Letter to the Editor

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What Is Needed to Make Interventional Radiology Ready for COVID-19? Lessons from SARS-CoV Epidemic

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Dear Editor,

We read with interest an article on novel coronavirus disease 2019 (COVID-19) recently published in the journal by Lin et al. (1). In this letter, we hope to provide some insights from an interventional radiologist (IR) perspective and provide relevant references to better help IR prepare for what is ahead while COVID-19 outbreak is evolving.

In December 2019, a cluster of patients with pneumonia of unknown cause appeared in Wuhan, Hubei Province, China. This was later found to be caused by a COVID-19 (previously provisionally named 2019-nCoV and SAR-CoV 2) (2), and within two months declared as a public health emergency of international concern (3). At the time of writing, it has affected more than 80000 patients globally in 33 countries (3). While thought to be less pathogenic, it has recorded more than 2600 deaths, surpassing the death toll of the Severe Acute Respiratory Syndrome (SARS-CoV) epidemic. During the initial stage, Singapore recorded one of the highest number of infections outside of China (3), reminiscence of the SARS-CoV epidemic 17 years ago (4).

Our institution is co-located with the National Center for Infectious Disease (NCID, previously Communicable Disease Center), and provides IR services to the center. In 2003, we were the designated SARS hospital and currently, the main hospital handling the COVID-19 cases for Singapore. In 2003, the authors were deployed to perform IR as well as critical care procedures in critically ill SARS-CoV patients, and today, providing IR support to the COVID-19 patients. The IR experience with SARS-CoV was first described 17 year ago (4).

Both the SARS-CoV and COVID-19 can cause severe respiratory illness, and are adept at human-to-human transmission. Save for the critically ill, the vast majority of patients with viral pneumonia will not require any IR procedure (28 IR procedures in 27 patients out of the cohort of 206 during SARS-CoV epidemic) (4). For the purpose of procedure planning and gearing, the procedure mix could be broadly divided into respiratory disease and critical care related (majority: e.g., peripheral/central lines, chest drains for effusions, caval filters), and related to underlying patient's comorbidity (minority: e.g., biliary drainage, dialysis catheters) (4). The main approach is to perform the procedures outside of the main radiology department as much as possible. We have a decentralized angiography suite with a angiography c-arm and a dedicated ultrasound machine, housed within NCID with negative pressure in a double door isolation room configuration. "Portable whenever possible" is also a valid approach in the absence of a decentralized suite or due to inability to transport unstable patients. This, however, is largely limited to ultrasound guided bedside procedures (e.g., peripheral lines and thoracocentesis).

Of particular concern is hospital-associated transmission to frontline healthcare workers, it is reported to account for up to 26% (40 out of 138 infections) in a recent series from a single hospital in the epicenter of the COVID-19 epidemic (1). Similarly during the SARS-CoV epidemic in Singapore, among the 206 cases, there were 84 healthcare workers infection resulting in 5 deaths. A known mechanism in hospital-associated transmission is through undiagnosed cases, where the healthcare workers were not adequately protected during unsuspected patient exposure. This is

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particularly a challenge with non-specific symptomatology (e.g., cough, diarrhea) and overlap clinical syndromes of the viral infection with other common diseases (e.g., acute pulmonary oedema vs. adult respiratory distress syndrome, bacterial pneumonia vs. viral pneumonia). One of the authors was quarantined after developing fever, on retrospective diagnosis of a SARS-CoV patient which he had previously performed thoracentesis. To this end, efficacious case identification and patient screening processes are pivotal in preventing this mode of spread. The department may also opt to broadly apply personal protective equipment (PPE) policy (N95 and eye protection) during the period of the outbreak, even in non-suspect cases to mitigate of staff infection from undiagnosed cases. It is important to note that during the SARS-CoV epidemic, the healthcare workers infection within our institution came to an abrupt halt with introduction of PPE against respiratory droplet infection, and exposure to other body fluids (detailed below), a testament to the efficacy of these protective measures when utilized correctly (4).

PPE is as per standard contact and airborne precautions, and should be donned prior to entry into the procedure room (Fig. 1). Besides gown and gloves, other pertinent component includes 1) protective eyewear to protect eye mucosa (goggles or disposable face shield that covers the front and sides of the face) and 2) respiratory protection (two types: N95 filtering facepiece respirator and powered air purifying respirator [PAPR]). Disposable N95 mask is sufficient for the majority of IR procedures, while the PAPR is reserved for procedures which are "cough/gag inducing" which increases the aerosolization load (e.g., endotracheal intubation) (5). IR units are best to discuss the use of appropriate use of PAPR with their respective infection control unit, in the context of IR procedures. For instance, use of PAPR should be considered during gastro-intestinal procedures (e.g., feed tube insertion and upper tract stenting) or during bronchial artery embolization for hemoptysis (4).

To assume that the COVID-19 outbreak would be the same as the SARS-CoV epidemic, would be overly simplistic and to ignore our prior experience. Significant strides have been made in our diagnostic capabilities, outbreak preparation and resourcing, as well as the unprecedented coordinated global effort. For the few of us who once again found ourselves back in the same trench, we are reminded that we are survivors but not victors of the SARS-CoV epidemic, as healthcare workers took casualties, and we lost friends and colleagues to the fight. Hopefully, with the lessons learned, the IR community can once again pull behind the medical fraternity in the fight against this old foe, but emerge victorious this time.

A B

Fig. 1. Personal protective equipment for IR.
A. Photograph of IR in sterile gown, using PAPR. PAPR is used for procedures that are considered high aerosolization (e.g., intubation, certain gastro-intestinal procedures). Operator is wearing two sets of sterile gown and gloves. 1) First layer of sterile gown and gloves, 2) followed by PAPR unit (3M™ Versaflo™ TR300, 3M), hood and air hose, 3) followed by final layer of sterile gown and gloves. Boots cover is optional as transmission is mainly droplets based. PAPR unit has battery life of 10 hours. **B.** Top layer of sterile gown lifted to reveal position of PAPR between two sets of sterile gown. IR = interventional radiologist, PAPR = powered air purifying respirator

Acknowledgments

We remember the sacrifice of our friends and colleagues, including the late Dr Alexandre Chao in the SARS-CoV epidemic, who taught us lessons which helped us prepare much better for this fight. We will also like to acknowledge the effort of the frontline medical and paramedical staff, as well as the healthcare volunteers in the current COVID-19 outbreak.

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