Review

CUTTING EDGE

Recommendations for general surgery activities in a pandemic scenario (SARS-CoV-2)

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The SARS-CoV-2 pandemic has over 1 million cases with more than 50 000 deaths globally to date (early April 2020)[1]. Disease spread in Italy has been rapid, with in excess of 115 000 SARS-CoV-2-positive patients and 13 000 deaths (1 April 2020). Mortality is currently 5·2 per cent in Tuscany, compared with 11 per cent nationwide. Healthcare systems have been forced to reorganize surgical activities[2] as they struggle with an overwhelming number of critically ill patients. One of the lessons we learnt from the 2003 SARS outbreak is that case identification was limited by non-specific mild symptoms, with a flu-like prodrome progressing to fulminant disease, which could quickly overwhelm hospitals[3] without plans for surge capacity, patient transfer, or sufficient numbers of trained staff. In addition to this, initial delays in transposing regional indications to stop surgical activities and to implement proper infection control procedures contributed to a disproportionate number of healthcare workers becoming infected (approximately 9000 in Italy alone by 30 March 2020).

The organizational model adopted was based on a rapid response to early signs of incoming crisis, and elective surgical activity (including outpatient consultations) was reduced to a minimum. Hospital areas capable of intensive care unit (ICU) level monitoring, including the post anaesthesia care unit or operating room, were repurposed as temporary ICU facilities. On 6 March the regional government defined three types of hospitals. Type A university hospitals are focused mainly on SARS-CoV-2 patient care, whereas type B hub-hospitals have ICU resources and the ability to organize two different pathways for SARS-Cov-2-positive and -negative patients; in both type A and B hospitals, scheduled elective surgery and outpatient activities are suspended, while emergency and urgent surgery, cancer treatments, transplants and burn care centres are running normally. Any admitted patient must be tested for SARS-CoV-2. Type C spoke hospitals with limited or no ICU beds, including private hospitals, are dedicated to non-SARS-CoV-2 patients.

Infected patients admitted via the emergency room should be quarantined (both spatially and in staff resources) according to the local infectious diseases policy. To decrease the risk of in-hospital transmission, patients with SARS-CoV-2 should separated from others, ideally in single rooms, and staff should consider wearing surgical or N95 masks, a disposable cap to cover the hair, and gloves[4]. Medical personnel should use fast-drying hand antiseptics and change gloves immediately after contact with a patient, body fluids or contaminated material[5]. Elective surgical activity is reduced to a minimum so operating rooms can be converted into ICUs using post anaesthesia care unit beds first, leaving space for emergency/urgent surgery. Admissions should follow two different pathways: one for SARS-CoV-2-positive and the other for -negative patients. To decrease the risk of in-hospital transmission hospitals should separate staff caring for patients with SARS-CoV-2 from others. All SARS-CoV-2-negative patients should also have the shortest possible hospital stay and be cared for in a designated 'infection-free' area or spoke (non-SARS-CoV-2) hospital.

High-intensity, pressured work will lead to staff fatigue and even psychological crises so staff need psychological support, reasonable scheduling, and appropriate rest. First-line medical staff should try to identify their negative psychological emotions, enable positive self-counselling, and seek professional help when needed[6]. Symptoms and/or fever should stimulate testing for the virus expediently. Ideally, there should be routine testing of healthcare

staff, serological confirmation immunity, and vaccination of those without natural immune responses.

The numbers of emergency admissions with coexistent viral infection are increasing, adding to the pressure on resources. Experienced surgeons should assess patients before admission to reduce unnecessary admissions by 20 to 30 per cent, with substantial resource savings[7]. Effective communication should ensure closed-loop information transfer on any patient's SARS-CoV-2 status. Transanal procedures, stomas for faecal diversion, and intestinal anastomoses may risk aerosol contamination[8]. Laparoscopy is an option but the relative risk of viral exposure *versus* open procedures remains unclear and in critically ill patients with lung dysfunction, sepsis or shock, open surgery is advised. An operating room maintained at negative pressure with a high frequency air exchanges (at least 25 cycles/h) or designated 'contaminated' surgery-only is sensible[9].

Surgical patients who are suspected of being or who test positive for SARS-CoV-2 infections should follow the local management protocol, which may include: wearing specified bracelets and surgical masks, having their medical records marked with warning labels, and being brought through defined routes and lifts to the special isolation area for recovery. A dedicated portable ventilator should be used when managing infected ICU patients, switching off the gas flow and closing the endotracheal tube to reduce aerosol production when connecting to the operating room ventilator[10]. The gas sampling tube should be protected by a high-efficiency particulate air (HEPA) filter and the soda lime should be changed regularly[10]. Anaesthetists should use three-level protective measures with HEPA filters on both limbs of the circuit and consider disposable components[9]. For surgical cases in infected patients, all staff should take a training course on personal protective equipment use: disposable double-layer hats, N95 masks, surgical gowns for single use or medical protective clothing, goggles, or full face mask, and double-layer sterile gloves. According to the Association for the Advancement of Medical Instrumentation (AAMI), the protection level of the surgical gowns depends on the type of procedure. Level 4 is the highest fluid and microbial barrier, and is needed for long, fluid-intensive procedures; level 3 is indicated as a moderate fluid barrier protection[11].

The Chinese New Coronavirus Infected Pneumonia Diagnosis and Treatment Plan (Trial Version 7) highlighted the following criteria for considering removing quarantine and transferring the patient to a general ward[12]: a normal body temperature for more than 3 days; respiratory symptoms significantly relieved; lung imaging showing that the inflammation has been significantly absorbed; and a negative SARS-CoV-2 nucleic acid amplification test (sampling interval at least 24 h) for specialist treatment or discharge based on their condition. The Italian Ministero della salute – Consiglio Superiore di Sanità stated on 28 February 2020 that SARS-CoV-2 patients can be considered cured if the symptoms resolve and two tests for SARS-CoV-2 at 24-h intervals are negative. For patients who clinically recover earlier than 7 days after onset, an interval of 7 days should elapse between the first and the final test. Virus clearance is defined as viral RNA disappearance from bodily fluids accompanied by the appearance of specific IgG.

The Singapore National Centre for Infectious Diseases (NCID) released the following guidelines on de isolation of SARS-CoV-2 suspected cases[13]: discharge patient with advisory and clinical follow-up if indicated and with daily calls until day 14 after the last possible exposure, under the following conditions: patient afebrile for at least 24 h, two respiratory samples tested negative for SARS-CoV-2 by polymerase chain reaction (PCR) in at least 24 h, day of illness from onset at least 6 days, or alternative aetiology found (for example, influenza, bacteraemia), or no close contact with a SARS-CoV-2 case, or no in-patient care required for other reasons. The US Centre for Disease Control released interim guidance for discontinuation of transmission-based precautions and disposition of hospitalized patients with SARS-CoV-2[14]: negative real-time PCR results from at least two consecutive sets of nasopharyngeal and throat swabs collected at least 24 h apart from a patient with SARS-CoV-2 (a total of four negative specimens) and resolution of fever, without antipyretic medications, improvement in illness signs and symptoms.

Regarding possible antiviral therapy, the Italian Society for Infectious and Tropical Disease released guidelines on 13 March 2020. The cut-off is the condition of the respiratory system evaluated using the Brescia Covid Respiratory severity scale: in patients before intubation the disease is primarily controlled by anti-inflammatory treatment (tocilizumab) in association with early antiviral and antiretroviral therapy. In mechanically ventilated patients the strategy is based on high-pressure ventilation and prone positioning. There is no evidence of efficacy of prophylactic chloroquine or hydroxychloroquine and the use is not recommended. Remdesvir has been shown to be active in preclinical studies on SARS-CoV and MERS-CoV infections by acting on the viral polymerase of coronavirus. The drug is not registered in Italy, and can be used only for 'compassionate' reasons, subject to approval by an Ethics Committee. There are multiple clinical trials ongoing and it is expected that a vaccine will be available within months.

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The *BJS* team wish to reach out to express our support and gratitude to surgeons and healthcare workers around the globe. These are difficult times and your leadership is key to providing the best care possible. *BJS* welcomes submissions relating to the challenges faced in this pandemic (expect publication within a week). A blog has been launched (cuttingedgeblog.com) and publication of accepted pieces will be within hours.

Best wishes to you all.

DesWinter MD (Editor-in-Chief) on behalf of the *BJS* Editors, Editorial Council and Board