



Is Invagination of Appendicular Stump in Appendicectomy Necessary? A Prospective Randomized Clinical Study

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Background: Invagination of appendicular stump during appendicectomy has traditionally been practiced by many surgeons despite lack of evidence to justify its benefit. This prospective randomized clinical study was conducted to evaluate, in our setting, the necessity of appendicular stump invagination during appendicectomy.

Methods: A prospective randomized clinical study was conducted at Bugando Medical Centre between April 2009 and March 2010 to evaluate the necessity of appendicular stump invagination during appendicectomy. Patients were randomized into two groups i.e. Group I (simple ligation without stump invagination) and Group II (ligation with stump invagination).

Results: A total of 87 patients were studied and randomized into two groups, one group of patients had the appendicular stump treated by ligation alone (n= 43) and the other group underwent ligation and invagination (n= 44). The two groups were similar with respect to age, sex, duration of illness, degree of appendiceal inflammation, anatomical location of appendix and antibiotic treatment. There was no statistically significant differences in the rate of postoperative complications and postoperative hospital stay between the two groups ($P > 0.05$). The mean operating time was significantly shorter in the group without invagination ($P = 0.002$). The rate of postoperative paralytic ileus was more in Group-II, 9.3% and 2.3% during first 48 hours and 72 hours respectively as compared to Group-I, which is significantly higher in group-II ($P < 0.05$).

Conclusion: We conclude that simple ligation of the appendicular stump during appendicectomy is safe, simple and shortens operating time. Simple ligation is therefore recommended as standard procedure in appendicectomy.

Introduction

Acute appendicitis remains the most common abdominal surgical emergency affecting approximately 6-10% of the general population¹. It may occur at any age but is most common in persons between 20 and 40 years of age^{1,2}. Appendicectomy remains the standard treatment of acute appendicitis, which is performed by both open and laparoscopic approaches³ and has the lifetime risk of appendicectomy of 12% for men and 25% for women; making it the most commonly performed operation in the world^{4,5}.

The technique of appendicectomy has been reported to vary from surgeon to surgeon or from center to center, starting from skin incision to the ligation and invagination of appendicular stump, and so on. After ligation or transfixation of the appendicular stump some surgeons invaginate the stump by means of a purse-string stitch or a Z- stitch or doubly invaginate the stump while others advocate simple ligation without invagination of the appendicular stump⁶. Despite lack of evidence in many randomized clinical trials to justify the routine invagination of appendicular stump during appendicectomy, many surgeons in many centres, including ours still advocate this technique of invagination of appendicular stump.

This prospective randomized clinical study was conducted to evaluate, in our setting, the necessity of appendicular stump invagination during appendicectomy and to compare the results with international literature.

Patients and Methods

This was a prospective randomized clinical study which was conducted at the Accident and Emergency department of Bugando Medical Centre between April 2009 and March 2010. All patients who were diagnosed as acute appendicitis and underwent appendicectomy were eligible for the study. The diagnosis of acute appendicitis was made based on the Modified Alvarado Scoring System (MASS). Patients with incidental appendicectomy, perforated appendicitis, appendicular abscess or mass were excluded from the study. All patients who met the inclusion criteria were, after informed written consent, consecutively enrolled in the study. Approval to conduct the study was sought from the CUHAS-Bugando/ BMC joint institutional ethic review committee before the commencement of the study.

In order to make a provisional diagnosis, a detailed history and thorough physical examination plus appropriate investigations were carried out. Total white blood cell count (WBC) was carried out for all patients. Abdominal ultrasonography was done to those patients with equivocal presentation. Patients with features suggestive of acute appendicitis were scored using the MASS; those who scored 5-9 were considered as having acute appendicitis and were eligible for the study.

All patients included in the study were randomized into two groups according to whether the appendicular stump was invaginated after ligation of the appendix or not. A computer program (random number generator, Microsoft excel 5.0) was used to generate random number list, whereby patients were randomly divided into two groups. In Group-I, after opening the peritoneal cavity through a standard Lanz skin incision, the appendicular stump was simply ligated. In Group-II after ligating the appendix, the stump was invaginated by purse-string suture with chromic 2/0 suture on an atraumatic needle applied 1 cm away from the appendix.

Abdomen was closed in layers with the skin closed subcutaneously with vicryl 3-0. None of the patient required drainage of abdominal cavity. Operative time was recorded in each case. It was taken from the start of incision to last skin suture. All operations were carried out by a consultant/specialist surgeon or senior registrar or under their supervision, in case the operative procedure was done by trainee surgeons or junior registrars. The surgeon was informed of whether to invaginate the appendicular stump or not just after ligation of the appendix.

Every patient was given only three doses of intravenous injection gentamicin, first dose being the pre-operative one. Injection pethidine deep intramuscular was given 8 hourly on first day only. Post-operative vomiting and fever, if any, were noted. Oral fluids were started after 18 to 24 hours, once flatus was passed and bowel sounds were audible. Operative site was examined on second and seventh post-operative day for any sign of infection, which was recorded. Patients were followed up for at least six months to check for the development of any complications.

Data were collected using structured questionnaire and analyzed using SPSS computer software version 11.5. Continuous variables were analyzed using means, standard deviation and compared using independent sample t-test. Categorical variables were analyzed using frequencies and percentages and compared using the chi-square (χ^2). The 95% confidence interval (95% CI) was calculated where appropriate. Statistical significance was set at *p*-value of less than 0.05.

Results

A total of 95 patients with acute appendicitis scoring 5-9 by the MASS were eligible for the study. Out of these, 8 patients were excluded from the study. 3 patients because of loss to follow up, 2 patients because of perforated appendix, and 1 patient each because of refuse to consent for the study, appendicular abscess and mass respectively. Hence, 87 patients, 48 (55.2%) females and 39 (44.8%) males (F: M= 1.2:1) aging between 6 and 42 years (mean 24.12 ± 11.02 years), were enrolled and

consented to participate in the study. The majority of patients were of a younger age in both groups with a modal age group in their second decade. The patients were randomly divided into two groups. Group-I comprised of 43 patients, simple ligation of the appendicular stump was done in these patients. Ligation and invagination of the appendicular stump by a purse-string method was done in the remaining 44 patients (Group-II). No randomized patients withdraw from the study. All 87 patients were included in the subsequent analysis. The two groups were similar with respect to age, sex, degree of appendiceal inflammation, anatomical location of appendix and antibiotic treatment. Table 1 shows patients characteristics. Postoperative wound infection was noticed in 2.3% patients in Group-I and 4.6% in Group-II. The difference between the two groups was not statistically significant. ($P > 0.05$).

Table 1. Patients' characteristics

Patients' characteristics	Group I (n= 43)	Group II(n=44)	p-value
Age (mean in years)	24.12 ± 12.14	26.28 ± 14.58	NS
Gender(male/female ratio)	20/23 (1:1.2)	21/23(1:1.1)	NS
Mean duration of illness (days)	4.63± 11.61	5.11± 0.86	NS
Mean operating time (minutes)	30.6± 33.4	45.3 ± 36.1	0.002
Mean length of stay (days)	6.3 ± 0.8	6.9 ± 12.2	NS

Table 2. Post-operative complications

Post-operative complications	Group I (n= 43)	Group II(n=44)	p-value
Post-operative wound infection	1 (2.3%)	2(4.6%)	NS
Post-operative pyrexia	2 (4.6%)	3(6.9%)	NS
Post-operative vomiting	1 (2.3%)	2(4.6%)	NS
Paralytic ileus			
• 24-48 hours	1 (2.3%)	4(9.3%)	<0.05
• 48-72 hours	0	1(2.3%)	
• > 72 hours	0	0	-
Peritonitis	Nil	Nil	-
Residual abdominal abscess	Nil	Nil	-
Intestinal obstruction due to adhesions	Nil	Nil	-
Other complications	Nil	Nil	-

Abbreviation: NS= Not Significant

The rate of postoperative ileus was more in Group-II, 9.3% and 2.3% during first 48 hours and 72 hours respectively as compared to Group-I, which is significantly higher in group-II ($P < 0.05$). None of the patients had paralytic ileus for more than 72 hours in both the groups. No case of postoperative peritonitis, residual abdominal abscess and intestinal obstruction due to adhesions was noticed in both groups during the postoperative period and follow up. Table 2 shows postoperative complications between the two groups. The mean length of hospital stay for Group I and II was 6.3 (± 0.8) and 6.9 (± 12.2) days respectively. The difference between the two groups was not statistically significant. ($P > 0.05$).

Discussion

Invagination of appendicular stump during appendicectomy has traditionally been practiced by many surgeons in many centres despite lack of evidence from randomized clinical trials to justify its benefit⁶⁻¹⁰.

The reasons given for this invagination of appendicular stump are safety against slipping of ligature from the stump or blow out of appendicular stump, less chances of peritonitis from spillage of

pathogens from remaining the stump, less incidence of post operative wound infection, better healing of gut by formation of granulation tissue and collagen from the serosal layer of caecum¹¹, on the other hand, who do simple ligation only found it simpler, less time consuming and leaving intact the anatomy of caecal wall⁸, with no difference in the incidence of postoperative wound infection or paralytic ileus. However, there are reports of more residual abscesses over the wall of caecum due to invagination of stump, besides the deformation (filling defect) may lead to the suspicion of a neoplasm^{9, 10}. Simple ligation of appendicular stump has been reported to obviate these misinterpretations⁶. In agreement with other randomized clinical studies^{6-10, 12-14}, our study showed no advantages of invagination of the appendix stump over simple ligation.

The present study showed no statistically significant differences in the rate of postoperative complications and postoperative hospital stay between the two groups which is in consistent with other trials^{8, 10, 12}. In this study, the mean operating time was significantly shorter in the group without invagination, a finding consistent with that reported by others^{7, 10, 15}. Like in other studies^{6, 9}, no case of postoperative peritonitis, residual abscess and intestinal obstruction due to adhesions was noticed in both groups during the postoperative period and follow up.

Conclusion

The study has shown that simple ligation of the appendicular stump is safe, simple and shortens operating time. It produces no deformation of the caecal wall that subsequently may be mistaken for a caecal neoplasm and may act as a lead point for ileo-caecal intussusception. Simple ligation is therefore recommended as standard procedure in appendicectomy.

Acknowledgements

The authors are grateful to all who participated in the preparation of this manuscript, and all those who were involved in the care of our patients.

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