

The THAI Journal of SURGERY

Official Publication of The Royal College of Surgeons of Thailand

Vol .47

April - June 2026

No. 2

The THAI Journal of SURGERY 2026;47(2):55-8
Official Publication of The Royal College of Surgeons of Thailand

Original Article

Acute Cholecystitis During the COVID-19 Pandemic: A Result of Delayed Surgical Intervention

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Abstract

Background: Biliary pathology represents 3–10% of acute abdominal pain cases in emergency departments, with a lithiasic origin in 90–95%. The SARS-CoV-2 pandemic placed immense strain on healthcare systems worldwide, leading to major reductions in surgical procedures. The Mexican Institute of Social Security (IMSS) reported a 38.38% decrease in interventions between 2019 and 2020 (546,654 fewer surgeries), while the Security and Social Services of the State Employees Institute (ISSSTE) noted an 80.53% reduction in laparoscopic cholecystectomies, from 9,896 in 2019 to 2,926 in 2020. This trend aligns with a global cancellation rate of 81.5%, which affected nearly all surgical specialties. These reductions likely influenced patient outcomes. This study assessed the impact of the pandemic on patients undergoing elective cholecystectomy.

Materials and Methods: We analyzed data from 513 patients who underwent elective laparoscopic cholecystectomy in 2019 and compared it with data from 52 patients in 2021, during the pandemic. Our findings were assessed against nationwide trends to evaluate the pandemic's impact on these procedures.

Results: During the study period, a variety of results (210) were observed, including acute cholecystitis (70%), classified as mild (63.8%) and moderate (6.19%) according to the Tokyo 2018 Guidelines. Other outcomes included pyocholecyst (15.71%), hydrocholecyst (12.85%), hepatic abscess (0.47%), emphysematous cholecystitis (0.47%), and gangrenous cholecystitis (0.47%). No significant difference in overall complication incidence was observed between the two years, except for moderate acute cholecystitis, which showed a statistically significant increase ($p = 0.024$).

Conclusion: The pandemic's effect on overall outcomes in patients who underwent delayed elective procedures during the established period was associated with a significant increase in cholecystitis severity, with a notable rise in moderate acute cholecystitis ($p = 0.024$). This study is the first to examine the effects of the pandemic on surgical patients whose care was delayed.

Keywords: Cholecystitis, SARS-CoV-2 pandemic, Laparoscopic cholecystectomy

Received for publication 25 July 2025; Revised 6 November 2025; Accepted 18 December 2025

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<http://doi.org/10.64387/tjs.2026.276763>

INTRODUCTION

Biliary pathology is among the most common conditions seen in general surgery services. Lithiasic cholecystitis is one of the main health problems affecting the adult population worldwide, with its acute presentation accounting for 3–10% of all cases of acute abdominal pain in emergency departments. Lithiasic etiology is responsible for 90–95% of these cases, and the gold standard for treatment is laparoscopic cholecystectomy.^{1,2}

During the COVID-19 pandemic, hospitals had to adapt to increased demand for resources to manage SARS-CoV-2, resulting in expanded space, additional materials, and redirected human resources toward patient care. This adaptation process also led to a reduction in those same resources for other departments, such as general surgery.³⁻⁹ Our institution was no exception.

These adaptations contributed to delays in surgical intervention for existing pathologies, thereby allowing these conditions to progress to more advanced inflammatory stages. Laparoscopic cholecystectomy for chronic lithiasic cholecystitis is the second most frequently performed surgery in our center. Therefore, identifying factors that worsen the progression of this disease and directly impact patient health is essential, as these affect both material and human resources and disrupt hospital operations.

Delaying elective surgery for patients with chronic lithiasic cholecystitis potentially increases the presence of acute cholecystitis, which disproportionately affects women at a 3:1 ratio compared to men under 50 years of age. Other outcomes of the delay of this elective procedure include gangrenous cholecystitis (found in 2–38% of cases), perforation, abscess formation (found in 3–19% of patients), and emphysematous cholecystitis (found in roughly 1% of cases).¹⁰

MATERIALS AND METHODS

Design

An analytic retrospective observational study comparing patients who underwent elective laparoscopic cholecystectomy for chronic lithiasic cholecystitis between January and December 2019 and those under the same conditions during the COVID-19 pandemic period, as well as postoperative outcomes. Exclusion criteria included patients with acute acalculous cholecystitis, gallbladder neoplasms, choledocholithiasis requiring bile duct exploration, concurrent biliary tract procedures, incomplete medical records, or age under 18 years. Pregnant patients and those with severe systemic infection

or hemodynamic instability at presentation were also omitted from the analysis.

Sample size

The sample size was obtained using a proportional difference formula. According to Nepogodiev,⁷ the global cancellation rate of elective surgeries was 72.3%, whereas gastrointestinal and gastrobiliary procedures were canceled at a rate of 81.5%.

The Kelsey formula was used to determine the required sample size for the study, establishing the need for at least 117 patients in the control group.

$$n1 = \frac{(Z\alpha + Z\beta)^2 * p(1-p)(r+1)}{r(p0 - p1)^2}$$

$$n1 = \frac{(1.96 + 0.842)^2 * 0.765(0.235)(2)}{1(0.09)^2}$$

$$n1 = \frac{7.8512 * 0.359}{0.0242}$$

$$n1 = \frac{2.8229}{0.0242}$$

$$n1 = 116.6$$

Using the same formula, we obtained a sample size of 53 for the case group, calculated according to results reported by Demetriou et al.¹¹ By comparing patients who underwent elective laparoscopic cholecystectomy in 2019 and 2021, they found that the prevalence of acute cholecystitis before the pandemic was 18.9%, rising to 35.8% during the pandemic.

$$n1 = \frac{(Z\alpha + Z\beta)^2 * p(1-p)(r+1)}{r(p0 - p1)^2}$$

$$n1 = \frac{(1.96 + 0.842)^2 * 0.265(0.735)(2)}{(1.017)^2}$$

$$n1 = \frac{7.8512 * 0.265(0.735)(2)}{0.0578}$$

$$n1 = \frac{3.05844}{0.0578}$$

$$n1 = 52.91$$

Statistics

We calculated averages and standard deviations for quantitative variables, and frequencies and proportions for qualitative variables. Quantitative variables were analyzed using the Student's t-test. For categorical variables, the

chi-square test was used. Two-tailed tests were applied, with p -values < 0.05 considered statistically significant. Data were entered into Excel, and statistical analyses were performed using the statistical package SPSS version 23.0 (IBM Corp., Armonk, NY).

RESULTS

A total of 565 patients were included from a general surgery census of 750 patients for 2019 and 2021, focusing on those who underwent laparoscopic cholecystectomy for chronic lithiasic cholecystitis. Of these, 185 were emergency cholecystectomies—60 (32%) in 2019 and 125 (68%) in 2021. Among the 565 patients analyzed, 513 (90.8%) had surgery in 2019 and 52 (9.2%) in 2021. The cohort consisted of 471 women (83.4%) and 94 men (16.6%), with an average age of 38.8 ± 14.8 years and an average hospital stay of 2 ± 1.7 days. Post-surgery, 235 patients (41.6%) retained the diagnosis of chronic lithiasic cholecystitis, while 330 (58.4%) received a different diagnosis. The frequency of surgical outcomes is detailed in **Table 1**.

Table 1 Surgical outcomes for delayed laparoscopic cholecystectomy during the COVID-19 pandemic

Results	Number of patients (%)
Acute cholecystitis	147 (26)
Pycholecyst	33 (5.8)
Hydrocolecyst	27 (4.8)
Necrotizing cholecystitis	7 (1.2)
Hepatic Abscess	1 (0.2)
Emphysematous cholecystitis	1 (0.2)
Gangrenous cholecystitis	1 (0.2)

When comparing surgical procedures in 2019 and 2021, it was found that before the pandemic, 58.3% (299 patients) had a surgical diagnosis of chronic lithiasic cho-

lecystitis. In contrast, in 2021, 47.7% (214 patients) had a diagnosis change following surgical findings. During the pandemic, 59.6% (31 patients) retained the diagnosis of chronic lithiasic cholecystitis, while 41.4% (21 patients) had a post-surgical change in diagnosis. This difference was not statistically significant ($p = 0.884$). In 2019, the mean hospital stay was 2.17 ± 1.7 days, compared to 1.4 ± 0.93 days in 2021—a statistically significant difference ($p = 0.009$). The comparison of postoperative outcomes found in both periods is presented in **Table 2**. During the pandemic, moderate acute cholecystitis was more frequent, occurring in 7.6% of cases, compared with 1.7% previously, a statistically significant increase ($p = 0.024$).

DISCUSSION

This study underscores the impact of the pandemic on surgical services, evidenced by a dramatic decrease in procedures and changes in rates of more severe inflammation stages. Our findings provide insight into how reduced surgical activity affected patient outcomes and highlight the need for continued research into the long-term effects of the pandemic on surgical care and patient management.

The pandemic affected healthcare systems worldwide, disrupting the delivery of surgical procedures. In this paper, we aimed to evaluate the impact on patients undergoing laparoscopic cholecystectomy by comparing the years 2019 and 2021.

Our findings suggest no significant difference between the pre-pandemic and pandemic periods, but a marked effect on the severity stage, according to the Tokyo 2018 Guidelines for cholecystitis: 7.6% of patients presented with moderate acute cholecystitis, compared to 1.7% before the pandemic (p -value = 0.024). This suggests a correlation between more severe inflammation stages and delays in elective surgeries.

These findings corroborate national data showing

Table 2 Comparison between surgical postoperative outcomes according to the year of intervention

Complication	n = 186 patients in 2019 (%)	n = 24 patients in 2021 (%)	P value
Acute cholecystitis	133 (25.9)	14 (36.9)	0.869
Mild acute cholecystitis	124 (24.1)	10 (19.2)	0.271
Moderate acute cholecystitis	9 (1.7)	4 (7.6)	0.024
Pycholecyst	28 (5.5)	5 (9.6)	0.215
Hydocholecyst	23 (4.5)	4 (7.7)	0.299
Hepatic abscess	0	1 (1.9)	0.092
Emphysematous cholecystitis	1 (0.2)	0	0.750
Gangrenous cholecystitis	1 (0.2)	0	0.750

an overall decrease in procedures within the public health system: an 80.53% reduction in ISSSTE and a 38.38% reduction in IMSS. Globally, an 81.5% cancellation rate was reported. However, the frequency and nature of complications remain to be fully evaluated.

Additionally, our data showed that the average length of hospital stay decreased from 2.17 ± 1.7 days in 2019 to 1.4 ± 0.93 days in 2021. This reduction could be attributed to changes in surgical practices or hospital protocols during the pandemic. While this shorter stay might reflect improved efficiency or reduced resource utilization, it also warrants further investigation to understand its impact on patient outcomes and recovery.

A limitation of this study is the relatively small sample size in 2021, which may have reduced the statistical power of our analyses. This limited sample size, particularly during the pandemic, warrants caution when interpreting the results, especially regarding the detection of minor differences between the pre-pandemic and pandemic groups.

While our findings suggest a notable change in cholecystitis severity, further studies with larger sample sizes are needed to validate these observations. Four years after the pandemic, there remains a lack of comprehensive data on patients whose procedures were delayed, underscoring a critical gap in understanding the long-term effects of these delays on surgical outcomes.

CONCLUSION

The COVID-19 pandemic significantly reduced the number of elective laparoscopic cholecystectomies performed. Despite this decline, overall postoperative diagnosis rates among patients who eventually underwent surgery remained essentially unchanged—except for a notable rise in moderate acute cholecystitis. This suggests that delays in surgery may have led to a shift in disease severity and inflammation stage, as defined by the Tokyo 2018 Guidelines.

Although specific predictors of complications were not statistically analyzed, prior evidence and clinical observation indicate that patients of older age, male sex, and those with comorbidities such as diabetes or obesity are more likely to develop severe inflammatory changes and postoperative complications. Recognizing these characteristics in the emergency setting may help identify patients who would benefit from earlier surgical management, while others with lower risk could be considered for delayed or conservative treatment when surgical capacity is limited.

Yet an important question remains unanswered: Have health systems managed to clear the backlog of postponed procedures? While elective surgeries have gradually resumed, there is little data to confirm whether hospitals have fully returned to pre-pandemic volumes or whether a hidden burden of untreated conditions continues to grow.

Moving forward, research must assess whether surgical services are truly back on track—not just in terms of volume, but also in timeliness. Persistent delays could have lasting effects on patient outcomes, underscoring the need to address this gap in our understanding. Strengthening surgical systems will be key to ensuring timely care, especially amid future healthcare disruptions.

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