



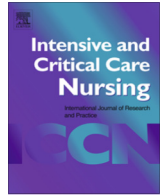
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Editorial

Ultrasound applications to support nursing care in critically ill COVID-19 patients



At the end of 2019, novel coronavirus pneumonitis (Coronavirus disease 2019, COVID-19) flared up in Wuhan, China. Soon thereafter the World Health Organization (WHO) characterised COVID-19 as a pandemic (Hansson et al., 2020; Pattison, 2020). COVID-19 carries great morbidity and mortality and aspects of excessive workload, strict PPE use, unseen clinical needs and comforting patients and family in difficult situations make this disease a huge challenge (Huang et al., 2020; Lucchini et al., 2020). Critical care ultrasound offer nurses the opportunity to execute some procedures with greater ease or safety. These include peripheral venous and arterial punctures, pulmonary physiotherapy, positioning of a gastric tube and skin protection. Following our experience of using critical care ultrasound in the epidemic in Wuhan, we summarised how ultrasound can be utilised in COVID-19 patients.

Low success rates of peripheral venous and arterial punctures

At grade III protection state (disposable working cap, protective glasses and/or protective face screen, medical protective mask, disposable protective clothing, disposable latex gloves, disposable shoe covers, quick-drying hand sanitiser), protective goggles can easily form fog, thereby hampering smooth insertion of the catheter. Ultrasound-guided puncture provides a higher chance of successful catheter placement. (Jahns et al., 2019). Under the condition of wearing two-layer gloves, the artery can be dynamically observed by ultrasound-guided catheterisation, which is helpful to locate the puncture point and guide the puncture.

Difficulty in positioning of a gastric tube

The placement of a nasogastric tube is the easiest and the most commonly used method to provide short-term enteral nutrition. Placement of a nasogastric tube might cause cough in patients, leading to the risk of spraying droplets and easily causing occupational exposure. (Walldorf et al., 2020). Moreover, at grade III protection state, ears are wrapped in protective clothing and gurgling sound cannot be heard by auscultation. If gastric contents cannot be aspirated through the gastric tube, it is very difficult to evaluate the correct positioning of the gastric tube (Andresen et al., 2016). Checking correct tube placement before initiating enteral tube feeding is absolutely necessary to avoid complications such as

aspiration pneumonia (Taylor et al., 2019). If a double-track sign was observed when scanning the oesophagus' long axis with ultrasound, then it is considered that a nasogastric tube has entered the oesophagus. Meanwhile, if a double-track sign is observed in the gastric body, then it can be judged as placed in the stomach. In addition, through water injection test, it can be judged whether a "Fogging" effect exists or not.

Monitoring of gastric residual volume with conventional method presents risk

The gastric residual volume should be monitored in severe COVID-19 patients with high aspiration risk every 4 hours, but drawing the gastric residue with a syringe presents the risk of splashing of gastric contents. There is good correlation between the "gastric antrum area measured by ultrasound gastric antral single-section method" and "gastric residual volume" (Schmitz et al., 2012). The use of ultrasound to measure gastric antrum area to assess the gastric residual volume substantially reduces the risk of a nurse's occupational exposure.

Difficulty to assess the effectiveness of postural chest physiotherapy

Postural chest physiotherapy is considered very important in severe COVID-19 patients and prone ventilation is often required. However, the effectiveness of postural chest physiotherapy is difficult to assess. Lung ultrasonography facilitates the determination of the duration and frequency of prone position ventilation. It dynamically monitors the disease progression and evaluates the effectiveness of the ongoing therapy based on the increase and decrease of B lines, B line zones, and consolidation area and volume. (Peng et al., 2020; Xirouchaki et al., 2014).

Difficulty to in detecting early, emergency events in COVID-19 patients

The condition of severe COVID-19 patients can change quickly. When the vital signs of patients change, ultrasound can be used to quickly exclude the underlying cause. For example, if a patient has dyspnoea and decreased blood oxygen saturation, the nurse can quickly judge the cause of it through lung ultrasound. When oliguria appears in severe COVID-19 patients, bladder ultrasound can be used effectively measure bladder volume.

Table 1
Critical care nursing difficulties and ultrasound application at personal protection equipment in Covid-19 patients management.

Difficulty	Ultrasound application
Peripheral venous and arterial punctures	Position arterial and vein, guide the puncture process
Positioning gastric tube	Double-track sign in esophagus long axis and gastric body, "Fogging" effect visualization (pushing salt solution through the tube and seeing it inside the stomach by ultrasound)
Gastric residual volume	gastric antrum area measured by using ultrasound gastric antral single-section method
Effectiveness of postural chest physiotherapy	Dynamic change of B lines(multifocal, discrete, or confluent), non-translobar and translobar consolidation
Oliguria	Bladder volume estimations calculated and Foley position assessment using ultrasound
Thrombosis screening	Lack of compressibility of the vessel, echogenic material within the lumen
Deep tissue injury in pressure ulcers	Unclear layered structure, hypoechoic lesion, discontinuous fascia, and heterogeneous hypoechoic area.

Conclusion

In summary, through visual qualitative and quantitative assessments (Table 1), critical ultrasound supports a goal-oriented care strategy that can be useful in the care for severe COVID-19 patients. In addition, the use of ultrasound allows the execution of nursing care with more advanced level of safety for the health-care worker.

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