

## EDITORIAL

# New ICCUs – a Modern Perspective on Acute Cardiac Care

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The first report describing a reduction in mortality from acute myocardial infarction (AMI) in patients admitted to a specialized care unit was published by Killip and Kimball in 1967. They demonstrated a mortality decrease from 26% to 7% if patients were admitted to dedicated units specialized for coronary care. This observation introduced the concept of Coronary Care Unit (CCU) and led to its rapid implementation in the following years.<sup>1</sup>

Taking into consideration the major impact of CCU, Killip and Kimball stated that “*the development of the CCU represents one of the most significant advances in the hospital practice of medicine*”, while in 1981, Braunwald considered that “*the development of the CCUs represents the single most important advance in the treatment of AMI*”.<sup>2</sup>

Various disease groups are currently admitted to intensive cardiac care units. According to data from the Blitz-3 registry, the most frequent pathology admitted to the CCUs is represented by acute coronary syndromes (over 50% NSTEMI or STEMI), followed by heart failure (14%), various types of arrhythmia and atrioventricular blocks (16%), while a minority of cases are represented by syncope, chest pain, post-PCI or post-surgery, pulmonary embolism, myo-pericarditis, cardiac tamponade, aortic dissection, or endocarditis.<sup>3</sup>

In parallel with the increase in the diversity of cases admitted to the CCUs, there is also a significant development in terms of case complexity, which is directly reflected in costs and mortality rates. The possible explanation for these facts are multiple. For instance, the implementation of STEMI networks allowed the survival of a significant cohort of patients with complex pathology,

including cardiogenic shock, renal failure, or multivesel disease. In parallel, effective regional networks allow the rapid transfer of critical patients to highly specialized CCUs, which increases the number of complex patients admitted to the CCU. In a study published by Daval *et al.*, the incidence of cardiogenic shock in the CCUs increased from 3.5% in 2003 to over 10% in 2010.<sup>4</sup> As a consequence, we faced a complex transition of dedicated cardiac units, from coronary care units focused on rapid resuscitation to units providing comprehensive critical care.

This complex development of nowadays cardiac intensive care units was the result of a significant progress in medical technology, treatment options, and medical training, to cover the needs arising from a changing patient population. While the first generation of CCUs were developed as special medical entities focused of STEMI patients with nurses as 1st responders, able to provide post-MI care, next-generation units evolved from rapid resuscitation to preventive intervention, aiming all ACS and heart failure cases with an expanded pharmacotherapeutic approach. As the result of a multifactorial transition, last-generation CCUs implemented comprehensive critical care based on invasive and noninvasive monitoring, mechanical circulatory support, renal replacement therapies, and advanced modes of ventilation, for patients with complex cardiovascular diseases and severe comorbidities.

As an image of this fast changing ground, in 2005 the Acute Cardiovascular Care Association gave the 1st endorsements regarding the structure, organization, and function of ICCUs, highlighting their role in ‘caring for

patients in the immediate aftermath of thrombolysis and with post-myocardial infarction complications'.<sup>5</sup>

Ten years later, on behalf of the changing patient population, an updated position paper gave the nowadays typical ICCU role as 'carrying for acute cardiac patients on 3 levels of complexity'.<sup>6</sup> Given that modern ICCUs ensure acute cardiovascular attendance for a broader field of cardiovascular pathologies involving variate levels of acuity and requests of care, in order to streamline resource allocation and results optimization, ICCUs acuity of care was graded and defined in three levels of expertise and technical requirement based on the case mix of patients with acute cardiovascular conditions.

Level I ICCU – enhanced cardiovascular units – mainly focus on patients with acute cardiovascular disorders associating increased risk for status deterioration, acute coronary syndromes, CHF without cardiogenic shock or arrhythmias, demanding intensive cardiovascular expertise, special resources or high-level continuous rhythm and hemodynamic monitoring. A level I ICCU should be able to provide 24/7 noninvasive monitoring, noninvasive ventilation, and medical staff with expertise for acute cardiovascular conditions.

Level II ICCU – cardiovascular high dependency units – address patients with acute cardiovascular pathologies requiring more advanced observation or management such as the need for central venous access or arterial line for monitoring and medication delivery, temporary cardiac pacing, and percutaneous ventricular assist device. Intermediate ICCUs should manage severe cases of CHF complicating an acute or chronic cardiac pathology. As it requires a 24/7 coronary interventional cath-lab, a level II ICCU should be, ideally, the hub of a STEMI network.

Level III ICCU – cardiovascular critical care units – refers to the management of level-3 patients presenting severe cardiovascular conditions requiring advanced monitoring, invasive mechanical ventilator support, kidney supportive care, or extracorporeal life support. A level III ICCU should be developed in tertiary or university hospitals with interventional treatment, anesthesiology, and cardiovascular surgical services available.

In order to optimize the management of acute cardiovascular cases, the current expertise recommendation regards ICCUs developing within a formalized regional network for acute CV conditions management.<sup>6</sup> The impact of the implementation of STEMI networks on AMI patient outcomes is unquestionable at this moment. Therefore, the implementation of an already-existing platform, represented by a STEMI network, could lead to similar results for other acute CV conditions. Those benefits may result

from the implementation of well-established transfer protocols, standardization of the procedures between the centers, and delays shortening.<sup>6</sup>

The implementation of modern ICCUs proved to be after all a life-saving strategy. The results of a study published by Soo Jin Na *et al.* demonstrated that a high-intensity staffed CCU management is an independent prognostic predictor for CCU mortality reduction in patients with cardiogenic shock (CS). In this study, the involvement of a cardiac intensivist in the CCU management of CS patients was associated with a significant reduction of in-hospital mortality.<sup>7</sup> Moreover, the experience of ICCU staff proved to have a major impact on clinical outcomes and mortality. In a study conducted by Stolker *et al.* on AMI patients admitted to ICCUs, centers with lower volumes of acute myocardial infarction admissions presented higher rates of ICCU and in-hospital mortality, and longer hospitalization.<sup>8</sup> At the same time, preliminary unpublished data from our center show that the implementation of dedicated protocols in a new ICCU led to a significant increase in the rate of urgent catheterization in NSTEMI patients, from 41.86% before the opening of the new ICCU in 2018 to 89.04% in present.

All these reports prove that a modern ICCU has a definite role in reducing mortality of acute cardiac patients, and the implementation of a regional network of acute cardiac care, on top of a pre-existing regional STEMI network, might be life-saving for patients presenting various types of cardiovascular emergencies.

## CONFLICT OF INTEREST

Nothing to declare.

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