Laparoscopic Appendectomy Using a Polymetric Clip to Close the Appendicular Stump

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ABSTRACT

Background: The objectives of this study were to establish whether the occlusion of the appendicular stump by using nonabsorbable polymeric clips is technically feasible and whether differences exist in the postoperative course of patients to whom polymeric clips are applied compared with patients whose appendicular stump is closed with a surgical stapler.

Methods: This was a prospective study in 2 stages. In phase 1, 28 patients operated on for resection of the appendix between March 2002 and September 2003 were assigned to 1 of 2 groups. In 14 patients, the appendicular base was occluded by using an endoscopic linear cutting stapler. In the remaining 14, the appendicular base was ligated by using nonabsorbable polymeric clips (Hem-o-lock). We compared the surgical time, hospital stay, hospital costs, and complications. In phase 2, 250 patients were analyzed who underwent laparoscopic appendectomies performed between March 2002 and 2006 using a Harmonic scalpel for the section and hemostasis of the appendicular mesentery. Ligation of the appendicular stump was performed with Hem-o-lock clips.

Results: We found a significant difference in procedure costs, with the endoscopic staplers being more expensive.

Conclusion: The use of polymeric clips is feasible, safe, and an economic alternative for ligation of the appendicular stump during laparoscopic appendectomies.

Key Words: Laparoscopic appendectomy, Polymeric clips, Appendicular stump.

INTRODUCTION

Laparoscopic appendectomy has become a frequently used alternative in the treatment of acute appendicitis. In 1983, laparoscopic appendectomy was first described by Semm, a German surgeon, and in 1987, Schreiber carried out the first laparoscopic appendectomy for acute appendicitis. Laparoscopic appendectomy has not gained the same widespread popularity and enthusiasm as has laparoscopic cholecystectomy.1 Recent reports1–2 have documented the feasibility and safety of laparoscopic appendectomy, even suggesting it as the new “gold standard.” Currently, it is the standard treatment for this disease at our institution. Several studies have compared laparoscopic appendectomy with the conventional open procedure, regarding surgical time, hospital stay, return of the patient to normal life and complications.1,3–8 Various techniques have been used for the ligation of the appendicular stump, such as preformed suture loops (Endoloops) and endoscopic linear cutting staplers (endo GIA), the LigaSure System, the Harmonic scalpel,9–15 and even bipolar coagulation.16 Some series have used polymeric clips for occlusion of the appendicular stump.17,18

We evaluated the application of nonabsorbable polymeric clips as a feasible and safe technique. The objectives of the present study were1 to establish the feasibility of the occlusion of the appendicular stump by using nonabsorbable polymeric clips;2 to establish whether differences exist in the postoperative course of patients where polymeric clips were used, in comparison with those patients whose appendicular stump was closed with a surgical stapler (EndoGIA); and3 to compare the cost of both techniques and evaluate whether use of nonabsorbable polymeric clips is a safe alternative during laparoscopic appendectomies.

METHODS

This prospective study was carried out in 2 stages; Stage 1 was performed between March 2002 and September 2003. In this stage, 28 consecutive patients were operated on at the Instituto Médico La Floresta in Caracas, Venezuela for resection of the appendix by laparoscopic appendectomy. CO₂ pneumoperitoneum was installed by using a Veress
needle. Three laparoscopic trocars were placed: one 10-mm trocar at the umbilicus, one 5-mm trocar at the middle line just cephalic to the pubic bone, and one 12-mm trocar at the left iliac fossae. After the initial laparoscopic evaluation of the abdominal cavity, the appendicular mesentery was grasped with endograspers, avoiding injury to the appendicular wall. For the first 14 patients, a single application of an endoscopic 4.5-mm x 2.5-mm linear cutting stapler was used (EndoGIA, Tyco Healthcare, U.S. Surgical, Norwalk, CT), for stapling and cutting the appendicular mesentery and the base of the appendix. For the next 14 patients, a Harmonic scalpel was used (Ultracision, Ethicon Endosurgery, Cincinnati, OH) for the section and hemostasis of the appendicular mesentery. Ligation of the appendicular base was done by using nonabsorbable Hem-o-lock MLX polymeric clips (Weck Closure Systems, Triangle Park, NC) (Figure 1), placing 2 of them in the proximal portion of the appendicular base and one a few millimeters distally (Figure 2), cutting the appendix between the 2 proximal clips and the distal clip, using endoscopic scissors (Figure 3). The surgical specimen removal was completed in all cases in both groups through the 12-mm port placed in the left iliac fossae, by using special specimen bags (Endobag, Ethicon Endosurgery Cincinnati, OH). The Kruskal-Wallis test was used to compare surgical times, hospital stay, and hospital costs in both groups.

In Stage 2, 250 patients diagnosed with acute appendicitis who underwent laparoscopic appendectomy between March 2002 and March 2006 were evaluated. The pneumoperitoneum was installed by using a Veress needle. Three laparoscopic ports were placed: one 10-mm at the umbilicus, one 5-mm at the middle line just cephalic to the pubic bone, and one 10-mm trocar at the left iliac fossae. After the initial laparoscopic evaluation of the abdominal cavity, a Harmonic scalpel was used (Ultracision, Ethicon Endosurgery, Cincinnati, OH) for the section and hemostasis of the appendicular mesentery. Occlusion of the appendicular base was done by using nonabsorbable Hem-o-lock MLX polymeric clips (Weck Closure Systems, Triangle Park, NC) in the same way as in the first stage clip group.

RESULTS

In the first stage of our study, surgical time measured from the installation of pneumoperitoneum to the complete closure of the port wounds was 40 minutes to 90 minutes (mean, 53.4) in the patients where the appendicular...
stump was occluded using polymeric clips, and 30 minutes to 110 minutes (mean, 62.36) in the group where the EndoGIA was used (P=0.094).

None of the 14 patients whose appendicular stump was ligated with polymeric clips had complications with a follow-up of 3 weeks to 6 months.

Likewise, none of the patients in the surgical stapler group had complications with a follow-up of 3 to 20 months. Hospital stay in the polymeric clip group was 2 days (range, 1 to 5), while hospital stay in the surgical stapler group was 1 day to 6 days, with a mean of 2.78 days (P=0.53).

Hospital expenses for the patients (total amount of hospital bill) in the clip group was Bolivares (Bs): 4,935,760.20 ($3,084.85), while the mean hospital bill in the EndoGIA group was Bolivares (Bs): 6,779,285.60 ($4,237.05) (P=0.01414).

The reports of the histological examinations in the polymeric clip group showed 2 cases of follicular lymphoid hyperplasia, without frank histological signs of acute appendicitis and 12 with histological findings consistent with acute appendicitis. Four of them were phlegmonous with periappendicular peritonitis, one perforated and one with Entamoeba histolytica trophozoites present in the lumen and wall of the appendix. The 6 remaining reports indicated the presence of inflammatory infiltrate of white cells in the appendicular wall. Histological examination of specimens in the EndoGIA group showed 2 without findings of acute appendicitis (one with a hyperplastic polyp within, one chronic parasitaria appendicitis) and 11 cases of acute appendicitis (one perforated and 5 phlegmonous with periappendicular peritonitis and 6 with acute inflammatory infiltrate of the wall). A 34-year-old female patient underwent laparoscopy for the evaluation of pelvic pain. Her appendix appeared to be rigid and hard; therefore, we decided to perform an appendectomy by using an EndoGIA. The histological examination of the surgical specimen revealed a “carcinoid tumor 1.3 cm x 0.5 cm, with infiltration of the entire appendicular wall reaching the serosal layer.” The base was free of tumor with adequate margins. At the second stage of our study, the surgical time, measured from the installation of pneumoperitoneum to the complete closure of the port wounds, was 20 minutes to 60 minutes (mean, 45). Hospital stay was 1 day to 2 days.

The hospital expenses for patients in this stage were Bolivares (Bs): 9,498,978.95 ($4,418.13).

DISCUSSION

In first stage of our study, 2 groups of 14 patients each were compared. An endoscopic linear cutting surgical stapler for the closure and section of the appendicular mesentery and base was used in one group, and the Harmonic scalpel for the section and hemostasis of the appendicular mesentery and polymeric clips for the ligation of the appendicular stump was used in the other group. Surgical time, hospital stay, hospital costs, and complications in both groups were evaluated. No differences in surgical time or hospital stay were found, whereas a significant difference in cost of the procedures was. When the final hospital bills were compared, polymeric clips were found to be less expensive. No complications occurred in either group. Tan et al18 conducted a study to evaluate the efficiency of polymeric clips in minimally invasive surgery, and no complications related to the clips were observed.

The reports of histological examinations in the polymeric clip group are similar those reported by Klaiber et al.10 Several studies have shown that the use of the EndoGIA is a safe, quick, and easy method for the completion of laparoscopic appendectomies.9–11,14 Polymeric clips have been used in some patient series for ligation of the appendicular stump, without complications related to the procedure.17,18 Other studies13–15 have reported the use of LigaSure or the Harmonic scalpel for the occlusion of the appendicular stump.

The force needed to retrieve polymeric clips has been compared with the force needed to retrieve metallic clips of conventional use. Higher axial and transverse forces are needed to dislodge polymeric clips.17–19 These findings suggest that polymeric clips provide safer ligation of structures than do metallic clips. These reports motivated us to use polymeric clips in our study for the ligation of the appendicular stump.

The results of our series suggest that nonabsorbable polymeric clips are a useful alternative for ligation of the appendicular base and have encouraged us to continue to use this technique to gain more experience in a larger series of patients. Further cost savings can be gained if the appendicular mesentery is severed between clips (polymeric clips or others can be used). Bipolar or monopolar instruments are useful for the hemostasis of the mesentery; however, in all clip group patients in our study, we used the Harmonic scalpel for this purpose.
CONCLUSION

This study demonstrates that it is feasible to use nonabsorbable polymeric clips for the ligation of the appendicular stump and that the same is a safe economic alternative during laparoscopic appendectomies.

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