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RESEARCH ARTICLE
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APPENDICULAR STUMP MANAGEMENT IN OPEN APPENDECTOMY: SIMPLE LIGATION VERSUS INVERSION.

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Abstract

Background: Management of the appendicular stump in open appendectomy remains debated, with simple ligation and stump invagination being the most commonly used techniques. This study aimed to compare these two methods in terms of operative duration, complications, and hospital stay.

Methods: A prospective study was conducted over two years (November 2020–October 2022) in 256 patients undergoing open appendectomy for acute appendicitis or appendicular perforation. Patients were randomly allocated into two groups: Group A (simple ligation, n=128) and Group B (ligation with stump invagination, n = 128). Outcomes measured included operative time, intraoperative and postoperative complications, and length of hospital stay.

Results: Retrocecal appendix was the most common position (62%). Appendicular perforation occurred in 23.43% of patients. Pyrexia was observed in 21.9% of Group A and 21.8% of Group B. Wound infection occurred in 10.1% and 10.9%, while wound dehiscence was 4.7% and 0.01%, respectively. Mean operative time was significantly shorter in Group A (41.11 ± 3.26 minutes) compared to Group B (51.4 ± 3.47 minutes), whereas hospital stay was similar between groups.

Conclusion: Simple ligation of the appendicular stump is a safe, effective, and time-efficient technique in open appendectomy, with comparable complication rates to stump invagination. Stump invagination offers no significant clinical advantage and prolongs operative time.

Keywords: Appendicitis, Appendectomy, Appendicular stump, Ligation, Stump invagination, Open surgery

INTRODUCTION:

Acute appendicitis remains the most frequent surgical emergency worldwide, with a lifetime risk estimated at 7–8% in the general population[1]. Its clinical spectrum ranges from uncomplicated inflammation to complicated cases with perforation or abscess, and management typically requires surgical intervention, either by open or minimally invasive techniques[2]. The first laparoscopic appendectomy was performed by Kurt Semm in 1983, marking a major advancement in minimally invasive surgery[3].

Since the earliest descriptions of appendectomy, management of the appendicular stump has been a matter of debate. Initially, simple ligation was the predominant technique; however, some surgeons questioned its adequacy, raising concerns regarding stump leakage or infection and advocating burying the stump by invagination sutures[4,5]. In stump invagination, the appendiceal base is crushed,

ligated, and inverted into the cecum, with early descriptions including adjunctive measures such as chemical carbolisation to reduce infection risk[6]. Conversely, simple ligation is technically easier, quicker, and preserves the cecal wall without additional manipulation[7].
Recent randomized controlled trials and systematic reviews have shown no significant advantage of invagination over simple ligation in reducing wound infection or intra-abdominal complications[8-10]. Moreover, invagination may prolong operative time and carries a small risk of postoperative ileus or obstruction, whereas simple ligation remains safe, efficient, and sufficient in most cases[9,10]. Current evidence therefore supports simple ligation as the standard approach in open appendectomy, reserving invagination for selected situations such as a friable or broad-based appendiceal stump.

AIMS AND OBJECTIVES:

Primary Objective

- To compare the efficacy of **simple ligation** versus **stump invagination** techniques in open appendectomy with respect to:
  - Duration of surgery
  - Intraoperative complications
  - Postoperative complications
  - Length of hospital stay

Secondary Objectives

- To evaluate the safety profile of each technique in routine clinical practice.
- To assess whether stump invagination offers any additional benefit over simple ligation in reducing postoperative morbidity.
- To generate evidence that may guide the choice of appendicular stump management technique in open appendectomy.

METHODS:

The study was done in the Department of General Surgery in Government Medical College Rajouri. Due informed consent was taken from the patients enrolled in the study. Patient details were taken according to the established proforma. Intraoperative data was taken with respect to operative time, intraoperative, post operative complications and hospital stay. The data was tabulated and results were expressed using statistical package for the social sciences (SPSS) software.

DESIGN:

It was a Prospective observational single center hospital-based study conducted at Govt. Medical College Rajouri

DURATION

The duration of the study was from November 2021 to October 2022.

INCLUSION CRITERIA

All the patients diagnosed with acute appendicitis and appendicular perforation who underwent open appendectomy were included in the study.

EXCLUSION CRITERIA

Patients with appendicular lump, appendicular abscess, immunocompromised patients, diabetics, pregnancy and interval appendicectomy.
The present prospective study included **256 patients** who underwent surgery for acute appendicitis or appendicular perforation in the Postgraduate Department of Surgery, Government Medical College (GMC), over a **two-year period from November 2020 to October 2022**. Patients were allocated into two groups of equal size: **Group A** (n = 128), in whom the appendicular stump was managed by simple ligation, and **Group B** (n = 128), in whom ligation followed by stump invagination was

performed. Both groups were comparable in terms of baseline characteristics, including age, sex, and presenting complications.

RESULTS:

Among the 256 patients included in the study, 166 (64.8%) were males and 90 (35.2%) were females **(Table 1)**

Table 1. Sex distribution		
Male	**Female**	**Total**
166	90	256

The highest proportion (28.9%) belonged to the 11–20 years age group. The youngest patient was 2 years old, while the oldest was 74 years, with a mean age of 27.9 years at presentation **(Table 2).**

Table 2. Age distribution of patients.					
S. No.	**Age (yrs)**	**Male**	**Female**	**Total**	**%age**
1	<10	14	8	22	8.59
2	10-20	48	26	74	28.9
3	20-30	50	28	78	30.4
4	30-40	22	8	30	11.7
5	40-50	20	14	34	13.2
6	50-60	6	3	9	3.5
7	60-70	**3**	**2**	**5**	**1.9**
8	>70	**3**	**1**	**4**	**1.5**
Total		**166**	**90**	**256**	**100**

Patients were randomly allocated into two equal groups of 128 each: Group A, in which simple ligation of the appendicular stump was performed, and Group B, in which ligation followed by stump inversion was carried out.

In this study, the retrocecal position of the appendix was the most frequently observed anatomical variation, present in 62% of cases, followed by the pelvic position in 25%**,** subcecal in 9%**,** and other positions in 3% of patients **(Table 3).**

Table 3. position of appendix					
S. No.	**Position of appendix**	**Male**	**Female**	**Total**	**%age**
1	Retrocecal	102	59	161	62
2	Pelvic	44	20	64	25
3	Sub cecal	14	9	23	8.9
4	others	06	2	08	3.1
Total		**166**	**90**	**256**	**100**

Overall, 23.43% of patients presented with appendicular perforation**,** of which 63.33% occurred in males and 36.66% **i**n females. The remaining 76.57% had simple appendicitis **(Table 4).**

Table 4. Intraoperative Findings		
FINDINGS	**GROUP A (N=128)**	**GROUP B (N=128)**
SIMPLE APPENDICITIS	98	98
APPENDICULAR PERFORATION	30	30

In terms of postoperative outcomes, among the 128 patients in Group A (simple ligation)**,** 21.9% developed pyrexia, while wound infection and wound dehiscence were noted in 10.1% and 4.7%**,** respectively. In Group B (ligation with stump invagination)**,** pyrexia occurred in 21.8%, wound infection **i**n 10.9%**,** and wound dehiscence in only 0.01% of patients **(Table 5).**

Table 5. Complications			
Complications	**GROUP A (N=128)**	**GROUP B (N=128)**	**p-value**
Pyrexia	27	28	0.821 (insignificant)
Wound Infection	13	14	0.726 (insignificant)
Wound Dehiscence	6	02	0.221(insignificant)
Fistula	nil	nil	

The mean operative time was significantly shorter in Group A **(**41.11 ± 3.26 minutes) compared to Group B (51.4 ± 3.47 minutes). However, the average hospital stay was comparable between the two groups (**Table 6).**

Table 6. Average duration of Surgery.			
	GROUP A (N=128)	GROUP B (N=128)	p-value
Duration (in mins)	41.11± 3.26	51.4 ± 3.47	<0.01 (significant)

DISCUSSION:

Demographics and Anatomical Variations: In our cohort of 256 patients, the most prevalent age group was 11–20 years (28.9%), with a mean age of 27.9 years. Anatomically, the retrocecal position of the appendix was observed in 62% of cases, consistent with previous studies reporting retrocecal appendices in approximately 50–70% of patients[11]

Perforation Rates and Gender Distribution: Our study found that 23.43% of patients had appendicular perforation, with a male predominance (63.33%). This aligns with literature indicating higher perforation rates in males, particularly in younger age groups[12]

Postoperative Outcomes

Pyrexia: Pyrexia occurred in 21.9% of Group A (simple ligation) and 21.8% of Group B (ligation with invagination). These rates are comparable and align with findings from a meta-analysis by Qian et al., which reported no significant difference in postoperative pyrexia between the two techniques[13]

Wound Infection and Dehiscence: Wound infection rates were 10.1% in Group A and 10.9% in Group B, while wound dehiscence occurred in 4.7% and 0.01%, respectively. These findings are consistent with other study by Naqvi et al., that have found no significant difference in wound infection rates between simple ligation and stump invagination[13,15]. The lower incidence of wound dehiscence in Group B may be attributed to the additional layer of closure provided by stump invagination.

Operative Time and Hospital Stay: The mean operative time was significantly shorter in Group A (41.11 ± 3.26 minutes) compared to Group B (51.4 ± 3.47 minutes). This is in line with a study by Qian et al., which reported shorter operative times for simple ligation compared to stump invagination[14].Interestingly, the average hospital stay was similar between the two groups, suggesting that the increased operative time in Group B did not translate into longer hospitalization.

Literature Comparison: A systematic review by Qian et al. concluded that while stump invagination may offer a lower risk of stump appendicitis, it is associated with longer operative times and does not significantly reduce postoperative complications compared to simple ligation[3]. Similarly, a study by Ellis et al. recommended simple ligation as the standard technique due to its simplicity and shorter operative time[11,12].

CONCLUSION

Our study supports the findings of previous research, indicating that simple ligation of the appendicular stump is a safe, effective, and time-efficient technique for stump closure in open appendectomy. While stump invagination may offer theoretical advantages, our data suggest that it does not provide significant clinical benefits over simple ligation.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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