Nangarhar University
International Journal of Biosciences

Received: 20 Sep 2022
Accepted after revision: 15 Nov 2022
Published Online: 25 Feb 2023

ORAGINAL ARTICLE Vol 2, Issue 1 (2023) e-ISSN: 2957-9988

# Comparison of Simple Ligation versus stump Invagination in open Appendectomy

Sherzad Farhad[1], Zafarzai Imran[2], Saeed Samiullah*[3], Sadat Gul Aqa[4]

[1]Department of Pediatric Surgery, Faculty of Medicine, Nangarhar University, Jalalabad City, Nangarhar, Afghanistan
[2]Department of Forensic Medicine, Faculty of Medicine, Nangarhar University, Jalalabad City, Nangarhar, Afghanistan
[3]Department of Anesthesiology, Faculty of Medicine, Nangarhar University, Jalalabad City, Nangarhar, Afghanistan
[4]Department of General Surgery, Faculty of Medicine, Nangarhar University, Jalalabad City, Nangarhar, Afghanistan

*Corresponding Author Email: drsamiullahsaeed@gmail.com

## ABSTRACT

**Background:** Acute appendicitis (AA) is one of the most prevalent abdominal crises and faced by the surgeon in practice. The best treatment for the appendicular stump during open appendectomy is unknown. This is a randomized controlled trial comparing simple ligation with appendicular stump invagination.

**Materials and Methods**: The MASS (Modified Alvarado Score System) test was used to confirm the diagnosis of acute appendicitis. When necessary, an ECG & a chest X-ray were taken. All of the patients were put under spinal anesthesia for the procedure.

**Findings**: The appendicular stump of 305 patients were treated with simple ligation (161 patients) in group I, and ligation and invagination (144 patients) in group II. “Pyrexia, vomiting, serous discharge, wound infection, peritonitis, residual abscess, and post-operative pain in the right iliac fossa are all comparable after surgery. Paralytic ileus occurred in 2 (1.24%) of patients in groups I and 7(4, 36%) patients in group II, respectively, and was statistically significant.

**Conclusion**: Easy ligation of the appendicular stump after open appendectomy is advised since it is safe, simple, and takes less time.

**Keyword:** Acute appendicitis; Appendectomy; Appendicular stump; Simple ligation; Invagination

## INTRODUCTION

In and around the Kathmandu valley, acute appendicitis (AA) is one of the most prevalent abdominal crises. Males have a 0.15 percent incidence of AA, while females have a 0.19 percent incidence, with a lifetime risk of 6-20 percent (Khan, 2010; SHAHID & IBRAHIM, 2004). Clinically, AA has been known as 'peri typhlitis' (associated with severe cecal inflammation) since the 16th century, but the first successful appendectomy was documented in 1736. Reginald Fitz initially documented the function of surgical excision of an inflamed appendix as a curative therapy in 1886 (Engström & Fenyö, 1985; Khan, 2010). In 1889, three years later, Mc Burney stressed the significance of early appendectomy. After five years, he developed his well-known muscle-splitting incision, which carries his name to this day. Appendicitis has been the most prevalent surgical emergency since

then. From skin incision through ligation and invagination of the appendectomy stump, the technique of appendectomy varies from surgeon to surgeon or from center to center. The best way to handle appendectomy stump has been debated for almost a century, and Ochsner and Lilly published a thorough historical assessment in 1937 (Engström & Fenyö, 1985). Following the ligation or Tran's fixation of the arteries, to help in diagnosis, several clinical and laboratory-based scoring systems have been developed. The Alvarado (MANTRELS) score is the most popular." 9 A score of 7 or above indicates a high likelihood of acute appendicitis. Abdominal ultrasonography or contrast-enhanced CT scan decreases the probability of negative appendectomy even more in individuals with an ambiguous score (Körner et al., 1997; Schein, 2010). The most frequent acute surgical disease of the abdomen is acute appendicitis." As a result, appendectomy is one of the most popular general surgical procedures (Cooperman, 1983). The popularity of conducting appendectomy through a laparoscopic method has grown due to the development of laparoscopic appendectomy (LA) and meta-analyses revealing lower post-operative discomfort and a shorter hospital stay following LA (Tate et al., 1993). However, open appendicitis is still a common surgery, with 34% of appendicitis patients in the UK undergoing it. In circumstances where laparoscopy is not an option and conversion is required due to technical challenges in removing the appendix safely, an open approach may be required. Total or sub-total appendectomy are two types of open appendectomy (Delaria, 1987). Appendicitis is the most common abdominal surgical emergency in developed countries, affecting approximately 6-10 percent of the general population and most commonly occurring in the second decade of life (Boswell, 1999), by maturity, one out of every six people will have had their appendix removed (Tate et al., 1993). It can strike anyone at any age, although it is most frequent in those between the ages of 20 and 40 years (Chhetri & Shrestha, 2005) Appendicitis affects about 8% of persons in Western nations at some point in their lives, with a peak occurrence between the ages of 10 and 30 (Schein, 2010). "Appendectomy has a 12-percent lifetime risk for males and a 25-percent lifetime risk for women, making it the most regularly done procedure in the world (Cooperman, 1983; Schein, 2010). Appendectomy for acute appendicitis is performed on about 7% of the population. Appendectomy, which can be done open or laparoscopically, is still the usual therapy for acute appendicitis (Scott-Conner et al., 1992). The appendix can be anywhere from 2 and 20 cm long, with an average length of 9 cm in adults (Delaria, 1987). The pathophysiology of acute appendicitis has long been thought to be the result of luminal obstruction caused by a fecality, hyperplastic lymphoid tissue, parasitic infestation, or tumor, with subsequent localized venous ischemia leading to mucosal disruption and invasive bacterial infection; viral ulceration may also be the cause of mucosal ulceration in some patients. Localized inflammation and uncomplicated, or supportive, appendicitis developed from infection restricted to the appendix. Appendectomy is one of the most often performed surgical procedures. The total prevalence of acute appendicitis is estimated to be approximately 14% (Khan, 2010). Although the introduction of laparoscopic surgery is a significant advancement in the area of surgery, open appendectomy is still a prevalent procedure (Neves et al., 2011). When the diagnosis of acute appendicitis is in dispute, most tertiary institutions in Pakistan and industrialized nations prescribe diagnostic laparoscopy. Surgical techniques may differ depending on the surgeon and the desire of the center (Neves et al., 2011). Simple wound infection to abscess development (superficial or deep), paralytic ileus, and other Colo-cutaneous fistula is a distinct postoperative complication, following appendectomy that causes intestinal blockage and is an uncommon consequence of stump appendicitis. As a result of these complications, the length of time spent in the hospital increased (IA & AA, 2005; Neves et al., 2011). Stump burial following appendectomy was once a common operation performed by surgeons, but it has recently been shown that this

surgery is linked to a rare complication known as stump appendicitis, which is difficult to diagnose and treat (Neves et al., 2011). Furthermore, invagination of the stump causes a bulk appearance during contrast investigations, causing diagnostic issues. (IA & AA, 2005). Another complication of stump closure is the creation of a fistula due to the passage of the needle into the gut lumen (Khan, 2010; Rafi et al., 2006). Many studies have found that appendicular stump invagination has a higher risk of problems than simple ligation. However, stump invagination is often essential when the base of the appendix is damaged (Asif Zaman & Muhammad, 2011).

## MATERIALS AND METHODS

This was a prospective randomized study. It was conducted in the surgical ward of Nangarhar" University Hospital from December 29, 2019 till December 20, 2020. 303 patients with appendicitis were underwent surgery. The study was approved by the research committee; the research was conducted as a descriptive observation. Two groups of patients were formed. Operations performed on odd days of the week (Mondays, Wednesdays, Fridays, and Sundays) were assigned to Group I, which included simple appendicular stump closure, while operations were performed on even days of the week (Tuesdays, Thursdays, and Saturdays). They were placed in group II, which included a simple closure with a burial. The patient's criteria for admission were diagnosis of MASS, acute appendicitis, patient consent to participate in the trial, and the patient's suitability for spinal anesthesia. Appendicular perforation, appendicular abscess, appendicular mass, cecal edema, unwanted appendectomy with other abdominal diseases, and appendectomy with interval were all considered exclusion criteria. MASS test was used to confirm the diagnosis of acute appendicitis (modified Alvarado scoring system) **(Table. 1).** If necessary, ECG and chest radiograph were performed too. All patients were given spinal anesthesia during the operation. In group A, the appendicular stump was simply closed with 2-0 vicryl after opening the peritoneal cavity with a Mc Burney incision, while in group B, the appendicular stump was closed sero-muscular sutures with 2-0 vicryl on a 1 cm atraumatic needle. Around the base of the appendix," after simple ligation, it was invaginated into the cecum. Depending on the patient's weight, each patient received three doses of antibiotics, ceftriaxone IV and metronidazole IV. "The first dose was given before surgery after confirmation of diagnosis. The second dose was given during surgery and the third dose was given 12 hours after surgery. Ketorolac injection was provided if needed to manage postoperative pain. Oral fluids began when the patient passed bloating or intestinal sounds were heard. After 48 hours, it was checked whether the dressing was completed. On the seventh day after the operation, the stitches were removed. After discharge, patients were followed up for 3 to 7 days after surgery. The surgical site was evaluated for any wound complications such as wound infection, dilation and most severe discomfort, duration of ileus and length of hospital stay.

**Table 1:** An Alvarado scoring system

| N0 | Diagnostic Criteria | S/S | Point Value |
|---|---|---|---|
| 1 | Symptoms | Migration pain | 1 |
| | | Anorexia | 1 |
| | | Nausea/emesis | 1 |
| 2 | Sign | RUQ tenderness to palpation | 2 |
| | | Rebound tenderness | 1 |
| | | Pyrexia 37.3C | 1 |
| 3 | Laboratory values | Leukocytosis | 2 |
| | | Left shift | 1 |

## RESULTS

In this research, 340 individuals with an appendicitis diagnosis (MASS score 5-9) were operated. The trial was terminated when 35 patients were found to be ineligible. 16 patients had cecal oedema, 4 suffered perforations, and 15 were lost to be follow-up. The research comprised a total of 105 patients. The ages of the participants varied from 15 to 65 years old. Patients in group I were 28.83 years old, whereas those in group II were 27.54 years old.

**Table 2**: Patients' statistics

| N0 | Total | Patients group I (161) | Patients group II(144) |
|---|---|---|---|
| 1 | Male | 84(52.17%) | 77(53.47%) |
| 2 | Female | 77(47.82%) | 67(46.52%) |
| 3 | Mean age (year) | 38.83 year | 37.54) year |
| 4 | average length of sickness | 2.7 days | 2.6 days |
| 5 | Time spent operating average | 40.6 mint | 43.5mint |
| 6 | Average stay in the hospital | 8.5days | 8.5days |

Vomiting was reported by 46 (28.57%) of patients in group I and 36 (25.00%) of patients in group II. Fever was a symptom in 16 (9.93%) of group I patients and 11 (7.63%) of group II patients, respectively. All patients in both groups presented with pain in the right iliac fossa, followed by anorexia/ nausea in 98 (60.86%) of group I patients and 96(66.66%) of group II patients.

**Table 3**: shows the clinical signs and symptoms

| No | Clinical features | Group -I (161) patients | Group – II(144)patients |
|---|---|---|---|
| 1 | Vomiting | 46(28.57%) | 36 (25.00%) |
| 2 | Anorexia/nausea | 98(60.86%) | 96(66.66%) |
| 3 | Fever | 16(9.93%) | 11(7.63%) |
| 4 | RIF pain | 161(100%) | 144(100%) |
| 5 | Blumberg sign | 30(18.63%) | 26(18.05%) |

**Table 4:** Patient's presentation in the hospital after occurrence of symptoms.

| N0 | Time | Group -I(161) | Group -I (144) |
|---|---|---|---|
| 1 | 1 -12 hours | 6(3.72%) | 7(4.16%) |
| 2 | 13 – 24 hours | 11(6.83%) | 11(7.63%) |
| 3 | 25 -36 hours | 30(18.63%) | 28(19.44%) |
| 4 | 37 – 48 hours | 40(24.84%) | 34(23.61%) |
| 5 | >74 hours | 71(44.09%) | 61(42.36%) |

**Table 5:** Duration of surgery

| N0 | Time | Group I | Group II | p. value |
|---|---|---|---|---|
| 1 | Minimum | 23mints | 25 mints | |
| 2 | Maximum | 75 mints | 72 mints | 0.225 |
| 3 | Mean operating time | 38.40 mints | 42.90mints | |

Although group I mean operating time (38.40 minutes) was smaller than group II (42.90 minutes), the difference was not statistically significant.

**Table 5:** Complications following surgery.

| No | Complication | Group -I | Group -II | p - value |
|---|---|---|---|---|
| 1 | Pyrexia | 6(3.72%) | 7(4.86%) | 0.5968 |
| 2 | Vomiting | 8(4.96%) | 10(6.94%) | 0.4443 |
| 3 | Paralytic ileus (24-48hor) | 2(1.24%) | 7(4.86%) | |
| | (48-72hour) | 1(0.62%) | 2(1.38%) | 0.2 |
| | >72 hour | 0(0.00%) | 0(0.00%) | |
| 4 | Peritonitis | 0(0.00%) | 0(0.00%) | - |
| 5 | Wound infection | 5(3.10%) | 5(3.47%) | 0.4038 |
| 6 | Serous discharge | 6(3.72%) | 7(4.86%) | 0.9281 |
| 7 | Residual abscess | 0(0.00%) | 0(0.00%) | - |
| 8 | OB due to adhesion | 0(0.00%) | 0(0.00%) | - |
| 9 | R I F pain Intestinal | 3(1.86%) | 3(2.08%) | 0.4132 |

Patients in groups A and B experienced post-operative pyrexia in 6 (3.72%) and 7 (4.86%) cases, wound infection in 5 (3.10%) and 5 (4.86%) cases, and serous discharge in 6(3.86%) and 7(4.86%) cases, respectively. Which were not significantly difference between the two groups.

## DISCUSSION

"Invagination of appendicular stump during appendectomy has traditionally been practiced by many surgeons in many centers despite lack of evidence from randomized clinical trials to justify its benefit (Lavonius et al., 1996). In this study we can compare the results of our study with the fact that there was a slight difference between the group I and the group II., which was as follows: vomiting was reported by 46 (28.57%) of patients in group I and 36 (25.00%) of patients in group II. Fever was a symptom in 16 (9.93%) of group I patients and 11 (7.63%) of group II patients, respectively. All patients in both groups presented pain in the right iliac fossa, followed by anorexia and nausea in 98 (60.86%) of group I patients and 96 (66.66%) of group II. Patients in groups I and group II, experienced post-operative pyrexia in 6 (3.72%) and 7 (4.86%) cases; wound infection in 5 (3.10%) and 5 (4.86%) cases; and serous discharge in 6 (3.86%) and 7 (4.86%) cases, respectively. We compared the results of our study with the result of the prospective randomized study which was conducted by Suvera et al. (2013).

The study showed 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. 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 According to Neves LJ et al. (2011). ligation and injection operations took 5.5 minutes longer on average than basic ligation operations. The group without intussusception had a much shorter mean operating time. Furthermore, Neves LJ et al. (2011) found that wound infection, which occurred in 9.7% of patients and there was no statistically significant difference in wound infection rates between the two groups which is consistent with our finding. In agreement with other randomized clinical studies. "Our study showed no advantages of invagination of the appendix stump over simple ligation (Dass et al., 1989; Lavonius et al., 1996). 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 (Engström & Fenyö, 1985; Lavonius et al., 1996).

In addition, "although, the mean operating time was not significantly shorter in the group without invagination, a finding consistent with that reported by others (Engström & Fenyö, 1985; MS & RU, 2006). Like in other studies 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 findings of this study suggest that simple appendicular stump closure is a safe and straightforward surgery with little downtime and postoperative complications. It does not create any intestinal wall distortion, which might subsequently be misinterpreted as an abdominal tumor. As a consequence, simple closure as a natural therapy for appendectomy is advised

### Acknowledgement

The authors would like to acknowledge the contribution of nursing and medical staff at the surgical ward of Nangarhar University Teaching Hospital during the period of this study.

### Conflict of interest

The authors declare no conflict of interest

## REFERENCES

Asif Zaman, R., & Muhammad, T. (2011). Appendicectomy; assessment of caecal invagination of appendicular stump. *Professional Medical Journal-Quarterly.* 2011; 18 (1): 102-105

Boswell, C. B. (1999). Diseases of appendix. In. Doherty GM, Meko JB, Olson JA, Peplinski GR, Worrall NK eds. *The Washington Manual of Surgery*, *2*, 228-35.

Chhetri, R. K., & Shrestha, M. L. (2005). A comparative study of pre-operative with operative diagnosis in acute abdomen. *Kathmandu Univ Med J (KUMJ)*, *3*(2), 107-10.

Cooperman, M. (1983). Complications of appendectomy. *Surgical Clinics of North America*, *63*(6), 1233-1247.

Dass, H. P., Wilson, S. J., Khan, S., Parlade, S., & Uy, A. (1989). Appendicectomy stumps:'to bury or not to bury'. *Tropical doctor*, *19*(3), 108-109.

Delaria, G. A. (1987). Textbook of Surgery—Thirteenth Edition. *The Biological Basis of Modern Surgical Practice.*

Engström, L., & Fenyö, G. (1985). Appendicectomy: assessment of stump invagination versus simple ligation: a prospective, randomized trial. *Journal of British Surgery*, *72*(12), 971-972.

IA, C., & AA, M. (2005). Is it necessary to invaginate the stump after appendectomy?.

Khan, S. (2010). Assessment of stump invagination versus simple ligation in open appendicectomy. *Journal of Institute of Medicine Nepal*, *32*(1), 7-10.

Körner, H., Söndenaa, K., Söreide, J. A., Andersen, E., Nysted, A., Lende, T. H., & Kjellevold, K. H. (1997). Incidence of acute nonperforated and perforated appendicitis: age-specific and sex-specific analysis. *World journal of surgery*, *21*, 313-317.

Lavonius, M. I., Liesjärvi, S., Niskanen, R. O., Ristkari, S. K., Korkala, O., & Mokka, R. E. (1996, January). Simple ligation vs stump inversion in appendicectomy. In *Annales chirurgiae et gynaecologiae* (Vol. 85, No. 3, pp. 222-224).

MS, A., & RU, H. (2006). Appendicectomy: non invagination vs. invagination of appendicular stump. *Professional Medical Journal-Quarterly.* 2011; 18 (1):

Neves, L. J. V. A., Wainstein, A. J. A., Mathias, W. C., Costa, F. P. D., Castro, J. H. D., & Avassi-Rocha, P. R. (2011). Simple ligation or ligation and purse string invagination for the treatment of the appendiceal stump: a prospective, randomized trial. *ABCD. Arquivos Brasileiros de Cirurgia Digestiva (São Paulo)*, *24*, 15-19.

Rafi, M., Saleem, L. A. M., Ahmad, S., & Haq, R. U. (2006). Appendicectomy; non-invaginaton vs. invagination of appendicular stump. *Annals of King Edward Medical University*, *12*(1).

Schein, M. (2010). Schwartz's Principles of Surgery, F. Charles Brunicardi, Dana K. Andersen, Timothy R. Billiar, David L. Dunn, John G. Hunter, Jeffrey B. Matthews, Raphael E. Pollock (Eds) McGraw-Hill Professional, New York, 2009, 1888 pp, $143.20, ISBN-10: 007154769X (amazon. com).

Scott-Conner, C. E., Hall, T. J., Anglin, B. L., & Muakkassa, F. F. (1992). Laparoscopic appendectomy. Initial experience in a teaching program. *Annals of surgery*, *215*(6), 660.

SHAHID, C. N., & IBRAHIM, K. (2004). Appendicectomy: Non-invagination vs. invagination of appendicular stump. *The Professional Medical Journal*, *11*(02), 117-120.

Suvera, M. S., Kharadi, A. H., Asari, U. S., Damor, P. B., Shah, M. T., & Patel, M. B. (2013). Open appendicectomy stump: invaginate or not to invaginate. *Int J Res Med Sci*, *1*(3), 248-251.

Tate, J. J. T., Chung, S. C. S., Dawson, J. W., Leong, H. T., Chan, A., Lau, W. V., & Li, A. K. C. (1993). Conventional versus laparoscopic surgery for acute appendicitis. *British journal of surgery*, *80*(6), 761-764.