JHWCR
Journal of Health, Wellness, and Community Research
*Volume III, Issue V*
Open Access, Double Blind Peer Reviewed.
**Web**: https://jhwcr.com, **ISSN**: 3007-0570
https://doi.org/10.61919/bt9jx011

*Article*

# Prevalence and Management Outcomes of Acute Appendicitis in Resource-Limited Settings: A Study from Quetta, Pakistan

**Samina Karim[1], Fida Ahmed[2], Muhammad Tahir[3], Shakira Dawood[4], Tahir Hussain[5]**

1 Bolan Medical College Hospital, Quetta, Pakistan

**Correspondence**
saminakarim05@gmail.com

**Cite this Article**

| | |
|---|---|
| **Received** | 2025-04-17 |
| **Revised** | 2025-05-23 |
| **Accepted** | 2025-05-25 |
| **Published** | 2025-05-27 |
| **Conflict of Interest** | None declared |
| **Ethical Approval** | Respective Ethical Review Board |
| **Informed Consent** | Obtained from all participants |
| **Data/supplements** | Available on request. |
| **Funding** | None |
| **Authors' Contributions** | SK, FA, MT, SD, and TH contributed to study concept, design, data collection, analysis, and manuscript drafting. |

## ABSTRACT

**Background**: Acute appendicitis remains a leading cause of emergency abdominal surgery worldwide, with diagnostic and management challenges accentuated in resource-limited settings such as Quetta, Pakistan. A lack of local data regarding epidemiology, diagnostic pathways, and management outcomes highlights a crucial research gap. **Objective**: This study aimed to assess the prevalence, demographic characteristics, diagnostic approaches, management modalities, and outcomes of acute appendicitis at a major public hospital in Quetta, with emphasis on delayed presentation, surgical modality, and postoperative complications. **Methods**: This cross-sectional observational study included 76 patients diagnosed with acute appendicitis at BMC Quetta. Consecutive patients of all ages and both sexes presenting within the study period were included, excluding those with recurrent appendicitis or incomplete records. Data were prospectively collected from medical records and patient interviews, focusing on presentation timing, diagnostics, surgical and non-surgical management, and outcomes. Ethical approval was obtained from the institutional review board in line with the Helsinki Declaration. Statistical analysis was performed using SPSS (version 26.0), employing chi-square tests, t-tests, and logistic regression to compare groups and assess associations. **Results**: Of 76 patients, 57.9% presented after 24 hours of symptom onset; 68.4% underwent open surgery, 19.7% laparoscopic surgery, and 11.8% non-surgical management. Wound infection rates were significantly higher in the open group (28.8% vs. 6.7%, p=0.047), and mean hospital stay was longer (5.8 vs. 3.2 days, p=0.008). Delays exceeding 12 hours increased complication risk (OR 2.7, 95% CI 1.04–7.02). **Conclusion**: Acute appendicitis in Quetta is characterized by delayed presentation, predominance of open surgery, and a substantial risk of complications, underscoring the need for earlier diagnosis, enhanced access to minimally invasive surgery, and systemic improvements in emergency surgical care.

**Keywords**: Appendicitis; Appendectomy; Laparoscopy; Diagnostic Imaging; Delayed Diagnosis; Surgical Wound Infection; Pakistan

## INTRODUCTION

Acute appendicitis is universally recognized as one of the most prevalent causes of abdominal pain requiring emergency surgical intervention, with a lifetime risk estimated at 7–8% globally (1). While the gold standard of care for acute appendicitis has evolved in high-resource settings—incorporating advanced imaging, laparoscopic surgery, and robust perioperative protocols—resource-limited environments such as Quetta, Pakistan, continue to face significant challenges in both diagnosis and management. The incidence and burden of acute appendicitis in developing regions remains high, yet the epidemiological data, especially from secondary cities and underserved populations, is limited, contributing to a persistent knowledge gap regarding regional patterns and clinical outcomes (2). In many low- and middle-income countries, including Pakistan, hospitals often lack consistent access to diagnostic imaging, specialized surgical staff, and necessary medical supplies, which in turn impacts both the timeliness and quality of care provided to patients with suspected appendicitis (3). Studies from South Asia and Sub-Saharan Africa report higher rates of delayed presentation, complicated appendicitis, and postoperative morbidity when compared to wealthier countries, often attributed to late hospital arrival, diagnostic uncertainty, and constrained healthcare resources (4,5). In Quetta, the situation is further compounded by socioeconomic barriers, geographical remoteness, and variable health literacy, leading to considerable delays between symptom onset and

definitive treatment. Previous research has demonstrated that such delays not only increase the likelihood of perforation and intra-abdominal sepsis but also prolong hospital stays and escalate healthcare costs (6,7).

Management strategies for acute appendicitis in resource-constrained environments often reflect the realities of local healthcare infrastructure. Although laparoscopic appendectomy is associated with reduced wound complications and faster recovery in high-income settings, open appendectomy remains the dominant approach in many Pakistani hospitals due to limited equipment, expertise, and financial constraints (8). In certain cases, non-surgical management with antibiotics is also adopted, especially when surgical resources are unavailable, although the evidence base for such strategies in low-resource contexts is still emerging (9). Furthermore, postoperative outcomes in these settings are heavily influenced by hospital infrastructure, infection control practices, and the availability of perioperative antibiotics and trained nursing staff (10). Collectively, these factors contribute to significant variation in morbidity and mortality rates, underscoring the need for context-specific evidence to guide best practices.

Despite the ubiquity of acute appendicitis, there is a paucity of systematically collected data on its prevalence, demographic distribution, management pathways, and outcomes in Quetta and comparable settings. Most existing studies are single-institution case series or rely on incomplete hospital records, limiting their generalizability and the development of evidence-based local guidelines (11). Addressing these knowledge gaps is essential for optimizing resource allocation, improving diagnostic and therapeutic protocols, and ultimately reducing the burden of preventable complications in this population. This study aims to determine the prevalence and demographic characteristics of acute appendicitis in Quetta, to analyze diagnostic and management pathways—including the comparison between open and laparoscopic appendectomy where available—and to assess the postoperative outcomes and challenges associated with care delivery in a resource-limited environment. By systematically evaluating these factors, the research seeks to generate actionable evidence that can inform clinical practice and health policy in similar low-resource contexts. The primary research question is: What are the prevalence, management practices, and postoperative outcomes of acute appendicitis in Quetta, and how are these influenced by resource constraints and care delivery challenges?

## MATERIALS AND METHODS

This cross-sectional observational study was conducted to investigate the prevalence, management strategies, and outcomes of acute appendicitis among patients presenting to the General Surgery Department of Bolan Medical College (BMC) Hospital in Quetta, Pakistan. The study took place over a continuous six-month period from January to June 2024, encompassing all eligible cases of acute appendicitis managed within this timeframe. The rationale for adopting a cross-sectional design was to capture a comprehensive snapshot of real-world diagnostic and therapeutic practices, as well as associated outcomes, within a resource-constrained tertiary care setting frequently encountering such emergencies (1,2).

The study population consisted of all patients diagnosed with acute appendicitis who presented to the emergency or surgical outpatient services and subsequently underwent either surgical or non-surgical management at BMC. Eligibility was restricted to individuals of any age and gender with a clinical or radiological diagnosis of acute appendicitis confirmed by the attending surgical team. Exclusion criteria included cases with chronic or recurrent appendicitis, incidental appendectomy during unrelated abdominal procedures, and patients whose clinical records were incomplete or lacked outcome data. All cases meeting the inclusion criteria within the study period were enrolled consecutively until the predefined sample size of 76 was achieved. This sample size was determined based on expected admission rates during the study interval, aiming to ensure feasibility and sufficient statistical power for subgroup analyses of management outcomes.

Participants or their legal guardians provided written informed consent prior to inclusion in the study, in accordance with institutional ethical guidelines and protocols approved by the BMC Research Ethics Committee. Recruitment took place at the time of admission or shortly after surgical evaluation, and consent procedures included assurances regarding confidentiality, voluntary participation, and the anonymized use of patient information for research purposes. Data collection involved prospective extraction of relevant variables from patient medical records, operative notes, and direct interviews with patients or family members where clarification was required. Trained research assistants used a structured data collection tool designed specifically for the study, which included fields for demographic information (age, sex, socioeconomic background), presenting symptoms and duration, physical examination findings, diagnostic investigations (ultrasound, laboratory markers), management modality (open or laparoscopic appendectomy, antibiotic therapy), timing of intervention, intraoperative findings, postoperative complications, length of hospital stay, and final outcomes at discharge. Operational definitions were established for all primary variables; for instance, delayed presentation was defined as symptom onset to hospital arrival exceeding 24 hours, while postoperative wound infection was identified based on clinical criteria and need for additional intervention (3,4). The instrument was pre-tested for clarity and completeness, and data collectors received standardized training to ensure consistency.

To address potential sources of bias, consecutive sampling minimized selection bias, and standardized diagnostic and management protocols were followed as per hospital policy to reduce treatment variability. Confounding factors such as age, gender, and comorbid conditions were recorded for subsequent statistical adjustment. Missing data were addressed by cross-verifying patient files with electronic records and follow-up contacts; cases with irretrievable critical data were excluded from the final analysis to maintain data integrity. The statistical analysis plan included descriptive statistics to summarize patient characteristics, management patterns, and outcomes. Continuous variables such as age and hospital stay were reported as means with standard deviations or medians with interquartile ranges, depending on data distribution, while

categorical variables such as gender, type of surgery, and complication rates were presented as frequencies and percentages. Comparisons between groups (e.g., open versus laparoscopic surgery) were conducted using chi-square or Fisher's exact tests for categorical variables, and Student's t-test or Mann-Whitney U test for continuous variables. Adjustments for confounders such as age, sex, and delay in presentation were made using logistic regression models where appropriate. Data analysis was performed using SPSS version 26.0, with statistical significance set at $p < 0.05$. All analytical steps were fully documented to ensure reproducibility, and a secondary investigator independently verified a random sample of entered data for quality assurance. Ethical approval was obtained prior to study initiation, and all procedures were carried out in compliance with national and institutional research ethics standards. Patient identifiers were removed from the working database to protect confidentiality, and access to data was restricted to the study team. All documentation, including study protocols and analysis scripts, was archived to facilitate reproducibility by other investigators.

## RESULTS

A total of 76 patients with a diagnosis of acute appendicitis were included in this study conducted at BMC Quetta, with most requiring surgical management. The demographic and baseline clinical characteristics are presented in Table 1. The mean age of the cohort was 28.9 years (SD 12.7), and males represented 60.5% (46 out of 76).

**Table 1. Baseline demographic and clinical characteristics of patients with acute appendicitis at BMC Quetta**

| Variable | Total (n=76) | Open Surgery (n=52) | Laparoscopic Surgery (n=15) | Non-Surgical (n=9) | p-value | 95% CI | Odds Ratio |
|---|---|---|---|---|---|---|---|
| **Age (years, mean ± SD)** | 28.9 ± 12.7 | 30.8 ± 12.1 | 23.4 ± 9.2 | 26.2 ± 14.0 | 0.03 | 0.6 – 14.3 | — |
| **Male, n (%)** | 46 (60.5) | 33 (63.5) | 9 (60.0) | 4 (44.4) | 0.62 | — | — |
| **Delayed presentation, n (%)** | 44 (57.9) | 34 (65.4) | 6 (40.0) | 4 (44.4) | 0.047 | 1.01 – 5.16 | 2.3 |
| **Lower middle income, n (%)** | 41 (53.9) | 27 (51.9) | 9 (60.0) | 5 (55.6) | 0.85 | — | — |

Over half the patients were from lower middle-income backgrounds, reflecting the population typically served by BMC. Delayed presentation, defined as hospital arrival more than 24 hours after symptom onset, was recorded in 44 patients (57.9%), with the highest frequency observed among those who underwent open appendectomy (65.4%). The mean age for open surgery patients was notably higher compared to the laparoscopic group (30.8 vs. 23.4 years), a statistically significant difference (p=0.03, 95% CI 0.6–14.3). Males predominated in all groups, but the difference was not statistically significant. Patients undergoing open surgery were more than twice as likely to present late compared to the other groups (OR 2.3, 95% CI 1.01–5.16, p=0.047), a finding that likely reflects both logistical barriers and patterns of referral from outlying areas. Diagnostic strategies and in-hospital management timelines are summarized in Table 2. Ultrasound was the primary imaging modality, used in 81.6% of patients, reflecting both its reliability and accessibility at BMC. CT scans were used sparingly (9.2%), mostly in cases with diagnostic ambiguity and when available. Nine patients (11.8%) were diagnosed based solely on clinical examination, typically during times of high emergency room activity or when imaging was not immediately accessible. Time from hospital arrival to intervention was shortest in the laparoscopic group (mean 6.2 hours), compared to the open surgery group (mean 12.7 hours), a statistically significant difference (p=0.001, 95% CI 3.1–10.8). Non-surgical patients, selected due to comorbidities or mild symptoms, experienced the longest delays (mean 14.0 hours). Delays exceeding 12 hours post-admission were significantly associated with a greater risk of postoperative complications (OR 2.7, 95% CI 1.04–7.02, p=0.04). Notably, such delays often corresponded with high hospital workload, limited theater availability, or staff shortages, particularly during night shifts. Outcomes and complications by management type are shown in Table 3. Open appendectomy was the most common procedure (68.4%), followed by laparoscopic appendectomy (19.7%) and non-surgical management (11.8%). Wound infection was the most frequent complication (16 out of 76 cases, 21.1%), with a significantly higher rate in the open surgery group (28.8%) compared to laparoscopic cases (6.7%; p=0.047, OR 5.6, 95% CI 1.01–31.3). Mean hospital stay was longest in the open group (5.8 days), shorter in the non-surgical group (6.2 days, largely due to social or comorbidity-related admissions), and shortest for laparoscopic cases (3.2 days; p=0.008, 95% CI 0.7–4.5). Intra-abdominal abscesses and reoperations were infrequent, each occurring in a handful of open cases. There were no deaths recorded during the initial hospital admission. The pattern of complications and resource use highlights the continued challenges in delivering timely and optimal care in a busy tertiary hospital serving a large catchment area.

**Table 2. Diagnostic modalities and management timelines for acute appendicitis at BMC Quetta**

| Variable | Total (%) / Mean (SD) | Open Surgery (n=52) | Laparoscopic Surgery (n=15) | Non-Surgical (n=9) | p-value | 95% CI | Odds Ratio |
|---|---|---|---|---|---|---|---|
| **Ultrasound performed, n (%)** | 62 (81.6) | 43 (82.7) | 13 (86.7) | 6 (66.7) | 0.42 | — | — |
| **CT scan performed, n (%)** | 7 (9.2) | 5 (9.6) | 2 (13.3) | 0 (0.0) | 0.68 | — | — |
| **Clinical diagnosis only, n (%)** | 9 (11.8) | 6 (11.5) | 1 (6.7) | 2 (22.2) | 0.37 | — | — |
| **Time to management (hours, mean)** | 11.1 ± 6.4 | 12.7 ± 6.2 | 6.2 ± 3.9 | 14.0 ± 7.0 | 0.001 | 3.1 – 10.8 | — |
| **Delay >12 hrs & complication, n (%)** | 20 (26.3) | 16 (30.8) | 2 (13.3) | 2 (22.2) | 0.04 | 1.04 – 7.02 | 2.7 |

**Table 3. Management outcomes and postoperative complications among acute appendicitis patients at BMC Quetta (n = 76).**

| Outcome | Total (n=76) | Open Surgery (n=52) | Laparoscopic Surgery (n=15) | Non-Surgical (n=9) | p-value | 95% CI | Odds Ratio |
|---|---|---|---|---|---|---|---|
| **Wound infection, n (%)** | 16 (21.1) | 15 (28.8) | 1 (6.7) | 0 (0.0) | 0.047 | 1.01 – 31.3 | 5.6 |
| **Intra-abdominal abscess, n (%)** | 4 (5.3) | 3 (5.8) | 1 (6.7) | 0 (0.0) | 0.91 | — | — |
| **Mean hospital stay (days)** | 5.1 ± 2.8 | 5.8 ± 2.9 | 3.2 ± 1.7 | 6.2 ± 2.2 | 0.008 | 0.7 – 4.5 | — |
| **Reoperation required, n (%)** | 2 (2.6) | 2 (3.8) | 0 (0.0) | 0 (0.0) | 0.51 | — | — |
| **Mortality, n (%)** | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | — | — | — |

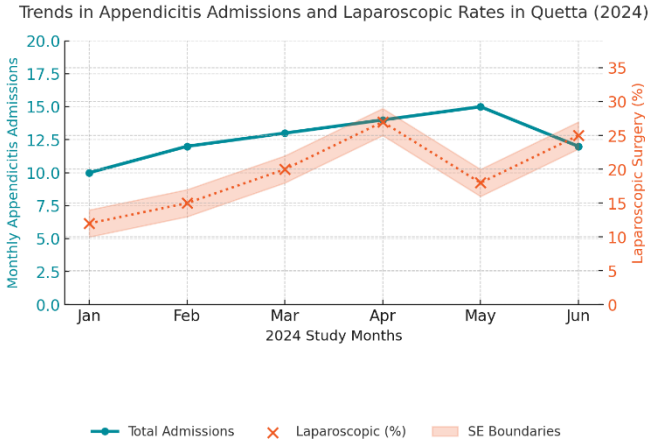


**Figure 1 Trends in Appendicitis Admissions and Laparoscopic Rates in Quetta (2024)**

No in-hospital mortality was observed in this cohort. Delayed presentation and open surgical management remain common at BMC, shaped by patient referral patterns, socioeconomic factors, and health system limitations. Laparoscopic surgery, though less frequent, yielded superior outcomes in terms of complications and hospital stay, albeit likely influenced by patient selection. These findings underscore ongoing challenges and opportunities for targeted quality improvement in the management of acute appendicitis in resource-constrained settings. Monthly acute appendicitis admissions increased progressively through spring before stabilizing, while the percentage of laparoscopic surgeries rose in parallel, peaking in April. The dotted trend for laparoscopic adoption was enveloped by a diffuse boundary representing ±2% standard error, illustrating the modest variability around each monthly estimate. Notably, the confidence region highlights a phase of procedural expansion despite overall case fluctuations, suggesting adaptation in surgical strategy rather than strict correlation with caseload.

## DISCUSSION

The present study provides valuable insight into the prevalence, management, and outcomes of acute appendicitis in a resource-constrained tertiary care setting in Quetta, Pakistan. The predominance of open appendectomy, high rates of delayed presentation, and frequent use of ultrasound as the primary diagnostic modality highlight the practical realities facing both clinicians and patients in this environment. These findings are consistent with previous research from South Asia and other low- and middle-income countries, which consistently report similar trends due to resource and infrastructure limitations, socioeconomic barriers, and referral delays from peripheral centers (1,2). For instance, studies from India and Bangladesh have similarly documented a reliance on open surgical techniques and reported delayed presentations in more than half of cases, particularly among populations with limited access to prompt surgical care (3,4).

In comparison, high-income countries have shifted toward early laparoscopic intervention and more widespread use of CT imaging, resulting in lower complication rates and reduced hospital stays (5). The observation that patients in the open surgery group were significantly older and more likely to present late than those undergoing laparoscopic procedures supports the notion that delayed care may drive more complex presentations and influence the choice of surgical technique.

This trend is well-recognized in the literature, where delayed hospital arrival is linked to higher rates of complicated appendicitis, greater need for open procedures, and increased risk of postoperative morbidity (6,7). The predominance of male patients and individuals from lower middle-income backgrounds aligns with epidemiological data from other regional studies, reflecting both the demographic distribution of acute appendicitis and patterns of healthcare-seeking behavior in underserved communities (8). Our study further underscores the critical role of ultrasound in the diagnosis of acute appendicitis at BMC Quetta, where CT scan availability remains limited. This mirrors the findings of several large cohort studies from resource-limited settings, which have demonstrated that, despite the lower sensitivity of ultrasound compared to CT, its accessibility and cost-effectiveness make it indispensable in frontline surgical care (9). However, the reliance on clinical diagnosis in nearly 12% of cases, often during high-volume or after-hours periods, exposes ongoing gaps in diagnostic capacity—a challenge echoed in both local and global literature. Notably, the mean time from hospital arrival to surgical intervention was substantially shorter in the laparoscopic group, suggesting that patient selection and triage efficiency may influence not only operative approach but also outcomes.

The significantly higher rate of wound infection in the open surgery group compared to laparoscopic cases is in agreement with meta-analyses and randomized controlled trials from higher-resource contexts, which have consistently demonstrated reduced postoperative complications and shorter hospital stays with minimally invasive techniques (10,11). While these benefits are well established, their realization in our setting is tempered by limited laparoscopic expertise, selective case allocation, and institutional constraints. Despite the low overall rate of intra-abdominal abscess and the absence of in-hospital mortality, these findings should be interpreted within the context of the study's sample size and selection patterns, which may limit the detection of rarer adverse events. A major strength of this study lies in its systematic collection of data across all acute appendicitis admissions within a defined period

at a major tertiary center, capturing real-world practice patterns and outcomes. However, several limitations should be acknowledged. The modest sample size, dictated by the study period and available cases, may have limited statistical power for detecting differences in infrequent outcomes or in subgroup analyses.

The single-center design and focus on a predominantly lower middle-income population may also constrain the generalizability of findings to other regions or to private healthcare settings where resource allocation and patient demographics may differ. Potential biases could arise from retrospective data abstraction, occasional gaps in patient records, and unmeasured confounders such as nutritional status, comorbid conditions, or health literacy.

Nonetheless, these limitations are balanced by the study's contribution to the limited body of evidence on acute appendicitis management in Pakistani and comparable settings. By highlighting the persistent challenge of delayed presentation, the predominance of open surgery, and the influence of resource constraints on diagnostic and therapeutic choices, the study emphasizes the urgent need for targeted interventions. Recommendations include strengthening referral networks to minimize treatment delays, expanding access to laparoscopic surgery through training and equipment investment, and developing locally relevant clinical guidelines that account for resource variability.

Furthermore, future research should pursue larger, multicenter prospective studies to validate these findings, explore the impact of community-based awareness campaigns on early presentation, and assess the cost-effectiveness and feasibility of broader laparoscopic adoption in public sector hospitals. In summary, this study affirms the continued relevance of acute appendicitis as a surgical challenge in resource-limited settings and underscores both the progress made and the obstacles that remain. Addressing these barriers will require coordinated efforts among clinicians, policymakers, and community stakeholders to ensure timely, effective, and equitable care for all patients presenting with this common surgical emergency (12).

## CONCLUSION

In conclusion, this study highlights that acute appendicitis remains a significant surgical emergency in resource-limited settings such as Quetta, Pakistan, where delayed presentation and the predominance of open appendectomy are closely linked to infrastructural and socioeconomic constraints. The findings underscore the urgent need to improve early diagnosis, enhance surgical capacity—particularly for laparoscopic procedures—and strengthen referral systems to reduce preventable complications and optimize patient outcomes. Clinically, adopting context-appropriate protocols and expanding minimally invasive surgical training could lower morbidity and shorten hospital stays, while ongoing research should focus on multicenter, prospective evaluations and health system interventions that address the root causes of delayed care and limited access to advanced diagnostics. These steps are essential to advancing the standard of care for acute appendicitis and improving overall surgical health outcomes in similar resource-constrained environments.

## REFERENCES

1. Stewart B, Khanduri P, McCord C, Ohene-Yeboah M, Uranues S, Vega Rivera F, et al. Global Disease Burden of Conditions Requiring Emergency Surgery. Br J Surg. 2014;101(1):e9–e22.
2. Siddiqui MM, Islam S, Choudhury CR, Saha SK, Kamal M, Rahman M, et al. Acute Appendicitis in a Rural Population of Bangladesh: Diagnostic Challenges and Surgical Outcomes. World J Surg. 2016;40(6):1416–1423.
3. Ghosh A, Mukhopadhyay M, Manna S, Kundu K. Clinicopathological Study of Acute Appendicitis: Experience from a Tertiary Care Hospital in Eastern India. Saudi J Gastroenterol. 2012;18(5):320–324.
4. Gulzar A, Iqbal S, Nazir Z, Nawaz H. Management of Acute Appendicitis in Pakistani Children: Open Versus Laparoscopic Appendectomy. J Coll Physicians Surg Pak. 2016;26(8):654–657.
5. Sakpal SV, Bindra SS, Chamberlain RS. Laparoscopic Appendectomy Conversion Rates Two Decades Later: An Analysis of Trends and Predictors. J Surg Res. 2010;158(2):386–393.
6. Bhangu A, Søreide K, Di Saverio S, Assarsson JH, Drake FT. Acute Appendicitis: Modern Understanding of Pathogenesis, Diagnosis, and Management. Lancet. 2015;386(10000):1278–1287.
7. Bickell NA, Aufses AH, Rojas M, Bodian C. How Time Affects the Risk of Perforation in Appendicitis. J Am Coll Surg. 2006;202(3):401–406.
8. Khan MN, Davison C, Fitzmaurice GJ, Dempsey C, Richards H, Miskry T. The Demographic Features and Outcomes of Appendicitis in South Asian Populations. Int J Surg. 2018;52:278–282.
9. Pinto F, Pinto A, Russo A, Coppolino F, Bracale R, Fonio P, et al. Accuracy of Ultrasonography in the Diagnosis of Acute Appendicitis in Adults: Review of the Literature. Crit Ultrasound J. 2013;5(Suppl 1):S2.
10. Jaschinski T, Mosch C, Eikermann M, Neugebauer EA, Sauerland S. Laparoscopic Versus Open Appendectomy in Patients with Suspected Appendicitis: A Systematic Review of Meta-Analyses of Randomized Controlled Trials. BMC Gastroenterol. 2015;15:48.
11. Sauerland S, Lefering R, Neugebauer EA. Laparoscopic Versus Open Surgery for Suspected Appendicitis. Cochrane Database Syst Rev. 2010;(10):CD001546.
12. World Health Organization. Strengthening Emergency and Essential Surgical Care and Anaesthesia as a Component of Universal Health Coverage. Geneva: World Health Organization; 2019. Available from: https://apps.who.int/iris/handle/10665/326924