

## Research Article

# Open appendicectomy stump: invaginate or not to invaginate?

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**Received:** 13 June 2013

**Accepted:** 29 June 2013

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### ABSTRACT

Acute appendicitis remains the most common abdominal surgical emergency. Appendicectomy is the standard treatment of acute appendicitis, which performed by open or laparoscopic approach. During open method, after removal of appendix, stump simple ligation or simple ligation and invagination. A prospective randomized study conducted at Smt SCL General Hospital, Smt NHL municipal Medical College, Ahmedabad between October 2009 to September 2011 to evaluate the necessity of appendicular stump invagination during appendicectomy. A total 110 patients were studied and randomized into two group, Group I stump simple ligation, transfixation and invagination and Group II stump simple ligation and transfixation only. There was no statically significant difference in the rate of postoperative complication and post operative hospital stay between the two groups. The mean operating time was significantly shorter in group without invagination. The rate of postoperative paralytic ileus was more in group I. We conclude that simple ligation of the appendicular stump during appendicectomy is safe, simple and shortens operating time.

**Keywords:** Appendicitis, Ligation, Invagination, Alvarado (MANTRELS) score, Transfixation

### INTRODUCTION

Acute appendicitis remains the most common abdominal surgical emergency in developed countries, most common in the second decade of life and affecting approximately 6-10% of the general population.<sup>1,2</sup> By adulthood one in six people will have undergone removal of their appendix.<sup>1</sup> It may occur at any age but is most common in person between 20 and 40 years of age.<sup>2</sup> About 8% of people in Western countries have appendicitis at some time during their life, with a peak incidence between 10 and 30 years of age.<sup>3</sup> Lifetime risk of appendicectomy 12% for men and 25% for women

making it the most commonly performed operation in the world,<sup>4,6</sup> with Approximately 7% of all people undergoing appendectomy for acute appendicitis.<sup>6</sup> Appendicectomy remains the standard treatment of acute appendicitis, which is performed by both open and laparoscopic approaches.<sup>7</sup> The length of the appendix varies from 2 to 20 cm, and the average length is 9 cm in adults.<sup>3</sup> The pathophysiology of acute appendicitis has long been thought to be the result of luminal obstruction by a fecalith, hyperplastic lymphoid tissue, parasitic infestation, or tumor, with subsequent localized venous ischemia resulting in mucosal disruption followed by invasive bacterial infection; viral ulceration may also be

the cause of mucosal ulceration in certain patients.<sup>8</sup> Infection limited to the appendix itself results in localized inflammation and simple, or suppurative, appendicitis.<sup>8</sup>

A number of clinical and laboratory-based scoring systems have been devised to assist diagnosis. The most widely used is the Alvarado (MANTRELS) score.<sup>9</sup> A score of 7 or more is strongly predictive of acute appendicitis.<sup>9</sup> In patients with an equivocal score (5–6), abdominal ultrasound or contrast-enhanced CT examination further reduces the rate of negative appendectomy.<sup>9</sup> Abdominal ultrasound examination is more useful in children and thin adults, particularly if gynaecological pathology is suspected, with a diagnostic accuracy in excess of 90%.<sup>9</sup>

The technique of appendectomy has been reported to vary from institute to institute, from unit to unit, from surgeon to surgeon, starting from skin incision to the simple ligation, transfixation and invagination of appendicular stump, and so on. After ligation and transfixation of the appendicular stump some surgeon invaginate the stump by purse-string stitch or doubly invaginate the stump, while other advocate simple ligation and transfixation only, no invagination of the appendicular stump. Many surgeons believe invagination of the appendiceal stump is unnecessary.<sup>9</sup>

This prospective randomized study was conducted in our institute to evaluate, the necessity of the appendicular stump invagination during appendectomy.

## METHODS

The prospective randomized study was conducted at Smt SCL General Hospital, Smt NHL Municipal Medical College, Ahmedabad during October 2009 to September 2011. All patients who were diagnosed as acute appendicitis and underwent appendectomy were eligible for the study. The diagnosis of acute appendicitis was made based on the Alvarado (MANTRELS) score and abdominal ultrasonography. Patients with perforated appendicitis, appendicular mass or abscess, incidental appendectomy were excluded from the study. All patients who met the inclusion criteria were, after informed written consent, consecutively enrolled in the study.

In order to make a provisional diagnosis, a detailed history, thorough physical examination plus Blood investigation were carried out. Patients with features suggestive of acute appendicitis were scored using the Alvarado (MANTRELS) score. Those who scored 7-10 were considered as having acute appendicitis and those who scored 5-6 with abdominal ultrasonography show inflamed appendix considered as acute appendicitis.

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. After confirmation of inclusion criteria the patients were

then randomized into two groups using a balloting method; *i.e.*, consecutive patients were asked to pick one of two sealed envelopes containing a folded paper on which one of the two methods was written. All patients were operated through a standard gridiron skin incision; the appendicular stump was ligated with silk 1-0 free tie and transfixed with silk 2-0 round body needle. In Group I after ligation and transfixation, invagination of stump done by purse-string suture with silk 2-0 on a round body needle applied 1-2 cm away from the base of appendix while in group II only simple ligation and transfixation of appendicular stump. All operation carried out in by assistant professor, 3<sup>rd</sup> year resident doctors or under supervision, in case of it done by 1<sup>st</sup> year resident doctor. Operative time was recorded in each case. It was taken from the start of incision to the last skin suture. No any patients required to put drain in abdominal cavity. Abdomen was closed in layers with vicryl 1-0 and skin with ethilon 2-0.

Every patient was given only three doses of intravenous injection ceftriaxone and metronidazole, first dose being the preoperative one. Analgesic and antacid given intravenously on initially till sips orally started. Post operative fever, vomiting if any noted. Oral fluids were started after 12 to 24 hours, once patient passed flatus and bowel sounds were audible. Operative site was examined on 3<sup>rd</sup> and 7<sup>th</sup> 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 collected and analysis done.

## RESULTS

A total of 133 patients with acute appendicitis scoring 5-9 by the Alvarado (MANTRELS) score were eligible for the study. Out of these, 13 patients were excluded from the study. 8 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, 110 patients, 63(57.3%) females and 47 (42.7%) males (F: M= 1.3:1) aging between 17 and 43 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 56 patients, simple ligation, transfixation and invagination of the appendicular stump by a purse-string method was done in these patients. Ligation and transfixation of the appendicular stump was done in the remaining 54 patients (Group-II). No randomized patients withdraw from the study. All 110 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 in various ways.

**Table 1: Patients characteristics.**

Patients Characteristics	Group I	Group II	p-value	
Mean Age in years	28.36±5.5	27.11±4.9	0.213	
Gender (M/F ratio)	Males	23	24	0.847
	Females	33	30	
Mean duration of illness (days)	3.77±1.6	3.65±1.3	0.663	
Mean operating Time (Minutes)	46.36±5.2	37.26±5.4	0.000	
Mean Length of stay (days)	3.67±0.9	3.31±0.7	0.029	

Study shows mean operating time in minute was less in Group-II compare to Group-I. Mean length of Hospital stay also less in Group II patients.

**Table 2: Post-operative complications.**

Post-operative complications	Group I	Group II	p-value	
Wound Infections	3	2	0.677	
Fever	4	3	0.733	
Vomiting	2	1	0.580	
Paralytic Ileus in Hours	24-48	6	2	0.092
	48-72	1	Nil	
	>72	Nil	Nil	
Peritonitis	Nil	Nil		
Residual Abdominal Abscess	Nil	Nil		
Intestinal Obstructions	Nil	Nil		
Other Complications	Nil	Nil		

Postoperative wound infection was noticed in 3(2.7%) patients in Group-I and 2(1.8%) in Group-II. The difference between the two groups was not statistically significant. ( $P > 0.05$ ).

The rate of postoperative ileus was more in Group-I, 6 and 1 during first 48 hours and 72 hours respectively as compared to Group-II, which is significantly higher in group-I. 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.

## 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 benefit.<sup>10-14</sup>

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 caecum,<sup>1</sup> on the other hand, who do simple ligation only found it simpler, less time consuming and leaving intact the anatomy of caecal wall,<sup>14</sup> 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.<sup>10,12</sup> Simple ligation of appendicular stump has been reported to obviate these misinterpretations.<sup>11</sup> In agreement with other randomized clinical studies<sup>10-15</sup> 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.<sup>10,14</sup> In this study, the mean operating time was significantly shorter in the group without invagination, a finding consistent with that reported by others.<sup>10,13,16</sup> Like in other studies<sup>11,12</sup> 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 with transfixation of the appendicular stump is safe, simple, shortens the operating time. It produces no deformation of the caecal wall, as in invagination it may be mistaken for a caecal mass or it may act as a lead point for ileocecal intussusception. Simple ligation with transfixation of appendicular stump is therefore recommended as standard procedure in open appendicectomy.

## REFERENCES

1. Ellis BW. Acute appendicitis in Brian W Ellis and Simon Paterson-Brown, Hamilton Bailey's Emergency Surgery 13<sup>th</sup> edition, Hodder Arnold: 399-410.
2. Boswell CB, Doherty GM. Diseases of appendix. In Doherty GM, Meko JB, Olson JA, Peplinski GR, Worrall NK eds. The Washington Manual of

- Surgery 2<sup>nd</sup> edition Lippincott Williams and Wilkins 1999 Philadelphia: 228-35.
3. Sabiston Textbook of Surgery 18<sup>th</sup> edition, The Biological Basis Of Modern Surgical Practice, Section X Abdomen , Chapter 49 The appendix.
  4. Addis DG, Shaffer N, Fowler BS, Tauxe RV: The epidemiology of appendicitis and appendicectomy in United States. *Am J Epid* 1990; 132: 910-925.
  5. Korner H, Sordenaa K, Soreide JA et al. Incidence of acute non-perforated and perforated appendicitis: age specific and sex-specific analysis. *World Surg* 1997; 21: 313-317.
  6. Schwartz principle of surgery, 8<sup>th</sup> edition, F Charles Brunicaudi 29:The Appendix.
  7. Scott-Conner C et al: Laparoscopic appendicectomy . *Ann Surg* 1992; 215: 660.
  8. Mastery of Surgery 5<sup>th</sup> edition, Josef E. Fischer, M.D. , Kirby I. Bland, M.D. , Wolters Kluwer/ Lippincott Williams and Wilkins, Chapter 129: Appendicitis and Appendiceal Abscess.
  9. Bailey and Love's Short practice of surgery, 25<sup>th</sup> edition, Norman S. Williams, Christopher J. K. Bulstrode and P. Roman O'connell 67: The Vermiform Appendix 1204-1218.
  10. Engstrom L, Fenyo G. Appendicectomy: assessment of stump invagination versus simple ligation: a prospective randomized trial. *Br J Surg* 1985; 72(12): 971-2.
  11. Chaudhary IA, Samiullah, Mallhi AA, Afridi Z, Bano A. Is it necessary to invaginate the stump after appendicectomy? *Pak J med Sci J* 2005; 21(1) : 58-60.
  12. Jacobs PP, Koeyers GF, Buryninckx CM. Simple ligation superior to inversion of the appendicular stump; a prospective randomized study. *Ned Tijdschr Geneesk.* 1992; 136(21): 1020-3.
  13. Mahzar R, Leem AM, Sarfraz A, Riaz U. Appendicectomy; non-invagination vs. invagination of appendicular stump. *Ann King Edward Med Coll* 2006; 12(1): 58-60.
  14. Lavonius MI, Liesjarvi S, Niskanen RO, Ristkari SK, Korkala O, Mokka RE. Simple ligation vs stump inversion in appendicectomy. *Ann Chir Gynaecol*, 1996; 85(3): 222-4.
  15. Das HP, Wilson SJ, Khan S, Parlade S, Uy A. Appendicectomy stump : 'to bury or not to bury'. *Trop Doct.* 1989; 19(3): 108-9.
  16. Naeem S, Khalid I, Appendicectomy: Non-invagination vs. invagination of appendicular stump. *The professional* 2004;11(2):117-20.

DOI: 10.5455/2320-6012.ijrms20130817

**Cite this article as:** Suvera MS, Kharadi AH, Asari US, Damor PB, Shah MT, Patel MB. Open appendicectomy stump: invaginate or not to invaginate? *Int J Res Med Sci* 2013;1:248-51.