

EDITORIAL COMMENT

The “Right” Side of Cardiogenic Shock*



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Acute right ventricular (RV) failure remains a diagnostic and therapeutic challenge. Attention is often focused on the left ventricle (LV) in cases of cardiogenic shock, but the circulatory system involves the interdependence of LV and RV connected in series and in parallel (1). Patients with acute cardiogenic shock and RV dysfunction are at high risk of early mortality (2). The differential diagnosis of acute isolated RV failure includes myocardial infarction, pulmonary embolism, vasospasm, myocarditis, pulmonary arterial hypertension, and trauma (2). Identifying a specific etiology is crucial as therapy can range from mechanical or pharmacological removal of an obstructing thrombus to pulmonary vasodilators to inotropic support.

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In this issue of *JACC: Case Reports*, Carreras-Mora et al. (3) highlight a rare etiology of acute RV failure. They present a case of an 82-year-old woman who presented with hypotension, hypoxia, and elevation of cardiac biomarkers and lactate after recent trauma. Echocardiography revealed normal LV systolic function but a dilated and severely dysfunctional RV. The investigators rightfully considered myocardial infarction and pulmonary embolism as the most common etiologies of isolated RV failure and ruled out both with appropriate testing. Rapid resolution of RV

dysfunction led them to conclude that the etiology of the transient presentation in this patient was Takotsubo cardiomyopathy.

Whereas Takotsubo cardiomyopathy typically presents with apical dyskinesia of the LV, other presentations can be seen. This report adds to the sparse publications describing Takotsubo syndrome (TTS) with isolated RV involvement. The diagnosis of TTS can employ the use of diagnostic scores (this patient had low to intermediate probability by the InterTAK [International Takotsubo Registry] score) and, most importantly, multimodality imaging (4). There are now specific cardiac magnetic resonance imaging criteria for the diagnosis of TTS, including regional wall motion abnormalities, myocardial edema, and the absence of late gadolinium enhancement (4). Unfortunately, Carreras-Mora et al. (3) were unable to assess for edema in this patient, but they did demonstrate RV free wall dyskinesia and a lack of late gadolinium enhancement.

One aspect of this case is worth noting. The patient presented with severe hypoxia, which may have been due to right-to-left shunting through a patent foramen ovale in the setting of decreased RV compliance, although it raises the possibility of pulmonary or pulmonary vascular etiologies for the presentation. As was done in this case, it is important to comprehensively review biomarkers, noninvasive imaging, and invasive studies before determining TTS as the etiology of the cardiogenic shock.

We see this case as a keen opportunity to mention the value of multidisciplinary teams. As medicine becomes more complex and physicians more specialized, the multidisciplinary teams have become the standard at many institutions. In patients with acute RV failure, shock teams and Pulmonary Embolism Response Teams are instrumental to rapidly evaluate patients and allocate appropriate resources. These teams offer expertise of multiple specialists to diagnose, risk stratify, and offer therapy that best matches patient's risk profile (5,6).

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MANAGEMENT STRATEGIES

The main pillars of managing RV failure include optimization of RV preload, afterload, and contractility and addressing the underlying etiology. In this case, preload was only mildly elevated and afterload was normal, so the primary therapy was inotropic support, which was achieved with milrinone. Use of milrinone in RV failure is controversial due to the potential for systemic vasodilation to decrease right coronary perfusion, exacerbating RV dysfunction (2,7). In TTS, particularly, inotropes should be used with caution due to the proposed mechanism of elevated levels of circulating catecholamines causing cardiac dysfunction. However, milrinone may be a preferred agent due to previous descriptions of TTS occurring after dobutamine administration (8,9). In rare cases, mechanical circulatory support may be required to allow time for the cardiogenic shock to resolve.

As presented in the case, invasive hemodynamic parameters are of critical importance in patients with cardiogenic shock (3). There are several hemodynamic parameters used to assess RV function including pulmonary artery pulsatility index, pulmonary vascular resistance, and RV stroke work in-

dex. These indices are instrumental for a deeper understanding of the underlying pathophysiology and can assist in therapeutic decision making, including the appropriate mechanical circulatory support when required (10).

Takotsubo cardiomyopathy with isolated RV dysfunction is a rare diagnosis and requires an algorithmic approach to exclude more common etiologies of RV failure. Medical management is controversial and multidisciplinary teams may be helpful to establish the diagnosis and rapidly allocate appropriate resources.

One of the major benefits of the newly established *JACC: Case Reports* journal is to provide the forum for such excellent cases, as described by Carreras-Mora et al. (3) and perhaps teach us to consider even the rarest diagnoses.

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