

Vascular access in COVID-19 patients: Smart decisions for maximal safety

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Abstract

The 2020 COVID pandemic has forced everyone to update the usual medical procedures and adapt them to a new situation characterized by a high risk of contamination of the health operator. The placement of a venous access device is no exception. In the experience of the vascular access team of our hospital, hit by the COVID epidemic in March 2020, the safety of both the patient and the staff can be ensured by an insertion bundle of few smart strategies, which include choice of long dwelling peripheral catheters (midline catheters) rather than short venous cannulas; use of power injectable peripherally inserted central catheters in the COVID patients in intensive care unit requiring a central line; use of wireless probes—easy to carry, easy to clean—for ultrasound guided venipuncture; avoidance of x-rays, using alternative methods for tip location such as intracavitary electrocardiography or trans-thoracic echocardiography; strict adoption of the barrier precautions recommended by the international guidelines.

Keywords

COVID, coronavirus, venous access device, central venous catheter, PICC, midline, tip location, ultrasound guidance

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Approximately 1 month ago, the first patient with COVID-19 was identified in Northern Italy; 30 days later, more than 60,000 Italians have been contaminated and more than 6000 have died because of this disease. The medical and nursing staff of our 1300-bed University Hospital in Rome have been forced to change dramatically its daily routine and adapt to this unexpected health emergency. In particular, our multi-professional, multi-disciplinary vascular access team—that usually takes care of the insertion of most short-term and all medium-long term venous access devices (VAD) in our hospital (about 7,000 per year)—has faced the challenge of inserting VADs in suspected or confirmed cases of COVID-19, yet maintaining the maximal safety for both the operator and the patient. Grounded on the international recommendations of World Health Organization (WHO) and Centers of Disease Control and Prevention (CDC), as well as on our previous experience, we have rapidly developed a bundle of strategies apt to minimize the risks for our team, without giving up the basic principles of good clinical practice for reducing the potential complication associated to VAD insertion.

We report these few strategies, hoping that they might be useful to other vascular teams that are in our same situation right now or that might be (unfortunately) in the next future.

Wise choice of the peripheral VAD

Patients with suspected COVID-19 or with confirmed COVID-19 but without need for intensive care usually can be safely treated just with a peripheral venous access, for

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hydration, supportive therapy and blood sampling. In order to reduce as much as possible, the number of vascular procedures on these patients (considering that each maneuver is associated with the use of precious resources and some risk to the staff), we are currently adopting the policy of inserting power injectable polyurethane midline catheters (MC) in these non-intensive care patients. We refer to “standard” MC, 20–25 cm long, which have several advantages: long duration (several weeks), high flow, low risk of dislodgment, and feasibility of blood withdrawal.¹ To optimize the function of these VAD, we use ultrasound to assess that the location of the tip is in the axillary vein, just before the clavicle (in our experience this is the ideal position for ensuring easy blood sampling).²

Wise choice of the central VAD

COVID patients in intensive care unit, on the other hand, require a central VAD for several purposes: fluid support, vasopressors, parenteral nutrition, hemodynamic monitoring, and repeated blood sampling. We think that the ideal central VAD in this situation is a power injectable peripherally inserted central catheter (PICC), either 5Fr double lumen or 6Fr triple lumen. Recent literature has shown that power injectable polyurethane, non-valved PICCs perform as good as centrally inserted central catheters (CICCs) in intensive care unit;^{3,4} in particular, they tolerate very high flow of infusion, they are appropriate for measurement of central venous pressure⁵ and for measurement of the cardiac output by thermodilution.^{6,7} The risk of thrombosis and infection is similar to CICCs and—for both devices—depends mainly on the insertion technique.⁸ Though, in COVID patients, PICC may have some specific advantages: its insertion and management is more compatible with an optimal respiratory care (particularly in the patient who wears non-invasive ventilation devices, or has a tracheostomy, or needs periodical pronation); also the site of insertion of PICC at midarm moves the operator far from the mouth and nose of the patient, hopefully reducing the risk of airborne contamination.

Wise choice of the technique of insertion

As much as all international recommendations currently recommend the use of ultrasound guidance for choosing, puncturing and cannulating the vein,^{9,10} in COVID patient we found extremely useful to adopt wireless ultrasound probes, preferably connected by wi-fi technology with the display of a smartphone or with a tablet. We have used these devices since a few years, mainly because they are easy to carry and more comfortable during bedside VAD insertion. Now we have discovered that they are precious, if not mandatory, in ultrasound maneuvers on COVID patients, since they are easily and rapidly cleaned with appropriate solution/wipes soon after the maneuver. Of

course, the wireless probe (with a linear transducer) is properly wrapped in a sterile cover, and the display (smartphone or tablet) in a non-sterile envelope. One other relevant issue in COVID patients is to avoid unnecessary x-rays (both as bedside x-ray in the ICU and as transport to the radiology suite), so to reduce the chances of contamination: thus, for proper assessment of the location of the tip of the central VAD, we use non-radiological methods such as intracavitary electrocardiography (IC-ECG) or trans-thoracic echocardiography (TTE), which have been using since many years and that are now recognized to be safer, more accurate and more cost-effective than chest-x-ray.^{9–11} TTE can be done very rapidly using wireless probes with convex, micro-convex or sectorial probe. IC-ECG can be performed using wireless ECG devices, dedicated to this technique, connected by Bluetooth technology to smartphones or tablets.

Adoption of the recommended precautions for avoiding contamination

Last but not least, insertion of MC and PICC is performed following the CDC recommendations for vascular access in COVID patients:¹² the operator must strictly adopt the “standard” maximal barrier precautions (hand hygiene, surgical mask, beret, sterile impermeable gown, sterile gloves, wide sterile drapes over the patient, appropriate sterile cover for the ultrasound probe); furthermore, the patient and all other persons in the room must wear a mask. The use of N95 mask is strongly recommended for aerosol generating procedures, which is usually not the case of VAD insertion, and in particular not when the VAD (MC or PICC) is inserted at the arm. Nonetheless, in COVID patients, a N95 mask should be always considered, and used appropriately (i.e. coupled with a surgical mask).

As COVID-19 unfortunately continues, it is important to focus on infection control. For this reason, we expect that more and more hospitals will have to develop local policies for vascular access insertion in these very special patients. We hope that these few suggestions from our VAD team can aid others to develop insertion bundles apt to minimize any possible harm to the patient and to the staff.


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