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Original Research Article

A study to evaluate the safety and cost effectiveness of preformed catgut endoloops and polyglactin 910 extracorporeal ligation in the management of appendicular stump closure in laparoscopic appendicectomy

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ABSTRACT

Background: The most essential component of laparoscopic appendectomy is the closure of appendicular stump. Failure of which can result in catastrophic complications including intra-abdominal and surgical site infections and rarely faecal fistula. The aim of this study was to verify the effectiveness of preformed catgut endoloop and extracorporeal polyglactin 910 for appendicular stump closure.
Methods: This prospective study was carried out in 64 patients. We compared patient demographics, duration of surgery, intra and post-operative complications, hospital stay and cost of surgery between the two groups.
Results: A total of sixty-four patients were finally included in the analysis, catgut group (n=34), polyglactin 910 group (n=30). The demographics between the two groups were similar. The mean age in catgut group was 23.94 years and polyglactin 910 groups was 23.33 years. Mean duration of surgery was 41.6 and 41.8 minutes in catgut and endoloop group respectively. Mean hospital stay was 3 days. There was no mortality but complications were seen in 6 patients. However, there was no statistical significance in between the two groups with any of the parameters studied.
Conclusions: Multiple studies have demonstrated safety and effectiveness of various techniques of appendicular stump. The use of extracorporeal single polyglactin 910 extracorporeal suture knot is safe and cost-effective technique for closure of appendicular stump in rural and resource poor regions.

Keywords: Cost effective technique, Laparoscopic appendicectomy, Stump closure

INTRODUCTION

Acute appendicitis is the commonest intra-abdominal surgical emergency and appendectomy is the most common procedure done in general surgery practice.[1-5]

Laparoscopic appendectomy is being considered as the new gold standard and recent studies have shown the feasibility and safety of laparoscopic appendectomy.[6]

Laparoscopic appendectomy is the preferred procedure for acute appendicitis due to faster recovery, lesser post-operative pain, decreased wound infection, lesser hospital stay and early return to work.[7,8] Laparoscopic appendectomy has better visualization of structures and advantage of identifying other intra-abdominal pathology.[5,9] Although laparoscopic appendectomy is being performed since many years surgical technique is being still modified and improved in regard to cost and complications.

The main concern in laparoscopic appendectomy is the technique of closing appendicular stump.[9,10] Closure of

appendicular stump is vital to avoid complications like peritonitis, post-operative fistula and sepsis.[10,11]

In laparoscopic appendectomy several techniques are being used for appendicular stump closure. Most commonly used are endoloop, ligature, metal or polymer clips, laparoscopic stapler, and purse string suture, invagination of appendicular base into caecum, titanium clips, handmade loops, extracorporeal sliding knot, intracorporeal sliding knot and bipolar cautery.[12]

Linear staplers and endoloops are often used now as alternatives for closing appendicular stump as they are equally safe. Economic constraints and safety have to be considered in following these methods.[12] Inappropriate management can lead to serious post-operative complications such as stercoral fistulas, post-operative peritonitis and sepsis.[10,11]

In many retrospective and prospective studies different techniques is being compared not reaching a consensus for a particular technique.[5,13]

This study was undertaken to compare two techniques-preformed catgut endoloop and extracorporeal polyglactin 910 sutures.

METHODS

This is a prospective randomized clinical study conducted on patients admitted to Yenepoya Medical College hospital emergency department with acute appendicitis. The duration of study was 2 years from October 2017 to September 2019. The study was conducted after approval from ethical committee.

A total of seventy patients were randomly assigned into two groups' catgut group and polyglactin 910 group. Six patients were excluded from the study as the procedure was converted to open appendicectomy.

Inclusion criteria

Patients admitted with diagnosis of appendicitis and confirmed by radiodiagnosis were included in the study.

Exclusion criteria

Patients having pain for more than four days duration, mass in the right lower quadrant, diffuse peritonitis, evidence of pelvic inflammatory diseases and patients where laparoscopic procedure was converted to open due to adhesions and improper anatomic conditions were excluded from the study.

Then patients were divided into two groups chosen at random, using closed envelop method. Subsequently they underwent laparoscopic appendectomy.

All the surgeries were done by the single surgeon with more than ten years' experience in minimally access surgery.

Surgical technique

Patients were started on intravenous antibiotics preoperatively. General anaesthesia was given to all the patients. Pneumoperitoneum was achieved with carbon dioxide insufflation by using open technique.

Three ports were inserted, one infraumbilical camera port, one port in hypogastrium and one in right side of abdomen. All the patients were placed in Trendelenberg position with left tilt to facilitate exposure of caecum and appendix. The abdominal cavity was inspected and inflammation of appendix was confirmed. The appendices were dissected off the adhesions. Attention was directed to appendicular stump closure based on randomisation. In the catgut group, preformed loops were used and base ligated. In the polyglactin 910 group, the extracorporeal knots were made using Roeder's knot and slid down the base of appendix. Appendix was amputated and bought out through hypogastric port. The peritoneal cavity was irrigated with around 500 ml saline. In the polyglactin 910 group, the linea alba at umbilicus and skin were approximated with same remaining suture. In the catgut group, additional sutures or staplers were required to close the linea alba and skin. All patients were prescribed same antibiotic regimen, oral cefixime for 5 days.

Statistical analysis

Statistical analysis was performed using SPSS 24.0, results were expressed as mean±SD qualitative data was presented as number and percent. Comparison was done using chi square test, student T test or fisher's exact test. A value of $p<0.05$ was accepted significant.

RESULTS

This study was conducted on sixty-four patients. They were divided into two groups extracorporeal polyglactin 910 group had thirty patients and catgut endoloop group had thirty-four patients. None of the patients were excluded from the research analysis.

The mean age in catgut group was 23.94 and polyglactin 910 group was 23.33. There was no statistically significant difference in age and gender difference between the two groups.

Pre-operative analysis

In catgut group 13 (38.2%) and polyglactin 910 11 (36.7%) had fever but it was not statistically significant. Radiological investigations confirmed appendicitis among both the groups.

The intra operative findings in catgut endoloop group were acute appendicitis 29 (85.3%), gangrenous appendix with associated in abscess 1 patient (2.9%), early mass formation in 1 patient (2.9%), mass formation with abscess in 3 (8.8%) and perforation in 0% as shown in Table 1.

Table 1: Intra operative findings.

Group	Intra operative findings						Total
	Abscess	Acute appendicitis	Gangrene with abscess	Mass	Mass with abscess	Perforation	
Catgut group	0 (0.0%)	29 (85.3%)	1 (2.9%)	1 (2.9%)	3 (8.8%)	0 (0.0%)	34 (100.0%)
Polyglactin group	1 (3.3%)	22 (73.3%)	0 (0.0%)	4 (13.3%)	1 (3.3%)	2 (6.7%)	30 (100.0%)
Total	1	51	1	5	4	2	64
Chi-square tests			Value		df	P value	
Pearson Chi-square			7.540[a]		5	0.183	
Number of valid cases			64				

Polyglactin 910 group had abscess formation in 1 patient (3.3%), acute appendicitis 22 (73.3%) gangrenous appendix with associated abscess 1 (2.9%), early mass formation in 1 patient (2.9%), mass and associated abscess 3 (8.8%) and perforation in 0%. They were not statistically significant between the 2 groups.

Post-operative complications shown in Table 2, in catgut group were abscess in 0%, paralytic ileus in 1 patient (2.9%), wound infection in 2 patients (5.9%). In the polyglactin 910 group, 2 (6.7%) had pelvic abscess formation, paralytic ileus in 1 (3.3%); wound infection in 0% which was not statistically significant.

Table 2: Post-operative complications.

Group	Post-operative complications				Total
	Abscess	Nil	Paralytic ileus	Wound infection	
Catgut group	0 (0.0%)	31 (91.2%)	1 (2.9%)	2 (5.9%)	34 (100.0%)
Polyglactin group	2 (6.7%)	27 (90.0%)	1 (3.3%)	0 (0.0%)	30 (100.0%)
Total	2	58	2	2	64
Chi-square tests		**Value**	**df**	**P value**	
Pearson Chi-square		4.042[a]	3	0.257	
Number of valid cases		64			

Table 3: Duration of surgery and hospital stay.

	Group	Mean	Std. deviation	Mean difference	P value
Duration of surgery	Catgut	41.62	9.979	-0.216	0.936
	Polyglactin 910	41.83	11.408		
Hospital stay	Catgut	3.24	2.571	0.169	0.749
	Polyglactin 910	3.07	1.363		

There were no mortality and serious complications like faecal fistula. Paralytic ileus resolved in 72 hours and was managed conservatively. Wound infection was Southampton grade IIB and were managed conservatively. Two cases of pelvic abscess presented with diarrhoea and were treated with intravenous antibiotics directed against gram negative enteric bacteria. Drainage was not required; both abscesses were less than 3 cm in diameter and resolved with conservative management. None of our patients required reoperation.

Table 3 shows the duration of surgery in catgut group was 41.62±9.98 and polyglactin 910 group was 41.83±11.41 and again showed no statistical significance. The hospital stay in catgut group was 3.24±2.57and Polyglactin 910 group was 3.07±1.36 did not show any statistical significance.

DISCUSSION

Laparoscopic appendectomy has become more popular in the recent times and is the benchmark treatment for acute appendicitis.[13,14]

There are several significant steps in laparoscopic appendectomy procedure such as placement of trocar,

safe release of adhesions, dissection and clipping of appendicular artery, closure of appendicular stump and delivery of appendix. The most important issue is closure of appendicular stump.[12,13,15]

Effective closure of appendicular stump in laparoscopic appendectomy is important to prevent significant post-operative complications. It is crucial to have an approach which is safe and requires lesser skills as most cases of appendectomies are performed by surgery residents.[13]

The most important concern for closure of appendicular stump in laparoscopic appendectomy is the safety of the method.[15,16] Therefore advanced techniques for the best closure of appendicular stump are being done such as endoloops, linear staplers, bipolar coagulation, ultrasonic dissection tool and intracorporeal sutures.[16,17]

In none of the above-mentioned techniques safety and effectiveness has been proved, hence best technique is yet to be determined.[18] Using laparoscopic intestinal staplers are safe and easier method of stump closure but the cost prohibits its routine use in developing countries.

The new techniques may increase the cost of surgery or as well as duration of procedure.[6] For closure of appendicular stump many surgeons prefer either stapler or endoloop.[19,20] Closure with endoloop is commonly done due to its lower cost compared to stapler.[21]

The use of endoloop is less expensive but needs trained surgeon and stapler is safe and fast but expensive. The disadvantage of clips being spilled into abdominal cavity may cause peritoneal adhesion and intestinal obstruction.[22]

We compared two types of endoloop techniques; one is a preformed catgut loop and other one handmade extracorporeal polyglactin 910 loop. Both the loops are made of absorbable material.

In present study there no significant difference in duration of surgery (41.83±11.91), intraoperative and post-operative complications and length of the hospital stay (3.24±2.57). In several studies the duration of surgery and mean duration of hospital stay for closure of appendicular stump in laparoscopic appendicectomy was between 45-60 minutes and 1-7 days respectively, current data correlate well with these studies.[13,23]

In present study, the complication rates observed correlate well with similar studies.[13,23,24] According to recent studies the lack of evidence of superiority of the technique the surgeon should choose suitable technique for him as well as the patient.[13]

The optimum technique should have safety and least complication rate and should be cost effective. When catgut is used additional suture material is needed for closing the rectus sheath and skin where as if polyglactin 910 is used same suture can be used for closing the rectus sheath and skin. The cost of surgery can be reduced. In our study wound infection rate was 2.54% which correlates with other similar study.[25]

Another significant advantage of using the polyglactin 910 extracorporeal knot is the manipulation to ligate the base is easier. This is because with introduction of preformed loops one of the ports is already occupied. Hence, we are left with one working port. With polyglactin 910 sutures, the suture can be introduced with working instruments and dropped and both working ports can be used for manipulation of appendix for ligation of the base. This technique can be quickly learnt by residents and easily performed.

CONCLUSION

Multiple studies have demonstrated safety and effectiveness of various techniques of appendicular stump. The use of extracorporeal single polyglactin 910 extracorporeal suture knot is safe and cost-effective technique for closure of appendicular stump in rural and resource poor regions.

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