

Original Article**Clinical Outcomes of Early Versus Delayed Appendectomy**

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Abstract**Background**

Acute appendicitis is one of the most common surgical emergencies worldwide. The controversy still exists about the timing of operation for appendicitis. The aim of this study was to compare the outcomes between early appendectomy and delayed appendectomy and assess the feasibility of delayed operation.

Materials and Methods

A hospital based prospective comparative study of patients diagnosed with acute appendicitis was conducted at Nobel Medical College Teaching Hospital from April 2025 to July 2025. Ethical clearance was taken from the Institutional Review Committee. Parameters such as, operative time, postoperative complications, duration of hospitalization, and time to return to normal activity were evaluated.

Results

Out of one hundred twenty-one patients who underwent laparoscopic appendectomy, mean age of the patients in Group A was 33.16 $\pm$ 10.38 years and that in Group B it was 35.23 $\pm$ 9.16 years. Male: Female ratio was 7:8 in Group A and 2:3 in Group B. The Early group had an average surgery time of 56.67 $\pm$ 11.88 minutes and an average hospital stay of 2.33 $\pm$ 0.60 days whereas the Delayed group showed a slightly higher mean surgery time of 57.50 $\pm$ 11.18 minutes and a longer average hospital stay of 2.70 $\pm$ 0.70 days. During follow up in OPD, surgical site infection was noted in eight patients of Group A and five patients of Group B. Overall, only hospital stay showed a meaningful difference between the groups, while other variables remained comparable.

Conclusion

Early and delayed laparoscopic appendectomy yield similar clinical outcomes in patients with acute appendicitis. While delayed appendectomy appears to be a safe and feasible alternative, early appendectomy is associated with a significantly shorter hospital stay and may provide economic benefits through reduced hospitalization and earlier recovery.

Keywords: *Appendicitis, Appendectomy, Hospitalization, Surgical site infection*

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Introduction

Appendicitis is one of the most common causes of acute abdominal pain encountered in the ER, for which immediate appendectomy had been the standard of care. A delay in surgical management raises concern among surgeons as appendicitis can progress over time to complications such as peri-appendiceal abscess and perforation, thereby predisposing patients to increased morbidity and mortality [1, 2].

However recent studies have challenged this traditional concept of emergency appendectomy, suggesting that acute appendicitis may be managed medically or that delaying surgery does not necessarily increase morbidity. Conversely, other studies maintain that prompt surgical intervention is essential, as any delay can lead to higher complication rates and prolonged hospital stays.

Despite numerous studies, controversy exists regarding the optimal timing of surgery for appendicitis. This study aims to compare the outcomes of early versus delayed appendectomy including postoperative length of stay and complications in patients diagnosed with acute appendicitis who underwent appendectomy and evaluate the feasibility of delayed surgical interventions.

Materials and Methods

This is a prospective comparative study conducted on patients attending to the OPD or ER of Nobel Medical College Teaching Hospital from April 2025 to July 2025. Ethical approval was taken from the Institutional Review Committee of Nobel Medical College and written informed consent was obtained from the patients. A total of 121 patients diagnosed as a case of acute appendicitis who underwent early laparoscopic appendectomy within 24 hours of admission as well as delayed appendectomy after 24 hours of conservative management were enrolled in the study. Critically ill patients and pregnant females were excluded from the study. The diagnosis of acute appendicitis was made on the basis of presenting history, clinical examinations and ultrasonography of abdomen and pelvis.

The sample size for the study was calculated to be 121. The sample size (n) was calculated using Cochran's formula, $n = Z^2 * p * q / e^2$ [$n = 1.962 * 0.1305 * 0.8695 / (0.06)^2 = 121$, where, $Z = 1.96$ for a 95% confidence interval, p = the prevalence of appendicitis among patients admitted to the

Department of Surgery of a tertiary care center, $q = 1 - p$, e = margin of error = 5%] [3].

The 121 patients were randomly assigned into two groups: early laparoscopic appendectomy group (Group A) and delayed laparoscopic appendectomy group (Group B) with 60 patients in the former group and 61 patients in the latter group. Injection ceftriaxone (1gm) and metronidazole (500mg) were started for each patient. In the early group patients, intravenous antibiotics were continued till the first or second postoperative day and switched over to oral antibiotics and discharged. In the other group (delayed) patients, the antibiotics were given intravenously in the day of admission; in these patients, delayed appendectomy was done the next day. They were given intravenous antibiotics till the first postoperative day, then switched over to oral antibiotics and then discharged. Laparoscopy was done with conventional three-port technique; a 10 mm camera port was created around umbilicus, and two 5-mm ports in the suprapubic region and left lower quadrant. Pneumoperitoneum necessary for the procedure was created using Verres needle technique and pressure was maintained at 12-15 mm of Hg. The patients were placed in Trendelenburg position with slight tilt to the left for better view of the appendix. The soft tissues were dissected and the appendix was identified and removed. Hemostasis was achieved and the appendix was kept in retrieval bag and taken out through umbilical port. All obtained specimens were sent for histopathological examinations. Soft solid and liquid diet were allowed to patients after 2 hours of surgery and for postoperative pain, injection Ketorolac 30 mg was given three times for 24 hours, then switched over to oral analgesics. Once the vitals were stable and pain was controlled, patients were discharged. The parameters examined in the study were the demographic data of patients (Age and Sex), operative time (from skin incision to closure), length of hospital day (from the day of admission to discharge), and conversion to open appendectomy. Data were entered in Microsoft Excel and analyzed using SPSS software.

Results

Table 1: Demographic Comparisons of Group A and B

	Group A (n=60)	Group B (n=61)	P value
Age (Years)	33.16 +/- 10.38	35.23 +/- 9.16	0.249
Sex	Male (28)	Male (24)	0.461
	Female (32)	Female (37)	
	M: F= 7:8	M: F= 2:3	



Table 2: Comparison of operative time between Group A and Group B

	Group A	Group B	P value
Operative time (in minutes)	56.67 +/- 11.88	57.50 +/- 11.18	0.693

Table 3: Comparison of hospital stay between Group A and Group B

	Group A	Group B	P value
Duration of hospital stay (in days)	2.33 +/- 0.60	2.70 +/- 0.74	0.0036

Table 4: Comparison of conversion to open appendectomy between Group A and Group B

	Group A	Group B	P value
Conversion to open procedure	7	3	0.322

Table 5: Comparison of wound infection between Group A and Group B

	Group A	Group B	p value
Wound infections	Infected= 8 Noninfected=52	Infected= 5 Noninfected=56	0.378

A total of one hundred twenty-one patients underwent laparoscopic appendectomy. Mean age of the patients in Group A was 33.16 +/- 10.38 years whereas in Group B it was 35.23 +/- 9.16 years. Male: Female ratio was 7:8 in Group A and 2:3 in Group B as shown in Table 1. The Early group had an average surgery time of 56.67 +/- 11.88 minutes and an average hospital stay of 2.33 +/- 0.60 days. In comparison, the Delayed group showed a slightly higher mean surgery time of 57.50 +/- 11.18 minutes and a longer average hospital stay of 2.70 +/- 0.70 days as shown in Tables 2 and 3. These results indicate that, in this dataset, delayed management is associated with both a marginally longer surgical duration and a statistically significant longer hospital stay at ($p=0.0036$) than early management. Seven patients from Group A and three patients from Group B had to be converted to open appendectomy. During follow up in OPD, surgical site infection was noted in 8 patients of Group A and 5 patients of Group B as shown in Table 5. Overall, only hospital stay showed a meaningful difference between the groups, while other variables remained comparable.

Discussion

Acute appendicitis (AA) is widely regarded as the most common cause of acute abdominal emergencies worldwide, occurring at a rate of about

90–100 cases per 100,000 people each year and with an estimated lifetime risk of developing appendicitis ranges from 7% to 12% [4]. Appendectomy remains the most frequently performed non-elective operation by general surgeons [5, 6]. Traditionally, it was carried out soon after the diagnosis of appendicitis to prevent further inflammatory progression. Although recent literature has documented successful outcomes with antibiotic-based, nonsurgical management in selected cases of uncomplicated appendicitis, it still should not be considered a purely medical condition [1].

Debate persists regarding the optimal timing of surgery for patients requiring operative management. Some studies continue to support immediate or early appendectomy, reporting better outcomes and noting higher rates of postoperative complications such as surgical site infections when surgery is delayed [7-9]. Conversely, other studies have found no significant differences in outcomes between early and delayed appendectomy [10].

In our study, mean age of patients in group A was 33.16 +/- 10.38 years whereas in Group B was 35.23 +/- 9.16 years which was statistically insignificant at $p=0.249$ with female predominance in each group as shown in Table 1. The mean duration of surgery in Group A patients was 56.67 +/- 11.88 minutes whereas in Group B patients it was 57.50 +/- 11.18 minutes, which was statistically insignificant at $p=0.693$. These findings suggest that there is no statistically significant association between group allocation and sex distribution as well as operative time.

The mean duration of Hospital stay in Group A patients was 2.33 +/- 0.60 days whereas in Group B was 2.70 +/- 0.74 days which was statistically significant at $p=0.0036$. These timings were calculated from the day of admission till discharge of patients. Overall, the hospital stay was longer in Group B patients because of the need for conservative management for the first 24 hours and surgery. This is comparable to the findings in a similar study by Kumar et al.[11]. Also, Ud-giri et al.[7] reported that, in their study of 211 appendicitis patients, those who underwent delayed appendectomy (more than 10 hours after admission) had higher complication rates, longer hospital stays, and increased readmissions compared with patients who received immediate appendectomy (within 10 hours).

Seven patients in Group A and three patients in



Group B needed conversion to open appendectomy which showed no statistically significant difference at $p=0.322$. Similar results were seen in a study by Kim SH et al.[12], where no significant difference was seen in conversion rates between early and delayed appendectomy.

Surgical site infection was noted in eight patients of Group A and five patients of Group B which was statistically insignificant ($p=0.378$). There was no significant difference between early versus delayed laparoscopic appendectomy in our study except hospital stay. A narrative review by Ashari et al.[13] also concluded that delaying appendectomy but not for more than 48 hours does not show significant correlation to the incidence of surgical site infections.

Adopting early appendectomy protocols can improve patient recovery, decrease hospital workload, and enhance overall surgical efficiency in acute care settings [11]. The total cost of treatment in our study was agreeably greater in the second group, owing to delaying surgery and longer hospital stay for appendectomy. Evidence states that early appendectomy is generally more cost-effective than delayed appendectomy, as it reduces complications, repeat admissions, and additional procedures. The costs were also calculated to be greater, albeit slightly, in the delayed group along with significant hospital stay than in the immediate group by Kim SH et al [12]. Although emergency surgery may have higher initial costs in complicated cases, the overall expenses of delayed management are typically higher due to prolonged care [14, 15]. Thus, delaying appendectomy might prove to be a financial burden in our community due to prolonged care and hospital stay even if other results do not favour one over the other.

The limitations of the study included small sample size and inability to analyse the total hospital costs. It was conducted in a single centre with limited follow-up of 4 weeks postoperatively and long-term complications of the procedures were not taken into account. As the time from the onset of pain was not accounted for in the analysis, it may have introduced a confounding factor that could not be controlled.

Conclusion

In this prospective comparative study, early and delayed laparoscopic appendectomy demonstrated comparable outcomes with respect to operative time, conversion to open appendec-

tomy, and postoperative surgical site infection rates. However, patients undergoing early appendectomy had a significantly shorter hospital stay compared to those managed with delayed surgery.

Recommendation

These findings suggest that delayed appendectomy after a short period of conservative management is a safe and feasible option in selected patients with acute appendicitis. Nevertheless, early appendectomy offers the advantage of reduced hospitalization and may be more cost-effective by facilitating earlier discharge and decreasing the overall burden on patients and healthcare resources. Further multicenter studies with larger sample sizes and long-term follow-up are recommended to validate these findings.

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Conflict of interest: None

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