National Board of Examinations - Journal of Medical Sciences
Volume 4, Issue 3, Pages 401–411, March 2026
DOI 10.61770/NBEJMS.2026.v04.i03.012

ORIGINAL ARTICLE

A Randomized Comparative Study of Peritoneal Closure versus Non-Closure During Open Appendicectomy

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Accepted: 13-February-2026 / Published Online: 03-March-2026

Abstract

Background: Open appendicectomy is still commonly performed, particularly in hospitals with limited resources. Traditionally, the peritoneum is closed to restore normal anatomy and to reduce adhesions. However, recent experimental and clinical studies suggest that leaving the peritoneum open may shorten surgery time and reduce postoperative discomfort without increasing complications. **Objectives:** To compare peritoneal closure and non-closure during open appendicectomy in terms of operative time, postoperative pain, need for analgesics, length of hospital stay, and postoperative complications. **Methods:** This randomized controlled study was carried out at a tertiary care teaching hospital in South India between October 2017 and October 2018. A total of 200 patients with uncomplicated acute appendicitis undergoing open appendicectomy were randomly divided into two groups: peritoneal closure (Group A, n=100) and peritoneal non-closure (Group B, n=100). Outcomes assessed were operative duration, postoperative pain measured using the Visual Analogue Scale (VAS), analgesic requirement, postoperative complications, and length of hospital stay. Data were analyzed using SPSS software, and a p-value <0.05 was considered statistically significant. **Results:** The mean operative time was significantly shorter in the non-closure group (87.5 minutes) compared to the closure group (100 minutes) ($p<0.001$). A higher requirement for postoperative analgesics was seen more often in the closure group (41%) than in the non-closure group (25%) ($p=0.016$). Postoperative pain scores, complication rates, and duration of hospital stay were similar in both groups. **Conclusion:** Leaving the peritoneum open during open appendicectomy reduces operative time and the need for postoperative analgesics without increasing complications. This supports the routine use of peritoneal non-closure in patients with uncomplicated appendicitis.

Keywords: Open appendicectomy, Peritoneum, Non-closure, Postoperative pain, Operative time

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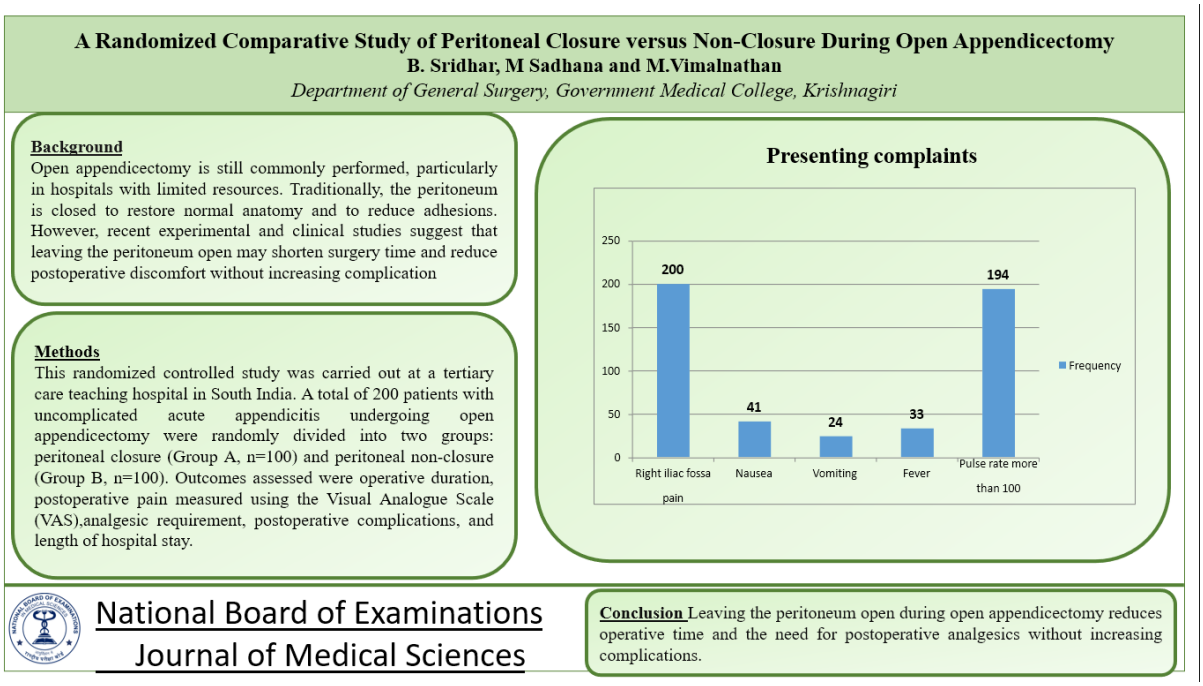
Graphical Abstract



Introduction

Acute appendicitis is one of the most common surgical emergencies worldwide, and appendicectomy is among the most frequently performed abdominal surgeries [1]. Though laparoscopic appendicectomy is increasingly used, open appendicectomy is also still practiced in some developing countries because of limited resources and surgeon preference [2].

Commonly, during open appendicectomy, the parietal peritoneum is closed with the belief that it helps restore normal anatomy and also helps in reducing adhesion formation [3]. However, studies have shown that the peritoneum has a natural ability to heal quickly, with re-formation of the peritoneal lining which usually happens within 48–72 hours even without suturing [4].

Several experimental and clinical studies noted that suturing the peritoneum may cause local tissue damage thus reducing the blood supply, inflammation, and reaction to suture material, which may increase postoperative pain and actually promote adhesion formation rather than preventing it [5,6]. In contrast, leaving the peritoneum unclosed has been noted to be associated with shorter operative time, less postoperative pain, reduced need for analgesics, and faster recovery in various abdominal and obstetric surgeries [7–9].

There is substantial evidence supporting peritoneal non-closure in procedures like cesarean sections and major abdominal surgeries. Data specific to open appendicectomy are limited and show variable results, particularly in the Indian setting [10]. Given the large number of appendicectomies performed, even small improvements in surgical time and postoperative recovery may have important clinical and economic advantages.

Therefore, the present randomized controlled study was conducted to compare peritoneal closure and non-closure during open appendicectomy in terms of operative duration, postoperative pain, analgesic

requirement, length of hospital stay, and postoperative complications.

Materials and Methods

Study Design and Setting

A randomized controlled study was carried out in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai, over a one-year period from October 2017 to October 2018.

Study Population

Patients aged between 15 and 65 years who were clinically and radiologically diagnosed with uncomplicated acute appendicitis and underwent open appendicectomy were included in the study.

Exclusion Criteria

Patients with perforated appendix, appendicular abscess or mass, generalized peritonitis, pregnancy, immunocompromised conditions, diabetes mellitus, chronic kidney or liver disease, malignancy, psychiatric illness, or those unwilling to give consent were excluded.

Sample Size

The sample size was calculated based on postoperative analgesic requirement using data from a previously published Indian study comparing peritoneal closure and non-closure during open appendicectomy [11]. The mean analgesic requirement reported was 48.9 ± 47 units in the closure group and 23.5 ± 40.8 units in the non-closure group. With a two-sided alpha error of 0.05 and a power of 80%, the minimum sample size required was 47 patients in each group. To improve the reliability of results, 100 patients were included in each group, giving a total sample size of 200.

Randomization and Intervention

Patients were randomly assigned into two groups based on computer generated randomisation:

- Group A: Open appendicectomy with peritoneal closure
- Group B: Open appendicectomy with peritoneal non-closure

All surgeries were performed using standard open appendicectomy techniques. Except for the peritoneal closure step, all other surgical steps were the same in both groups.

Outcome Measures

The primary outcomes were operative time and postoperative analgesic requirement. Secondary outcomes included postoperative pain measured using the Visual Analogue Scale (VAS), postoperative complications, duration of hospital stay, and persistence of pain during follow-up. Blinding was not done at any level.

Postoperative Management

All patients received the same postoperative analgesia in the form of injectable diclofenac for three days. Patients who needed additional or prolonged analgesia were considered to have a high analgesic requirement.

Statistical Analysis

Data analysis was done using SPSS software. Quantitative data were expressed as mean ± standard deviation, and qualitative data as frequencies and percentages. The Chi-square test and independent t-test were used where

appropriate. A p-value of less than 0.05 was taken as statistically significant.

Results

Table 1 shows that the study included 200 patients with a mean age of 26.2 years, and most participants were males (63.5%), indicating a young male-predominant population. Table 2 demonstrates that the non-closure group had a significantly shorter mean operative time (87.5 minutes) compared to the closure group (100 minutes) ($p<0.001$), and fewer patients required high doses of analgesics (25% vs 41%, $p=0.016$), suggesting less postoperative discomfort. Table 3 further confirms that a larger proportion of patients in the non-closure group completed surgery in less than 60 minutes, while most closure group surgeries exceeded 90 minutes ($p<0.0001$). Postoperative pain scores (VAS) were similar in both groups ($p=0.8388$), indicating that non-closure did not increase pain perception. Postoperative complications were low and comparable between groups ($p=0.174$), showing that non-closure is safe. Hospital stay was significantly shorter in the non-closure group ($p=0.012$), and pain persistence at one month was significantly lower (3% vs 14%, $p=0.0052$), although there was no difference at 15 days or 3 months. Overall, non-closure reduces operative time, decreases strong analgesic requirement, shortens hospital stay, and improves short-term recovery without increasing complications.

Table 1. Baseline Demographic Characteristics

Variable	**Overall (n=200)**
Mean age (years)	26.2 ± 6.7
Male	127 (63.5%)
Female	73 (36.5%)

Table 2. Operative Time and Analgesic Requirement by Study Group

Outcome	**Closure (n=100)**	**Non-closure (n=100)**	**p value**
Mean operative time (minutes)	100	87.5	<0.001
High analgesic requirement	41 (41%)	25 (25%)	0.016

Table 3. Postoperative Outcomes

Outcome	**Closure (n=100)**	**Non-closure (n=100)**	**p value**
Operating Time			
Mean duration	100 min	87.5 min	<0.0001*
<60 minutes	0%	61%	
61-90 minutes	47%	34%	
>90 minutes	53%	5%	
Postoperative Pain (VAS)			0.8388 (NS)
No pain	30%	41%	
Mild pain	37%	46%	
Moderate pain	22%	24%	
Analgesic Requirement			
Standard analgesic	59%	75%	0.016*
High analgesic	41%	25%	
Postoperative Complications			
Present	4%	1%	0.174 (NS)
Absent	96%	99%	
Hospital Stay			
<3 days	21%	30%	0.012*
3-6 days	65%	67%	
>6 days	14%	3%	
Pain Persistence - 15 Days			
Present	83%	78%	

Absent	17%	22%	0.372 (NS)
Pain Persistence - 1 Month			
Present	14%	3%	0.0052*
Absent	86%	97%	
Pain Persistence - 3 Months			
Present	2%	1%	0.561 (NS)
Absent	98%	99%	

*NS = Not Significant; *p<0.05 = Statistically Significant

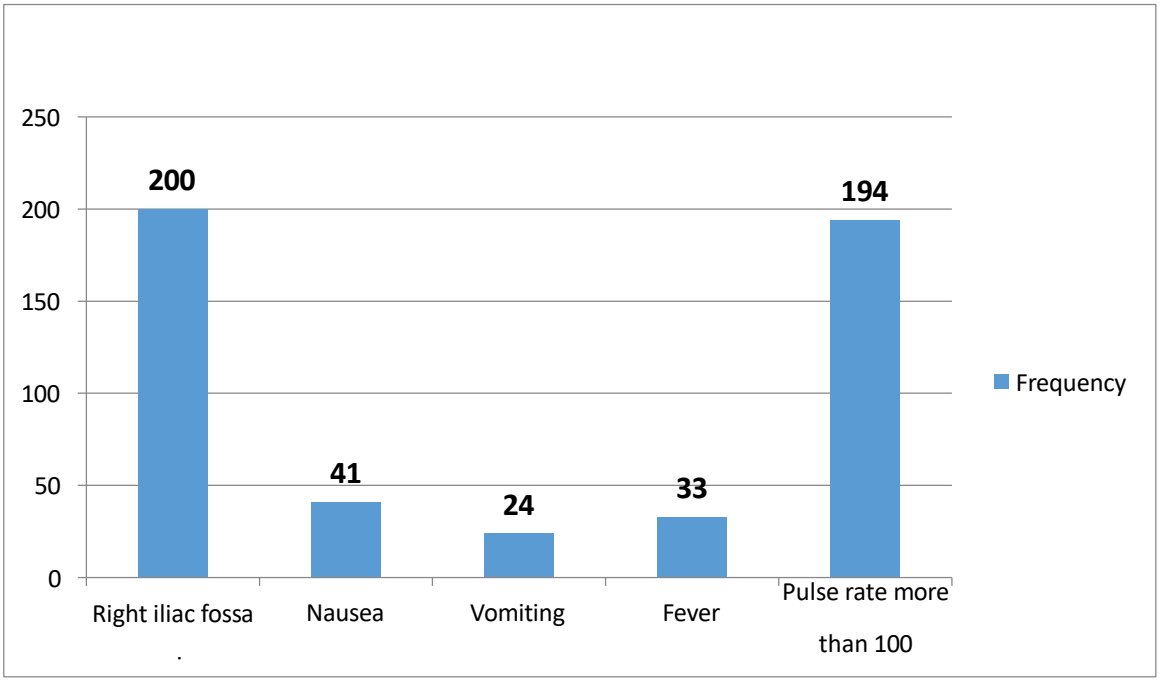


Figure 1. Presenting complaints

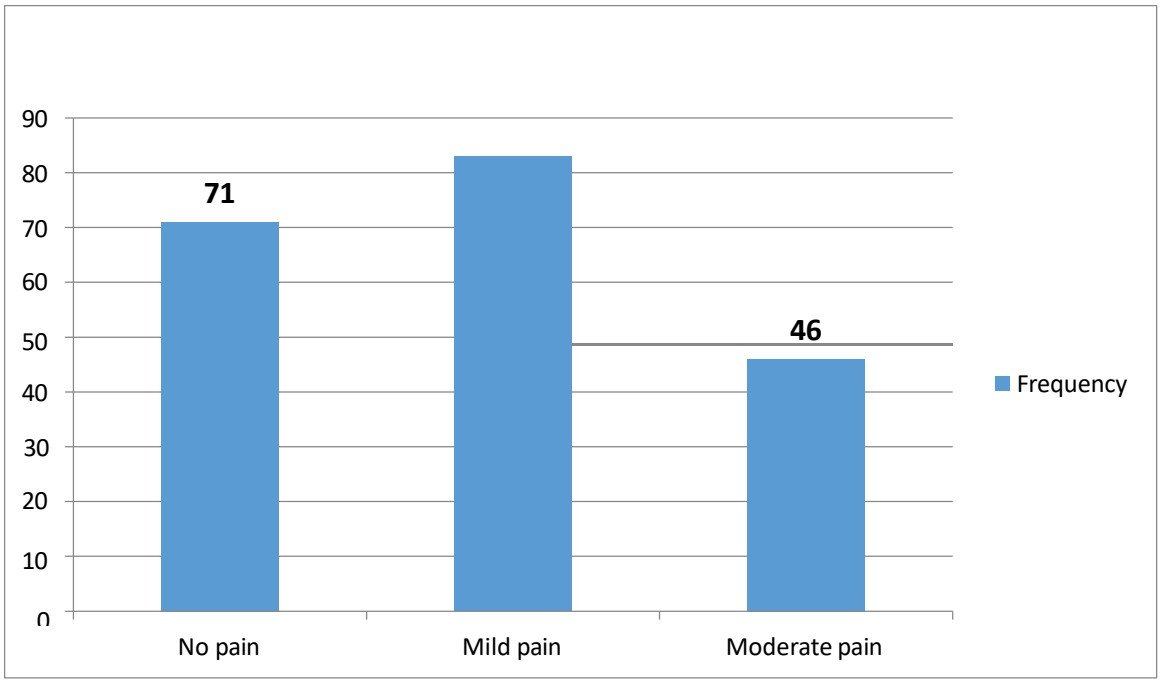


Figure 2. VAS scale

Discussion

This randomized controlled study shows that leaving the peritoneum open during open appendicectomy reduces the operative time and decreases the need for postoperative analgesics, without increasing postoperative complications.

The shorter operative time in the non-closure group is consistent with earlier studies, which report that skipping peritoneal suturing saves time by eliminating an additional surgical step [7,11]. In busy surgical units where many appendicectomies are performed, this reduction in operating time can improve operating room efficiency and may also lower overall treatment costs. A recent study from Bangladesh also reported a significant reduction in operative duration with peritoneal non-closure without affecting patient safety [12].

Patients in the non-closure group required fewer postoperative analgesics. This may be because suturing the peritoneum can cause more tissue handling, inflammation, and irritation of nerve endings, which can increase postoperative pain [5,6]. Although the VAS pain scores were similar in both groups, the reduced need for additional analgesia in the non-closure group is clinically important. Experimental studies have also shown that peritoneal suturing can trigger inflammatory responses that contribute to pain and adhesion formation through increased pro-inflammatory cytokines and reduced fibrinolysis [13,14].

Importantly, leaving the peritoneum open did not increase postoperative complications such as wound infection or length of hospital stay. This finding is supported by several randomized trials and systematic reviews which conclude that peritoneal non-closure does not raise the risk of surgical site infection or adhesion-related complications [8,9]. The peritoneum has a strong healing ability, and mesothelial cells rapidly regenerate the peritoneal lining within 5–7 days even without suturing [15].

Postoperative adhesions are a common concern after abdominal surgery, occurring in a large proportion of patients undergoing laparotomy [16]. Adhesions can lead to complications such as intestinal obstruction, chronic abdominal pain, infertility, and difficulty during future surgeries. Evidence suggests that peritoneal closure may actually increase adhesion formation due to local ischemia, foreign body reaction to sutures, and prolonged inflammation [17]. Recent reviews also highlight the role of inflammatory processes, macrophage activity, and impaired fibrinolysis in adhesion development, which may be worsened by peritoneal suturing [18].

Adhesion-related complications also impose a significant economic burden due to readmissions and repeat surgeries. Therefore, a simple and cost-effective step like avoiding unnecessary peritoneal closure may have important clinical and economic benefits. Although anti-adhesion barriers such as hydrogels are being developed, non-closure of the peritoneum remains a practical and low-cost strategy [19].

Several Indian studies on open appendicectomy have reported similar findings, especially regarding reduced postoperative pain and analgesic requirement with peritoneal non-closure [10,11]. However, studies in obstetric surgeries have shown variable results, indicating that the impact of peritoneal non-closure may differ depending on the type of surgery and patient characteristics.

Current guidelines for acute appendicitis emphasize early diagnosis and appropriate surgical management. While laparoscopic appendicectomy is now preferred in many centers due to faster recovery and fewer wound complications [20], open appendicectomy is still widely performed in resource-limited settings. In such settings, peritoneal non-closure is a simple modification that can improve patient outcomes without the need for additional equipment, cost, or advanced surgical expertise.

Conclusion

Peritoneal non-closure in open appendicectomy is a safe and effective option when compared to routine peritoneal closure. It helps reducing the duration of surgery and the need for postoperative pain medication without increasing complications or length of hospital stay. Non-closure of the peritoneum may be routinely considered in patients undergoing open appendicectomy for uncomplicated appendicitis.

Strengths

The main strength of this study is it is randomized controlled study, that helps in reducing selection bias and also improves the reliability of the findings. Adequate sample size with equal numbers in both groups adds to the statistical strength of the study. Clear inclusion and exclusion criteria ensured that only patients with uncomplicated appendicitis were included, making the groups comparable. The use of a standardized surgical technique and uniform postoperative analgesic protocol reduced variation in treatment. The study assessed clinically meaningful outcomes like operative time, postoperative pain, analgesic requirement, complications, and duration of hospital stay.

Limitations

This study has certain limitations. Being a single-center study, the results may not be fully applicable to all clinical

settings. Blinding was not done at any level. Differences in surgeon experience and operating speed could have influenced operative time. The follow-up period was limited, and long-term outcomes such as adhesion-related complications were not assessed. In addition, postoperative pain assessment is subjective, even though a standardized pain scale was used.

Author Contributions

BS has contributed to the conceptualization and definition of the intellectual content of the manuscript, design of the study and Manuscript preparation. SM contributed to the literature search, manuscript editing, and manuscript review. VM contributed towards data acquisition Statistical analysis, Manuscript review and editing. BS will act as the corresponding author of the manuscript

Statements and Declarations

Conflicts of interest

The authors declare that they do not have conflict of interest.

Funding

No funding was received for conducting this study.

Data availability statement

The datasets generated and analysed in this study are available from the corresponding author on reasonable request. They are not publicly shared because they contain sensitive information that could indirectly identify participants.

Informed Consent

Written informed consent was obtained from all participants after explaining the study procedures, potential risks and benefits. Consent covered both participation and publication of anonymised findings, with assurance of confidentiality and data privacy.

References

1. Manueli Laos EG, Ducas A, Huh N, Mangano A, Lopez P, Masrur MA. Challenges in management of acute appendicitis: A narrative review. Curr Probl Surg. 2024 Nov;61(11):101596. doi: 10.1016/j.cpsurg.2024.101596.
2. Sahoo DR, Naik D, Prasad V, Sunil J. Effect of peritoneal non-closure and closure during open appendectomy on post-operative pain: a randomized, double-blinded study. Langenbecks Arch Surg. 2025 Oct 30;410(1):319. doi: 10.1007/s00423-025-03806-5.
3. Rao M.S.V.M, Sai Kumar D.N.S., Neelesh K. Peritoneal Closure Versus Non-Closure in Open Appendicectomies. Indian Journal of Applied Research. 2021;11–2. http://dx.doi.org/10.36106/ijar/5010357.
4. Nelson S, Kumar G, Fernando R. Comparative Analysis of Peritoneal Closure Versus Non-Closure in Emergency Open Appendicectomy: A Clinical Trial Study. International Journal of Academic Medicine and Pharmacy [Internet]. 2023 Feb 24;5(4):490–3.
5. Nagalekshmi G, Asik Roy GV, Ram Praveen P, Geolin Mithun J. A Prospective Study on Effect of Peritoneal Closure vs Nonclosure on Post Operative Analgesia Requirement in Emergency Open appendectomy in a tertiary care hospital. International Journal of

Academic Medicine and Pharmacy. 2025 Apr 25;7(2):1191–6.
6. Herrick SE, Wilm B. Post-Surgical Peritoneal Scarring and Key Molecular Mechanisms. Biomolecules. 2021 May 5;11(5):692. doi: 10.3390/biom11050692.
7. Wang R, Guo T, Li J. Mechanisms of Peritoneal Mesothelial Cells in Peritoneal Adhesion. Biomolecules. 2022 Oct 17;12(10):1498. doi: 10.3390/biom12101498.
8. Lin Z, Liu Z, Huang Y, Zhao C. Postoperative abdominal adhesions: pathogenesis and advances in hydrogel-based multimodal prevention strategies. Acta Biomater. 2025 Sep 15;204:76-108. doi: 10.1016/j.actbio.2025.07.066.
9. Christensen RR, Wright KE, Ives JK, Minnick CE, Chen Q, Girgis MD, Ko C, Gibbons MM, Russell TA, Huy TC, Bercz A, Smith JJ, Bailey A, Ten Broek RPG, de Wilde RL, Zindel J, Cardenas JC, Mutsaers S, Wiseman D, Meany EA, Appel EA, Foster DS, Delitto DJ, Longaker MT, Rinkevich Y, Bauer SR, Carmichael SP. A Developmental Roadmap Toward Abdominal Adhesions Prevention Technologies. Ann Surg Open. 2025 Dec 16;6(4):e637. doi: 10.1097/AS9.0000000000000637.
10. Bektasoglu HK, Yigman S, Kartal A, et al. Nonclosure of the Peritoneum during Appendectomy May Cause Less Postoperative Pain: A Randomized, Double-Blind Study. Pain Res Manag. 2019;2019:9392780. doi: 10.1155/2019/9392780.
11. Schaefer SD, Alkatout I, Dornhoefer N, Herrmann J, Klapdor R, Meinhold-Heerlein I, Meszaros J, Mustea A, Oppelt P, Wallwiener M, Kraemer B. Prevention of peritoneal adhesions after gynecological surgery: a systematic review. Arch Gynecol Obstet. 2024 Aug;310(2):655-672. doi: 10.1007/s00404-024-07584-1.
12. Kollol FF, Uddin MA, Hossain MM, Hoque KR, Shakil MA, Sufiyan AHM, Biswas N, Islam N, Hasan SMS, Jahan I, Mashruh M, Anon MA, Islam MW, Shanta TR, Mamun MAA, Baten MA, Azad MAK. Early Post-Operative Outcomes in Closure and Non-Closure of Peritoneum in Open Appendicectomy for Uncomplicated Appendicitis. Mymensingh Med J. 2025 Jul;34(3):707-713.
13. Moris D, Chakedis J, Rahman A, Clancy TE. Postoperative Abdominal Adhesions: Clinical Significance and Advances in Prevention and Management. J Gastrointest Surg. 2024;28:146-156.
14. Yin M, Tan Y, Huang Y, Wang X, He Y, Li J. Post-Operative Adhesions: A Comprehensive Review of Mechanisms. Biomedicines. 2021 Aug;9(8):867. doi: 10.3390/biomedicines9080867.
15. Mutsaers SE, Birnie K, Lansley S, Herrick SE, Lim CB, Prêle CM. Mesothelial cells in tissue repair and fibrosis. Front Pharmacol. 2015;6:113.
16. ten Broek RP, Issa Y, van Santbrink EJ, et al. Burden of adhesions in abdominal and pelvic surgery: systematic review and met-analysis. BMJ. 2013;347:f5588.
17. Arung W, Meurisse M, Detry O. Pathophysiology and prevention of

postoperative peritoneal adhesions. World J Gastroenterol. 2011;17:4545-4553.

18. Liu ZY, Li RF, Qin HY, Ma PF. Postoperative adhesion formation: the role of peritoneal macrophages and targeting therapy. Front Immunol. 2025 Aug 5;16:1601642. doi: 10.3389/fimmu.2025.1601642.
19. Sakari T, Langenskiöld S, Sköldberg F, Karlbom U. Economic Consequences of Surgery for Adhesive Small Bowel Obstruction: A Population-Based Study. Gastroenterol Res Pract. 2023 Feb 25;2023:1844690. doi: 10.1155/2023/1844690.
20. Oyedele TJ, Ali SH, Asini AO, Agunbiade AA, Dolapo KP, Olufunmilayo IS, Babalola AE, Aderinto N. Laparoscopic versus open appendectomy for acute appendicitis in Sub-Saharan Africa. Ann Med Surg (Lond). 2025 Nov 27;88(1):728-735. doi: 10.1097/MS9.0000000000004445.