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Commentary: Incremental steps to solve challenging problems

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Surgeons recognized shock long ago. In 1862, Samuel Gross described shock as the rude unhooking of the machinery of life.¹ David Cheever stated in 1888, “It (surgery) has not prevented shock. This is still a cause of much fatality.”² The fundamental pathophysiology of shock was a career-long interest for Alfred Blaylock.³ Despite decades of research into the mechanisms of shock and methods to treat shock, including drugs and mechanical circulatory support devices, the mortality associated with acute cardiogenic shock (CS) remains high.

Recently, CS became the subject of studies from the CS Working Group.⁴ The group defined stages of CS and analyzed prospectively gathered outcome data. The heterogeneity of etiologies for CS, time until presentation, and variability in therapy for CS challenge investigators to define optimal treatment algorithms for management. In one analysis, the CS Working Group compared the prevalence of 8 therapeutic approaches across 5 stages of CS.⁴ Various combinations of therapies that included extracorporeal membrane oxygenation (ECMO), intra-aortic balloon pumps (IABP), and Impella ventricular assist devices (Abiomed, Danvers, Mass) were used in the most severe stages of CS (stages D and E). Defining optimal management will be difficult with so many permutations of CS severity and combinations of therapies to compare. Moreover, the patients have conditions ranging from subacute decompensation of chronic heart failure to sudden cardiovascular collapse. The urgency associated with severe CS

CENTRAL MESSAGE

Physicians treat cardiogenic shock (CS) with ECMO, but mortality remains high. Pre-ECMO IABP improved 180-day survival in patients with CS, emphasizing the importance of expeditious therapy for CS.

makes randomized controlled trials difficult, if not impossible.

ECMO is a powerful tool to manage patients with CS. However, patient mortality remains high. The present paper⁵ examines the effects of direct or indirect left ventricular unloading with an IABP or Impella on patient outcome for CS. The heterogeneity of etiologies for CS, severity of CS, and duration of CS before the initiation of therapy make meaningful comparisons of unloading strategies difficult in a small group of patients. The inclusion of patients placed on ECMO due to cardiopulmonary arrest with nonreturn of spontaneous circulation (patients who received extracorporeal cardiopulmonary resuscitation [ECPR]) further increases the degree of difficulty because patients who receive ECPR are at especially high risk for death, brain, or other end-organ injury and ventricular distension (VD). Recently published management guidelines for patients receiving ECPR suggest IABP, direct left ventricular venting, Impella, or atrial septostomy for relief of VD.⁶ These guidelines did not mention timing of venting or methods for diagnosing VD.

The present retrospective analysis of single-institution data⁵ does not provide definitive information, but it is a useful step forward. The authors' state “clinicians should not hesitate to place an IABP early on in patients who may ultimately require VA-ECMO support,” emphasizing the paramount importance of expeditious therapy for CS. A

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need clearly exists for additional research based on multi-center collaboration. Mock circulation studies and computational analyses that quantitatively describe the complex interactions of ECMO flow coupled with the effects of an Impella or an IABP are other promising approaches to guide research in this rapidly expanding field.^{7,8}

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Commentary: Left ventricular unloading: Getting it just right

Jason J. Han, MD, and Pavan Atluri, MD

Although cardiopulmonary rescue with peripheral venoarterial extracorporeal membrane oxygenation (VA-ECMO) may be life-saving for patients with acute cardiogenic shock as a bridge to recovery or more durable therapies, adequate left ventricular (LV) unloading is essential to avoid worsening LV distension and its potential sequelae, such as severe pulmonary edema and root thrombosis.^{1,2} Depending on clinical circumstances, patients require a combination of decreasing afterload, augmenting native contractility, or introducing other forms of mechanical support such as an intra-aortic balloon pump (IABP) or a percutaneous left ventricular assist device (eg, Impella).³

Pavan Atluri, MD (left), and Jason J. Han, MD (right)

CENTRAL MESSAGE

Approach toward left ventricular unloading during extracorporeal membrane oxygenation therapy may have important clinical implications.

However, understanding which approach is best in these scenarios remains one of the most elusive questions in the field. The heterogeneity of these patients' presentations renders it challenging to compare various strategies. Prospective trials are difficult to enroll, given these patients' acuity and dynamic clinical trajectories. Thus, the evidence on the clinical efficacy of these strategies remains mixed. In this context, large, retrospective cohort studies with granular hemodynamic data such as the study published in this issue of the *Journal* by Char and colleagues⁴ are highly

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