

APPENDICEAL BASE LIGATION WITH THE HAND-MADE POLYDIOXANONE (PDS) EXTRACORPOREAL KNOT

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Abstract

Objective: This study describes our experience with a low cost handmade polydioxanone (PDS) extracorporeal knot to reduce the cost of laparoscopic appendectomy in a surgical practice.

Methodology: This retrospective study was conducted from January 2018 to December 2019 in a general surgical unit of the University College Hospital Ibadan. The files of 20 patients with complete data for whom extracorporeal hand-made PDS'0' knots were used for appendiceal stump closure during laparoscopic appendectomy were retrieved.

Results: The mean age was 28.4 ± 13.2 years. There were nine male and eleven female patients. All the operations were performed by the same surgical team.

The mesoappendix was coagulated with bipolar cautery and cut with scissors. The appendix base was double ligated with two extracorporeal knots and divided. The mean duration of surgery was 59.2 ± 31.2 minutes. The median length of hospital stay was 2 days. The mean duration of follow up was 2.80 ± 0.50 months. One patient developed superficial port site infection.

Conclusion: The handmade extracorporeal knot used in this retrospective study for securing appendicular stump was found to be safe and cheaper than pre-tied extracorporeal loop. This will reduce dependency upon preformed endoloops making the procedure cheaper. There was no incidence of failed application of the handmade extracorporeal knot.

Key words: laparoscopy; appendectomy; extracorporeal

Introduction

Appendicitis is the most common surgical emergency in general surgery¹. Laparoscopic appendectomy (LA) has gained global acceptance over open appendectomy which is an older technique. While studies have demonstrated minimal differences in operative times for both laparoscopic and open appendectomy with experienced surgeons, LA has fewer wound infection rates, faster recovery, and earlier return to work in comparison with open appendectomy^{2, 3}. Postoperative complication rates are slightly less in LA. ⁽³⁾ Despite this evidence, LA has failed to gain unequivocal acceptance by the general surgical community as an alternative to open appendectomy (OA) especially in developing countries.

Some reasons often mentioned against the universal acceptance of laparoscopic appendectomy include the elevated cost of laparoscopic surgery⁴. However, the cumulative cost inclusive of admission, treating complications and medications is in favour of LA⁵.

Utilising reusable instruments in laparoscopic surgery reduces the overhead cost of the procedure.

The most critical part of LA is a safe closure of the appendix stump to prevent intra-abdominal complications from faecal leak into the abdominal cavity. The appendix stump may be closed in several ways which are broadly divided into traditional ligatures (such as intracorporeal or extracorporeal ligatures or Roeder loops) and mechanical devices (such as clips, stapling devices or electrothermal devices^{6,7}).

Many modifications have been made to reduce cost of laparoscopic appendectomy further in developing countries. These include the one- or 2-trocar techniques, instrument-assisted knotting, and closure of the stump by clip applier, staplers or the endoloop suture. However, despite these wide range of stump closure techniques, these appliances are either not readily available or significantly increase the cost of surgery for the patient. Two PDS sutures with an approximate price equivalent of one American dollar (USD) are required for two handmade loops. On the other hand, the endoloop costs an equivalent of 15 USD each in Nigeria making the hand-made loop a much cheaper alternative.

Secondly laparoscopic surgeons with limited experience may not be adept in intracorporeal knotting. We present our experience with the use of hand -made

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extracorporeal PDS Roeder's knots for securing the appendix stump.

Materials and Methods

Patients and Method

This retrospective study was carried out in Department of Surgery University College Hospital from January 2018 to December 2019. Within this study period sixty-nine patients with appendicitis were admitted. Twenty-three patients had laparoscopic appendectomy with the hand-made extracorporeal knots. The files of 20 patients who had the appendix stump closure with hand-made extracorporeal knots PDS'0' at laparoscopic appendectomy were retrieved. The complete records of three patients could not be obtained making a data retrieval rate of 87%. Prior to surgery every patient was informed about the details, risks, and benefits of the technique. Routine consent was obtained all patients. Exclusion criteria for laparoscopic appendectomy included patients with clinical or radiological features of ruptured or perforated appendicitis, patients with previous abdominal surgery, patients not fit for general anaesthesia, non-consenting patients. Procedures which were converted to an open procedure were not included in this review because no extracorporeal knot was applied. Paediatric patients are not treated by this surgical division.

Procedure

All the operations were under general anaesthesia. One gram of cephalosporin and 500mg of metronidazole was administered as preoperative antibiotics. Pneumoperitoneum was created using the veress needle through an umbilical port. Subsequently a 10mm trocar was inserted through the umbilical port. Consequently, a 10mm trocar and a 5mm trocar were inserted in the left iliac fossa and the suprapubic regions, respectively.

A 10 mm zero-degree telescope was inserted through the umbilical port while a yohan forceps was inserted through the 5 mm supraumbilical port. An 5mm adaptor was attached to the 10mm left iliac port which was used for introduction of the 5mm Maryland dissector, the 5mm scissors or the 5mm bipolar forceps as required.

Sequel to the establishment of the three ports, the caecum was identified, and the appendix was located and retracted towards the anterior abdominal wall with the yohan forceps. This displayed the mesoappendix which was sequentially coagulated close to the appendix base with the bipolar forceps and divided

with the scissors until the base of the appendix was adequately exposed. Subsequently a hand tied PDS '0' Roeder's knot was introduced through the 10mm port using a 5mm knot pusher. The appendix was guided into the loop of the knot using the yohan forceps. The knot was manipulated to the base of the appendix and was tightened at the base of the appendix by advancing the knot pusher. Two Roeder's knots were applied to the base of the appendix about 0.2 to 0.4 cm apart. The appendix was then coagulated with the bipolar forceps at the energy of 35 watts about 0.5 cm and 1cm distal to the applied loop to seal the lumen following which the appendix was divided between these coagulated points.

This was to avoid spillage of enteric contents. The appendix was retrieved through the 10mm trocar in the left iliac fossa. The appendix stump was visualised to ensure there was no bleed. The operating ports were removed under direct vision while the trocar in the umbilical port was withdrawn with the telescope partially withdrawn. The fascia closure of the umbilical port was with Nylon '0' while other ports had only skin closure done.

To form the endoloop we used the (1: 3: 1) method. First, a loop was made around the assistant's fore finger with one short limb and one long limb. Next a simple knot was made with one throw resulting in a long limb and a short limb. Then with the shorter limb, three winds were made around both limbs. After that the third wind a half hitch was made. The loop was tightened and checked for sliding (Figure 1). The long limb of the suture was passed through a 5mm reusable knot pusher. The duration for making the two loops was about two minutes.

Each knot was tested by sliding the knot forward slightly to make sure it would secure the appendix base. If the knot did not slide it was reconstructed using the same suture.

Figure 1 The Configuration of Roeder's knot

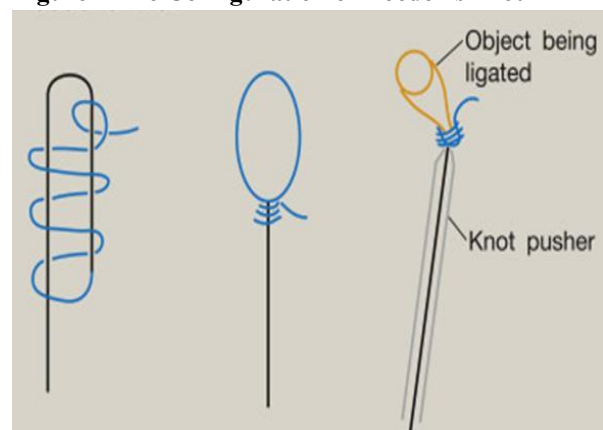


Figure 2 Application of the first knot

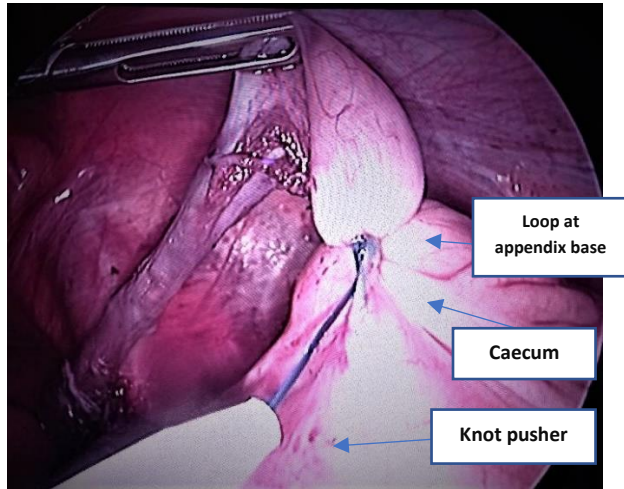


Figure 3 Application of the Second knot



Results

Twenty patient records were reviewed. The mean age was 28.4 ± 13.2 years. Table 1 shows the socio-demographic and clinical characteristics of the study subjects. The mean duration of surgery was 59.2 ± 31.2 minutes. The median estimated blood loss (EBL) was 10 ml. In all patients, 2 sutures (one each) were used for the endoloops. The median length of hospital stay was 2 days. The mean duration of follow up was 2.80 ± 0.50 months.

Discussion

Although the laparoscopic surgery is well established globally, laparoscopic appendicectomy unlike laparoscopic cholecystectomy has not been accepted as a gold standard in low-income countries, Nigeria inclusive. The relatively high fee of the procedure which is due to the cost of instrumentation is one of the hinderances to its acceptance^{4,5}. The crux of laparoscopic appendicectomy is the closure of the appendix stump. Methods of closure of the stump include intracorporeal or extracorporeal knots and mechanical devices such as GIA stapling devices, clips, or electrothermal devices^{6,7}.

Table 1 Socio-demographic and clinical characteristics of the study subjects

Variable	Frequency (%)
Gender	
Male	9 (45)
Female	11 (55)
Comorbidity	
Present	3 (15)
Absent	17 (85)
Diagnosis	
Acute appendicitis	6 (30)
Subacute appendicitis	14 (70)
ASA-PS grade	
I	17 (85)
II	3 (15)
Appendicectomy type	
Interval	17 (79.4)
Early	3 (20.6)
Appendiceal location	
Retrocecal	16 (88.2)
Pre-ileal	1 (2.9)
Pelvic	2 (6.0)
Paracolic	1 (2.9)
Complication	
Yes	1 (5)
No	19(95)
Duration of admission	
17 (3 days)	
2 (4 days)	
1 (5 days)	

Although mechanical devices are more expensive, it remains unclear whether they truly provide safer closure of the appendix stump than their cheaper ligature counterparts. When the appendix is significantly inflamed, these ultra-modern devices cannot be relied upon in serving their function. However, the degree of local inflammation and the expertise of the operating surgeon play a decisive role in the technique of closure of the stump. The use of non-absorbable polymeric clips is less expensive than the GIA stapler but in the stump closure however these

clips may not be suitable when the diameter of the appendix exceeds 1 cm.⁸. Manual polyglactin suture knots for closing the appendix stumps have been demonstrated to be safe⁹. Similarly polypropylene knots have also been demonstrated to be safe¹⁰. We present our experience with the use of handmade PDS suture in our facility. PDS is a slowly absorbable monofilament suture composed of the polyester, poly (p-dioxanone).

The median duration of postoperative hospital stay was two days which is like other studies¹¹. However, the two patients who were discharged on the fourth post operative day had prolonged ileus. The third patient with prolonged stay of five days had superficial surgical site infection which resolved with oral antibiotics. The mean duration of surgery of 59.2 ± 31.2 minutes is not significantly different from 62±/26.2 minutes in a previous review of laparoscopic appendectomy using pretied extracorporeal knots¹². The mean duration of admission prior to discharge of two days was also like a previous study on laparoscopic appendectomy using the generic pretied extracorporeal knot¹².

Our experience in this descriptive study demonstrates that the use of handmade PDS loops for closure of the appendiceal stump in laparoscopic appendectomy resulted in no stump leakage. We have demonstrated that extracorporeal handmade PDS loop for the closure of the appendiceal stump in laparoscopic appendectomy is reliable. The cost of a pretied extracorporeal knot was 12 United States Dollars (USD) while a PDS suture cost approximately 2 USD. Consequently, the cost of laparoscopic appendectomy may be further reduced. There was no intraabdominal knot failure.

Conclusion

The handmade PDS endoloop is a cheap and easily applicable method which further reduces the cost of laparoscopic appendectomy in poorer countries without significantly compromising safety. It is a cheaper method of stump closure especially for younger surgeons without laparoscopy suturing skills. The limitations of this study are the small sample size, retrospective study design and the lack of a control arm of the study.

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