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Cholecystectomy during COVID-19: A Single-Center Experience

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Abstract

COVID-19 pandemic has impacted health care globally with restructuring and prioritization of health care services. We prospectively analyzed 104 patients who underwent laparoscopic cholecystectomy during the peak of COVID-19 in 2020 and compared with 217 patients from the same period in 2019. Emergency admissions constituted majority of cases with no statistical difference between both groups ($p = 0.49$). Most cholecystectomies were for biliary colic (41.3 vs. 35.5%) and cholecystitis (37.5 vs. 43.8%) without any statistically difference ($p = 0.31$ and $p = 0.29$, respectively). This study demonstrates that laparoscopic cholecystectomy was feasible and safe in patients with symptomatic gall bladder disease during the peak period for COVID-19.

Keywords
- COVID-19
- gall stone disease
- cholecystectomy

The impact of COVID-19 on surgical practice has been far-reaching, ranging from workforce and staffing redistribution to risk of intraoperative viral transmission. In addition to the far-reaching impact on surgical education and training and procedure prioritization, nonurgent noncancer surgical procedures have been cancelled in favor of emergency and cancer operations.[1–3] Acute cholecystitis and other gall stone–related conditions are among the common acute surgical conditions requiring hospitalization. Consequently, cholecystectomy is one of the routine surgical procedures performed in those presenting with symptomatic gall stone disease.[4] The benefits of the laparoscopic approach over open cholecystectomy is well documented and considered as the gold standard for treating cholecystitis and other gall stone–related conditions.[5] In COVID-19 times, the optimal timing of offering laparoscopic cholecystectomy has been a cause for debate with respect to early or delayed cholecystectomy. Various published randomized controlled trials and meta-analysis have demonstrated the benefits of early cholecystectomy over a delayed approach. These include a shorter length of hospital stay with no significant difference in operative complications or open conversion rate, and eliminating the risk of recurrent admissions of up to 25% while awaiting a delayed cholecystectomy.[4,6–13]

With the 2020 COVID-19 pandemic, the debate surrounding the safety of surgical intervention, particularly laparoscopic surgery, persists. The Intercollegiate General Surgery Guidance on COVID-19, a collaboration of the Royal College of Surgeons in the United Kingdom and Ireland and UK Surgical Associations, advocated for nonoperative management of acute cholecystitis where possible due to potential risk of aerosol spread. Laparoscopy was advised only when benefit outweighs potential risk of viral contamination. To address these concerns, we evaluated the outcomes of laparoscopic cholecystectomies performed during the peak period for COVID-19 and compared this with data from the same period in 2019.

Methods

Study Population

Data were collected prospectively to study the outcomes of patients who underwent laparoscopic cholecystectomy for symptomatic gall stone disease during the peak period for COVID-19 from March 1, 2020, to June 30, 2020, at the Royal

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Stoke University Hospital. These data were then compared with outcomes from the same period in 2019.

The inclusion criteria are patients of all age and sex who underwent a laparoscopic cholecystectomy for symptomatic gall stone disease, with a minimum follow-up of 30 days. The exclusion criteria were patients treated conservatively with no operative intervention, those undergoing combined procedures, and patients with gall bladder malignancy. The study parameters were patient demographics, route of admission, COVID-19 testing, preoperative imaging, post-operative complications, length of hospital stay, readmission, re-operation and mortality.

Statistical Analysis

IBM SPSS version 27 was utilized for statistical analysis. Continuous variables were compared using the independent samples *t*-test. Mann–Whitney *U*-test was used to analyze nonparametric variables.

Follow-up

We do not routinely follow up patients after laparoscopic cholecystectomy in our unit. In view of the COVID-19 pandemic, all patients were discharged with a 2 weeks "open access letter" to the Surgical Admissions Unit (SAU) of the Royal Stoke Hospital. Patients were advised to have a very low threshold to visit SAU should they develop any untoward events or symptoms of COVID-19.

COVID-19 Testing

At the start of the pandemic, patients were not routinely tested for COVID-19 due to lack of specific guidelines and limited test availability. Patients with no symptoms of COVID-19 were not routinely tested. Only symptomatic patients or those in contact with confirmed COVID-19 cases were tested. For those undergoing diagnostic imaging such as a computed tomography (CT) of the abdomen, a CT of the thorax was routinely included to investigate for evidence of COVID-19. In the later part of the peak period for COVID-19, all patients undergoing surgery were routinely tested for COVID-19.

Perioperative Management

All patients underwent detailed physical examination and routine blood tests prior to surgery. As per our hospital guidelines, a single dose of prophylactic antibiotic was given in all cases apart from patients who were already on antibiotics. As per our hospital protocol, all patients were provided with thromboembolic prophylaxis (venous thromboembolism) based on the risk assessment.

Safety in Operating Room

All patients undergoing surgery were intubated and extubated in the operating room with minimal staffing levels with full use of personal protective equipment (PPE). Universal precautions were implemented in the operative care of every patient irrespective of their COVID-19 status.

Surgical Approach and Technique

All patients underwent a laparoscopic cholecystectomy with the use of AirSeal device to minimize aerosol spread during the pandemic period. In all laparoscopic cholecystectomies, an open cut-down technique (modified Hasson's technique) was utilized for port insertion and induction of pneumoperitoneum. A standard four-port technique was used. Intraoperatively, the standard Calot dissection to obtain a wide posterior window and a critical view of safety was implemented. Following the procedure, the specimen was extracted in a BERT bag.

Results

The study cohort (SC) comprised 104 patients who underwent laparoscopic cholecystectomy for symptomatic gall stone disease during the peak period for COVID-19 from March 1, 2020, to June 30, 2020. The control cohort (CC) consisted of 217 patients who underwent laparoscopic cholecystectomy during the same period in 2019.

Both cohorts were comparable with regard to patient demographics. Median age in the SC was 51.5 years (range: 15–84 years), and it was 52 years (range: 19–91 years) in the CC ($p = 0.49$). Male:female ratio was 1:2 in the SC and 1:2.2 in the CC ($p = 0.67$). Emergency admissions constituted the majority of cases and there was no statistically significant difference between both groups (61.5% in SC vs. 61.8% in CC, $p = 0.97$). Details are summarized in ►**Table 1**.

Most cholecystectomies were for biliary colic (41.3% in SC vs. 35.5% in CC) and acute cholecystitis (37.5% in SC vs. 43.8% in CC), and there was no statistically significant difference between both groups ($p = 0.31$ and $p = 0.29$, respectively). Details are summarized in ►**Table 2**.

The presenting symptoms in the SC were abdominal pain (100%), nausea and vomiting in 17 (16.3%), anorexia (1%), fever (15.4%), and jaundice (11.5%). Due to limited test availability, only 52 (50%) of the SC patients had a swab test for COVID-19 preoperatively. Of these, two patients (2%) tested positive. An additional 14 patients (13.5%) had a CT of the thorax as part of a diagnostic workup to investigate for COVID-19. An additional 33 (31.7%) patients with respiratory symptoms also had a CXR to investigate for COVID-19.

In the SC, more males (Hb $\geq$ 130; 85.7%) had normal hemoglobin as compared with females (Hb $\geq$ 115; 76.8%). Forty (38.5%) patients in the SC had leucocytosis (range: 11.1–35.9), 51 (49%) had a neutrophil count greater than 7.5 (7.6–30.7), and 88 (84.6%) had a CRP greater than 3

Table 1 Patient demographics and mode of presentation

Demographics	COVID-19	2019	*p*
Median age (range)	51.5 (15–84)	52 (19–91)	0.48
Gender			
Male (%)	35 (33.65)	68 (31.34)	0.68
Female (%)	69 (66.35)	149 (68.66)	0.68
Admission			
Elective (%)	7 (6.73)	39 (17.97)	0.007
Delayed (%)	33 (31.73)	44 (20.28)	0.02
Emergency (%)	64 (61.54)	134 (61.75)	0.97

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Table 2 Investigations and clinical presentation

Imaging	COVID-19	2019	*p*
US (%)	81 (77.88)	180 (82.95)	0.28
CT (%)	41 (39.42)	42 (19.35)	0.0001
MRCP (%)	44 (42.31)	75 (34.56)	0.18
ERCP (%)	6 (5.77)	12 (5.53)	0.93
Indication			
Biliary colic (%)	43 (41.35)	77 (35.48)	0.31
Cholecystitis (%)	39 (37.5)	95 (43.78)	0.29
Cholangitis (%)	3 (2.88)	15 (6.91)	0.14
Gall bladder perforation (%)	4 (3.85)	12 (5.53)	0.52
Gall bladder polyp (%)	0 (0)	4 (1.84)	0.16
Pancreatitis (%)	15 (14.42)	14 (6.45)	0.02

Abbreviations: CT, computed tomography; ERCP, endoscopic retrograde cholangiopancreatography; MRCP, magnetic resonance cholangiopancreatography; US, ultrasound.

(range: 4–456.3). Less than 50% of patients had abnormal LFTs—elevated serum bilirubin, 43 (41.3%); raised ALT, 49 (47.1%); and elevated ALP, 39 (37.5%); and 14 (13.5%) had a raised serum amylase (293–4,152). In the SC, 81 (77.9%) patients and in the CC 180 (83%) patients underwent abdominal ultrasound as a diagnostic workup prior to cholecystectomy ($p = 0.28$). However, significantly more patients underwent CT of the abdomen in the SC (39.4 vs. 19.4%; $p = 0.0001$).

Median ASA in both cohorts was 2, while 21 (20.2%) patients in the SC and 53(24.4%) in the CC had an ASA grade ≥ 3 ($p = 0.40$). In the SC, three patients (2.8%) were deemed high risk for early cholecystectomy, and patients who were not responding to initial conservative treatment with antibiotics had radiology-guided percutaneous cholecystostomy for cholecystitis.

Details of postoperative outcomes are summarized in ►**Table 3**.

There was no statistically significant difference in postoperative complications in both groups except in hospital-acquired pneumonia (HAP) seen in two COVID-19-negative patients in SC (1.92 vs. 0%, $p = 0.04$). The most frequent complication in the SC was surgical-site infection (2.9%), while it was postoperative intra-abdominal collection (4.6%) in the CC. Median length of stay was 2 days (range: 0–25 days) in the SC and 1 day in the CC (range: 0–30 days; $p = 0.21$). There was no statistically significant difference in readmission rate (14.4 vs. 11.2%, $p = 0.46$), and no 30-day mortality was recorded in either group.

Table 3 Post-operative outcomes

Complications	COVID-19	2019	*p*
Bile leak (%)	2 (1.92)	4 (1.84)	0.96
Collection (%)	2 (1.92)	10 (4.61)	0.24
Hemorrhage (%)	0 (0)	1 (0.46)	0.49
PE (%)	0 (0)	0 (0)	–
HAP (%)	2 (1.92)	0 (0)	0.04
SSI (%)	3 (2.88)	2 (0.92)	0.18
CBD injury (%)	0 (0)	0 (0)	–
Retained CBD stone	0 (0)	2 (0.92)	0.33
ITU (%)	0 (0)	1 (0.46)	0.49
LOS			
Preoperative LOS (median)	3 (0–34)	4 (0–15)	0.09
Total LOS (median)	2 (0–25)	1 (0–30)	0.21
Readmissions			
Total (%)	15 (14.42)	25 (11.52)	0.46
Reoperation			
Total (%)	0 (0)	5 (2.3)	0.12
Mortality			
Total (%)	0 (0)	0 (0)	0 (0)

Abbreviations: CBD, common bile duct; HAP, hospital-acquired pneumonia; ITU, intensive therapy unit; LOS, length of stay; PE, pulmonary embolism; SSI, surgical site infection.

Discussion

With the rapid spread of COVID-19 pandemic, health care systems world over experienced an overwhelming influx of acute admissions requiring hospitalization and critical care support. Health delivery services and staffing were prioritized to meet this challenge. Due to the increased demand for hospital beds and manpower, a priority was given to emergency and cancer operations and elective nonurgent operations were cancelled.[1,14] This resulted in a reduction in volume of operations performed globally, including laparoscopic cholecystectomy. Our experience shows a 52% reduction in overall numbers during the peak period of the pandemic in our center compared with the same period in the previous year.

The gold standard for treating symptomatic gall stone disease remains laparoscopic cholecystectomy. For emergency admissions with acute cholecystitis and other gall stone–related conditions, two recognized treatment pathways exist —laparoscopic cholecystectomy at index emergency admission or as a delayed procedure at a later date after an initial conservative treatment. Although studies have shown the benefit of early cholecystectomy on index admission over a delayed approach, this was a unique challenge during the COVID-19 pandemic for not only for anxiety with regard to safety but also for logistic reasons. The decision on which approach best meets the needs of patients depends on a balance between availability of surgical staff, operating room capacity, and above all patient's clinical need.

Significantly more patients underwent delayed laparoscopic cholecystectomy after index emergency admission during the pandemic (31.7 vs. 20.3%; $p = 0.02$). Majority of cases (61.5%) still underwent an emergency inpatient cholecystectomy during the pandemic and this was similar in the control group (61.8%, $p = 0.97$). This was due to our center adopting a safe

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method of surgical smoke evacuation using the AirSeal system for all laparoscopic procedures to reduce the risk of aerosolization of body fluids, a potential viral infection. As expected, there was a significant drop in elective cholecystectomy from 18% (39) in 2019 to 6.7% (7) in 2020 COVID-19 pandemic period ($p = 0.007$) in our center.

NICE guidelines suggest early cholecystectomy (within 1 week of presentation) in patients with symptomatic gall stone disease.[15] We continued to adhere to NICE guidelines with the median length of stay prior to emergency cholecystectomy being 3 days in the SC and 4 days in the CC ($p = 0.09$). There are very few published studies on outcomes following cholecystectomy during the COVID-19 pandemic; a majority of the studies are case reports and case series.[16–18]

The reduction in the number of cholecystectomies performed during the pandemic peak period compared with the same period of time the previous year was mainly due to a reduction in elective and delayed cholecystectomy as the pandemic progressed (6.7 and 31.7 SC vs. 18 and 20.3% CC; $p = 0.007$ and 0.02, respectively). Biliary colic and cholecystitis constituted the main indication for cholecystectomies in both groups. The proportion of laparoscopic cholecystectomies on index emergency admission was higher in the pandemic period for biliary colic (41.35% SC vs. 35.48% CC) and pancreatitis (14.42% SC vs. 6.45% CC), although not statistically significant.

In our study, most patients had abdominal ultrasound for diagnostic purposes which are expected given the role of abdominal ultrasound as the first-line imaging modality in investigation for gall stone disease. However, there was a statistically significant increase in abdominal CT in the SC compared with the control (39.4 vs. 19.4%; $p = 0001$). This is most likely due to a preference in requesting abdominal CT during the peak period of the pandemic with an addition of CT of the thorax at the same time to investigate for features of COVID-19 in emergency admissions. However, in the pandemic SC, the proportion of readmission was slightly higher (14.42% SC vs. 11.52% CC) and the proportion of reoperations was less in the consultant-led pandemic service in the SC.

There were two patients with HAP in the SC and tested COVID-19 negative. They were managed conservatively with antibiotics as per hospital guidelines. There was no statistically significant difference in other postoperative complications and length of hospital admission. No deaths were recorded in both groups.

Perioperative Course in Two Patients Who Tested Positive for COVID-19 in Study Cohort

While one patient denied any classical symptoms of COVID-19 (asymptomatic) on presentation, the other patient gave history of fever, throat irritation, and dry cough in addition to the features of cholecystitis. Both these patients were managed in predetermined isolation ward and subjected to CT of the thorax which showed bilateral patchy ground-glass opacities with peripheral predominance limited to the lower lobes in both patients. No pleural effusion or lymphadenopathy was seen. On biochemical evaluation, these patients showed raised leucocytes and CRP levels, which may also be the result of cholecystitis which was demonstrated in both patients. The postoperative recovery in both these patients was uneventful. None of the patient required any additional oxygen requirements or ventilation support. Both patients were discharged 2 days postoperatively which was comparable to others in the SC.

Imaging Features in Patients with Respiratory Symptoms but a Negative Swab Test

Despite negative swab result, a total of 12 patients (11.5%) were subjected to a CT of the thorax as part of a diagnostic workup to investigate for COVID-19. An additional 33 (31.7%) patients also had a CXR to investigate for COVID-19, as they gave history of respiratory symptoms. Twelve patients gave history of fever, cough, fatigue, and throat irritation. None of these patients reported history of anosmia or loss of taste. On CT scan, ground-glass opacification was seen bilaterally in five patients and unilateral opacification in two patients. Two patients also showed coarse horizontal linear opacities. All these changes were mainly limited to lower lobes. No appearance of nodules, lymphadenopathy, or effusion was seen. One patient with chest X-ray showed patchy shadowing. Despite the imaging features and negative swab result, all these patients were still considered suspicious for COVID-19 and all precautions taken with regard to isolation and full PPE care. Postoperative outcomes in all these patients were comparable with other study and CC group patients.

Limitations of the Study

While evaluating surgical outcomes during a pandemic in patient with symptomatic gallstone disease and cholecystitis seems reasonable, the COVID-19 pandemic can affect the overall outcomes by multiple other means. We have ourselves seen delays in patient consultation due to severely impacted working capacity as well as delayed referrals in addition to patient's fear of health care environment. Our own experience shows a 52% reduction in overall numbers in our center compared with the same period in the previous year. This might contribute to the progression of disease including increased frequency of pancreatitis as seen in our study. More patients in study group have been subjected to chest X-ray and CT scans as compared with CC. Taking this into consideration, it would have been interesting to look into health care costs per patients in both the groups. Also, a section of patients with positive COVID-19 test and symptomatic gallstones/cholecystitis were deemed unsuitable for surgery and managed conservatively with antibiotics and/or cholecystostomy tube placements during the time of our study. It would have been ideal to include data on such patients with regard to progress of the disease, any associated morbidity due to the long delays, were they offered surgery once completely recovered from COVID-19, etc. However, with reemergence of the second wave of COVID-19 in the United Kingdom meant our hospitals are again overwhelmed and staff redeployed to cover medical services, in addition to increasing waiting list and backlog.

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Conclusion

Laparoscopic cholecystectomy can be safely performed in patients presenting with symptomatic gall stone during the COVID-19 pandemic. Our fight against the COVID-19 pandemic will be a long-drawn one. As we wait for definitive treatment options to tackle this deadly virus, we are challenged by new evidence on a daily basis which impacts our decision-making capacity. The results of our study only serve to reenforce the belief that with stringent patient evaluation and implementation of a rigorous preoperative screening measures, protocols, and best surgical practices, we can restart our emergency services for common surgical condition like cholecystitis, in a world where we may have to learn to live with this novel virus for a while.

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Conflict of Interest
None declared.

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