Monitoring and Management of Cardiogenic Shock

in Patients with end stage heart failure

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Monitoring

Cardiac failure with a low flow state, clinical and biochemical signs of hypoperfusion albeit increased filling pressure, is defined as cardiogenic shock (CS). Although the etiologic features of CS are often not easy to determine with routine hemodynamic monitoring tools, routine baseline hemodynamic variables have been shown to be strong predictors of outcome. In this situation, the goals of hemodynamic monitoring include preservation of multi-organ functions at a circulatory and microcirculatory level. Because most of patients with CS have hemodynamic instability, require vasopressor and frequent arterial blood gas assessment, direct arterial blood pressure measurement is preferred to non-invasive arterial BP monitoring. Pulmonary artery catheter and central venous catheter have been used as diagnostic and monitoring tool in patients with CS. However, as with all invasive tools, complications of central venous and pulmonary artery catheterization may occur and need to be recognized. Moreover, many issues encountered in daily ICU practice, such as rhythm disorders, cardiac pacing, high positive end-expiratory pressure ventilation, and irregular breathing patterns, can impede the proper interpretation of these pressures. Doppler echocardiography can help assessment of current hemodynamic status including preload, afterload, LV and RV function.

Management

Intravenous fluid replacement should be guided by measurement of the PCWP, arterial oxygen saturation (SaO2), systemic arterial pressure, and cardiac output. Despite the frequent use of catecholamines which are administered in most patients in CS, there is only limited evidence from randomized trials comparing catecholamines in CS. Furthermore, despite beneficial effects on hemodynamics, there are no randomized data showing a prognostic benefit. Because catecholamines increase myocardial oxygen consumption and vasoconstrictors may impair microcirculation as well as tissue perfusion, their use should be restricted to the shortest possible duration and the lowest possible dose. Lung-protective ventilation should be performed to prevent pulmonary injury. Urinary production should be measured and continuous renal

replacement therapy be initiated in case of acute renal failure. To overcome the limitations of inotropes and vasopressors with limited effects to maintain adequate perfusion pressure, prevent or reverse multi-organ dysfunction, mechanical circulatory support to improve hemodynamics and outcome became appealing. Intra-aortic balloon pump (IABP) has been further downgrading with a new class IIIA recommendation for the routine use in CS. There is currently only the indication for IABP use in mechanical complications with a IIaC recommendation. Extracorporeal membrane oxygenation devices support cardiopulmonary system simultaneously. However, main drawbacks of these devices are large cannula sizes potentially causing lower limb ischemia and bleeding complications, lack of direct left-ventricular unloading, rise in afterload, and a limited support time. Percutaneous left-ventricular assist devices can provide a pulsatile support using an extracorporeal membrane pump. There are multiple open issues remain in mechanical device therapy such as optimal timing of device insertion. A potential benefit of an early use at onset of CS could be prevention of multi-organ dysfunction. However, early use might lead to complications associated with invasive mechanical support devices. Furthermore, appropriate patient selection is important and currently often based on subjective criteria. Despite all these uncertainties, current guidelines recommend considering the use of mechanical circulatory support in refractory CS without any preference for device selection. In this lecture, I will discuss about these issues for monitoring and management of cardiogenic shock in patients with end stage heart failure.