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Advanced hemodynamic support in toxicology

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Cardiovascular impairment manifesting as cardiac dysfunction (cardiac failure, arrhythmia) or vascular failure (integrity, vascular tone) is not uncommon in toxicology. The goal of hemodynamic support is to maintain organ perfusion till cardiovascular failure resolves and the effects of the toxin wears out. Broad principles of cardiovascular support include optimization of preload, cardiac contractility and afterload. Conventional hemodynamic support relies on adequate fluid resuscitation, modulating afterload with vasoactive agents and augmenting cardiac contractility with inotropes.

Some patients fail to respond to conventional therapy and require advanced hemodynamic support in the form of pacing, intra-aortic balloon pump (IABP), percutaneous ventricular assist devices (VAD) or even more specialized therapy such as veno-arterial extra corporeal membrane oxygenation (VA ECMO). The application of these supports in toxicology has increased over the last decade.

IABP helps by decreasing ventricular afterload, which in turn can enhance cardiac output by about 20%. While this is usually the first line of mechanical circulatory support in cardiogenic shock of diverse etiology, IABP may not work effectively in some situations. Optimal functioning of the pump may be limited by ventricular arrhythmias that impede synchronization of the pump with the patient's cardiac activity. IABP also does not work in the setting of cardiac arrest. In such situations, VA ECMO has the advantage of supporting the failing circulation even in the setting of cardiac arrest. Mortality with ECMO, from the limited available evidence, has been reported to be lower when compared to conventional therapy. VAD, another form of advanced cardiac support is generally used in chronic cardiac conditions. However case reports have highlighted a potential role for VAD in vasodilatory shock due to drug overdose.

Presently, there is limited evidence for the use IABP, VAD or ECMO for cardiac impairment in toxicology. Its role is restricted to patients who are refractory to conventional hemodynamic support. Widespread use of advanced hemodynamic support is also precluded by cost, resource and expertise.

Further studies are needed to clarify criteria for circulatory unresponsiveness to conventional treatment and the indications for initiation of advanced hemodynamic support.