LAPAROSCOPIC APPENDECTOMY WITH EXTRACORPOREAL KNOT TYING
A Safe, Feasible and Economical Method to Secure the Appendiceal Stump

Yasser TOHME, Houssam KHODOR ABTAR, Youssef BADRA, William BAKHOS, Mostapha MNEIMNEH

ABSTRACT • Purpose: Acute appendicitis is the most common abdominal pathology requiring emergent surgical intervention. Laparoscopic appendectomy (LA) is commonly performed and different procedures are used to close the appendiceal stump. The aim of the study is to evaluate the outcomes of patients who underwent appendectomy after securing the stump of the appendix with extracorporeal knots.

Method: Patients in whom the stump of the appendix was closed with extracorporeal knots (ECK) during LA over a period of 2 years were included in the study. Reports of patients were collected retrospectively from patient files. Laparoscopic appendectomy was applied through 3 ports. Two 2-0 vicryl ECK were placed at the stump of the appendix. Similar ECK has been described in the literature and has been shown to be safe.

Results: Twenty-two patients were included in the study. Eight of them (36.4%) were females, 14 (63.6%) were males. Mean age was 25.2 years (range: 15-55). During the post-operative period, one surgical intra-abdominal collection was detected after 7 days from surgery. And there was no leakage from the stump of the appendix in any of the patients. No surgery-related mortality was reported.

Conclusion: Stapler, endoloop, various clips or a handmade loop could be used to secure the appendiceal stump. We recommend using an extracorporeal knot tying for control of the appendiceal stump as a feasible, safe and cheap method.

Keywords: acute appendicitis, laparoscopic appendectomy, extracorporeal knot tying

INTRODUCTION

Acute appendicitis is the most common abdominal surgical emergency. Open appendectomy has been considered the standard treatment for acute appendicitis (AA) since first described by McBurney [1] in 1894. A recent meta-analysis based on randomized controlled trials (RCTs) revealed that laparoscopic appendectomy (LA) which was initially performed by Semm [2] in 1983 has a tendency of replacing the open procedure as a standard treatment for acute appendicitis. LA has many obvious advantages, including earlier bowel function recovery and postoperative oral intake, less invasiveness and post-surgical pain, shorter postoperative hospital stay, earlier return to normal diet, activities and work, lower rates of postoperative complications especially wound infection and mortality, and better cosmetic results, despite a possibly longer or equal operation time [3].

There is also evidence sustaining LA for children, obese population, and adults with complicated appendicitis [4]. However, a systematic review based on low-level evidence showed that LA might cause more fetal losses during pregnancy [5].

Disadvantages of LA are longer operative time, higher rate of developing intra-abdominal abscesses in some
studies and higher cost [6,7]. To lower costs, some methods have been tried out such as using two ports, closing the stump with clips, and a handmade loop [8,9]. Another way of lowering costs is using an extracorporeal knot instead of an endoloop or stapler. The aim of this study is to evaluate the outcomes of patients whose stump was closed with extra-corporeal knots.

MATERIALS AND METHODS

Patients in whom an extracorporeal knot was used during laparoscopic surgery of acute appendicitis between June 2012 and June 2014 were included. Gender, age, operative information and complications related to the operation were collected from patients’ clinical files. Purulent fluid collection in the abdomen was defined as intra-abdominal abscess. Purulent discharge from incision or erythema on incision were considered surgical wound infection.

All operations were performed laparoscopically by the same surgical team including those where a complicated appendicitis (i.e. with abscess or phlegmon) was identified. Patients received antibiotics preoperatively and were diagnosed by computed tomography (CT) scan of the abdomen and pelvis.

The first 11 mm port was placed at the umbilicus after CO₂ insufflation of the abdomen through Veress needle till 14 mmHg; afterwards two 5 mm ports were placed in the right and left lower quadrants of the abdomen. Patients were lying in Trendelenburg position, tilted slightly to the left side. Mesentery of appendix was dissected by direct cauterization, then two ties were placed to the healthy base of the appendix, prepared extracorporeally with 2/0 vicryl. There was a 2-3 mm distance between two knots (Figure 1). Afterwards, the appendix was cut above the ties and retrieved through the 11 mm umbilical port under vision.

Our knot is a modified extracorporeal knot tie described by Moreno et al. [10] that was proved to be safe. For preparation of this knot, a 75 cm long vicryl 2-0 thread is introduced through the right lower quadrant (RLQ) 5 mm trocar, turned around the base of the appendix held up by a grasper introduced through the left lower quadrant (LLQ) port. The end of the thread is brought out through the same port, a double hand surgical knot is made and pushed by a fenestrated grasper to be tightened at the base of the appendix, further two smooth knots are made extracorporeally and slid down in the same manner (Figure 2).
RESULTS

Twenty-two patients were included in the study, the majority of which (63.6%) were males. Average age was 25.2 (range, 15-55). All patients were operated as described before. There was no need for additional loop or stapler use or conversion to open procedure. On day 1 post-op, all patients were allowed clear fluid diet. The mean length of hospital stay was 1.8 (1-5) days. During the postoperative period, no surgical wound infection was encountered but one intra-abdominal collection (4.5%) was detected by CT scan on postoperative day 7. This patient was readmitted and CT-guided drainage was performed; then he/she was re-operated laparoscopically. Abnormally matted bowels were encountered. No evidence of an abscess was noted intraoperatively. Pathology reports of surgical cultures later revealed a picture of abdominal fungal infection, while the stump of the appendix and cecum were normal.

In one patient with a friable severely inflamed appendix, the appendix was transected at its base by the tightened knot and a figure of 8 vicryl 2-0 suture was stitched at the site.

There was no leakage from the stump of the appendix in any patient. According to histopathological examination, 5 (22.7%) specimens were considered complicated (i.e. perforated, with phlegmon and/or abscess) while the rest (77.3%) were considered non-complicated (i.e. early acute appendicitis, acute appendicitis, acute purulent appendicitis). One case showed an obstructing hyperplastic polyp as the cause of the appendicitis; however, no abnormal pathology was noted.

DISCUSSION

Laparoscopic appendectomy (LA) is becoming an increasingly popular choice of treatment for acute appendicitis after the widespread use of laparoscopy.

Several studies including meta-analyses and randomized controlled trials (RCTs) have shown less wound infection, less pain, earlier discharge, and earlier return to normal activities with LA than with open surgery [10]. We firmly consider LA and open appendectomy to be at least equivalent; however, LA entails higher costs of treatment.

Laparoscopic surgery is associated with higher costs compared to open appendectomy [11,12]. For this reason, some surgeons have tried to reduce those costs by decreasing the number of ports or other surgical instruments used [13]. Some studies have reported that closing the stump of the appendix with materials other than a stapler or endoloop could also lower the costs. Although studies in this context are limited, it has been reported that the stump of the appendix can be closed safely with clips, with handmade loops or with extracorporeal sliding knots [14,15].

Closure of the stump of the appendix with a stapler is a simple but more expensive method when compared with others [4-6, 13]. Closure with endoloop is a common way and has a lower cost than a stapler [4]. Some authors have described various clips for closure that are easier and cheaper. Partecke et al. demonstrated that using non-absorbable polymeric clips is safer and cheaper than a stapler [6]. But these clips are not appropriate for patients who have a stump diameter over 1 cm. Kiudelis et al. compared intracorporeal knotting with invagination suture used in 40 patients with endoloop used in 112 patients. The rate of intra-abdominal infection was similar in both groups. [14]. Yildiz et al. compared endoloop and the cheaper handmade endoloop; an intra-abdominal abscess developed in one patient out of 57 where a handmade loop was used and in one patient out of the 41 using endoloop [8]. Arcovedo et al. compared an extracorporeal sliding knot, which is similar to the knot used in our study, with a stapler and detected just one intra-abdominal abscess among 63 patients in whom an extracorporeal sliding knot was used. The authors concluded that the extracorporeal sliding knot method is a safe and cheaper way for closing the stump of the appendix [13].

Two extracorporeal knots made of vicryl 2-0 cost approximately two American dollars (USD) in our country. Costs of stapler, two endoloops, and two clips are 250 USD, 100 USD, and 7 USD, respectively. Thus, the extracorporeal knot is cheaper than all of them. In our study, an extracorporeal knot was used in all patients whatever the diameter of the appendix was. Leakage from the stump or cecal fistula did not develop. One case of intra-abdominal abscess was detected and drained in the Douglas pouch. Observation of the appendical stump showed normal morphology and no displacement of loops was detected.

Currently, LA is considered safe to perform, even for complicated or perforated appendicitis. Intra-abdominal abscess after LA is reported to be lower for LA than for the open procedure; however, in one study, intra-abdominal abscess formation rate after LA was 2-4%, which is higher than that with open appendectomy [13-17]. This may be due to insufficient treatment of local peritonitis laparoscopically. There is no relation between abscess formation and the method used for closure of the stump of the appendix [5-6,18]. In our study, like other series, one intra-abdominal collection out of 22 patients was detected in addition to one transection of appendix upon application of knot.

One limitation of this study was the small number of patients. As a result, definitive conclusions cannot be drawn from the findings. However, few previous articles have demonstrated the efficacy of stump ligation without higher than expected complication rates. The absence of any stump blowout or fistula, or any communication between the stump and an abscess in either group speaks in favor of their comparability in securing the stump. The use of 2-0 vicryl did not alter the outcomes for our patients. Tying the gangrenous base of an appendix also did not cause any problems.
CONCLUSION

Using extracorporeal knot to close the stump of the appendix during laparoscopic appendectomy seems to be a good alternative to the stapler and may help lower the costs of LA. No increased risk of stump-related complications, abscess formation, or wound infection was noted with extracorporeal knot tying. Extracorporeal knot tying requires a short time to be tied and secured. It uses a simple and economic 2-0 vicryl suture, which can be passed through a 5-mm trocar. In this way, the costs of the disposable material can thus be kept to a minimum, and potential larger trocar-site complications can be avoided.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES