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Novel Multidisciplinary Vascular Access Team Helps to Improve ICU Workflow Amidst Covid-19 Pandemic

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Brief Report

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Abstract

Objective: The surge in critically ill patients has pressured hospitals to expand their intensive care unit capacities and critical care staff. This was difficult given the country's shortage of intensivists. This paper describes the implementation of a multidisciplinary central line placement team and its impact in reducing the vascular access workload of ICU physicians during the height of the COVID-19 pandemic.

Methods: Vascular surgeons, interventionalists, and anesthesiologists, were redeployed to the ICU Access team to place central and arterial lines. Nurses with expertise in vascular access were recruited to the team to streamline consultation and assist with line placement.

Results: While 51 central and arterial lines were placed per 100 ICU patients in 2019, there were 87 central and arterial lines placed per 100 COVID-19 ICU patients in the sole month of April, 2020. The ICU Access Team placed 107 of the 226 vascular access devices in April 2020, reducing the procedure-related workload of ICU treating teams by 46%.

Conclusions: The ICU Access Team was able to complete a large proportion of vascular access insertions without reported complications. Given another mass casualty event, this ICU Access Team could be reassembled to rapidly meet the increased vascular access needs of patients.

Introduction

The current Coronavirus disease-2019 (COVID-19) pandemic has placed significant strain on the healthcare infrastructure as hospitals try to manage the rising number of patients admitted to their facilities. This strain is especially acute in the Intensive Care Units (ICU), where expanding the beds and staffing for the ICU can be challenging given the significant resources required, and the shortage of experienced nurses, critical care physicians, and support staff. In April 2020, at the height of the pandemic, our 1170-bed quaternary care academic hospital increased its ICU capacity from 94 to 233 beds to meet the increased demand for critical care facilities.

As part of the tiered staffing strategy, our institution created a mobile ICU Access Team to meet the heightened demand for vascular access and alleviate the burden on ICU providers who performed these procedures. Effective coordination of expertise and communication can lead to enhanced patient care, especially in a frequently changing and demanding pandemic environment.[1] Composed of nurses and physicians experienced in vascular access procedures, the team placed temporary Triple Lumen Catheters (TLCs), double-lumen Shiley Central Venous Catheters (CVCs), and arterial lines. In this paper, we describe the development of this multidisciplinary team and its impact in reducing the vascular access workload of ICU physicians, enabling them to oversee a greater number of patients.

Methods

Development of the ICU access team

The use of available staff with proficiency in vascular access procedures extended across multiple specialties. These included vascular surgeons, interventionalists, and anesthesiologists, who were redeployed to the mobile ICU vascular access team to place various central lines and arterial lines. All of the redeployed physicians had extensive experience performing vascular access procedures and were now available to add their expertise given the statewide suspension of elective surgeries. Nurses proficient in vascular access were recruited to the team to streamline the consultation process and assist with line placement.

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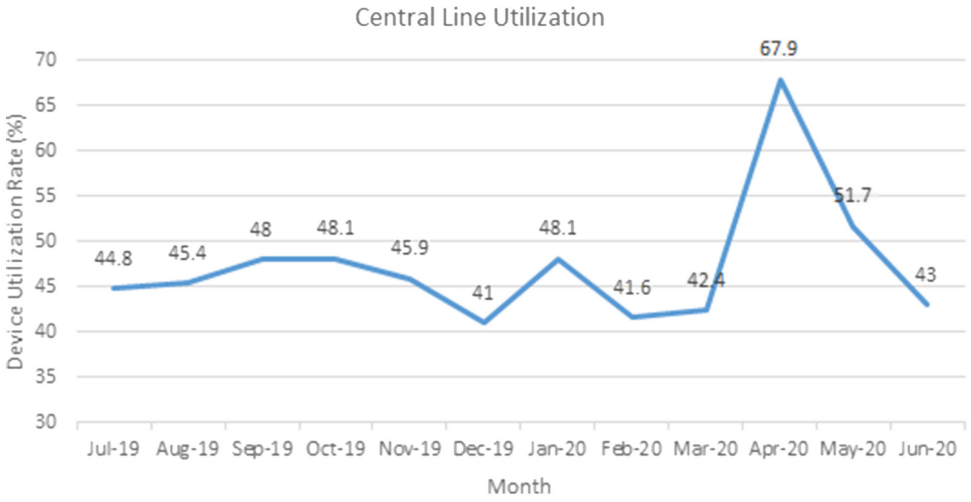

Figure 1. Central line utilization.

The ICU access process

The mobile ICU vascular access team was available 12 hours a day, 7 days a week, in 7 ICUs. Each multidisciplinary insertion team consisted of 1 or 2 physicians and 1 vascular access nurse. Redeployed physicians typically worked 3 or 4 8-hour shifts per week. When a vascular access personnel was needed, ICU providers would contact the mobile ICU vascular access team nurse via a dedicated phone line to identify a consult. The nurse triaged the patient and coordinated with the team physicians to schedule the catheter placement. The use of EPIC electronic medical record and USGPIV technology aided in the efficiency and communication of the team.

Once a consult was scheduled, the mobile ICU Vascular Access Team traveled to the patient's bedside to perform the required procedure. The vascular access nurses developed a supply cart to bring to the patient's location, which contained all the equipment needed to perform these procedures, including personal protective equipment (PPE), insertion kits, and extra sterile supplies. A total of 1 or 2 physicians would enter the room to evaluate the patient and select a site for line placement. Only necessary supplies for the planned line were taken into the patient's room. Furthermore, to mitigate the spread of COVID-19, all supplies brought inside the room were discarded after the procedure, regardless of whether they were utilized. In situations when 3 team members were available, the second physician assisted with insertion while the nurse was positioned outside the room to bring any additional needed equipment to the bedside. After the procedure, the team would remove and discard all PPE inside the room, perform hand hygiene, and exit. Once outside of the room, hand hygiene was repeated, facial protective gear was removed and cleaned, and hands were thoroughly washed with soap and water. The ultrasound machine and other reusable equipment were always cleaned by the ICU Vascular Access nurse, wearing full PPE, stationed outside of the room. If a nurse had assisted with insertion, PPE would be discarded inside of the room and replaced once outside of the room to clean the equipment.

Since the pandemic spread rapidly, each institution developed their own system processes. There were no specific recommendations from NYS Department of Health about vascular access interventions besides the foundational concepts like having enough PPE, proper masking, or expanding admission capacities. This meant hospitals quickly developed individual protocols to care for patients and adapt as the pandemic progressed.

Results

Historical data showed 51 central and arterial lines were placed per 100 ICU patients in 2019. In the sole month of April 2020, that number increased to 87 central and arterial lines per 100 ICU patients. Central line utilization (calculated by dividing the number of central line days by the number of patient days in the ICU)45.3% in the months prior to the pandemic and increased to 67.9% in April 2020 (Figure 1). The ICU Access Team placed 107 of the 226 vascular access devices placed in April 2020, reducing the procedure-related workload of ICU treating teams by 46%. Of these 107 lines, 40 were TLCs, 33 were dialysis catheters, and 34 were arterial lines. No insertion complications were recorded, which is comparable with the 0 complication rate before Covid-19. The average time from consult request to line insertion was 1.5 hours, which is the same as the time needed to place a catheter in the ICU before COVID-19 despite the increase in patients.

Limitations

Research limitation included the fact that we do not know how many patients would have been seen, or how long the time to insertion would have been without the ICU Access team in COVID-19 conditions so a comparison cannot be made. Also despite its success at our institution, several factors may limit the generalizability of this approach. The New York State Department of Health's decision to cancel elective surgeries resulted in a group of senior specialists becoming available for ICU line placement. In the absence of such a unique situation, a broader group of individuals including house staff would need to be identified, appropriately trained, and credentialed to take on these responsibilities.

Discussion

Strains on ICU capacity can ultimately lead to worse patient outcomes and higher mortality rates.[2] As the COVID-19 pandemic continues and resource shortages endure, innovations must be made to adequately care for the rising number of patients and

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vascular access needs in the ICU. Our ICU Access Team primarily consisted of senior specialists who were able to be redeployed due to the cancellation of elective surgeries. If elective surgeries were continued or another mass casualty event occurred in the future requiring the re-implementation of an ICU Access Team, other health care workers would need to be approached. Residents, fellows, and attending physicians from vascular and general surgery, anesthesia, interventional radiology, and cardiology, all normally possess adequate training to perform vascular access procedures with proficiency and would be good candidates to create a pool to draw from. By efficiently utilizing trained health-care providers in this way, we can help reduce the workload of ICU staff and care for a greater number of patients during times of need.

Conclusions

Many COVID-19 patients have ongoing acute respiratory failure, renal failure, sedation, and hemodynamic support requirements, all of which may necessitate CVC placement and invasive hemodynamic monitoring. Our data suggests that the COVID-19 pandemic not only created a surge in the number of patients admitted to our ICU's, but also given the severity of their illness, led to an increase in the requirement for invasive catheters. This initiative demonstrates that a mobile ICU Vascular Access Team was able to place vascular access catheters in a safe and timely manner. By taking on almost 50% of the vascular access responsibilities, they were able to reduce the ICU staff workload which could reduce physician burnout that could ultimately lead to medical errors. By minimizing the time spent on procedures, the ICU teams were able to focus on other aspects of the ICU care including updating decision makers on clinical plans and goals of care. Should another pandemic surge occur, a mobile ICU vascular access team can be quickly re-implemented to meet the vascular access needs of patients while ensuring that ICU staff are supported, and hospital resources are optimally utilized.

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