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FELLOWS-IN-TRAINING & EARLY CAREER PAGE

Cardiac Intensivism

A View From a Fellow-in-Training

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In a true and perfect form, imperturbability is indissolubly associated with wide experience and an intimate knowledge of the varied aspects of disease. With such advantages he is so equipped that no eventuality can disturb the mental equilibrium of the physician; the possibilities are always manifest, and the course of action clear.

—Sir William Osler (1)

Epidemiologic studies report a remarkable rise in intensive care unit (ICU) admissions from emergency departments (EDs) over the past decade in the United States, with an estimated absolute increase ranging from 49% to 79% (2,3). The most common causes for ICU admissions include nonspecified chest pain (with and without coronary syndrome), congestive heart failure, pneumonia, gastrointestinal bleeding, stroke, respiratory abnormality (including respiratory failure), and syncope (2). In concert with these findings, more than 1 in 3 U.S. adults have cardiovascular disease, with a projected incidence reaching 44% by 2030 (4). Collectively, this surge in intensive care demand with a disposition for cardiovascular pathology underscores the compelling need for specialized cardiac intensive care (5–8).

The middle of the 20th century marked a rapidly progressive time in critical care medicine (**Figure 1**). However, a paradigm shift in critical care and its constituency has precipitated over the past decade (5,6,9,10). Important contributive factors have resulted in this change. Foremost, the demographic composition of the coronary care unit (CCU) has become increasingly complex and predominantly comprised of cases wherein multiple comorbid processes are present. In 1 study, CCU admissions from 1989 to 2006 demonstrated an increase in the prevalence of noncardiac critical illnesses, including septic shock, acute kidney injury, respiratory failure, liver failure, and thrombocytopenia, among others (6). During the same period, the need for noncardiac procedures in the CCU, including bronchoscopy, endoscopy, and advanced airway management, rose (6). With the aging U.S. population, the consequent increase in elderly patients who have multiple comorbidities inextricably complicates care-management decisions and outcomes (10,11). Collectively, these epidemiologic trends reveal a heterogeneous patient case mix with a greater breadth of pathology compared to CCUs in the 20th century.

Second, hospital admissions over the past decade have a greater illness severity compared with those from the 1980s (11). Furthermore, a growing number of ED visits (+32% from 1999 to 2009), have resulted in ED crowding, triage delays, a disproportionate staff-to-patient workload, and bed assignment difficulties (12). Consequently, mean wait times in U.S. EDs have increased by 25% during this period (12,13). These collective circumstances limit continuous one-to-one nursing care and aggressive targeted therapy for ICU-level patients. These important changes have been compounded by increasing global pressures related to escalating healthcare costs, less funding, restrictions on staff duty hours, and a growing emphasis on performance metrics in the setting of a national shortage of intensivists (14–18). Inevitably, national policies will be implemented throughout U.S. hospitals, with keen focus on ICUs given the prohibitive costs associated with care in this population—consuming from 0.5% to 1.0% of the total U.S. gross domestic product (5,19–22).

Pertaining to these pressures, a number of studies have demonstrated significant reductions in ICU mortality, ICU length of stay, in-hospital mortality,

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TABLE 1 Dual Training Pathways in Cardiac Critical Care

	Training Rubric	Training Duration, yrs*	Clinical Time, Months*	Research Time, Months
Combined	Cardiology fellowship + Pulmonary-CCM fellowship	6	42	30
Combined	Cardiology fellowship + 2-yr CCM fellowship	5	36	24
Sequential	Cardiology fellowship + 1-yr CCM fellowship	4	36	12
Integrated	Cardiology fellowship with integrated CCM	4	30†	18†

*Listed values indicate *minimum* requirements for board certification per the American Board of Internal Medicine (32). †Clinical time may be customized to the goals of the trainee (i.e., 6 additional clinical months, if desired, may be added for a total of 36 months, with 6 fewer months for academic endeavors).

CCM = critical care medicine.

medical complications, and care-associated expenditures with a formally trained intensivist compared with other physicians (23-27). These findings underscore the unequivocal need for well-trained cardiovascular intensivists to meet present and projected critical care demands, with an intensivist deficit of 35% anticipated by 2030 (5,7,14-16,28-30).

A scientific statement from the American Heart Association has outlined avenues through which CCUs may integrate formal intensivist management (7). Potential strategies include shared rounding with a cardiologist and an intensivist in the CCU, multidisciplinary rounds in a combined medical and surgical ICU with multiple specialists (cardiologists, intensivists, surgeons, and anesthesiologists), niche units with disease-centric focus (similar to many existing heart failure units), or independent cardiac intensivist-driven CCU rounds (7). Indeed, although each may be potentially feasible, combination rounds—with an intensivist or multiple specialists, in the case of combined units—will further propagate the growing problem of fragmentation in clinical care, which is known to adversely affect patient outcomes (30,31). Niche units with a disease-centric approach may be difficult to implement as they inherently will be obliged to "bin" the emerging ICU demographic—with advanced disease in *multiple* organ systems—and may result in unit-to-unit friction as caregivers weigh the precedence of problems in different light.

Distinct from these venues is that of a dedicated cardiac intensivist, who offers the benefit of streamlined general critical care under the directive of a cardiovascular specialist. The manner in which each problem is weighed and handled requires the requisite knowledge depth of a cardiologist who can carefully place cardiac pathology in the context of multiple ongoing critical illnesses. Therefore, it is not surprising that this model has been deemed optimal for large tertiary care centers in a recent American Heart Association scientific statement (7). Current cardiovascular fellows-in-training (FITs) are ideally positioned to effect a change in the direction of cardiac critical care. There are a number of pathways that will allow for dual-board certification in critical care medicine and cardiology (**Table 1**). These include combining a full cardiology and pulmonary-critical care medicine (CCM) fellowship; combining a full cardiology and CCM fellowship; sequentially completing a 1-year focused CCM fellowship after cardiology fellowship; or integrating CCM training into cardiology fellowship. The American Board of Internal Medicine details the specific requirements necessary for each pathway with regard to fellowship training duration and the amount of time that trainees should spend performing clinical duties (**Table 1**) (32). Contingent upon the particular goals of a trainee, specific pathways may be most appropriate. In general, cardiovascular fellows have spent considerable time in training and therefore are less likely to enter into a second full fellowship in pulmonary-CCM. Additionally, the depth of knowledge that each specialty demands puts into question the ability to comprehensively navigate both cardiovascular and pulmonary specialties in a productive fashion. For most FITs, the sequential and integrated pathways conveniently offer full clinical training in both disciplines within a timeframe that reasonably parallels the cardiovascular subspecialties. A major benefit of the integrated pathway—generally arranged within an institution and coordinated between the 2 divisions—is that it allows for seamless integration of critical care curriculum, wherein ICU rotations from clinical cardiology training may be counted toward the 12-month CCM requirement (up to 6 months may be double counted) (32). This allows for less redundancy in clinical ICU time and makes available additional academic time for trainees so inclined. Alternately, FITs looking to focus their efforts on clinical experience may place emphasis on the clinical portion of their curriculum via the integrated pathway, or alternate avenues depending on total training time available.

Imperative to this training trajectory is the need for advanced planning. As a relatively young area within cardiovascular medicine, FITs face the challenge of securing programmatic and monetary support, particularly with integrated training. Ongoing discussions with cardiovascular and pulmonary-critical care fellowship directors will allow for institution-specific barriers to be addressed comprehensively prior to CCM training. Questions that often come up include: who will fund non-CCU clinical time, and

what time frame will CCM rotations be completed in? Furthermore, frequent interaction with program leadership allows trainees to develop a durable complementary research niche. Academic endeavors in cardiac intensive care are rich, with high-impact unanswered questions in coveted domains, including cardiac arrest, resuscitation medicine, pulmonary hypertension, heart failure, and mechanical assist devices.

The requisite skill-set of most pertinence for future cardiac intensivists is naturally within the cardiovascular domain, thereby making the cardiothoracic surgical ICU of clear necessity during CCM clinical training. Cardiothoracic surgical ICU rotations will enhance an FITs breadth of experience and depth of understanding in cardiac surgical pathology as well as perioperative cardiac complications. Depending on the institution and team structure, FITs may be given the opportunity to gain more hands-on experience as a primary operator in select procedures (i.e., intra-aortic balloon bump placement, extracorporeal membrane oxygenation cannulation, and emergent thoracotomy). A second rotation to consider is the trauma ICU, wherein experience with highest-acuity, whole-system resuscitative approaches is refined. Massive transfusion strategies and aggressive stabilizing measures for refractory shock are intimately centered upon the operative plan for a given patient, which allows trainees to become versed in perioperative shock management in a greater spectrum of pathology. The neurocritical care unit is also of importance, as this rotation provides a more sophisticated understanding of neurologic evaluation, which is particularly challenging in the rapidly growing era of targeted temperature management for cardiac arrest. Finally, the medical ICU offers various benefits to FITs, including the opportunity to learn endotracheal intubation and bronchoscopy as well as to perform as a junior attending alongside the attending physician of record in select cases. This experience provides invaluable time to develop team management skills, rounding structure, and multidisciplinary integration (with pharmacists, social work, and unit managers) as FITs transition to become independent cardiac intensivists.

Cardiac critical care is a relatively new frontier in cardiovascular medicine. CCUs now care for more complex patients who exhibit advanced multisystem pathology, the outcomes of which are objectively improved with intensivist-trained physician staffing. These collective findings mandate an active effort on the part of FITs to tailor their training such that they attain the requisite skills to take on this challenge for the new era of cardiac intensive care.

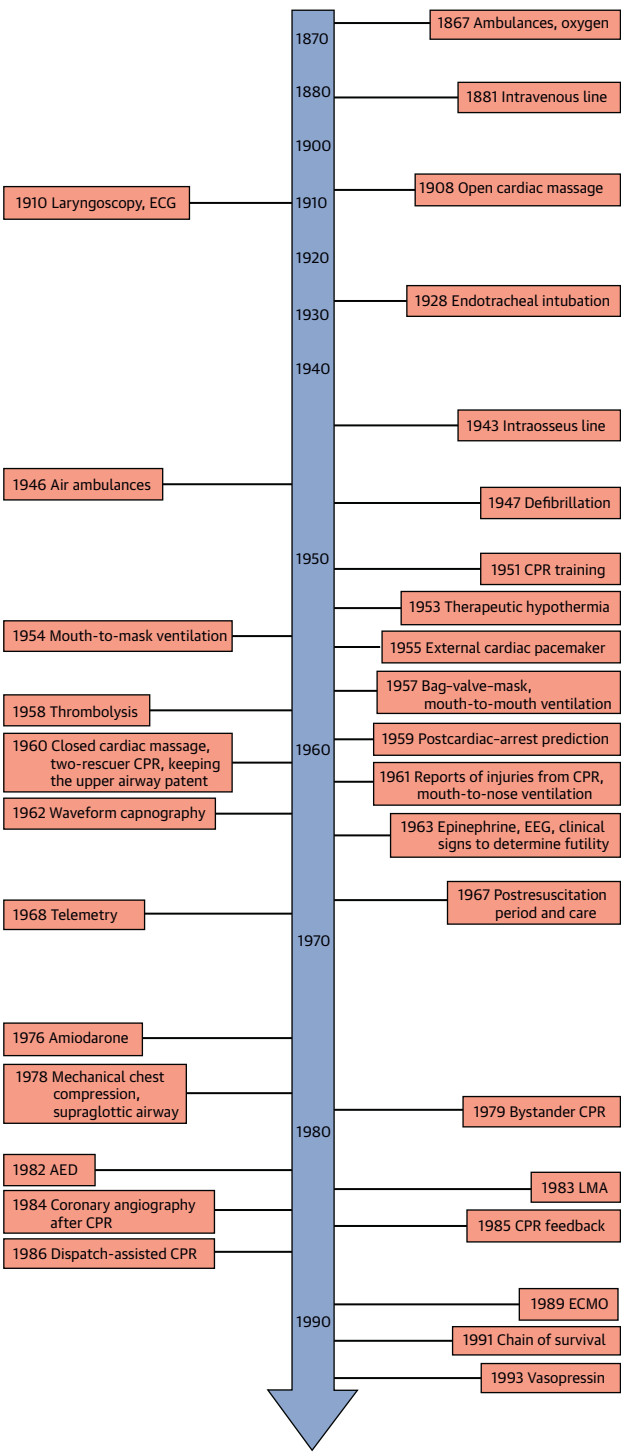

FIGURE 1 The Birth of Critical Care

Reprinted from Nolan et al. (33) with permission from Macmillan Publishers Ltd: Nature Reviews Cardiology. AED = automated external defibrillator; CPR = cardiopulmonary resuscitation; ECG = electrocardiogram; EEG = electroencephalogram; ECMO = extracorporeal membrane oxygenation; LMA = laryngeal mask airway.

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