendicitis. Twenty cases were in the LigaSure group and 20 cases were in the MD group. The mean operative times were 33.05 min and 43.80 min in the LigaSure and MD groups, respectively. Bleeding during appendicular

dissection as roughly estimated by the mean number of needed irrigations were 1.60 and 1.95 for the LigaSure and MD groups, respectively. No statistically significant differences regarding hospital stay, rate of infection, readmissions, or conversion to open appendectomy were found, whereas significant differences were observed in operative time and bleeding.

Conclusion The use of LigaSure for dissection of the mesoappendix shortens the operative time, and significantly decreases bleeding during LA. We believe that LigaSure is a safe and useful tool for mesoappendix dissection during LA. *Ann Pediatr Surg* 7:70–71 © 2011 Annals of Pediatric Surgery

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Introduction

Appendicitis is the most common surgical emergency in pediatrics; its early diagnosis and treatment greatly reduces morbidity and possible mortality [1]. Laparoscopic appendectomy (LA) has gained popularity within the last decade. Although the laparoscopic technique is now widely practiced and is relatively simple, there is variation among surgeons regarding the details of the technique; specifically, the method of dividing the appendix and mesoappendix [2]. Either cautery with monopolar diathermy (MD) or the use of LigaSure (valley Lab, Boulder, Colorado, USA) can be used to devascularize the mesoappendix. The decision as to which of these two techniques is to be used is usually based on the surgeon's preference rather than on the knowledge of the advantage of each. The aim of this study was to ascertain whether differences exist between the MD and the LigaSure, so that an evidence-based decision could be made.

Patients and methods

This prospective study included 40 children with acute appendicitis, who underwent LA procedure either by the MD or the LigaSure technique at the Alexandria University Children's Hospital during the period between September 2008 and September 2010. Patients with either perforated or nonperforated appendicitis were

included, whereas patients who concurrently underwent other procedures in addition to an appendectomy were excluded from the study.

A determination of which of the two LA techniques were used was chosen randomly. Both LA techniques utilized three trocars (KarlStorz, Culver, California, USA) and a 10-mm 0°-angled laparoscopic lens. In both techniques, the appendix was removed through the umbilical trocar. The MD technique consisted of blunt mobilization of the appendix. Electrocautery (Valley Lab) was then used to divide the mesoappendix and to control the appendiceal artery. The base of the appendix was then ligated with two endoloop ligatures or 2/0 vicryl ties using intracorporeal knot tying. A single ligature was placed 1-cm distal to the base, and the appendix was then excised sharply between the ligatures. For the LigaSure technique, the mesoappendix was divided by the sealing device.

The base of the appendix was then ligated with a single endoloop and divided distally with the LigaSure.

Comparative data on age of the patient, operative time, bleeding during appendiceal dissection, conversion to open appendectomy, port site infection, length of hospital stay, and readmission due to postoperative complications were obtained from medical reports and were tabulated. The amount of bleeding was estimated by the number of

irrigations required when the field is obscured; the final abdominal toilet was not included.

Statistical analysis was carried out using SPSS version 15 (Chicago, Illinois, USA). Quantitative data were compared using Student's *t*-test. Qualitative data were compared using Fisher's exact test. A *P* value of less than 0.05 was considered to be significant.

Results

A total of 40 patients underwent surgery for acute appendicitis, 20 patients in each group. The LigaSure group included six boys and 14 girls, whereas the MD group included five boys and 15 girls.

As shown in Table 1, the mean operative times were 33.05 ± 7.82 min and 43.80 ± 10.47 min in the LigaSure and the MD groups, respectively. This difference is statistically significant ($P = 0.001$). The lengths of hospital stay were 2.15 ± 0.81 days and 2.75 ± 1.41 days for the LigaSure and the MD groups, respectively ($P = 1.48$). Bleeding during dissection (estimated by the mean of numbers of times of irrigations) was found to be 0.7 and 1.40 for the LigaSure and the MD groups, respectively ($P = 0.008$).

Discussion

The technique of LA was started by gynecologists and was adopted later by general surgeons [3]. Although adopted by many centers as a gold standard, LA benefits compared with open appendectomy are still debatable by many surgeons. This may be attributed to the simplicity of open appendectomy, which is easy to perform and has relatively low morbidity and low cosmetic problems [4].

No inadvertent intraoperative complication was documented in the 40 patients included in the study. Open establishment of pneumoperitoneum proved to be safe, rapid, and easy. This is consistent with Bonjer *et al.*'s [5] study of 1244 cases who proved the technique to be safe when compared with the closed technique.

Sealing the two ends of the appendicular stump and cutting in between is an essential step during appendectomy [6]. Replacing the distal knot with simply applying the LigaSure is proved to be a safe procedure [7]. This was demonstrated by the absence of any cases of residual collection and the statistical insignificance between the two groups when comparing the occurrence of port site infection with the MD and LigaSure groups, respectively.

Table 1 Laparoscopic appendectomy outcomes by operative technique

	LigaSure	Monopolar diathermy	<i>P</i> value
Operating time in minutes (mean)	43.80 ± 10.47	33.05 ± 7.82	0.001
Hospital stay in days (mean)	2.15 ± 0.81	2.75 ± 1.41	0.138 NS
Bleeding during appendicular dissection (mean of number of irrigations)	0.7	1.40	0.008
Port site infection	0.0	2.0	0.487
Readmissions	1.0	3.0	0.605
Conversions	1.0	2.0	1.0

NS, not significant.

In our study, there was no significant difference in the length of hospital stay, rate of conversion, port site infection, or readmission due to complications. Bleeding is the most common cause of conversion during laparoscopy. The cost effectiveness of using a vessel-sealing device as the LigaSure, while controlling large vessels as with splenectomy, is unquestionable [8]. Using the LigaSure system, appendiceal vessels could be easily sealed and the mesoappendix could be easily dissected [9]. In our study, the use of the LigaSure during dissection of the appendix and devascularization effectively decreases the bleeding. We have proved this with significantly less number of irrigations and volume of blood during surgery (P value: 0.008).

In contrast, and as expected, the operating time was affected greatly by using the LigaSure. The operating time was significantly lower with the LigaSure group (33.05 ± 7.82 min) than the MD group (43.80 ± 10.47 min), with a P value of 0.001.

Several studies have discussed the relationship between the use of a sealing device and the operative time in LA, and concluded that it is a cost-effective procedure [7,9,10]. In contrast, Ponsky [11] proved that using the cautery alone can be as safe as using the more expensive devices and debated that the use of LigaSure or the harmonic scalpel is (Ultracision, Ethicon Endosurgery, Cincinnati, Ohio, USA) unwarranted.

Conclusion

The use of the LigaSure was associated with a shorter operating time and less bleeding than the use of the MD in LA. The LigaSure seems to be a safe and useful tool for mesoappendix dissection. Further studies are required for elucidating the definite role of the LigaSure in LA.

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