GMR
The Original

IMPACT OF SURGERY TIMING ON POSTOPERATIVE OUTCOMES FOLLOWING APPENDECTOMY: A RETROSPECTIVE COHORT STUDY

Amani Omar Safdar[1], Abdulaziz Mohammed Almehmadi[2], Raghad Khalid Bajudah[3], Manar Saeed Ali Alzahrani[4], Jawaher Abdullah Kariri[5], Ahmed saleh Almuqadam[6], Shahad Fahad Basamad[7], Zeyad Omar Alsehemi[8]

[1.] Medical intern, Collage Of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia, Email: anoodalabbas@gmail.com
[2.] Medical student, Collage Of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia
[3.] Medical student, Collage Of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia
[4.] Medical student, Collage Of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia
[5.] Medical student, College Of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia
[6.] Medical student, College Of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia
[7.] Medical student, College Of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia
[8.] Assistant Professor, Department of General Surgery, College of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia, zoseheni@uqu.edu.sa, orcid : 0009-0009-0173-6486

ABSTRACT

Background: The optimal timing of appendectomy remains a subject of debate, with concerns that nighttime surgery may be associated with worse postoperative outcomes due to factors such as reduced staffing and surgeon fatigue.

Objective: To evaluate the association between the timing of appendectomy (daytime versus nighttime) and postoperative complications and clinical outcomes.

Methods: This retrospective cohort study was conducted at a tertiary care center in Makkah, Saudi Arabia. A total of 183 patients who underwent appendectomy between February and June 2025 were included. Surgeries were categorized as daytime (06:00–17:59) or nighttime (18:00–05:59). Data on patient demographics, clinical characteristics, operative details, and postoperative outcomes were collected. Logistic regression analysis was performed to assess the association between surgery timing and postoperative complications, adjusting for relevant confounders.

Results: Of the 183 patients, 118 (64.5%) underwent daytime surgery and 65 (35.5%) underwent nighttime surgery. Postoperative complications occurred in 21 patients (11.5%), with a higher rate observed in the daytime group compared to the nighttime group (13.6% vs. 7.7%); however, this difference was not statistically significant ($p = 0.233$). No significant differences were observed between the two groups in terms of ICU admission, length of hospital stay, or postoperative recovery indicators (all $p > 0.05$).

Conclusion: The timing of appendectomy was not associated with an increased risk of postoperative complications or adverse clinical outcomes. These findings support the safety of performing appendectomy during both daytime and nighttime hours without compromising patient outcomes.

KEYWORDS: Appendectomy, Surgery timing, Daytime surgery, Nighttime surgery, Postoperative complications, Surgical outcomes, Retrospective cohort

INTRODUCTION

Acute appendicitis remains one of the most common surgical emergencies worldwide, with a lifetime risk estimated at 6.7% in females and 8.6% in males, necessitating timely intervention to prevent disease progression and complications [2–4]. Appendectomy continues to be the gold standard treatment, with generally favorable outcomes when performed promptly [7].

Despite the routine nature of this procedure, the timing of surgery has been a subject of ongoing debate. Concerns have been raised regarding whether surgeries performed during nighttime hours may be associated with increased postoperative complications due to factors such as reduced staffing, surgeon fatigue, or limited hospital resources.

Previous studies have reported inconsistent findings. While several studies have demonstrated no significant difference in postoperative complications between daytime and nighttime appendectomies [3,4,11–13], others have suggested that delays or off-hour surgical interventions may influence outcomes, particularly in resource-limited or high-demand settings.

Understanding whether surgical timing independently affects postoperative outcomes is essential, as it may influence clinical decision-making, optimize resource allocation, and enhance patient safety.

Therefore, this study aims to evaluate the association between the timing of appendectomy (daytime versus nighttime) and postoperative complications in a cohort of patients treated at a tertiary care center in Makkah, Saudi Arabia.

Objectives

Primary Objective

To assess the association between the timing of appendectomy (daytime versus nighttime) and postoperative complications.

Secondary Objectives

1. To compare the length of hospital stay between daytime and nighttime appendectomies.
2. To evaluate differences in postoperative recovery indicators between the two groups.
3. To assess the association between surgery timing and postoperative outcomes, including ICU admission.

METHODS

Study Design and Setting

This retrospective cohort study was conducted at King Faisal Hospital in Makkah, Saudi Arabia, a tertiary care center providing emergency surgical services to a diverse patient population.

All patients who underwent appendectomy between February 2025 and June 2025 were included. Surgeries performed during daytime (06:00–17:59) and nighttime (18:00–05:59) hours were compared.

Participants (Inclusion and Exclusion Criteria)

All patients who underwent appendectomy at King Faisal Hospital between February 2025 and June 2025 were eligible for inclusion in this study.

Inclusion Criteria

- Patients aged 14 to 65 years.
- Patients who underwent appendectomy during the study period.
- Patients with complete medical records.

Exclusion Criteria

- Patients with incomplete or missing key data required for analysis.
- Patients who underwent appendectomy in conjunction with other major surgical procedures.

Data Collection and Variables

Data were retrospectively collected from the hospital's electronic medical records and surgical logs.

The primary outcome was postoperative complications, defined as any deviation from the normal postoperative course, including but not limited to surgical site infections, gastrointestinal complications, or other clinically significant events.

The main independent variable was the timing of surgery, categorized as daytime (06:00–17:59) and nighttime (18:00–05:59).

Additional variables included patient age, body mass index (BMI), and the presence of complicated appendicitis, defined as cases involving perforation, peritonitis, or appendiceal mass.

Operative duration was also recorded and considered a potential confounding factor.

Statistical Analysis

Data analysis was performed using SPSS version 26 (IBM Corp., Armonk, NY, USA).

Descriptive statistics were used to summarize the data. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation or median with interquartile range, as appropriate.

Comparisons between daytime and nighttime groups were performed using the chi-square test or Fisher's exact test for categorical variables, and the independent samples t-test or Mann–Whitney U test for continuous variables, as appropriate.

To assess the association between surgery timing and postoperative complications, univariate logistic regression analysis was initially performed. A multivariable logistic regression model was then constructed, including surgery timing, age, and complicated appendicitis as clinically relevant confounders.

A sensitivity analysis was conducted by additionally including operative duration to evaluate the robustness of the model.

A p-value of <0.05 was considered statistically significant.

Sample Size

All eligible patients who underwent appendectomy during the study period were included using a consecutive sampling approach. No prior sample size calculation was performed due to the retrospective nature of the study.

Ethical Considerations

The study was approved by the Local Research Ethics Committee (IRB-Makkah, H-02-K-076). Due to the retrospective nature of the study and the use of anonymized medical records, the requirement for informed consent was waived.

RESULTS

A total of 183 patients were included in the study, of whom 118 (64.5%) underwent appendectomy during daytime hours and 65 (35.5%) during nighttime hours.

As shown in **Table 1**, most patients (59.0%) were aged ≤30 years, with a mean age of 29.93 ± 9.92 years. Males accounted for 72.1% of the study population. The mean body mass index (BMI) was 24.93 ± 4.91 kg/m², with 10.4% of patients classified as obese.

Complicated appendicitis was identified in 23 patients (12.6%). No statistically significant differences were observed between daytime and nighttime groups in terms of age, sex, BMI, or the presence of complicated appendicitis (all $p > 0.05$).

Table1: Association between surgery timing and patient demographics, body mass index (BMI), and complicated appendicitis (n = 183)

Variable	Total n (%)	Daytime n (%)	Nighttime n (%)	Test	p-value
Age (years)					
≤30	108 (59.0)	73 (61.9)	35 (53.8)	χ^2	0.291
>30	75 (41.0)	45 (38.1)	30 (46.2)		
Mean ± SD	29.93 ± 9.92	29.5 ± 10.02	30.71 ± 9.77	MW	0.317
Gender					
Female	51 (27.9)	34 (28.8)	17 (26.2)	χ^2	0.701
Male	132 (72.1)	84 (71.2)	48 (73.8)		
BMI category					
Underweight	8 (4.4)	5 (4.2)	3 (4.6)	χ^2	0.933
Normal weight	94 (51.4)	59 (50.0)	35 (53.8)		
Overweight	62 (33.9)	42 (35.6)	20 (30.8)		
Obese	19 (10.4)	12 (10.2)	7 (10.8)		
BMI (mean ± SD)	24.93 ± 4.91	24.76 ± 4.24	25.23 ± 5.97	MW	0.867
Complicated appendicitis					
No	160 (87.4)	101 (85.6)	59 (90.8)	χ^2	0.312
Yes	23 (12.6)	17 (14.4)	6 (9.2)		

Abbreviations: χ^2 = Chi-square test, MW = Mann–Whitney U test

As presented in Table 2, most patients had a surgery duration of 60–120 minutes (48.1%), followed by 30–60 minutes (36.6%). Open appendectomy was more commonly performed than laparoscopic appendectomy (62.3% vs. 37.7%).

Regarding hospital stay, nearly half of the patients (48.1%) were discharged within 2–3 days, while 36.1% had a hospital stay of 1 day.

Postoperative recovery indicators showed that 20.8% of patients tolerated oral intake on postoperative day 0, while 23.0% voided for the first time on the same day. Additionally, 16.4% passed gas or stool on postoperative day 0, and 23.0% were mobilized on postoperative day 0.

No statistically significant differences were observed between daytime and nighttime groups across all operative and postoperative variables (all $p > 0.05$).

Table2: Association between surgery timing and operative and postoperative outcomes (n = 183)

Variable	Total n (%)	Daytime n (%)	Nighttime n (%)	Test	p-value
Surgery duration				χ^2	0.298
<30 min	6 (3.3)	4 (3.4)	2 (3.1)		
30–60 min	67 (36.6)	48 (40.7)	19 (29.2)		
60–120 min	88 (48.1)	55 (46.6)	33 (50.8)		
>120 min	22 (12.0)	11 (9.3)	11 (16.9)		
Surgery type				χ^2	0.891
Laparoscopic appendectomy	69 (37.7)	45 (38.1)	24 (36.9)		
Open appendectomy	114 (62.3)	73 (61.9)	41 (63.1)		
Length of hospital stay				χ^2	0.746
1 day	66 (36.1)	41 (34.7)	25 (38.5)		
2–3 days	88 (48.1)	57 (48.3)	31 (47.7)		
>3 days	19 (10.4)	12 (10.2)	7 (10.8)		
>1 week	10 (5.5)	8 (6.8)	2 (3.1)		
First oral intake				χ^2	0.209

Variable	Total n (%)	Daytime n (%)	Nighttime n (%)	Test	p-value
Day 0	38 (20.8)	24 (20.3)	14 (21.5)		
Day 1	127 (69.4)	86 (72.9)	41 (63.1)		
Day 2–3	15 (8.2)	6 (5.1)	9 (13.8)		
>3 days	3 (1.6)	2 (1.7)	1 (1.5)		
First voiding				χ^2	0.083
Day 0	42 (23.0)	26 (22.0)	16 (24.6)		
Day 1	106 (57.9)	80 (67.8)	36 (55.4)		
Day 2–3	23 (12.6)	10 (8.5)	13 (20.0)		
>3 days	2 (1.1)	2 (1.7)	0 (0.0)		
Passing gas/stool				χ^2	0.114
Day 0	30 (16.4)	19 (16.1)	11 (16.9)		
Day 1	106 (57.9)	74 (62.7)	32 (49.2)		
Day 2–3	45 (24.6)	23 (19.5)	22 (44.8)		
>3 days	2 (1.1)	2 (1.7)	0 (0.0)		
Mobilization				χ^2	0.175
Day 0	42 (23.0)	26 (22.0)	16 (24.6)		
Day 1	114 (62.3)	78 (66.1)	36 (55.4)		
Day 2–3	25 (13.7)	12 (10.2)	13 (20.0)		
>3 days	2 (1.1)	2 (1.7)	0 (0.0)		

Abbreviations: χ^2 = Chi-square test.

Postoperative complications were observed in 21 patients (11.5%). The rate of complications was higher in the daytime group compared to the nighttime group (13.6% vs. 7.7%); however, this difference was not statistically significant ($p = 0.233$).

ICU admission was rare, occurring in only 2 patients (1.1%), both in the daytime group, with no statistically significant difference between groups ($p = 0.291$).

Among patients who developed complications, gastrointestinal complications were the most common (33.3%), followed by infections (28.5%).

Overall, no statistically significant association was found between surgery timing and postoperative complications, ICU admission, or type of complication (all $p > 0.05$).

Table3: Association between surgery timing and postoperative outcomes (n = 183)

Variable	Total n (%)	Daytime n (%)	Nighttime n (%)	Test	p-value
ICU admission				χ^2	0.291
No	181 (98.9)	116 (98.3)	65 (100)		
Yes	2 (1.1)	2 (1.7)	0 (0.0)		
Postoperative complications				χ^2	0.233
No	162 (88.5)	102 (86.4)	60 (92.3)		
Yes	21 (11.5)	16 (13.6)	5 (7.7)		
Type of complications (n = 21)				χ^2	0.801
Gastrointestinal	7 (33.3)	5	2		
Infection	6 (28.5)	5	1		
Infection + gastrointestinal	2 (9.5)	1	1		
Hematological / infection	2 (9.5)	2	0		
Respiratory	2 (9.5)	1	1		
Other	1 (4.7)	1	0		
Infection (other)	1 (4.7)	1	0		

Abbreviations: χ^2 = Chi-square test.

DISCUSSION

This retrospective cohort study evaluated whether the timing of appendectomy influences postoperative complications and clinical outcomes. The findings demonstrated no statistically significant association between surgery timing and postoperative complications, despite a numerically higher complication rate observed in the daytime group.

In this cohort, 11.5% of patients developed postoperative complications, with a higher proportion in the daytime group compared to the nighttime group (13.6% vs. 7.7%). However, this difference was not statistically significant, suggesting that surgical timing alone may not be an independent predictor of postoperative complications. These findings are consistent with previous studies reporting no significant differences in complication rates between daytime and nighttime appendectomies [5,11–13].

Gastrointestinal complications were the most common, accounting for one-third of all complications, followed by infections. This pattern aligns with existing literature, where surgical site infections and gastrointestinal disturbances are frequently reported as the predominant postoperative complications [5]. Importantly, no significant differences were observed between groups in terms of complication type, further supporting that surgical timing does not influence the nature of postoperative complications.

ICU admission was rare, occurring in only 1.1% of patients, all of whom underwent daytime surgery. Although a numerical difference was observed, the lack of statistical significance indicates that surgery timing does not meaningfully impact ICU admission rates. This finding is consistent with previous studies demonstrating similarly low ICU utilization and no association with surgery timing [5,11–13].

With respect to hospital stay, most patients were discharged within 2–3 days, with comparable distributions between daytime and nighttime groups. No significant association was observed between surgery timing and length of hospital stay, indicating that operative timing does not influence postoperative recovery duration.

Similarly, postoperative recovery indicators, including time to oral intake, voiding, bowel function, and mobilization, showed no statistically significant differences between groups, further reinforcing that appendectomy timing does not adversely affect postoperative recovery.

Overall, these findings suggest that appendectomy can be safely performed during both daytime and nighttime hours without an increased risk of postoperative complications or adverse clinical outcomes, supporting flexible surgical scheduling and optimized healthcare resource utilization without compromising patient safety.

Limitations

Several limitations of this study should be acknowledged. First, as this was a single-center study, the generalizability of the findings may be limited. Second, the relatively small sample size, along with the low number of postoperative complications, may have reduced the statistical power to detect subtle differences between groups. Third, the retrospective design may introduce selection and information bias. Finally, long-term outcomes were not assessed, limiting the ability to evaluate delayed complications.

CONCLUSION

In conclusion, this study found no significant association between the timing of appendectomy and postoperative complications or clinical outcomes. Appendectomy performed during nighttime hours was not associated with an increased risk of adverse outcomes compared to daytime surgery.

These findings support the safety of performing appendectomy at any time of day and may help guide clinical decision-making and resource allocation without compromising patient outcomes. Further studies with larger sample sizes and multicenter designs are recommended to confirm these findings.

REFERENCES

1. Bosbait S, Alrayes R, Aldahoos M, et al. A retrospective analysis of appendicitis symptoms in Saudi Arabia. IJCSNS. 2025;25:39–49.
2. Bhangu A, Søreide K, Di Saverio S, et al. Acute appendicitis: modern understanding of pathogenesis, diagnosis, and management. Lancet. 2015;386:1278–1287.
3. Nyström P, Nordberg M, Boström L. Is the performance of acute appendectomy at different times of day equal in terms of postoperative complications, readmission, death, and length of hospital stay? A Swedish retrospective cohort study of 4950 patients. Eur J Trauma Emerg Surg. 2023. doi:10.1007/s00068-023-02395-6.
4. Mönttinen T, Kangaspunta H, Laukkarinen J, Ukkonen M. Nighttime appendectomy is safe and has similar outcomes as daytime appendectomy: a study of 1198 appendectomies. Scand J Surg. 2021;110:227–232.
5. Wickramasinghe DP, Xavier C, Samarasekera DN. The worldwide epidemiology of acute appendicitis: an analysis of the Global Health Data Exchange dataset. World J Surg. 2021;45:1999–2008.
6. Brennan GD. Pediatric appendicitis: pathophysiology and appropriate use of diagnostic imaging. CJEM. 2006;8:425–432.
7. Kumar SS, Collings AT, Lamm R, et al. SAGES guideline for the diagnosis and treatment of appendicitis. Surg Endosc. 2024;38:2974–2994.
8. Flum DR. Acute appendicitis—appendectomy or the "antibiotics first" strategy. N Engl J Med. 2015;372:1937–1943.
9. Dencker EE, Bonde A, Troelsen A, Varadarajan KM, Sillesen M. Postoperative complications: an observational study of trends in the United States from 2012 to 2018. BMC Surg. 2021;21:393.

10. de Araújo Martins-Romeo D, Rivera Domínguez A. Complications after abdominal surgery. Radiologia (Engl Ed). 2023;65(Suppl 1):S99–S108.
11. Harriott CB, et al. Daytime versus nighttime (12–6 a.m.) laparoscopic appendectomy: is it safe to operate during the night? J Gastrointest Surg. 2022
12. San Basilio M, Martínez L, et al. Does the timing of appendectomy affect outcomes and postoperative complications? World J Surg. 2023.
13. Shah AA, Al-Zoubi RM, Al-Qudimat AR, et al. Daytime versus nighttime laparoscopic appendectomy in term of complications and clinical outcomes: a retrospective study of 1001 appendectomies. Heliyon. 2022;8(12):e11911. doi:10.1016/j.heliyon.2022.e11911