IMPACT OF THE COVID-19 PANDEMIC ON THE CLINICAL PROFILE AND SURGICAL MANAGEMENT OF ACUTE CHOLECYSTITIS

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Abstract

Acute cholecystitis is a common surgical emergency, often requiring urgent laparoscopic intervention. The COVID-19 pandemic disrupted healthcare systems globally, potentially altering patient presentation, disease severity, and management pathways. This study aims to compare the clinical characteristics and surgical outcomes of AC in the pre-pandemic and post-pandemic periods. We conducted a retrospective observational study at the General Surgery 1 Department of SCJU Târgu Mureș, including 434 patients diagnosed between January 2018 and January 2024. Patients were stratified into two groups: pre-COVID (2018–11 March 2020) and post-COVID (12 March 2020–2024). Of the 434 patients, 136 were treated pre-pandemic and 298 post-pandemic. Laparoscopic cholecystectomy remained the dominant approach (>90%) across both groups. The rate of gallbladder perforation decreased post-COVID (18.6% vs. 11.6%). Multivariate analysis revealed that the pre-pandemic period was independently associated with a higher risk of gallbladder perforation (OR = 2.13). Despite the systemic strain imposed by the COVID-19 pandemic, surgical management of acute cholecystitis remained effective and safe in our center. The decline in perforation and low mortality post-COVID suggests improved triage and perioperative protocols during the pandemic aftermath. Continuous adaptation in emergency surgical care is vital for resilience in future healthcare crises.

Keywords: acute cholecystitis, Covid-19, emergency surgery

Introduction

Acute cholecystitis (AC) remains a frequent cause of surgical admission, accounting for a significant proportion of emergency abdominal interventions worldwide [1]. It typically results from gallstone impaction in the cystic duct, leading to gallbladder wall inflammation, ischemia, and in some cases, progression to necrosis or perforation [2]. While early laparoscopic cholecystectomy remains the gold standard of

care, timely diagnosis and triage are crucial in preventing complications such as biliary peritonitis, sepsis, and prolonged hospitalization [3,4].

The COVID-19 pandemic has exerted unprecedented strain on global healthcare systems. In the early phases, surgical practice underwent substantial restructuring: elective procedures were postponed, patient triage protocols were revised, and emergency presentations were delayed due to fear of contagion or restricted access to medical services [5,6]. These changes impacted not only patient flow but potentially the severity and complexity of surgical pathologies encountered, including acute cholecystitis [7]. Existing literature has reported variable outcomes. Some centers noted a reduction in overall surgical volume with a simultaneous rise in complicated cases such as gangrenous cholecystitis or gallbladder perforation suggesting delayed presentation [8,9]. Conversely, other studies found no significant increase in morbidity or mortality, attributing this to adaptive perioperative workflows and focused surgical prioritization during the pandemic [10,11].

In this context, we sought to investigate how the COVID-19 pandemic influenced the clinical and surgical profile of patients diagnosed with acute cholecystitis at a tertiary Romanian emergency hospital. By comparing data from pre-pandemic and post-pandemic periods, our study aims to provide insight into changes in diagnostic severity, operative management, and outcomes over 6 years.

Materials and methods

This retrospective, observational, cross-sectional study was conducted at the Department of General Surgery I, Emergency County Clinical Hospital Târgu Mureș, Romania, and included patients diagnosed and treated for acute cholecystitis between January 2018 and January 2024. Patients were divided into two groups according to the period of admission: a pre-pandemic group (January 2018 – March 11, 2020) and a post-pandemic group (March 12, 2020 – January 2024), based on the timeline defined by the national COVID-19 emergency declaration.

Inclusion criteria consisted of adult patients (≥18 years) with a confirmed diagnosis of acute cholecystitis based on clinical presentation, imaging, and intraoperative findings. Exclusion criteria included cases of chronic cholecystitis, lack of imaging or operative confirmation, and incomplete medical records. Data were retrieved from the hospital's electronic registry system (Hipocrate) and included demographic characteristics, clinical and laboratory parameters, imaging findings, operative approach, gallbladder perforation, and in-hospital mortality.

Inflammatory markers (white blood cell count, neutrophils, and C-reactive protein), as well as biliary indicators (total and direct bilirubin), were analyzed. Operative modality (laparoscopic, open, conversion), dissection technique (retrograde vs. antegrade), preoperative imaging methods (ultrasound, CT, MRI), and presence of gallstones were recorded. The rate of conversion to open surgery, gallbladder perforation, and postoperative mortality were also evaluated.

Statistical analysis was performed using EasyMedStat© and GraphPad Prism version 9.0. Continuous variables were expressed as means with standard deviation (SD) or medians with interquartile range (IQR), and compared using the Mann–Whitney U test. Categorical variables were compared using the Chi-square or Fisher’s exact test. Correlation between inflammatory markers and hospital stay was evaluated using Spearman’s rank correlation. Binary logistic regression was employed to identify independent predictors of gallbladder perforation and mortality. Statistical significance was established for a p-value <0.05.

The study protocol was approved by the Ethics Committee of the Emergency County

Clinical Hospital Târgu Mureș (approval no. Ad.. 7055). All data were anonymized and analyzed by the Declaration of Helsinki and institutional ethical standards.

Results

A total of 434 patients diagnosed with acute cholecystitis were analyzed. Of these, 136 (31.3%) were hospitalized during the pre-pandemic period (January 2018 – March 11, 2020), and 298 (68.7%) during the post-pandemic period (March 12, 2020 – January 2024). The sex distribution included 190 male patients (43.8%) and 244 female patients (56.2%).

The mean age was 56.5 ± 18.3 years in the pre-pandemic group and 58.3 ± 17.2 years in the post-pandemic group, with no statistically significant difference (p = 0.318). (Figure 1).

Admissions sharply declined at the onset of the pandemic (2020), followed by a steady increase in 2021 and 2022, suggestive of deferred presentations. The median hospital stay remained similar in both groups (4 days), but the interquartile range was wider post-pandemic (IQR 2–19 vs. 4–6), indicating increased variability.

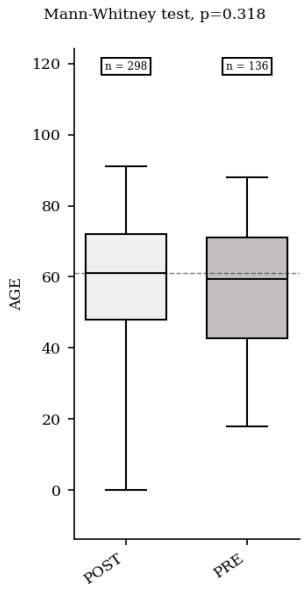

Figure 1 - Age Mann-whitney test

The mean WBC count was 11.58 ×10⁹/L pre-pandemic and 12.2 ×10⁹/L post-pandemic, without statistical significance (p = 0.344). Neutrophil counts followed a similar pattern: 8.78 ×10⁹/L vs. 9.38 ×10⁹/L, respectively (p = 0.194) (Figure 2).

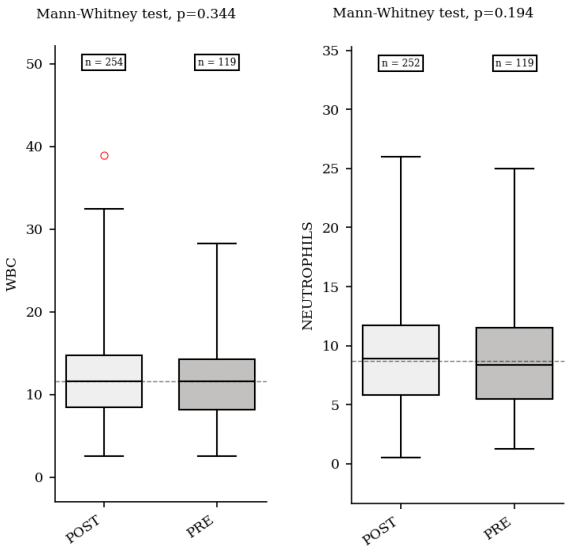

Figure 2 - WBC and neutrophiles - Mann Whitney test

CRP was only available post-pandemic and showed high values in a subset of patients (median 147 mg/L, IQR up to 320 mg/L), suggesting a hyperinflammatory state in delayed presentations.

Laparoscopic cholecystectomy remained the preferred method across both groups (>90%), with a conversion rate increase from 0.7% to 4.1% post-pandemic (not statistically significant, p = 0.138). Retrograde dissection remained the dominant technique, increasing from 77.4% to 85.3% post-pandemic (Figure 3).

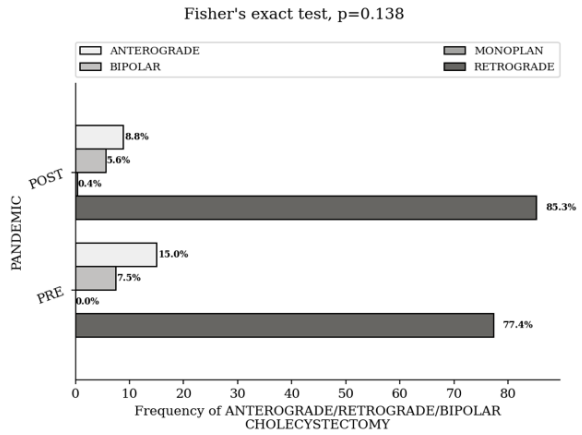

Figure 3 - Operative modality Fishers test

Total bilirubin levels were mildly elevated, averaging 1.07 mg/dL pre-pandemic and 1.53 mg/dL post-pandemic. Direct bilirubin values followed a similar pattern (0.71 vs. 0.94 mg/dL). Although elevated outliers existed, group comparisons were not statistically significant.

Gallbladder perforation was significantly more frequent in the pre-pandemic group (18.6%) versus post-pandemic (11.6%). Binary logistic regression confirmed that the pre-pandemic period independently predicted perforation risk (OR = 2.13, p = 0.018).

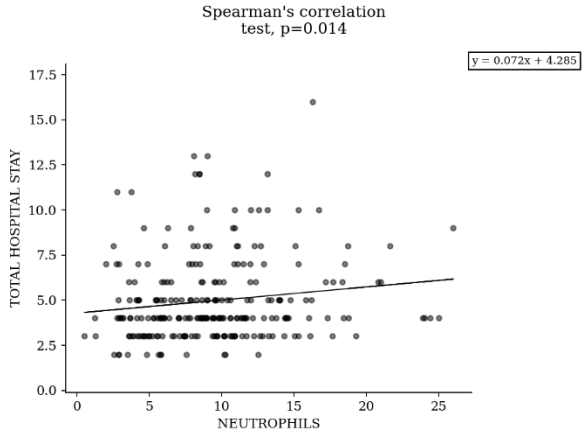

Figure 4 - Total hospital stay / Neutrophiles correlation

There was no significant correlation between CRP and hospital stay duration in either group (p = 0.117 pre-pandemic, p = 0.692 post-pandemic). Likewise, neutrophils did not correlate with hospitalization duration pre-pandemic (p = 0.559), (Neutrophils vs. Hospital Stay). However, in the post-pandemic group, neutrophil count did show a significant correlation with total hospital stay (p = 0.014) (Figure 4).

A statistically significant positive correlation was observed between age and hospital stay in both periods (p < 0.001), supporting age as an independent determinant of hospitalization duration.

In the logistic regression model for gallbladder perforation, the pre-pandemic period was the only significant predictor (OR = 2.13; p = 0.018). Hospital stay, anemia, and postoperative duration were not statistically significant.

In the second model assessing in-hospital mortality, variables such as age, CRP, gallbladder perforation, and conversion to open surgery did not independently predict death. The overall mortality rate remained low and did not differ significantly between groups (2.9% vs. 1%).

Discussions

This retrospective study assessed the impact of the COVID-19 pandemic on the clinical profile and surgical management of patients diagnosed with acute cholecystitis in a tertiary emergency center. By comparing pre-pandemic and post-pandemic periods over six years, we aimed to determine whether diagnostic severity, surgical approach, or postoperative outcomes were significantly altered. Our results reveal that while certain inflammatory and operative trends fluctuated, surgical safety and patient outcomes were largely preserved throughout the pandemic period.

Acute cholecystitis remains a prevalent surgical emergency, primarily associated with gallstone impaction and resulting in inflammation, ischemia, and potential

gallbladder perforation if left untreated [1,2]. Early laparoscopic cholecystectomy is the standard of care due to its lower morbidity and shorter recovery compared to delayed or open surgery [3,4]. In our study, over 90% of procedures were performed laparoscopically in both groups, aligning with global best practices [5,6].

The COVID-19 pandemic, particularly during its initial wave, caused substantial disruption to emergency surgical care. Numerous institutions delayed elective operations, implemented triage protocols, and witnessed a decline in emergency department attendance [7–9]. Our admission trends reflect this: a sharp drop in acute cholecystitis cases in 2020 was followed by a compensatory increase in subsequent years, indicating deferred presentations and surgical backlog. Despite this, the pandemic did not appear to significantly worsen key outcome measures such as mortality or hospital stay duration.

Laboratory values such as WBC, neutrophils, and CRP levels were slightly higher in the post-pandemic cohort. While WBC and neutrophil elevation did not reach statistical significance, we observed a significant correlation between neutrophil count and length of hospitalization after the pandemic. This may reflect increased severity on presentation due to delayed access to care—a pattern also seen in recent international cohorts [10,11]. CRP, a known severity marker in acute cholecystitis [4,12], was markedly elevated in a subset of patients, although incomplete data prevented formal comparison. Bilirubin levels were modestly higher post-pandemic, with some outliers suggestive of biliary obstruction or cholangitis. However, imaging rates (especially ultrasound) remained below ideal in both periods, limiting radiologic correlation. International guidelines such as TG18 and WSES emphasize the importance of structured imaging protocols for diagnosis and grading [13–15].

A noteworthy finding in our study was the reduction in gallbladder perforation post-pandemic (from 18.6% to 11.6%), confirmed by logistic regression analysis. This contradicts prior assumptions that delayed presentation would increase complications [16,17]. Similar outcomes have been reported in adaptive centers where emergency pathways were optimized during the pandemic [18,19]. One hypothesis is that tighter triage led to more efficient prioritization of severe cases, reducing progression to perforation.

Surgical modality remained consistent, with a rise in conversion rate (from 0.7% to 4.1%) post-pandemic, potentially reflecting more technically difficult cases due to inflammation or anatomical distortion. Yet this did not translate into higher mortality or prolonged hospitalization. The safety of laparoscopic cholecystectomy in acute cases, even in elderly and high-risk patients, has been demonstrated across numerous studies and meta-analyses [20–24].

Multivariate analysis in our cohort did not identify age, CRP, conversion, or perforation as independent predictors of mortality. While our overall in-hospital mortality was low (1–2.9%), other studies have shown age, delay to surgery, and septic complications as key mortality drivers [25,26]. The low fatality rate in our series likely reflects strong perioperative support, adherence to surgical timing, and selective patient management.

Our findings align with recent European and international data showing that acute cholecystitis care remained largely safe during the pandemic [27–30]. Although access pathways shifted and imaging practices were inconsistent, operative and survival outcomes remained comparable to pre-pandemic norms.

Conclusions

This six-year retrospective study demonstrates that despite the systemic challenges posed by the COVID-19 pandemic, the emergency surgical management of acute cholecystitis at our center remained safe,

effective, and largely uncompromised. Laparoscopic cholecystectomy continued to be the predominant operative approach, with consistent outcomes in both pre- and post-pandemic periods.

While inflammatory markers and conversion rates showed minor increases post-pandemic, these did not translate into longer hospitalization or higher mortality. Interestingly, gallbladder perforation was more prevalent before the pandemic, suggesting that enhanced triage, expedited surgical decision-making, or improved postoperative care may have mitigated late-stage complications in the pandemic aftermath.

Our findings support the resilience of emergency surgical systems and highlight the importance of maintaining structured clinical pathways and operative standards even during health crises. These results underscore the need for continued vigilance, data collection, and adaptive strategies to preserve the quality of care under strained conditions.

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