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Reply: Cardiogenic Shock Management Will Never Be All or None

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the *JACC: Cardiovascular Interventions* author instructions page.

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TO THE EDITOR

Management of Patients With Acute Myocardial Infarction and Cardiogenic Shock

We were interested to read the paper by Lemor et al. (1), which compared 198 patients from the NCSI (National Cardiogenic Shock Initiative) trial who were treated with either multivessel percutaneous coronary intervention (MV-PCI) or culprit-vessel PCI (CV-PCI) for acute myocardial infarction with cardiogenic shock (AMICS). Patients who underwent MV-PCI had a worse lactate (5.6 vs. 5.0 mg/dl) and cardiac output impairment (3.8 vs. 4.0 l/min) on presentation. Despite this, the 24-h post-intervention outcomes were similar.

Sabell et al. (2) analyzed a subset of 158 patients from the CardShock study (CardShock Study and Registry) to explore the association between angiographic results and 90-day mortality. Fifty-eight percent of patients survived post-operatively, and 81% of survivors had TIMI (Thrombolysis In Myocardial Infarction) flow grade 3 post-operatively compared with 60% of those who died. Moreover, the timing of cardiogenic shock (CS) played no role in patients with successful revascularization, with 32% of these patients developing CS pre-operatively and 34% developing CS post-operatively. Forty percent of survivors had single-vessel coronary artery disease, 34% had 2-vessel disease, and 26% had 3-vessel disease. Lemor et al. (1) did not explicitly subcategorize multivessel disease, and this an interesting perspective they may want to consider in the future.

Helgestad et al. (3) studied the use of mechanical circulatory support in patients with AMICS who were undergoing PCI between 2010 and 2017 from the Danish National Patient Registry. Forty patients were supported with early intra-aortic balloon pump, and 40 were supported with the Impella CP device (Abiomed, Danvers, Massachusetts), both were compared with matched control groups. Use of the early Impella CP resulted in a significantly lower 30-day mortality compared with the matched control group (40% vs. 77.5%; $p < 0.001$). Lemor et al. (1) did not specify which particular Impella device was included in their study.

We agree with the investigators that in patients with multivessel coronary artery disease who present with AMICS, MV-PCI of nonculprit lesions with early mechanical circulatory support is a safe and effective treatment protocol.

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REPLY: Cardiogenic Shock Management Will Never Be All or None

We read with interest the letters from Drs. Rao and Thiele and Khan and colleagues concerning our paper (1). Though randomized control trials (RCTs) are the gold standard of evidence-based medicine, simply dismissing the results of a well-conducted, prospective, single-arm study is unfair. In the past 2 decades, only ~2,500 patients have been enrolled into RCTs worldwide, representing <0.05% of cases (2). A single RCT, therefore, can and should be

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appropriately scrutinized. Patients enrolled into the CULPRIT-SHOCK (Culprit Lesion Only PCI versus Multi- vessel PCI in Cardiogenic Shock) trial were infrequently treated with mechanical circulatory support (MCS), unlike the patients in our study. Though MCS has yet to be sufficiently studied in an appropriately powered RCT, studies have demonstrated superior hemodynamic support and coronary perfusion with their use. Similarly, the use of an impractical revascularization strategy with the inclusion of chronic total occlusion percutaneous coronary intervention (PCI), may subject patients to the hemodynamic risks of PCI without the hemodynamic benefit of PCI, given the chronic nature of the occlusion. Hence, further study is warranted.

The National Cardiogenic Shock Initiative is the largest working group evaluating outcomes in acute myocardial infarction complicated by cardiogenic shock. It includes >60 sites and has enrolled >350 patients. Patients are enrolled using a shock definition and inclusion/exclusion criteria similar to previously conducted RCTs. The protocol was written in 2016, at which time both U.S. and European guidelines supported multivessel PCI (MV-PCI). In regard to MV-PCI, our protocol states, "We recommend against non-culprit PCI unless flow is impaired in the involved artery (i.e., less than TIMI [Thrombolysis In Myocardial Infarction] flow grade 3 and excluding chronic total occlusions); however, the ultimate decision of multi-vessel PCI lies with the primary operator." Our protocol recommendation was made before the results of the culprit shock trial with the understanding that complex hemodynamic changes occur during PCI. Balloon inflations cause transient cessation of blood flow and embolization, which can impair left ventricular function (3). However, selective MV-PCI may be appropriate in many settings as is mentioned by the 2017 European Society of Cardiology Task Force such as in the presence of multiple culprit arteries and in flow-limiting or severely obstructive lesions that jeopardize a large myocardial territory (4). Thus, the results of our study are important, given these scenarios frequently occur and may be better tolerated with the use of MCS.

We do regret that we did not report the odds ratio in the paper, which is included herein. The adjusted odds ratio for hospital survival was 1.70 (95% confidence interval: 0.79 to 3.63). Covariates included in the multivariate model included age, sex, and baseline comorbidities.

We read with interest the letter from Dr. Khan and colleagues. The Central Illustration subcategorizes patients on the basis of diseased vessels; 34% of patients (102 of 300) had single-vessel disease, 33% (100 of 300) had 2-vessel disease, and 33% (98 of 300) had 3-vessel disease (1). Similarly, Table 2 lists the Impella used (Abiomed, Danvers, Massachusetts): an Impella CP was used in 93.9% of patients, and an Impella 2.5 was used in 3.5% of patients.

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RESEARCH CORRESPONDENCE

Daycase Transcatheter Aortic Valve Replacement

Preliminary Experience

Transcatheter aortic valve replacement (TAVR) has evolved from a procedure requiring surgical vascular access and general anesthesia to one that can be performed routinely via percutaneous access using local anesthesia. As a result, the duration of hospital stay following TAVR has decreased, and next-day discharge has been shown to be safe for many patients (1). The primary reason for keeping patients in the hospital following TAVR is for cardiac