Acute General Surgical Emergency and COVID-19 Is a Pandemic Challenge for Surgeons: A United Kingdom-Based Practical Experience

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Abstract
Transmission of coronavirus (COVID-19) is a considerable risk during the perioperative period of emergency surgery. A prospective observational study was performed between March 30, 2020, and June 30, 2020, at a large District General Hospital in England. The primary outcome was perioperative COVID-19-related complications, and secondary outcome measures included incidence of COVID-19 infections among the acute surgical patients, doctors, and healthcare workers. A total of 584 patients admitted through the emergency surgical pathway and 43% (n = 253) underwent surgical intervention. Approximately 5% (n = 30) patients contracted COVID-19 during the perioperative period and 6 of them died. Eight surgical doctors and 11 theater staff were confirmed for COVID-19 by swab test. Acute surgical emergencies and perioperative management of the urgent surgical patients during the COVID-19 pandemic is a global challenge, but adequate preparedness and strategic plan to adjust the surgical services can reduce the exposures to this highly contagious virus.

Keywords
COVID-19, emergency surgery, pandemic, perioperative, surgeons

Introduction
The outbreak of the Severe Acute Respiratory Syndrome Coronavirus 2 officially started in December 2019, in China, and has rapidly spread all over the world (1). By March 2020, the World Health Organization (WHO) declared a global pandemic (2). The widespread outbreak has affected almost all countries across the globe. The United Kingdom is one of the worst affected countries and has one of the higher mortality numbers (3). The first confirmed diagnosis of coronavirus (COVID-19) in a patient in the United Kingdom was reported in February 2020. At the time of writing until January 15, 2021, the total number of COVID-19 cases in the United Kingdom was 3,316,015, with 87,295 confirmed deaths (4). Since then, the Department of Health & Social Care and Public Health England released recommendations regarding the management of patients with COVID-19 in collaboration with WHO (5). The Royal College of Surgeons has regularly published guidelines on the management of emergency and elective surgical services in this pandemic era (6). The changes in healthcare in the United Kingdom, seen over the last few months, are unprecedented. Hospitals undertook significant reconfiguration in order to increase intensive care capacity to meet the anticipated demand for respiratory support and ventilators. Barring emergency theaters, all operating theaters were converted into temporary intensive therapy unit beds (7).

As a consequence of the recent events, a need for adaptation to surgical services was necessary to reduce the rate of nosocomial infections to patients and healthcare workers. The majority of the elective surgeries were postponed with the exception of cancer operations which were transferred to private hospitals to reduce the risk of exposure to COVID-19 in designated “cold” sites (7,8). However, emergency general surgical conditions continued to be assessed with timely resolution at “hot” sites. Emergency operation during the
The pandemic has been challenging for a wide variety of reasons. While the principles of management for surgical emergencies are the same as in non-pandemic circumstances, the exhaustion of resources and the risk of infection during operations were yet to be quantified and clarified. In the early stages of the pandemic and with the lack of evidence available, conservative medical management was recommended over operative management unless a patient was in life-threatening condition. Conflicting advice was published with regard to the merits of the open approach versus laparoscopic. The classification of “aerosol generating procedure” became a defining term for risk with literature suggesting endoscopy, laparoscopy, intubation, and extubation as procedures during which droplets and particles can be aerosolized. Contracting COVID-19 has been shown to complicate the perioperative management with an unexpectedly high fatality rate.

This article aims to assess the COVID-19-related morbidity in acute surgical patients in a large district general hospital (DGH). We quantified the impact on emergency surgical and theater personnel by measuring the incidence of COVID-19 in staff. We have also documented the changes made to the ward and theater workflow during the pandemic to provide a record of how one DGH adapted their acute surgical emergencies in the dynamic circumstances of a pandemic. Due to lack of good-quality evidence on COVID-19 and the rapid evolution of the pandemic, the readers should be aware that some of the adaptation in the present article are based on the realistic experience of the pandemic.

Methods
A prospective observational study was performed between March 30, 2020, and June 30, 2020, at a large DGH in the south-east region of England. The primary outcome was perioperative COVID-19-related complications, and secondary outcome measures included incidence of COVID-19 infections among the surgical staff. Data were collected on the number of acute surgical admissions and emergency operations performed. The perioperative COVID-19 status of the patients, doctors, and the healthcare workers were recorded. The presence of at least one of the following symptoms has been considered suggestive of COVID-19 infection: cough, dyspnea, sore throat, chest pain, anosmia, or fever.

Local Measures Taken
All the patients coming through the acute surgical pathway were screened with a nasopharyngeal swab or reverse transcription polymerase chain reaction (RT-PCR) swab test for COVID-19. An additional computerized tomography (CT) scan of the chest was requested for all emergency surgical admissions in whom CT scan of the abdomen and pelvis was indicated. This was done, as there is a delay of 24 to 48 hours for the results of the swab test. Radiological signs compatible with COVID-19 were considered as the appearance of peripheral infiltrates in ground glass, diffuse alveolar pattern, bilateral patched shading, cobblestone pattern, and organizational pneumonia. Depending on the symptoms and radiological findings, patients were triaged as positive and suspected for COVID-19. While operating on emergency surgical patients, enhanced personal protection equipment (PPE) including the use of Filtering Face Piece 3 or 2 masks was recommended for all theater personnel, irrespective of the COVID-19 status of the patient. Dedicated pathways for emergency theatres were developed including separate areas for donning and doffing of PPE.

Results
The total number of patients admitted during this period (March 30, 2020, to June 30, 2020) was 584, which is 49 per week in comparison to 71 per week during the non-COVID era. It is worth noting that the number of admissions increased markedly as the pandemic surpassed the peak in the United Kingdom (Figure 1). Among them, 43% (n = 253) patients underwent emergency surgical interventions (Table 1). The median age of the patients was 40 (range: 6-95 years).
Of the 584 patients, 5% (n = 30) later tested positive for COVID-19; 6 of these patients (20%) subsequently died due to COVID-19-related complications (Table 2). At the time of writing all of the rest 24 patients were discharged. However, their length of stay in the hospital was significantly higher (11 ± 2 days) in comparison to non-COVID patients (3 ± 2 days). The rate of contracting COVID-19 infection during perioperative period was higher in male patients 60% (n = 18) in comparison to female patients 40% (n = 12). The most frequent comorbidities among these patients were obesity (40%), hypertension (33%), diabetes mellitus (20%), chronic obstructive pulmonary disease (23%), chronic kidney disease, atrial fibrillation (20%), and heart failure (13%).

During this period, 8 surgical doctors contracted COVID-19 infection that was confirmed with a positive swab test. In addition, 3 consultant surgeons were symptomatic and underwent self-isolation until their swab results were negative. Approximately 11 theater staff were tested positive for COVID-19, which caused significant staff shortages in the department (Figure 2). Fever, headache, and myalgia were the principal symptoms.

Acute cholecystitis or biliary colic and a significant number of appendicitis were managed conservatively with radiological drainage, antibiotics, and analgesia. On discharge, if there was a possibility that patients are still infectious with COVID-19, they were given clear advice on how to avoid transmitting, self-isolation, and prevent spread to members of their household.

**Table 2. Demographic Data, Clinical Background, and Surgical Data of 6 Mortalities After RT-PCR Positive COVID-19 (April-June 2020).**

| No | Age | Sex | Diagnosis                      | Background                                     | Conservative or Surgical management  |
|----|-----|-----|--------------------------------|-----------------------------------------------|---------------------------------------|
| 01 | 61  | F   | Severe necrotizing pancreatitis| DM, HTN, Hypothyroidism                       | Conservative medical                  |
| 02 | 78  | M   | Anastomotic leakage           | CA colon                                      | Laparotomy + double-barreled stoma    |
| 03 | 77  | M   | Sigmoid volvulus              | Prosthetic mitral valve, AF, HTN               | Failed decompression by flexible sigmoidoscopy. |
| 04 | 83  | F   | Small bowel obstruction       | AF, HTN, HF, hypercholesterolemia             | Conservative medical                  |
| 05 | 88  | F   | PR bleed                      | HTN, hypercholesterolemia, CKD                | Conservative medical                  |
| 06 | 88  | M   | Severe acute pancreatitis     | HTN, DM, CKD, Hypercholesterolemia            | Conservative medical                  |

Abbreviations: AF, atrial fibrillation; CA, carcinoma; CKD, chronic kidney disease; COVID, coronavirus; DM, diabetes mellitus; F, Female; HF, heart failure; HTN, hypertension; M, male; PR, per rectal; RT-PCR, reverse transcription polymerase chain reaction; +ve, positive.

Perioperative management of these patients has become challenging as relative immunocompromise after major surgical intervention worsens the prognosis of those who either contract COVID-19 perioperatively or have been asymptomatic carriers prior to intervention (14,15).

Despite hospitals instituting strategies to cohort patients with proven COVID-19 infection, the virus can spread to other patients (18). Patients may also be asymptomatic with infection acquired in community (19). Emergency surgical patients can be distinguished into COVID-19-positive confirmed cases and COVID-19 suspected cases. Either group should be handled as positive until proved otherwise for the safety of all healthcare workers. Swabs and CT scans are requested as appropriate at admission but obtaining results should not delay definitive surgical management (18,20).

Additionally, due to fear of contracting COVID-19, patients are presenting late to hospital, often with advanced surgical pathology. In the emergency setting, surgery cannot be
postponed. We suggest active surveillance with liberal use of RT-PCR test and thoracic CT scan in this setting, to rule out COVID-19 infection, in the effort to offer prompt treatment to infected patients and to protect other patients and health workers (21). A sensitivity of 71% has been reported for RT-PCR, whereas CT scans had a sensitivity of 98% (22).

To respond effectively to the COVID-19 pandemic, hospitals and the healthcare system should have anticipatory plans for acute surgical services (18,20). Guidelines should be updated regularly by the specific surgical colleges based on the emerging shreds of evidence worldwide as the pandemic progresses. Currently, most recommendations are based on expert opinions only and there are many areas of uncertainty. Some of the key recommendations agreed and followed by most of the United Kingdom trusts during the perioperative period of urgent surgical intervention are as follows:

Patient transport:

- The logistics of transferring patients to and from the operating theaters should be as quick as possible to minimize the risk of cross-infection. Involved staff alerted of COVID-19 status of the patients or suspected.
- Surgical face mask to be worn by the patient during transportation to minimize the dispersal of respiratory droplets (6).
- Local protocols should be established, and disinfection measures must be taken immediately if contamination occurs to prevent nosocomial spread.

Preoperative phase:

- All emergency patients should be screened for COVID-19 either by RT-PCR swab or CT chest (6) and informed verbal consents should be obtained with specifically mentioning about COVID-19 (6).
- A dedicated COVID-19 operating theater should be designed, ideally a negative pressure theatre. Thorough briefing and coordination between patient care teams and theater staff are essential for safe and efficient patient transfer.
- The COVID-19 theater should be adequately stocked with the equipment required for specific procedures and dedicated donning area for the theater staff should exist.

Intraoperative phase:

- Minimum number of staffs should be in theater during intubation and extubation to prevent aerosol dispersal. Surgical team enters the room after intubation.
- Enhanced PPE should be worn for all emergency surgical interventions (18).
- Trained and experienced surgeon outside of learning curve should perform the operative procedures to minimize the operating time, in order to minimize the possibility of infection.
- Consider stoma formation rather than anastomosis to reduce need for unplanned postoperative critical care for complications (6).
- Open approach should be preferred over the laparoscopic. Application of energy devices should be carefully evaluated.

Postoperative phase:

- Extubation is extremely dangerous for viral spread and therefore should be performed either in the negative-pressure theatre or in a dedicated anesthesia recovery room and transferred to an isolated ward (11).
- Dedicated doffing area for the theater staff, timely and inclusive team debriefing is essential to identify successful processes and potential challenges.
- Deep clean of the theater to be performed as per trust protocol for contact/droplet precautions.

Conclusion

The COVID-19 pandemic is having a major impact on healthcare systems worldwide, forcing the reorganization of available resources. To cope with the rapid spread of the coronavirus and its consequences, the surgical services must exponentially modify their surgical and healthcare activities. A robust and mindful utilization of financial and human resources are essential. Instituting precise well-established plans to perform undeferrable surgical procedures and emergencies on COVID-19-positive patient is mandatory. Hospitals must prepare specific internal protocols and arrange adequate training of the involved personnel.

Contracting COVID-19 infection to a large number of staff could potentially result in a dangerous shortage of staff within surgical teams. The surgical staff must adhere to strict perioperative pathways and must receive adequate training and instructions to reduce cross-infection. Surgeons should be prepared to manage a range of complications in patients with COVID-19 infection. We hope further multicentric research and randomized control trials will emerge soon with up-to-date suggestions to battle against COVID-19.

Authors’ Note

Ethical approval was obtained from the East Kent Hospitals University NHS Foundation Trust, United Kingdom. All procedures performed in this study were in accordance with the ethical standards of the trust and national research committee, United Kingdom, also with the 1964 Helsinki declaration and its later amendments ethical standards. The study complies with the current laws of the United Kingdom. Verbal informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.
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