Management of patients with suspected COVID-19 who underwent emergency surgery

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Case report

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Abstract

Background: Since the outbreak of COVID-19, no official guidelines for urgent surgical management of patients with the COVID-19 concern have been recommended. The current study provides our experience about the management for the patients with suspected or confirmed COVID-19 who required urgent surgical intervention.

Methods: From February 5, 2019, to May 26, 2020, there were 5 cases of patients with suspected or confirmed COVID-19 infection managed with urgent surgical intervention in two hospitals in Chongqing.

Results: The five cases with COVID-19 concern were admitted with different diseases, including acute intussusception, strangulated inguinal indirect hernia, acute purulent appendicitis, femoral fracture and onset to delivery. Finally, four patients obtained negative results afterwards. One pregnant woman with confirmed COVID-19 infection underwent caesarean section. All medical staff involved in the patients management were well, and no in-hospital transmission occurred

Conclusion:

Suspected COVID-19 patients must be managed as positive patients until proven or denied in order to minimize the spread and transmission of infection. The current protocol carried out in our practice might be plausible and technically feasible for hospitals when dealing with COVID-19 infection.

Background

An outbreak of atypical pneumonia was first reported by the Wuhan Municipal Health Bureau on December 31, 2019. Since then, Chinese scientists have isolated and sequenced the pathogen and called it “severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)”, which accounted for this pneumonia. This novel coronavirus was further named by the World Health Organization as COVID-19 on February 11, 2020 [1, 2]. COVID-19 spread rapidly worldwide, approaching 8000000 global cases (June 17, 2020).

The surgical society adopted an organizational model in respond to the high-speed outbreak dynamic of COVID-19. The 2003 SARS outbreak had provided evidence that surgical activity should be reduced to a minimum in endemic areas to prevent disease transmission [3, 4]. In practice, there is still medical urgency, which requires urgent surgical interventions in a rather wide range of clinical specialists (e.g., those with acute intussusception, acute purulent appendicitis, onset to delivery or bone breakage), while relevant practical protocol is scarce.

Reasonable surgical interventions during the pandemic require complex decision-making and consideration. Since the outbreak of the virus, no official guidelines for urgent surgical management of patients with COVID-19 or suspected COVID-19 patients have been presented or recommended. Additionally, past comparable viral outbreaks, such as the SARS outbreak, did not impose such a challenge to emergency surgery and thus did not give us valuable experience.

Here, we report preliminary experience with urgent diseases that should be treated with surgical management in our institutes in Chongqing, near the central outbreak site in Wuhan.

Case Series

There were 5 patients with COVID-19 involvement, who were managed with urgent surgical care in Chongqing from February 5, 2019, to May 26, 2020. We reviewed the patients' medical records to obtain detailed information, including epidemiological history, demographic characteristics, and clinical data. All data were individually reviewed and collected as comprehensively as possible by two well-trained clinical investigators (Yanzhe Tan and Chengwei Yan). We even communicated with the attending doctors and other medical workers to collect the associated detailed information. We also followed the clinical outcomes through connection with all the patients for at least two weeks.

Among the current patients, four patients travelled from Hubei province (most intense infection area) and were considered highly suspected cases. Two patients had a slight fever with chills, but none were observed to have a fever ($> 39^{\circ}\text{C}$). Upper respiratory tract infection symptoms were also present: a cough in three patients, myalgia in four patients, malaise in two patients, and a sore throat reported by one patient. Four patients presented with symptoms/signs of pneumonia, and three of them showed pulmonary infiltrations in the lung lobes on chest CT; however, they did not develop severe pneumonia requiring mechanical ventilation. No individuals died of COVID-19 pneumonia. Furthermore, obvious gastrointestinal symptoms of diarrhoea were indicated in one patient. The COVID-19 infection was immediately tested for all the involved patients at admission with a test kit for real-time polymerase chain (RT-PCR) (BioGerm, Shanghai, China) recommended by the Chinese Center for Disease Control and Prevention (CDC) with upper respiratory tract specimens following WHO guidelines [5, 6]. In terms of repeated RT-PCR testing for SARS-CoV-2, it would take 1 to 2 days to reveal the final results. COVID-19 was confirmed by the New Coronavirus Pneumonia Prevention and Control Program (4th edition).

During this period of widespread COVID-19, to reduce unnecessary admissions, trained surgeons assessed the risk of COVID-19 before admission. Effective communication regarding any patient's COVID-19 status should ensure closed-loop information transfer. All the patients suspected of having SARS-CoV-2 infection were admitted to the special isolation area following the local management protocol, wearing specified bracelets and surgical masks in our hospital due to the initial diseases. Due to the wide clinical spectrum of COVID-19 infection, the critical evaluation and discussion were conducted by a multidisciplinary team comprising professionals from respective consulting departments, including general surgery, fever clinics, respiratory medicine, infection control, and operating and anaesthesia centres, to make treatment decisions. The correlating tertiary protection regulations and full personal protective equipment (PPE) usage should be trained firstly for the Related staff.

The operating rooms (OR) for the patients with COVID-19 concern should be established with its own suction, ventilator and medical gas with negative pressure, high-frequency air exchange (25 cycles/h). A dedicated ventilator was used to switch off the gas flow and close the endotracheal tube to reduce aerosol production. We advise open surgical procedures for the patients with COVID-19 concern to prevent airborne

and aerosol viral transmission with laparoscopy procedures. The body fluid and smoke should be sucked away intensively due to the relative risk of aerosol contamination.

One patient with acute purulent appendicitis firstly managed conservatively with antibiotics, but deteriorated quickly, and emergency operation was scheduled. Two patients with acute intussusception and strangulated inguinal indirect hernia were directly scheduled with surgical intervention due to the patient's condition. All these patients underwent exploratory laparotomy, followed by gastrointestinal repair or partial resection based on the surgical findings and decisions by the surgeons. One woman with 36 gestational weeks pregnant was confirmed COVID-19 infection. She underwent caesarean section in our institute.

For the patients with bacterial infections, empirical antibiotics were administered. Three patients were administered oxygen support (nasal cannula) and antiviral therapy (Table 1). Lymphopenia ($< 1.0 \times 10^9/L$) was present in two patients. Elevated inflammatory markers, such as C-reactive protein ($> 10 \text{ mg/L}$) and white blood cell counts, were indicated in three patients. Another patient had increased concentrations of alanine aminotransferase (ALT) and aspartate aminotransferase (AST). Typical ground-glass shadows were demonstrated on chest CT in one patient.

Table 1
General information of the patients with suspected COVID-19

Clinical characteristics	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Gender	Male	Female	Male	Male	Female
Ages	1 year 6 months	3 years 6 months	14 year 6 months	2 years 6 months	26 years
Diagnosis	1. Acute intussusception	1. Strangulated inguinal indirect hernia	1. Acute purulent appendicitis	1. Femoral fracture 2. Asymptomatic COVID-19 infection	1. Onset to delivery 2. COVID-19 pneumonia
Epidemiological history	Yes (visit from Wuhan)	Yes (contact with infected person)	Yes (contact with infected person)	Yes (exposure to relevant environment)	Yes (visit from Wuhan)
Symptoms	Fever, Cough	Fever, Rigor	Rhinorrhea	Rhinorrhea	Fever, Cough, Diarrhoea
Chest CT	Normal	Normal	Bronchovascular shadows	Normal	Multiple patchy ground- glass shadows
RT-PCR for CO VID19	(-)	(-)	(-)	(+)	(+)
Surgery	Yes	Yes	Yes	No	Yes
Management		Nasal oxygen support	Empirical antibiotic; Antiviral therapy	Nasal oxygen support; Antiviral therapy	Nasal oxygen support; Antiviral therapy
Hospital stay (days)	7	11	9	15	24

Postoperatively, all patients with suspected and confirmed COVID-19 were transferred to isolated recovery rooms. Finally, three patients who underwent surgical management obtained negative results afterwards. One patient with a femoral fracture had positive COVID-19 results on one PCR test; afterward, all repeated tests were negative. The postoperative course for three of the five patients was uneventful, and these patients were discharged after 8–13 days, while one patient remains in the hospital but is recovering well. The woman with confirmed COVID-19 did not require mechanical ventilation. The new-born baby presented well, without COVID-19 infection. One patient with a femoral fracture was managed conservatively with popliteal and gastrocnemius muscle traction and cylindrical plaster cast immobilization within the isolated

recovery rooms. All medical staff involved in the treatment of these patients were well two weeks after patient management.

Table 1 summarizes the demographic and clinical features of the present patients.

Discussion

The primary role of surgeons is to provide outstanding surgical care. Beyond this, surgeons should practice assisting in difficult decisions, critical care, etc. The current COVID-19 pandemic has challenged traditional surgical systems worldwide[7]. Scheduled procedures should be deferred during the COVID-19 pandemic. When deferral is not possible for urgent cases, the surgical staff and appliances must be well organized and balanced to achieve effective resource allocation[8, 9], particularly in terms of medical staff, shielding material, medical suppliers and equipment, intensive care beds, blood products, etc. Here, we experienced several patients with suspected COVID-19 infection since December 2019 who should be managed with surgical procedures. Multi-disciplinary consults were conducted by our medical colleagues for these patients. We also carried out several dry runs before implementing the current protocol, with special attention being paid to COVID-19 protection. The following perspectives and precautions regarding surgical procedures are based on our experience during the outbreak of COVID-19 infection.

The surgical response to the COVID-19 pandemic by our surgeons begins with resource utilization and patient triage. There are difficulties in decision-making regarding the necessity for surgery involving patients with suspected COVID-19. Furthermore, the differential diagnosis of COVID-19 from other types of pneumonia before surgery should require time and resource allocation[10]. If not absolutely necessary, regular surgery for COVID-19 patients should be deferred, although the indications for emergency surgery should be the same as before during the regular period, even under the pandemic of COVID-19, with regard to the limited supply of bed space, staff, and medical supplies. Nevertheless, we must acknowledge that many elective procedures are time-sensitive (MN-TS) and medically necessary. The principle concern is to balance the timely treatment of these urgent cases with the protection of all medical staff.

The preservation of medical staff is paramount in the management of patients with suspected COVID-19 to preserve the personnel to treat surgical emergencies and associated activities. The infection or self-isolation of senior surgeons due to COVID-19 exposure might result in a shortage of expertise within surgical teams[11, 12]. If COVID-19 infection cannot be completely ruled out, the highest level of protection should be adopted. The scrub team performing emergency surgery in such patients should be specifically trained and equipped with personal protective equipment (PPE). Suspected COVID-19 patients must be managed as positive patients until proven or denied in order to minimize the spread and transmission of infection. To minimize unprotected exposure to infected patients and COVID-19 spread burnout, testing outpatients before admission is required, and only outpatients with urgent concerns are permitted for admission. Segregation of infected patients may help protect medical staff from infection.

The pathways of access to these patients must be clearly defined and available to health care professionals. The working personnel in the ORs should be reduced to the minimum for the operation [11]. During the procedures, the current patients wore masks to protect all non-COVID personnel and all medical staff. COVID-

19 has aerosol and fomite transmission potential, remaining in aerosols for 3 hours or more and on surfaces for up to 72 hours[13, 14]. Here, for all the present patients, we preferred open exploratory laparotomy instead of laparoscopic procedures due to the manageable operation time and the uncertainty of airborne and aerosol transmission risk. Further, appropriate filter equipment for the evacuation and entrapment of smoke and aerosols is needed for the potential substantial amount of operations performed for COVID-19 carriers and infected patients.

Positive-pressure air exchange is needed for ordinary working operating rooms. However, negative-pressure operating rooms, preferably isolated from the main surgical theatres, should be recommended to effectively reduce the in-hospital transmission risk of scheduling emergency surgery for patients with suspected COVID-19. A high negative-pressure air circulation rate (≥ 25 cycles/h) within ORs is more favourable to minimize the viral load [15]. The equipment and devices in each OR were pre-emptively recommended to be strictly necessary on a case-by-case basis. The required materials in general were preferred to be disposable and pre-emptively prepared. The specific transfer pathways and isolated recovery rooms, ICUs, or medical wards should be arranged well in advance. The use of electrocautery or ultrasonic scalpels should be limited (or the power settings lowered) as much as possible to reduce the risk of aerosol viral dispersal[12]. During the recovery phase, the present patients were cared for within the OR until direct transfer to the isolated inpatient ward for as short a time as possible to reduce the contact risk with the surrounding environment [16].

Conclusions

Ultimately, the current protocol carried out in our practice might minimize the exposure of the virus during surgical activity, which might be plausible and technically feasible for hospitals when dealing with COVID-19 infection.

Abbreviations

ALT, alanine aminotransferase

AST, aspartate aminotransferase

CDC, Center for Disease Control and Prevention

OR, operating rooms

PPE, personal protective equipment

RT-PCR, Real-time polymerase chain

Declarations

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Ethics approval and consent to participate

All patients gave consent for participating in the study. The need for ethics approval was waived because of the case series design.

Consent for publication

All patients gave consent for publication.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

YT, CG: study design, collection of data; CG: drafting, review of literature, tables; CY: drafting, review of literature; CG: critical revision. All authors read and approved the final manuscript.

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