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## Alternative cardiac intensive care unit locations during the COVID-19 pandemic at an academic medical center

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Due to the COVID-19 pandemic, hospitals around the globe have been inundated with critically-ill patients, which necessitate airborne isolation precautions and alterations in Intensive Care Unit (ICU) nursing and provider practices.<sup>1</sup> In addition, the sheer number of patients have overwhelmed ICU bed capacity in some locations, with several reports of hospitals who were forced to make difficult triage decisions limiting care for critically-ill patients with and without COVID-19.<sup>2,3</sup> Several descriptions of expanding medical ICU bed capacity to accommodate COVID patients have been described.<sup>3,4</sup> In addition, tools have been developed to address patient flow.<sup>5</sup> Because of these issues there has been a need to develop creative approaches to rapidly increase COVID-19 ICU bed capacity by finding additional locations to manage non COVID critically ill patients, particularly cardiac. In this letter, we share our institution's strategy, which increased the total number of ICU beds and allowed us to care for greater numbers of patients with and without COVID-19.

Our hospital, Johns Hopkins Bayview Medical Center, is a 420-bed academic hospital that predominantly serves residents in urban and suburban Baltimore, Maryland. Prior to the COVID-19 crisis, there were 52 adult ICU beds spread between several units, including the Medical ICU (MICU – 12 beds), Cardiac ICU (CICU – 12 beds), Neuro Critical Care Unit (NCCU – 8 beds), Surgical ICU (SICU – 10 beds), and Burn ICU (BICU – 10 beds). In March 2020, the greater number of patients with COVID necessitated ICU space that can accommodate specialized ventilation equipment. Thus, hospital leadership re-designated the 12-bed CICU into a COVID MICU, and a new location needed to be allocated for non-COVID critically ill patients (both cardiac and non-cardiac), which could allow for temporary transvenous pacemaker (TVP) insertion, right heart catheter placement, post-arrest targeted temperature management, invasive ventilatory support,

intra-aortic balloon pump management, continuous renal replacement therapy, and other CICU services. After many urgent meetings, nursing and physician leadership settled on an unorthodox solution by relocating the CICU to the post-anesthesia care unit (PACU), which could accommodate 10 patients. Below, we describe the process in relocating the CICU unit to the PACU and converting the CICU into a COVID ICU, including staff preparation, relocation of equipment, and building modifications.

### Relocation of the CICU to the post-operative care surgical recovery unit (PACU)

#### Nurse staffing

Moving the CICU into the PACU (PACU-CICU) while also maintaining COVID ICU services in the original CICU required significant staff preparation. In particular, there were insufficient numbers of CICU nurses to staff both units, thus, supplemental nursing staff were reassigned from several other units to serve in the PACU-CICU including the cardiac catheterization laboratory, intermediate care medical units (IMC), interventional radiology (IR), and post-operative care nurses (PACU) with ICU experience. In addition, several nurse practitioners and nurse anesthetists volunteered to serve as bedside PACU-CICU nurses.

Prior to the opening of the PACU-CICU, the supplemental nurses were provided orientation/refresher shifts in the original CICU, just prior to its conversion to a second COVID MICU. Many of these reallocated nurses had previous ICU training, and they were offered these orientation shifts to refresh and update their critical care knowledge and introduce them to current evidence-based practices in critical and coronary care medicine. Additional nursing support came from the hospital's internal ICU nursing float pool, as well as ICU nurses reassigned or shifted as census and/or acuity fluctuated from other units. Finally, one of the CICU assistant nurse managers, as well as several other experienced CICU nurses were reassigned to the new PACU-CICU, providing the expertise needed to care for the most complex cardiac patients and to mentor and support the supplemental staff.

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The small pool of experienced CICU nurses working in the PACU-CICU educated and supported PACU, IR, Cath lab, IMC, and other temporarily reassigned staff each shift throughout its duration as the relocated PACU-CICU. The reassigned nurses were mentored each shift in current evidence based practice regarding ventilator care and weaning, cardiac monitoring, PA catheters and hemodynamics, TVP care, and any/all other critical care monitoring and procedures that arose in the PACU-CICU. Despite the lack of traditional team-building activities due to crisis management workflows, a strong sense of teamwork was fostered between the many different nurses from various areas, who were willing to push outside their traditional comfort zones. Many nurses worked additional shifts, including additional off-shifts (night shifts and weekends) in order to provide coverage for patient care. The small pool of experienced CICU nurses working in the PACU-CICU voluntarily spread their shifts throughout the week, picking up extra nights and weekends to ensure at least one experienced CICU nurse was covering each shift. Experienced CICU nurses also functioned in the charge nurse role in order to support less-experienced staff, responded to Code calls for the rest of the hospital, served as the Bridge Team nurse for the Heart Attack Team, and performed CICU specific tasks or procedures (such as assisting with TVP insertion). This careful utilization of experienced CICU nurses allowed nurse-to-patient ratios to remain the same as pre-COVID standards and created an environment where less-experienced staff felt supported and less stressed.

Of note, the majority of the CICU nurses remained in the original CICU, converted to a second COVID MICU unit. Other CICU assistant patient care managers remained in the converted CICU, now COVID MICU, with the remaining CICU staff. This allowed for daily communication and collaboration between the assistant patient care managers regarding staffing and fluctuating patient acuity. The assistant managers could exchange staff between units each shift when acuity required specific skills, and additional experienced CICU nurses were needed in the PACU-CICU. Internal float pool or temporary travel nurses could also be utilized between the two units to provide additional coverage as the needs of patients varied from shift to shift.

#### Provider Staffing

Prior to the COVID-19 era, CICU provider staffing consisted of 1 attending cardiologist, 1 cardiology fellow, 3 interns, 3 second or third year internal medicine residents, and an occasional physician assistant resident. All of these providers transitioned to the new PACU-CICU. However, the resident call schedules were converted to a shift format. In addition to the medical providers, a clinical pharmacist, social worker, and case manager, consulted on each patient remotely. Respiratory therapists expanded their rotations to the relocated PACU-CICU.

The transition of the CICU to the PACU-CICU was operational from April to June 2020.

#### Respiratory

Our respiratory staff changed rotating patterns to include routine patient care in the PACU-CICU.

#### Equipment

All bedside cardiac monitors in the PACU-CICU were reprogrammed for cardiac critical care use. All potentially necessary equipment was relocated to the PACU-CICU including Continuous Renal Replacement Therapy (CRRT) machines, bedside ultrasound machines, targeted temperature management equipment, line insertion cart, and TVP and PA catheter bundles and supplies. Disposable supplies needed for

the new PACU-CICU were identified and a temporary stock room was allocated in the unit.

### Creation of a COVID ICU from the prior CICU

#### Structural accommodations

In order to create a biocontainment unit in the traditional CICU, facilities constructed an inner and outer chamber with the construction of doors from the corridor containing a donning and doffing area. Our clinical staff from various areas in the hospital were cross trained and redeployed to the donning and doffing areas as safety officers to ensure proper use of personal protective equipment (PPE). Appropriate signage was adhered to all surfaces.

All new HVAC, air exchange systems and HEPA filtration for negative pressure rooms were installed, so air from patient rooms could not escape into the hallways. We built new walls and doors to carve out anterooms and respite spaces for staff, who were adjusting to round-the-clock wardrobes of PPE. Virtually every department engaged with patient care and developed new workflows with great precision: linens, central sterile, materials management, food and nutrition, environmental services, pharmacy and the entire clinical staff.

#### Lessons learned

Prior to the transition of the CICU, there were detailed conversations conducted with pertinent stakeholders in the planning of such a conversion. The major issue was nursing staffing, including additional critical care staff for the additional ICU beds being created, as well as proper allocation of experienced Cardiac ICU trained staff to care for the cardiac-specific patient population. Training of nursing personnel in the care of critically ill cardiac patients is required prior to such relocation of a CICU, as well as proper division of experienced resources between the original CICU and the new PACU-CICU.<sup>6</sup> Patience and attention to detail is what contributes to success under these circumstances.<sup>7</sup>

#### Conclusion

The ability to address urgent pandemic challenges in an academic cardiology practice proves to be successful when multidisciplinary teams work closely together to plan the needs of critical care cardiology.

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