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STATE-OF-THE-ART REVIEW

Percutaneous Circulatory Assist Devices for High-Risk Coronary Intervention

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CME Objective for This Article: At the completion of this article, the learner should be able to: 1) consider the patient, anatomical and procedural characteristics that can elevate percutaneous coronary intervention to a high-risk procedure; 2) discuss the physiology underpinning the application of percutaneous circulatory assist devices for high risk percutaneous coronary intervention; and 3) determine which patients may benefit most from the utilization of the intra-aortic balloon pump, Impella, TandemHeart or extracorporeal membrane oxygenation.

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Percutaneous Circulatory Assist Devices for High-Risk Coronary Intervention

ABSTRACT

A unifying definition of what constitutes high-risk percutaneous coronary intervention remains elusive. This reflects the existence of several recognized patient, anatomic, and procedural characteristics that, when combined, can contribute to elevating risk. The relative inability to withstand the adverse hemodynamic sequelae of dysrhythmia, transient episodes of ischemia-reperfusion injury, or distal embolization of atherogenic material associated with coronary intervention serve as a common thread to tie this patient cohort together. This enhanced susceptibility to catastrophic hemodynamic collapse has triggered the development of percutaneous cardiac assist devices such as the intra-aortic balloon pump, Impella (Abiomed Inc., Danvers, Massachusetts), TandemHeart (CardiacAssist, Inc., Pittsburgh, Pennsylvania), and extracorporeal membranous oxygenation to provide adjunctive mechanical circulatory support. In this state-of-the-art review, we discuss the physiology underpinning their application. Thereafter, we examine the results of several randomized multicenter trials investigating their use in high-risk coronary intervention to determine which patients would benefit most from their implantation and whether there is a signal to delineate whether they should be used in an elective pre-procedure, standby, rescue, or routine post-procedure fashion. (J Am Coll Cardiol Intv 2015;8:229–44) © 2015 by the American College of Cardiology Foundation.

The evolution of percutaneous coronary intervention (PCI) has witnessed unprecedented advances in the past 2 decades. In the wake of such progress, interventional cardiologists are now attempting revascularization of more complex coronary anatomy in patients often declined for surgical intervention. Yet with greater complexity comes greater risk, hence the development of percutaneous mechanical circulatory support (MCS) devices. Borne from a sound physiological platform, in theory they serve to maintain coronary perfusion pressure and reduce myocardial workload, allowing the operator sufficient time to optimally complete the procedure. In this review, we highlight the criteria that elevate PCI to the high-risk category. Thereafter, we compare and contrast the physiology and evidence base underpinning MCS use to determine where these devices sit in the wider context of high-risk PCI.

WHAT DEFINES HIGH-RISK PCI?

A universally accepted definition of high-risk PCI remains elusive. This reflects the myriad adverse clinical, anatomic, and hemodynamic factors that, if taken in isolation, are potentially surmountable but

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