Arterial Emergencies During COVID-19: Ensuring Safety in Emergent Repair

Lessons learned from one Seattle center's experience.

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As the novel coronavirus, SARS-CoV-2, spread around the globe causing an infection known as COVID-19, hospital policies and procedures needed to be implemented quickly and on the fly to preserve supplies and protect hospital staff. This article provides lessons learned from a busy academic practice in Seattle, Washington—the heart of the United States ground zero for the COVID-19 pandemic.

BACKGROUND

The United States patient zero arrived on January 19, 2020, in Seattle after returning from a trip to Wuhan, China. The Centers for Disease Control and Prevention confirmed the patient's sputum sample was positive with COVID-19 on January 20. A month later, Dr. Helen Chu of the University of Washington ran COVID-19 tests, against a cease-and-desist order by the federal government, on 2,500 sputum samples used in another study of the flu virus. This action resulted in identifying the first community-acquired case in a 17-year-old boy who was asymptomatic and on the verge of returning to high school in Renton, Washington.

By early March, Seattle reported > 170 confirmed cases, including 22 deaths related to an outbreak at a skilled nursing facility. As a result of the increasing severity of the pandemic, leadership at the University of Washington Medicine canceled all work-related travel and halted all elective surgeries. As cases continued to climb in our region, our hospital began to conserve masks and other personal protective equipment (PPE).

Within the Division of Vascular Surgery, we decided to continue to offer surgery for patients with abdominal aortic aneurysms (AAAs) > 5.5 cm, dialysis access, and surgery for those with chronic limb-threatening ischemia (CLTI) with a potential for limb loss. However, by March 15, these decisions swiftly changed as a result of conversations with our colleagues Pierantonio Rimoldi and Germano Melissano in Milan, Italy. Their description of a health care system overrun by severe COVID-19 cases forced us to reevaluate the steps needed to manage our patients' needs.

Now, 5 months later, it is astonishing how our daily lives have changed. Our intent with this article is to provide lessons learned from our experience with this crisis. If we can offer even one small piece of information that might make a big difference in a different health care system, we will take that as a success.

VASCULAR TRAUMA

Upon shutting down all elective cases and being available only for true emergencies, we noticed an increase in the number of arterial emergencies. Penetrating vascular trauma initially spiked with gunshot wounds, both intentional and self-inflicted, in the city of Seattle. Our health system established a set of rules for dealing with these emergent cases.

The operating rooms were initially divided into COVID-19–positive and non–COVID-19 rooms, separated by a physical distance (we refer to them as East and West, respectively). The difference between these physical locations was that the operating rooms on the East side of the hospital could easily be converted to negative pressure ventilation rooms, which are preferable for the management of airborne infectious diseases. These operating rooms were therefore identified for COVID-19–positive patients.

The West-side operating rooms are all positive pressure ventilation rooms with the ability to perform 15 air exchanges per hour. Because of this, in the setting of an emergent case with unknown COVID-19 status, only those providers considered essential for the induction of the patient were present in the room during intubation. These few providers would don maximum PPE during this potentially highly contaminated portion of the surgical procedure. Liberal use of tourniquets for extremity vascular injuries allowed a pause of at least 30 minutes at the beginning of the case to allow all the air in the room to completely recycle with 99.9% efficiency.

Our essential faculty and providers were all fit tested for N95 respirator masks. If any provider failed a fit test, they were required to wear a PAPR (powered air-purifying respirator) hood, which decreased the ability to communicate dramatically for both speaking and hearing. We decided to make one of our hybrid operating theaters on the West side a COVID-19–positive room because we did not want to exclude high-quality imaging technology from being used for our urgent and emergent patients, especially given the high volume of ruptured AAAs that we historically see. This required that we cleverly protected all of our providers' lead with clear plastic bags, made special garbage containers in the room, created a "minimal cart" for the anesthesia providers, covered all cabinets that could not be closed or removed them from the room, and used a back room as a pass-through room to allow scrub nurses to bring supplies into that room so they could be collected by the nurse in the room separately (Figure 1).

Figure 1. Extra precautions for converting a hybrid operating room to a COVID-19–positive room. Outside the room: contact precautions cart with taped-off doffing zone and a yellow bin for dirty PAPR hoods (A); a donning cart and precautions signage (B); donning procedure signage, an N95/PAPR hood cart, red PPE disposal bin, and doffing procedure signage (C); all cabinets closed or placed outside of the operating room with alcohol-based hand disinfectant on an intravenous pole (D). Inside the room: additional PPE and disinfectant wipes (E); a pass-through area with closed cabinets (F).

The reality of the situation is that not many COVID-19–positive patients need surgery other than central line placement or extracorporeal membrane oxygenation cannulation. The ultimate goal in managing emergent vascular trauma is to safely perform a standard bypass or repair with the focus being to "protect the fighting strength" of the providers.

TEAM DIVISIONS

The consideration for surgeons and interventional specialists is determining our role in a pandemic and how we can continue to care for our patients without being a burden on the system. Resource use during a pandemic can be daunting, and the disposable PPE we use for procedures are a valuable commodity. We initially approached the pandemic with the idea that we needed to define what procedures were essential for vascular surgeons and which patients were truly elective versus emergent. We decided if a patient was seen in the clinic and scheduled for a procedure, then the patient was elective. This classification included AAAs > 5.5 cm as well as patients with CLTI or in need of dialysis access. Patients who were classified as emergent needed immediate care, such as a ruptured AAA and acute limb ischemia. Although we initially had some reservations about this classification, we felt that most elective patients do not undergo immediate intervention upon being seen, and many of these patients were hesitant to come to the hospital due to fear of contracting the virus.

The other aspect was how we, in a large academic system, ensure that we are available to take care of vascular emergencies. We quickly devised a rotation with one attending surgeon covering for a week and a second as backup. In addition, we divided our resident team to mirror the attending surgeons and used virtual platforms for education and team reports on our inpatients. By avoiding placing our entire team in the same room daily and the potential exposure that could wipe out a service at a hospital, we were able to effectively treat the emergent vascular patients.

At the University of Washington, we created a deployment pool for the faculty and residents. Our system encompasses four hospitals; therefore, it was imperative to have a system in place that could handle a large volume of ill patients. A graduate medical education–based surge management tool was created to allow trainees and faculty to rotate at sites that were needed to man the COVID-19 units. In particular, 90% of deployments were required to fill intensive care unit needs with 5-day rotations created with enough time off between these deployments to ensure rest as well as testing for potential exposure before the resumption of normal duties. Numerous trainees volunteered for these duties, and it was impressive to see their spirit in wanting to do something to help. These shifts were grueling for those residents and faculty who participated, being in full PPE and caring for sick patients on ventilators. Many of

the procedurally oriented trainees were involved in these rotations and were coveted for their skill in placing invasive lines and their comfort level with treating very sick patients.

Capacity in the hospital was created because elective procedures were halted, and as the number of COVID-19 patients increased, we were able to absorb this volume. Interestingly, when the Washington governor's mandate on elective procedures was lifted, we did not note any ruptured AAAs from those that were postponed electively. In addition, the number of acute aortic dissections did not increase, and none of the patients with CLTI who were postponed for 3 weeks underwent major amputation. We have noted recently several patients who presented with very advanced tissue loss and required an amputation who were afraid to come to the hospital earlier for intervention.

CONCLUSION

We have resumed our normal pace of procedures and incorporated COVID-19 testing within 72 hours of any elective procedure. For patients who require emergent treatment, we perform these procedures using full PPE with N95 masks or PAPR hoods as indicated until their test is performed and is negative. We have not encountered a positive COVID-19 test in our emergent vascular patients thus far, but these precautions will continue for the foreseeable future.

Our service has been very busy of late, and we have successfully been able to navigate elective and emergent cases at our institution. As the financial and educational implications of the pandemic are realized, we must remain nimble in our pursuit of safely caring for patients as well as providers and continuously evolve our capabilities. This situation will not change until we have an effective vaccine, but the lessons we have learned from the first wave of this pandemic should serve us well, as it is likely we will encounter another surge of patients in the near future. ■

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