

EDITORIAL COMMENT

The Evolving Medical Complexity of the Modern Cardiac Intensive Care Unit*



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Ask yourself this question: “Am I ready to round in the cardiac intensive care unit (CICU)?” If the answer is yes, now consider this question: “As a cardiologist, how familiar am I with:

- Recently revised consensus definitions of sepsis and contemporary management bundles?
- Recognizing and comprehensively managing acute kidney injury?
- Choosing an evidence-based vasopressor strategy?
- Management of acute respiratory failure and mechanical ventilation?
- Overseeing patients requiring advanced mechanical circulatory support, such as extracorporeal membrane oxygenation?”

Should these topics make you apprehensive, you would not be alone. This reflects the changing patient mix in the CICU, a medical environment that has evolved dramatically in the past half-century.

The first CICUs were established more than 50 years ago in an effort to deliver more rapid defibrillation or cardiopulmonary resuscitation for patients after uncomplicated acute myocardial infarction. Much has changed since then: patients with uncomplicated acute myocardial infarction are now frequently managed in non-intensive care unit settings, whereas the contemporary CICU serves a

considerably more heterogeneous population of patients.

Due to the aging population, growing medical complexity of treated patients, and improved survival from complex cardiovascular and medical conditions, patients with advanced cardiac disease complicated by severe noncardiovascular comorbidities (e.g., sepsis or kidney injury in a patient on extracorporeal membrane oxygenation) are increasingly common in the CICU. Similarly, thanks to advances in procedural techniques, patients with severe noncardiovascular illness complicated by secondary cardiovascular comorbidities (e.g., type II myocardial infarction or septic cardiomyopathy) are also increasingly prevalent in the CICU environment. It seems clear that the landscape in the CICU has changed, but just how profound this change is has remained unquantified.

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In this issue of the *Journal*, Holland and Moss (1) provide useful information to answer this question, performing a single-center retrospective chart review of more than 1,000 consecutive CICU admissions over 13 months at a rural tertiary care academic medical center with a 10-bed CICU. Their CICU is staffed with a general cardiology fellow under the supervision of an attending cardiologist, a fairly typical arrangement in an academic setting. Most of the patients (70%) were “medical,” in that they had no surgical procedures performed during their stay. The median CICU duration of stay was 2 days, with a median 6-day hospital duration of stay. Patient follow-up reached 8 months. Notably, 6.6% CICU mortality and 12% hospital mortality was observed, with a 30-day rate of readmission of 19% for the same condition among survivors to hospital discharge.

A central finding in the study by Holland and Moss (1) was that, regardless of the reason for

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CICU admission, physiological failure of noncardiac organs (particularly lungs and kidneys) were key contributors to prolonged length of stay and higher mortality. Acute respiratory failure (ARF) and acute kidney injury (AKI) each developed in about 30% of the study population, and their effect on CICU duration of stay was substantial: compared with a median CICU duration of stay of 2 days in the cohort, incident ARF added 6.7 days, whereas incident AKI added 5.5 days to the CICU course. Furthermore, both were independent multivariable predictors of in-CICU mortality, with an odds ratio of 1.85 (interquartile range: 1.15 to 2.98) for AKI and 3.64 (interquartile range: 2.17 to 6.11) for ARF.

The impact of sepsis on CICU outcomes is another major finding of Holland and Moss (1). Although a primary diagnosis in only 5%, sepsis was present as a major contributing diagnosis in 3 times as many patients, or 16% in this cohort. Presumably, sepsis developed during the CICU course, possibly secondary to cardiac procedures or iatrogenic harms, including catheter-related or ventilator-related infections.

These findings have substantial significance for the cardiologist managing patients in the CICU. Although the modern cardiologist may be facile at addressing uncomplicated cardiogenic pulmonary edema, comprehensive management of ARF includes noninvasive positive pressure ventilation, familiarity with mechanical ventilation modes, prevention of ventilator-associated pneumonia and ventilator-induced lung injury, and appropriate management of daily spontaneous awakening and breathing trials. Because iatrogenic lung injury and an inability to quickly wean from ventilation both lead to adverse outcomes and longer stays in intensive care, attention to these details is routinely built into “bundles” of care in pulmonary and medical intensive care units. Analogously, insights into the mechanism of AKI may be relevant to parsing specific effects on outcomes and optimizing future care, such as a broader attention to blood pressure and cardiac output goals in cardiogenic shock, management of renal replacement therapies, appreciating the effects of venous pressure on visceral organs in decompensated heart failure, and multidisciplinary rounding with pharmacists and other practitioners to minimize nephrotoxicity of medications. Last, the importance of sepsis after CICU admission cannot be discounted; because sepsis affects one-sixth of CICU patients and carries a 2-fold risk of CICU mortality (odds ratio: 2.09; interquartile range: 1.22 to 3.58), cardiologists must be aware of the potential sources,

etiology, trajectory, and microbiology of sepsis in the CICU.

The work of Holland and Moss (1) confirms what is widely known: CICU patients are a vulnerable lot, with poor physiological and cardiac reserve, and numerous comorbidities, and thus are less able to tolerate critical illness. With such patients in mind, more integrated management with critical care specialists (“intensivists”) must be championed as the new standard of practice in the CICU. Much change is yet to occur: in a 2012 survey of U.S.-based CICU directors conducted by O’Malley et al. (2), cardiologist and intensivist comanagement was practiced in only 3% of CICUs, and 11% of American CICUs reported having no intensivist consultation available. Given recent data from Na et al. (3) suggesting that the presence of a cardiac intensivist may reduce mortality in a typical CICU environment, attitudes on CICU management and staffing needs must evolve, with at least comanagement between cardiologists and intensivists, and possibly sole management by a cardiac intensivist—a new specialist adept in both disciplines.

How can we train this generation of cardiac intensivists? A sea change in cardiovascular medical education will be needed, because there is limited emphasis on critical care training within general clinical fellowships, according to current Accreditation Council for Graduate Medical Education requirements for Cardiovascular Disease fellows (4). This gap has been recognized, and there are growing movements to embed more critical care training into the general cardiovascular fellowship, and to create a new accreditation for level III critical care cardiology, involving a separate year of dedicated critical care training (5). However, due to the limited workforce availability of cardiac intensivists, at the very least, mandated intensivist coinvolvement in the CICU is an advisable, practical strategy for the foreseeable future. This comanagement strategy may lead to challenges regarding the balance of responsibilities, as well as financial aspects of care, but it is reasonable to envision future evolution of the CICU to an environment staffed entirely by cardiovascular specialists with critical care training.

In the 50 years since Dr. Desmond Julian first described the concept of the “coronary care unit,” the CICU has evolved, now featuring patients with substantially more severe acute primary and secondary cardiovascular diseases. Your CICU is not your grandfather’s “coronary care unit.” The observations of Holland and Moss (1) strengthen the impetus to have a dedicated intensivist presence in the modern

CICU. The CICU will benefit from not only the medical knowledge input from an intensivist perspective, but also from the culture of quality improvement and focus on prevention of iatrogenic harms (e.g., ventilator-associated pneumonia, catheter-related bloodstream infection) central to management in a modern medical ICU setting. So...ask yourself the

question one more time: Are you ready to round in the CICU?

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