STATUS QUO 2020: what have we learned so far in temporary mechanical circulatory support? Use of Impella beyond the cathlab: open issues and clinical needs

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In the past decade, the field of temporary mechanical circulatory support in patients with cardiogenic shock has been steadily growing with the increasing use of more powerful and complex support systems. New gaps are becoming evident to the clinical community. Indeed, the intensive care unit (ICU) environment is routinely challenged with this patient population, and notably, most patient management strategies to build survival occur during Mechanical Circulatory Support (MCS) support in the ICU.

However, ICU management and leadership are very different across each country in terms of structure; therefore, illness severities, responsibilities and competences vary greatly. As an example, some cardiac care units do not routinely manage patients on mechanical ventilation or on temporary circulatory support; by contrast, these patients are sometimes located in general ICU units without any specific expertise on cardiac diseases or advanced hemodynamic support driven by the need for intubation. Moreover, some countries have ‘active’ ICUs with 24/7 experienced physicians on duty, while others are mostly nurse driven with consultants available on call and junior residents in house overnight. Last, this patient population has a significant burden on logistics and resources and improving management would also benefit from this perspective. Along with the continuum of care that should be provided for patients transferred from the cardiac catheterization laboratory (cath lab), we envision a more prominent role in the ICU recognition of cardiogenic shock in settings besides acute coronary syndromes. Given the complexity of mechanical circulatory support, this will eventually challenge the clinical and technical skills of operators in these environments and increase the need for hemodynamic monitoring, echocardiography availability, etc., in the next future. This unified care (cath lab - ICU) should also be prepared to promptly respond to patient referrals; as a matter of fact, primary PCI centers do not automatically qualify as MCS centers. Ideally, immediate and pre-PCI MCS (ECMO or Impella unloading) should be available at all these sites, and thereafter, centralization to hub centers should follow structured pathways of care that qualify patients in need of ‘complex’ management or heart replacement therapies. Nevertheless, it is frequently current practice to extend the duration of Impella support in AMI patients beyond the duration of the interventional procedure, which results in the need for education and training in secondary centers.

This Supplement will focus on the critical points that can challenge a patient’s journey with Impella in the ICU in an attempt to offer practical tricks and tips to deliver best practices and improve outcomes despite a lack of controlled trials and hard evidence.

We believe that the cornerstone for a systematic approach in the ICU is to structure this EHJ supplement issue in a) standard ICU management, b) the identification/management of complications (device- and non-device-related), and c) treatment strategies (focusing on the primary disorder and circulatory support).

In regard to standard ICU management, we believe that it is fundamental to acknowledge the role of age, comorbidities, hemo-metabolic derangement, neurological status and end of life wishes in a sound clinical approach to expected outcomes and appropriate efforts in each individual patient. Moreover, interdisciplinary discussion on the opportunities and strategies of mechanical ventilation, differential diagnosis and treatment of inflammation vs
infection as well as the stratification and definition of mechanisms of renal dysfunction should be a structured part of consistent ICU management. Device-related complications should be systematically monitored, especially device placement and access site-related complications, and managed; this topic frequently challenges the issue of antithrombotic/antiplatelet strategies, which will also be discussed in the Supplement.

We strongly believe that no reasonable expectation can be drawn without a comprehensive diagnosis and understanding of the underlying hemodynamics leading to specific treatment for primary disorders with precipitated cardiogenic shock. This mostly refers to the timing and completeness of myocardial revascularization and to the complications secondary to massive myocardial infarction. In this regard, the strategy of Impella support should represent a complex interplay between the aim of recovering the native heart and the need to avoid multiorgan failure. Saving the heart and failing to restore global hemodynamics lead to multiorgan failure and death but saving end organs and losing the heart leads to heart transplantation, LVAD or death. In this regard, a chapter of the supplement will focus on the thorough pathophysiological identification of triggers for escalation or de-escalation of mechanical circulatory support, acknowledging that there is not a single technology that can currently serve all patients’ needs and that the different devices available should be used in cooperation rather than in competition with one another. Indeed, multidevice strategies are routine in top survival centers. In the specific setting of the ICU, the issue of timing and its key role in changing clinical history and mortality is associated with the acknowledgment that inotropic therapy is detrimental, as opposed to common ICU practices.

The chapter of hemodynamic monitoring is pivotal in expanding the concepts of monitoring options as well as the limitations and impact of punctual versus trend values; moreover, this chapter integrates a multifaceted vision of Impella support that embraces acute and late goals (management of pump failure/avoidance of LV remodeling and heart failure). Each parameter, moreover, has peculiar features in this clinical setting, and parameters, such as cardiac power output, have been validated in the context of cardiogenic shock and Impella support; additionally, the pulmonary artery catheter has been ‘resuscitated’ and deserves specific focus. Most recent technical development provides real time readings (Advanced Metrics, Impella Smart Assist) of these values on the display of the Automated Impella Console (AIC). Moreover, Impella Connect facilitates continuous remote monitoring of these values to optimize timely and efficient management of pump performance. Last, we still support the value of clinical judgment and acumen, as not all types of cardiogenic shock are the same.

We consider imaging as a crucial enhancement to hemodynamic monitoring, and the Supplement will offer a wide perspective of the opportunities for the imaging of Impella patients in the ICU, not only because different modalities can be used but also because different issues should be captured over time to guide management, improve device performance and ultimately improve outcomes. As a matter of fact, this is a continual interplay among the determination of hemodynamics, the assessment of pump-specific parameters, and the evolution of the primary disorder. In this regard, the issue of assessing heart recovery and mode as well as the timing of weaning is paramount in this scenario, and the Impella device has peculiar features that allow for native heart recovery, not only on a pathophysiological background of LV unloading but also via the opportunity of prolonged titratable support in a mobilized patient.

Last, the issue is also complemented by vascular access, the ECpella concept and device management by key opinion leaders.

The editors hope that this issue will be of interest to the readers of the European Heart Journal.

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