ICU
MANAGEMENT & PRACTICE

Mechanical Circulatory Support in Cardiogenic Shock

The 1967 case series by Killip and Kimball is a landmark study that reported an 81% in-hospital mortality rate for patients with acute myocardial infarction complicated by cardiogenic shock (AMICS). Since then, survival rates have improved significantly, with current in-hospital mortality reduced to approximately 40%. This progress is attributed to advancements in care systems, including the routine use of emergent reperfusion therapies and the creation of multidisciplinary shock teams. The establishment of long-term, advanced heart failure therapies has also played a critical role in improving patient outcomes.

Contemporary cardiogenic shock management often relies on a standardised, algorithmic approach, advocating for the early use of mechanical circulatory support (MCS). Over the past 15 years, MCS use in cardiogenic shock cases has increased due to its potential to enhance systemic and coronary perfusion, limit organ dysfunction, and support cardiac recovery. However, this approach has developed without robust evidence for MCS's effectiveness and safety, and its use has raised concerns due to associated complications such as bleeding, limb ischaemia, and haemolysis.

Recently, two clinical trials examined different MCS devices: venoarterial extracorporeal membrane oxygenation (VA-ECMO) and the Impella CP microaxial flow pump. The European ECLS-SHOCK trial, with 417 participants, found no survival benefit from early VA-ECMO use compared to standard care, noting increased bleeding and vascular complications. In contrast, the DanGer Shock RCT showed a mortality benefit for select patients using the Impella device, though it also reported higher risks of bleeding, vascular injury, and the need for renal replacement therapy.

The study enrolled patients with acute ST-elevation myocardial infarction (STEMI), biochemical evidence of hypoperfusion (lactate levels ≥2.5 mmol/L), and significant left ventricular heart failure (ejection fraction <0.45) without right heart failure. A crucial exclusion criterion was that participants could not be in a comatose state (Glasgow Coma Scale score ≥8) if they had experienced a cardiac arrest before randomisation, minimising the impact of postarrest anoxic brain injury on mortality. Consequently, the patient population eligible for the DanGer Shock trial likely represents a small subset of all AMI-CS patients.

The DanGer Shock trial, despite its carefully selected population, only just achieved its primary endpoint of all-cause mortality at 180 days. A small change in event numbers—just 1 to 2 more events in the MCS group or fewer in the control group—could have altered the trial's success. In an as-treated analysis that excluded patients in the control group who received MCS and those in the MCS group who did not, the confidence interval for treatment benefit crossed the line of unity. The fragility of these findings emphasises the need for clinicians to be careful and selective when determining patient eligibility for this treatment.

The applicability of the DanGer Shock trial's findings to broader patient populations may mirror results from larger observational studies on the Impella microaxial flow pump (MAFP), which have not demonstrated a mortality benefit. The benefits of MCS were primarily seen in patients with anterior AMI-CS, particularly those with more than 70% blockage. However, the trial indicated higher rates of complications, such as the need for renal replacement therapy and moderate to severe bleeding in the MAFP group. The trial found no benefit in the small cohort of women enrolled, suggesting that the margin of benefit for MCS therapy may be narrow, particularly among patients with multivessel coronary disease and lower blood pressure.

The DanGer Shock trial provides encouraging data on haemodynamics and the use of vasopressors and inotropes. The MAFP device was linked to reduced early administration of these medications, alongside nominally higher blood pressures and lower arterial lactate levels, with quicker lactate normalisation. However, a significant number of patients in the control group were stabilised within 72 hours and subsequently discharged from the ICU with favourable outcomes. This suggests selective use of MCS rather than routine application. While not supporting the left ventricle may risk losing potentially salvageable patients with AMI-CS, indiscriminate use of MCS could lead to excess complications that might outweigh any benefits.

Several key areas require further investigation. Establishing the role of right heart catheterisation and haemodynamic phenotyping to identify MCS candidates and guide device selection and management; enhancing diversity in trial enrollment, particularly including women, who may have different benefit/risk profiles due to the size of MCS devices; evaluating whether patients with non-STEMI AMI-CS experience similar benefits from MCS; and exploring the efficacy and safety of alternative MCS devices using a more selective study design.

These areas represent crucial opportunities for advancing knowledge and optimising MCS use in clinical practice.

Source: JAMA Cardiology
Image Credit: iStock

Published on : Mon, 4 Nov 2024