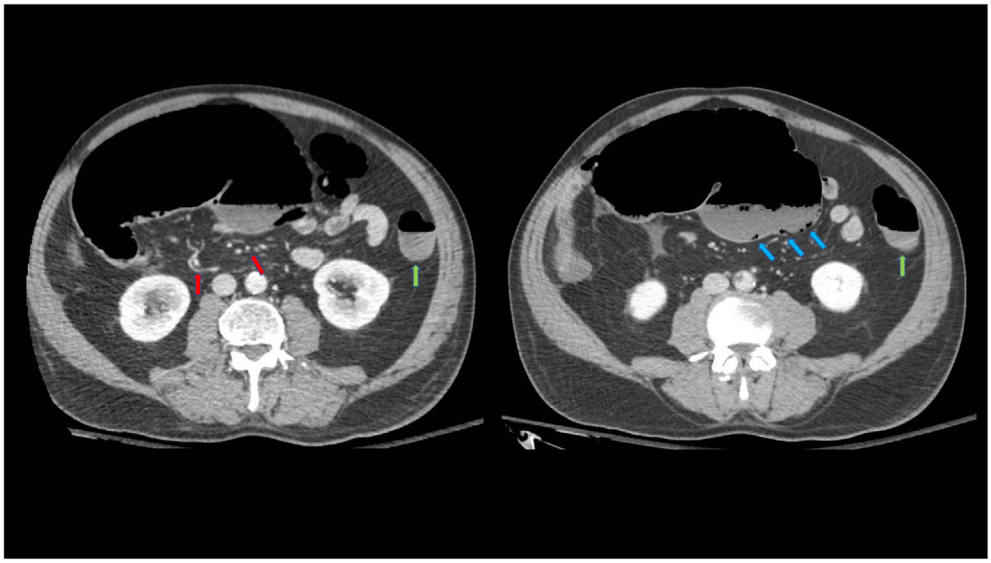

Fig 3. Marked dilatation of the caecum and ascending colon, with intestinal pneumatosis (blue arrows), patent mesenteric vessels (red arrows) and normal left colon (green arrows).

that revealed marked dilatation of the caecum and ascending colon, with intestinal pneumatosis and patent mesenteric vessels. The colonoscopy showed normal mucosa with atonic right colon. A colon decompression tube was inserted. Unfortunately, his clinical conditions progressively worsened and the patient deceased after 2 days.

The clinical manifestations of COVID-19 are multiform, and patients with abdominal symptoms should be thoroughly evaluated with bowel sonography, followed by CT scan and colonoscopy if necessary, because the abdominal examination often underestimates the severity of the eventual underlying disease.

Moreover, when COVID-19 patients need abdominal surgery, we encourage surgeons to investigate the intestinal blood flow intraoperatively (i.e. using fluorescence imaging), to look for intestinal vascular damage in surgical specimens and to perform microbiota and peritoneal fluid analysis whenever possible, to gain new significant data.

Author Contributions

Marco Lotti: Conceptualization; data curation; formal analysis; investigation; methodology; supervision; writing-original draft; writing-review and editing. **Michela Giulii Capponi:** Formal analysis; writing-original draft. **Stefano Magnone:** Data curation. **Luca Campanati:** Data curation. **alessandro lucianetti:** Data curation.

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doi: 10.1111/ans.16384

COVID-19 pandemic consciousness: droplet contamination and aerosolization during pleural decompression

In response to the current coronavirus disease 2019 (COVID-19) pandemic, it has been argued that pleural decompression (PD) is an aerosol-generating procedure (AGP) and that personal protective equipment (PPE) provides adequate protection. Droplet transmission occurs when infectious droplets, generally greater than 5–10 μm, come in contact with another person's mucosa. Conversely, airborne transmission occurs via droplet nuclei or aerosols. An aerosol is a suspension of particles (such as a liquid or solid particle) within a gas.[1] We investigated this by simulating and mapping viral droplet contamination during PD and intercostal catheter (ICC) insertion in the setting of trauma to elucidate the hazard to the clinician during this pandemic.

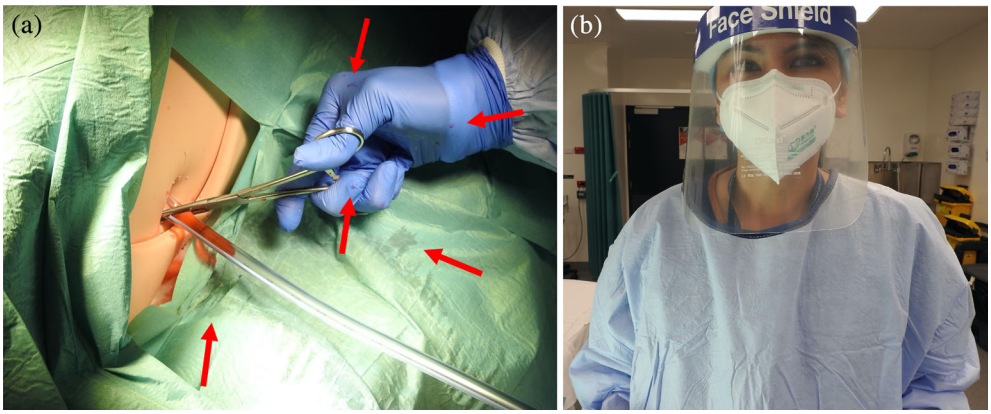

Fig 1. (a) Visible contamination of procedural field and proceduralist's gloves. (b) Proceduralist with no visible contamination to head, neck or chest of the proceduralist under normal lighting post-procedure.

Ethical approval was gained from the institutional review board. We constructed a model using the Life/form Chest Tube Manikin (3B Scientific, Hamburg, Germany), designed specifically for PD and ICC insertion.

To simulate a tension haemopneumothorax, the manikin's hemithoraces were filled with ~1000 mL of red-dyed water, 2 mm of 100 mg/mL fluorescein and ~500 mL of air.

The proceduralist was a Royal Australasian College of Surgeons Fellow in General Surgery and Trauma wearing the currently recommended PPE for AGPs, which included an N95 mask, a face shield visor, a surgical cap, a long-sleeved surgical gown and gloves.

The manikin was placed supine on an operating table. A standard open cut-down technique used by the Alfred Hospital Trauma Service was employed to decompress the right pleural space. A skin incision was made at the fifth intercostal space anterior to the midaxillary line, blunt dissection was carried out down through the chest wall and the pleural space was entered bluntly with a haemostat. A finger thoracostomy was performed and a 28-Fr ICC was then inserted into the right pleural space. The procedure was filmed, and photographs were taken in normal lighting and under blue light to visually assess fluorescent marker contamination.

Post-procedure, areas of red fluid were visible on both gloves, the right dominant forearm and waist of the gown. There was no visible contamination to head, neck or chest of the proceduralist under normal lighting (Fig. 1).

However, under blue light, droplet contamination not visible to the naked eye was visible extending onto the visor, both shoulders and chest (Figs 2,3).

COVID-19 caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in Wuhan, China, in late 2019. The World Health Organization declared a global health emergency on 31 January 2020.[2] The primary mode of SARS-CoV-2 transmission is thought to be via droplet transmission, as well as object and surface fomite contamination within the infected person's environment.[1] Airborne transmission of SARS-CoV-2 is considered possible during AGPs, including endotracheal intubation, bronchoscopy and positive pressure ventilation.[3]

Surgeons and emergency physicians commonly perform PD in the setting of trauma. Aerosolization is plausible when pressurized gas escapes from the pleural space. The British Thoracic Society recommends that level 2 PPE should be worn during PD, including an FFP-3 mask, visor, gloves and a long-sleeved gown.[4,5] It has been speculated that chest drains with active air leak may also potentially generate aerosols, as gas can bubble through the chest drain bottle and escape via the suction port.[6] However, literature/quantitative evidence on this subject is limited.

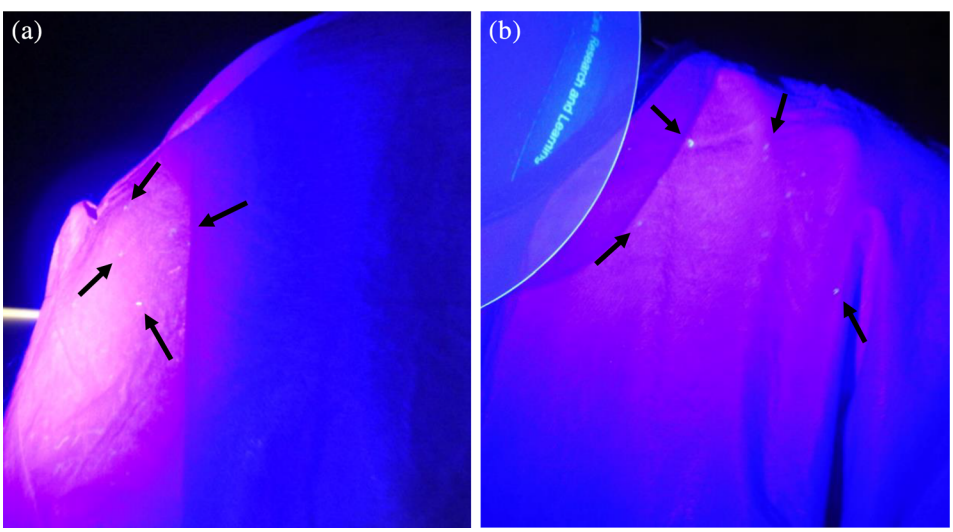

Fig 2. (a) Proceduralist's dominant right shoulder with visible contamination under blue light post-procedure. (b) Proceduralist's non-dominant left shoulder with visible contamination under blue light post-procedure.

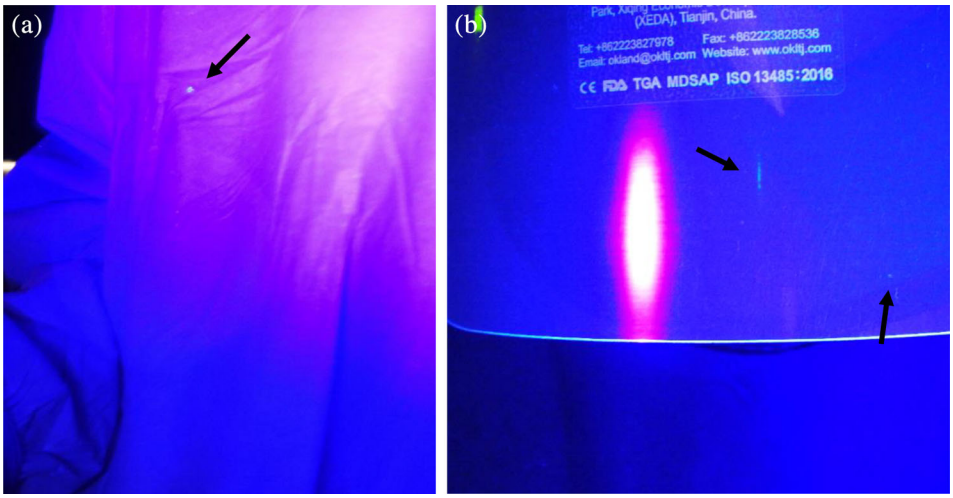

Fig 3. (a) Proceduralist's chest with visible contamination under blue light post-procedure. (b) Proceduralist's visor with visible contamination under blue light post-procedure.

We used a fluorescent agent widely used in infection control that can simulate contamination. It is commonly used for evaluation of hand hygiene in schools and industry settings, donning and doffing PPE, simulations for SARS and Ebola virus and assessing surgical contamination of equipment and splatter contamination in dental practices.[7–10]

In our simulation, we observed patches of the fluorescent marker extending onto the proceduralist's visor, shoulders and chest without visible red staining. In this simulation, the PPE described appeared to provide adequate barrier protection.

This re-emphasizes the caution required when performing PD. Appropriate PPE including a face shield visor, long-sleeved impermeable gown, respirator mask, impermeable footwear, surgical cap and gloves should be worn to provide aerosol barrier protection. Healthcare staff should advocate for the use of 'buddy surveillance' whilst doffing PPE wearables post PD to reduce the risk of self-contamination.

In conclusion, our simulation demonstrates that droplet contamination to the proceduralist occurs during PD. It is highly plausible that aerosolization occurs as well, although this may not be visible to the naked eye. There appears to be no other studies, to date, reporting on the evidence relating to this subject.

Author Contributions

Sunjuri Sun: Writing-original draft; writing-review and editing. **Nandhini Ravintharan:** Writing-original draft; writing-review and editing. **Karishma Jassal:** Conceptualization; writing-original draft. **Rohan Nandurkar:** Project administration. **Yesul Kim:** Project administration. **Ellaine Boo:** Project administration. **DeVilliers Smit:** Supervision. **Mark Fitzgerald:** Conceptualization; supervision.

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doi: 10.1111/ans.16388