

## Original Research Article

# Emergency abdominal surgery during a pandemic-related lockdown: a Vietnamese experience

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## ABSTRACT

**Background:** The fourth wave of COVID-19 in Vietnam was associated with prolonged lockdown measures that may have influenced access to emergency surgical care. This study evaluated temporal changes in operative volume, prehospital presentation, disease severity, and early postoperative outcomes in common emergency abdominal conditions across distinct pandemic phases.

**Methods:** A retrospective study was conducted at a tertiary referral center, including adult patients undergoing surgery for appendicitis, cholecystitis, peptic ulcer perforation, and bowel obstruction during three periods: social distancing (June–September 2020), lockdown (June–September 2021), and post-lockdown (March–June 2022). Variables included demographic characteristics, prehospital symptom duration, disease severity graded by the American Association for the Surgery of Trauma (AAST) classification, and postoperative complications classified by Clavien–Dindo.

**Results:** A total of 1,251 patients were included. During lockdown, emergency operative volume decreased by approximately 50% compared with the social distancing period. Delayed presentation (>1 day) increased significantly in appendicitis and peptic ulcer perforation ( $p < 0.01$ ), accompanied by higher proportions of AAST Grade III–IV disease in both groups. No significant differences were observed in cholecystitis or bowel obstruction. Postoperative morbidity remained stable overall, except for an increase in moderate-to-severe complications in peptic ulcer perforation during lockdown ( $p = 0.02$ ). After lifting restrictions, operative volume, severity distribution, and early outcomes returned to pre-lockdown patterns.

**Conclusions:** During the lockdown period of Vietnam's fourth COVID-19 wave, reductions in surgical volume and delayed presentation were observed in selected time-sensitive abdominal emergencies, accompanied by higher anatomic severity and morbidity in perforation cases. These patterns were not observed in the period following restoration of healthcare access.

**Keywords:** COVID-19, Emergency abdominal surgery, Lockdown, Appendicitis, Peptic ulcer perforation

## INTRODUCTION

Since its emergence in December 2019, coronavirus disease 2019 (COVID-19) has evolved into a global public health crisis. On January 30, 2020, the World

Health Organization (WHO) declared the outbreak a Public Health Emergency of International Concern (PHEIC), the highest level of alert.<sup>1,2</sup> In Vietnam, the pandemic unfolded in multiple waves, with the fourth wave (June–September 2021) representing the most

extensive surge in community transmission during which prolonged lockdown measures were implemented in major urban regions.

Emergency abdominal conditions such as appendicitis, cholecystitis, peptic ulcer perforation, and bowel obstruction require timely surgical management to prevent progression to severe complications, including generalized peritonitis, sepsis, and mortality. However, strict public health measures, including social distancing and mobility restrictions, as well as concerns regarding in-hospital infection risk, may have influenced healthcare-seeking behavior during the pandemic. Several international studies have reported prolonged symptom duration before hospital presentation and increased disease severity in emergency general surgery during COVID-19 waves.<sup>3-5</sup>

Although social and healthcare systems gradually resumed routine activity after the lifting of restrictions, the extent to which emergency surgical practice returned to pre-lockdown patterns remains incompletely characterized, particularly in Southeast Asian settings. The present study aimed to evaluate changes in operative volume, prehospital symptom duration, disease severity, and early postoperative outcomes among patients undergoing surgery for appendicitis, cholecystitis, peptic ulcer perforation, and bowel obstruction across three

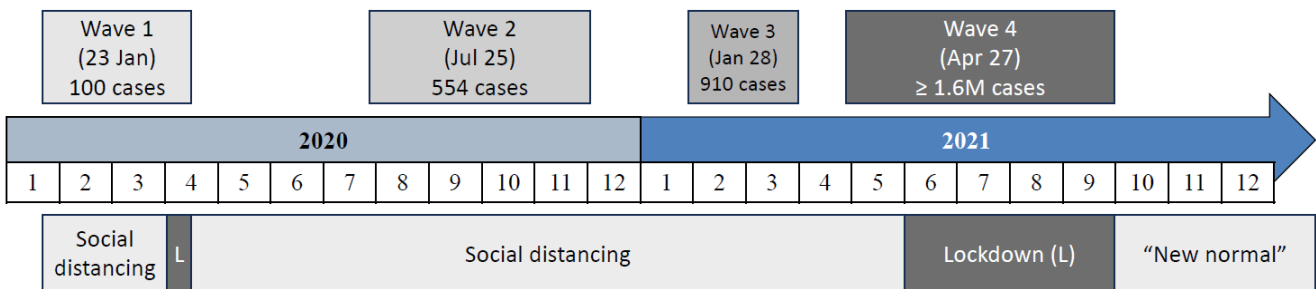
defined phases: before lockdown, during lockdown, and after lifting of restrictions.

**METHODS**

*Study design*

This retrospective study was conducted at Nhan Dan Gia Dinh Hospital, Ho Chi Minh City, Vietnam. The study was conducted in accordance with the Declaration of Helsinki and received Institutional Review Board approval before data collection.

Vietnam experienced four waves of the COVID-19 pandemic, of which the fourth wave (June–September 2021) was the most severe and predominantly affected Ho Chi Minh City.<sup>6</sup> As a tertiary referral center serving the Northeastern region of the city and neighboring provinces, our institution continued to provide emergency surgical care throughout this period. Public health measures during the pandemic were categorized into two principal levels: social distancing and lockdown (Figure 1). Social distancing included masking, physical distancing, and restrictions on gatherings, whereas lockdown involved suspension of non-essential services, mobility restrictions, and stay-at-home orders. The lockdown period in 2021 constituted the primary exposure phase analyzed in this study.



**Figure 1: Timeline of COVID-19 waves and corresponding levels of social restrictions in Vietnam from 2020 to 2021.**

The timeline was constructed by the authors based on epidemiological data reported by Minh et al.<sup>6</sup>

Data were extracted from medical records of adult patients undergoing surgery for appendicitis, cholecystitis, peptic ulcer perforation, and bowel obstruction during three predefined periods: June 1–September 30, 2020 (Group 1, social distancing); June 1–September 30, 2021 (Group 2, lockdown); and March 1–June 30, 2022 (Group 3, post-lockdown). These periods were selected to reflect distinct levels of public health restrictions in Ho Chi Minh City. The 2021 interval corresponded to the strict lockdown phase (May 31–September 30, 2021). The 2020 interval represented a period of social distancing with limited community transmission, whereas the 2022 interval reflected the recovery phase following the lifting of restrictions. To

minimize seasonal variation, equivalent calendar months were chosen when possible, and none of the study periods coincided with major public holidays (Figure 1).

Data from 2019 (pre-pandemic) were not included. At the time of data collection, paper medical records from 2019 had been archived off-site and were not readily accessible. In addition, a fully integrated electronic medical record system was not yet implemented at our institution, limiting retrospective retrieval of complete datasets from that year.

*Study population*

Adult patients (≥18 years) who underwent surgery for appendicitis, cholecystitis, peptic ulcer perforation, or bowel obstruction (benign and malignant causes) during

the three predefined study periods were included. Patients with positive rapid antigen or polymerase chain reaction tests for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) were transferred to designated COVID-19 treatment centers for operative management and were therefore not included in the present analysis. The number of such cases was small relative to the total surgical volume; however, complete data were not retrievable because these patients were managed in temporary field hospitals where paper-based records were archived separately and not integrated into the hospital's electronic system.

**Data collection and variable definitions**

Collected variables included admission time, emergency surgical diagnosis group, age, sex, comorbidity burden assessed using the Charlson Comorbidity Index (CCI), duration from symptom onset to hospital admission, disease severity graded according to the American Association for the Surgery of Trauma (AAST) 2016 emergency general surgery grading scale, and postoperative complications classified according to the Clavien–Dindo system.<sup>7-9</sup> The duration from symptom onset to admission was obtained at presentation through structured clinical history taking and documented in the medical record. Intraoperative diagnoses were recorded in operative reports and, when applicable, confirmed by histopathological examination (appendicitis and cholecystitis). Comorbidities and postoperative complications were verified through the systematic chart review, including documentation by emergency physicians, surgeons, anesthesiologists, and nursing staff throughout hospitalization.

**Statistical analysis**

Data were analyzed using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY,

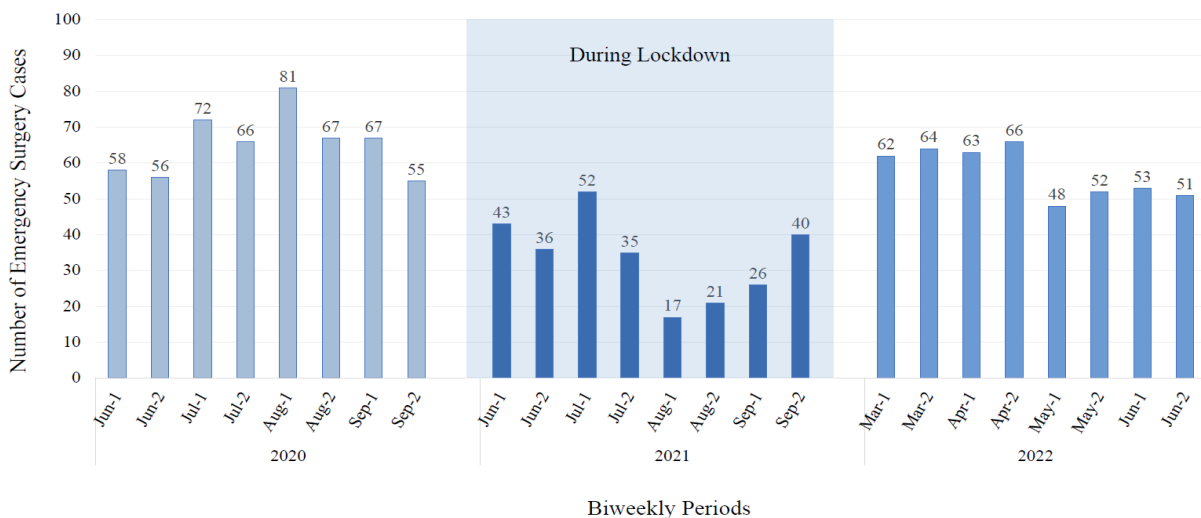
USA). Continuous variables were expressed as mean±SD and compared using the independent samples t-test. Categorical variables were presented as frequencies and percentages and compared using the Chi-square test or Fisher's exact test, as appropriate. All statistical tests were two-sided, and a p value <0.05 was considered statistically significant.

**RESULTS**

A total of 1,251 patients underwent emergency abdominal surgery during the three study periods, including 522 in Group 1 (2020), 269 in Group 2 (2021), and 460 in Group 3 (2022). During the lockdown period, surgical volume decreased by nearly 50% compared with the social distancing period. As illustrated in Figure 2, biweekly case counts in 2021 remained consistently lower than those observed in the corresponding months of 2020 and 2022. In the post-lockdown period, case numbers increased and approached pre-lockdown levels.

Despite the reduction in total volume, the proportional distribution of disease categories remained stable (Figure 3). Appendicitis accounted for approximately three-quarters of cases across all periods, followed by cholecystitis (approximately 10%), while peptic ulcer perforation and bowel obstruction each represented smaller proportions.

No significant redistribution of surgical indications was observed during lockdown. Demographic characteristics and comorbidity burden did not differ significantly between groups (Table 1). However, changes were observed in prehospital symptom duration. During lockdown, the proportion of appendicitis patients presenting more than 24 hours after symptom onset increased from 28% to 44% (p<0.01). A similar pattern was noted in peptic ulcer perforation, with delayed presentation increasing from 18% to 50% (p=0.01).



**Figure 2:** Each bar represents a two-week interval. Within each month, the first two-week interval is labeled as “Month-1” (early month), and the second two-week interval is labeled as “Month-2” (late month).

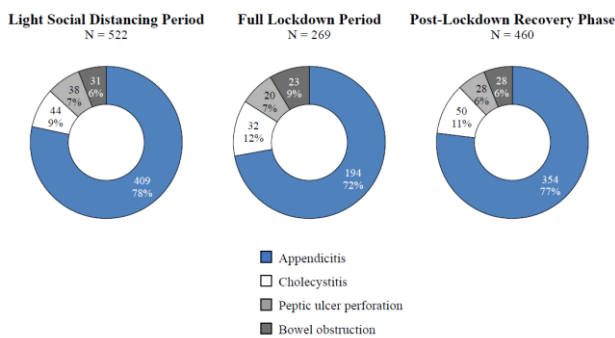
**Table 1: Prehospital symptom duration, disease severity, and early postoperative outcomes across the three study periods.**

	Group 1 n=522	Group 2 n=269	Group 3 n=460	p (1-2)	p (1-3)
<b>Demographic characteristics</b>					
Age (years)	45±18	44±17	47±18	0.37	0.12
Sex				0.48	0.46
Male	252 (48)	137 (51)	233 (51)		
Female	270 (52)	132 (49)	227 (49)		
Charlson comorbidity index (CCI)				0.88	0.08
CCI ≤ 2	411 (79)	213 (79)	340 (74)		
CCI > 2	111 (21)	56 (21)	120 (26)		
<b>Prehospital symptom duration</b>					
Appendicitis				<0.01	<0.01
≤1 day	295 (72)	109 (56)	219 (62)		
>1 day	114 (28)	85 (44)	135 (38)		
Cholecystitis				0.64	0.98
≤1 day	23 (52)	15 (47)	26 (52)		
>1 day	21 (48)	17 (53)	24 (48)		
Peptic ulcer perforation				0.01	0.76
≤1 day	31 (82)	10 (50)	22 (79)		
>1 day	7 (18)	10 (50)	6 (21)		
Bowel obstruction				0.81	0.27
≤1 day	9 (29)	6 (26)	12 (43)		
>1 day	22 (71)	17 (74)	16 (57)		
<b>Operative severity (AAST classification)</b>					
Appendicitis				<0.01	0.05
I-II	266 (65)	93 (48)	206 (58)		
III-IV	143 (35)	101 (52)	148 (42)		
Cholecystitis				0.46	0.75
I-II	38 (86)	30 (94)	42 (84)		
III-IV	6 (14)	2 (6)	8 (16)		
Peptic ulcer perforation				0.01	0.78
I-II	11 (29)	0 (0)	9 (32)		
III-IV	27 (71)	20 (100)	19 (68)		
Adhesive small bowel obstruction*				0.57	1.00
I-II	7 (88)	5 (63)	3 (100)		
III-IV	1 (12)	3 (37)	0 (0)		
<b>Postoperative outcomes (Clavien-Dindo classification)</b>					
Appendicitis				0.36	0.34
No	395 (97)	190 (98)	337 (95)		
II-V	14 (3)	4 (2)	17 (5)		
Cholecystitis				1.00	0.41
NO-I	40 (91)	30 (94)	48 (96)		
II-V	4 (9)	2 (6)	2 (4)		
Peptic ulcer perforation				0.02	0.45
NO-I	29 (76)	9 (45)	19 (68)		
II-V	9 (24)	11 (55)	9 (32)		
Bowel obstruction				0.35	0.16
NO-I	25 (81)	16 (70)	18 (64)		
II-V	6 (19)	7 (30)	10 (36)		

Group 1: social distancing; Group 2: lockdown; Group 3: post-lockdown. p (1–2) represents the p-value for comparison between Group 1 and Group 2. p (1–3) represents the p-value for comparison between Group 1 and Group 3. AAST: American Association for the Surgery of Trauma. \*AAST grading was applied only to adhesive small bowel obstruction cases. Continuous variables are expressed as mean±standard deviation (SD); categorical variables are presented as number (percentage).

No statistically significant differences were identified in the cholecystitis or the bowel obstruction. An increase in the operative severity paralleled this shift in presentation. In appendicitis, the proportion of AAST Grade III–IV cases increased from 35% in Group 1 to 52% in Group 2 ( $p < 0.01$ ). In peptic ulcer perforation, all cases during lockdown were classified as Grade III–IV compared with 71% in the pre-lockdown period ( $p = 0.01$ ). No significant differences in AAST grade were detected in cholecystitis or adhesive small bowel obstruction. In Group 3, severity distributions were comparable to those observed before lockdown.

Postoperative outcomes were largely consistent across periods. In appendicitis and cholecystitis, more than 90% of patients experienced no or minor (Grade I) complications, without significant intergroup differences. In contrast, peptic ulcer perforation demonstrated a significant increase in moderate-to-severe complications (Clavien–Dindo Grade II–V), rising from 24% before lockdown to 55% during lockdown ( $p = 0.02$ ). No statistically significant differences in postoperative complications were observed in bowel obstruction.



**Figure 3: Total number of cases and percentage within each study period (N, %). The total number of patients in each period is indicated above each chart.**

## DISCUSSION

This study presents data from a Vietnamese tertiary referral centre during the fourth wave of the COVID-19 pandemic and offers a clinical perspective on how periods of stricter public health measures were temporally associated with patterns of emergency abdominal surgical care. By examining operative volume, prehospital symptom duration, anatomic severity, and early postoperative outcomes across three defined phases, the analysis provides a structured view of surgical activity before, during, and after lockdown. A marked reduction in emergency operative volume was observed during the lockdown period, followed by a return toward pre-lockdown levels once restrictions were lifted. Similar decreases in emergency general surgery activity during periods of strict containment have been reported by Kurihara et al in Italy.<sup>10</sup> The subsequent recovery of case numbers in our cohort suggests that the decline during

lockdown was temporally associated with restricted access and altered healthcare-seeking behaviour rather than sustained changes in the underlying epidemiology of surgical emergencies.

Despite fluctuations in overall volume, the proportional distribution of disease categories remained stable throughout the three periods. Appendicitis consistently accounted for approximately three-quarters of cases, followed by cholecystitis, with peptic ulcer perforation and bowel obstruction comprising smaller proportions. Comparable distributions were described by Khalaf et al in Egypt and Surek et al in Türkiye, indicating that the relative spectrum of emergency abdominal pathology remained largely preserved during the pandemic.<sup>11,12</sup> These findings suggest that lockdown measures influenced the number of patients presenting for surgery rather than substantially altering disease composition. Prehospital symptom duration demonstrated a selective shift during lockdown. Delayed presentation was more frequently observed in appendicitis and peptic ulcer perforation, whereas no significant differences were identified in cholecystitis or bowel obstruction. Similar patterns have been reported internationally. Balvardi et al in Canada and Carpio Colmenares et al in Peru described prolonged intervals before hospital admission during the pandemic, and Hessheimer et al in Spain, as well as An et al in Korea, documented statistically significant increases in time from symptom onset to presentation.<sup>12-15</sup> Although causal mechanisms cannot be directly established in this retrospective analysis, these consistent observations across different healthcare systems suggest that mobility restrictions and concerns related to infection risk may have contributed to delayed care in time-sensitive surgical conditions.

The observed delay in presentation during lockdown was accompanied by a higher proportion of advanced AAST grades in appendicitis and peptic ulcer perforation. This association between prolonged symptom duration and increased anatomic severity is compatible with the known progression of untreated intra-abdominal inflammatory and perforative processes. Similar observations have been described by Atri et al and Mulita et al in previous reports. However, Carpio Colmenares et al did not report a significant shift in severity distribution, highlighting that the magnitude of impact may vary depending on healthcare accessibility, institutional organization, and public adherence to restriction measures.<sup>3,5,13</sup> Early postoperative outcomes remained largely stable for appendicitis and cholecystitis across periods, similar to findings reported by Rajesh et al in Ireland, where emergency abdominal surgical outcomes were largely preserved despite pandemic-related service disruption.<sup>16</sup> In contrast, peptic ulcer perforation was associated with an increased proportion of moderate-to-severe (Clavien–Dindo Grade II–V) complications during lockdown. This finding may reflect more advanced disease at presentation rather than differences in operative or perioperative management.

The normalization of both severity distribution and complication rates in the post-lockdown phase further supports the interpretation that the changes observed during lockdown were temporally associated with restriction intensity and were not sustained after easing of restrictions. Several limitations merit consideration. The retrospective, single-center design introduces the possibility of incomplete documentation and residual confounding. Pre-pandemic data from 2019 were unavailable due to restricted access to archived paper records, limiting comparison with a true baseline period. Patients with confirmed COVID-19 infection who were transferred to designated field hospitals were not included, and comprehensive data from these institutions were not accessible, which may have introduced selection bias. In addition, the analysis was confined to operative cases and did not include patients managed nonoperatively, potentially underestimating the overall burden of emergency abdominal disease during the pandemic. Given the heterogeneity in pathophysiology and clinical progression among the included conditions, further disease-specific analyses are warranted to ensure greater interpretive precision and validity of the conclusions. In addition, strengthening public health communication regarding warning signs of emergency surgical diseases and optimizing timely access to medical care represent important strategies to mitigate delayed presentation in the context of healthcare system strain.

## CONCLUSION

In conclusion, pandemic-related lockdown was associated with a reduction in emergency abdominal surgical volume and delayed presentation in patients with appendicitis and peptic ulcer perforation, accompanied by increased disease severity in these groups. Acute cholecystitis and bowel obstruction showed no significant changes in prehospital duration or severity. Early postoperative outcomes remained largely stable, except for a temporary increase in complications among peptic ulcer perforation during the peak restriction period. After lockdown measures were lifted, surgical volume and clinical outcomes returned to levels comparable to the pre-lockdown period.

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*Conflict of interest: None declared*

*Ethical approval: This retrospective study was conducted at Nhan Dan Gia Dinh Hospital and approved by the Institutional Review Board of the hospital. The study was performed in accordance with the Declaration of Helsinki*

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