

EDITORIAL

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Advancing care of the vulnerable and failing RV in the perioperative period

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RV dysfunction is an important and often underrecognized cause of perioperative morbidity and mortality (Houston et al., 2023; Shelley et al., 2024). It has been estimated that 70 million people in the United States alone have abnormal RV function (Lahm et al., 2018), but the true incidence of perioperative RV dysfunction remains unknown. Additionally, there have been few systematic attempts to quantify perioperative RV dysfunction. The existing reports that have assessed RV dysfunction following surgical procedures have used varying definitions and methods of assessment of RV failure (Shelley et al., 2024). Cardiac MRI, the gold standard assessment of RV function, is often not feasible in the perioperative period due to both availability and patient stability. The presentation of RV dysfunction is non-specific, presenting with signs of venous congestion and end-organ dysfunction that can be errantly attributed to other disease states (Murphy and Shelley 2019). RV failure can also present insidiously as it can lead to organ dysfunction from decreased perfusion pressure due to high venous pressure despite a normal MAP (McEvoy et al., 2024). In a study of 364 perioperative echocardiograms performed for unexplained hemodynamic instability, Markin et al. found RV systolic dysfunction occurred almost equally to LV systolic dysfunction both intra-operatively (9.9% vs 11.4%) and post-operatively (24.1% vs 22.2%) (Markin et al., 2015). Post-operative RV dysfunction has been associated with prolonged lengths of ICU and hospital stay, prolonged duration of mechanical ventilation, and

increased risk of complications like arrhythmias, renal dysfunction, and mortality (Shelley et al. 2024). By extension, RV dysfunction likely causes a significant financial burden on patients and the healthcare system.

Risk factors for RV dysfunction such as advanced age, HTN, DM, ischemic heart disease, and lung disease are overrepresented in our current surgical population (Shelley et al., 2024). Perioperative insults that cause increased RV afterload, RV chamber distortion, and decreased contractility all negatively impact RV function and contribute to the potential for the development of de novo RV dysfunction and failure or decompensation of pre-existing RV dysfunction. Cardiac surgical patients are at a particularly high risk for perioperative RV dysfunction due to the combination of higher baseline risks with the effects of cardiopulmonary bypass and perioperative medical and surgical interventions. RV dysfunction can lead to an impaired ability to respond to physiologic stress, which can cause symptoms that may limit a patient's daily activities. This may be due to the development of decreased RV contractile reserve, which has been demonstrated by increased perioperative RV dysfunction with exercise that can persist for weeks to months (Okada et al. 1994; McErlane et al 2023), a change that can significantly impact a patient's quality of life. Identifying when the normal response to perioperative insults, such as increased venous pressure and RV dilation, becomes pathological is a known challenge. The most diagnostic biomarkers and imaging techniques for this population have yet to be validated (Shelley et al., 2024).

It stands to reason that if providers can identify patients at high risk for developing RV failure and those with undiagnosed pre-existing RV dysfunction, then

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appropriate adjustments in clinical management may lead to improved patient outcomes and reduce healthcare costs. Unfortunately, there remains a significant knowledge gap in the identification, assessment, and management of RV dysfunction and failure in the perioperative period. A 2018 statement from the AHA concluded “it is remarkable how misunderstood are some basic concepts of right-sided heart dysfunction among practicing clinicians and the impact that such misunderstanding can have on appropriate patient management.” (Konstam et al. 2018). The Perioperative Quality Initiative IX (POQI-IX) group has taken on the substantial task of closing knowledge gaps of epidemiology and physiology of RVD and RVF in the perioperative period while also providing recommendations to improve the identification and management of patients with RVD and RVF.

The POQI group is an international, multispecialty, non-profit organization of experts in perioperative care made up of anesthesiologists, surgeons, hospitalists, intensivists, and nursing providers. They have created a reputation for providing high-quality recommendations for optimal perioperative care based on the available evidence through consensus conferences and subsequent published clinical recommendations using methods based on the Acute Disease Quality Initiative consensus conferences. Conference participants are selected based on their expertise. The POQI-IX group identified RV dysfunction and failure as a topic of interest. Literature pertaining to perioperative RVD and RVF was reviewed, and consensus statements interpreting the available data with recommendations to improve patient care were created using a multi-round modified Delphi technique with the GRADE system (McEvoy et al., 2024) and shared knowledge processes (Arora et al., 2024). The POQI-IX group is to be applauded for creating a highly effective, easily adoptable, and accessible review of RV physiology, epidemiology of RV dysfunction, assessment of RV function, and recommendations for perioperative management of these patients. These recommendations are all open access, with documents and infographics available at www.thepoqi.org.

Two focal points of the recommendations are the scoring systems, PIRRAAT and POQI9 RV Risk Score, proposed by the POQI-IX groups to help identify, assess, and risk stratify patients at-risk for RV dysfunction or failure in the perioperative period. While promising, it is important to note that these scores were derived from expert opinion and will require validation before they can be widely adopted. The POQI-IX Individualized Right Heart Risk Assessment Tool (PIRRAT) is proposed to be used pre-operatively to screen patients with no known advanced cardiac disease (O. Ibekwe et al., 2023). The PIRRAAT score includes known medical and surgical risk

factors along with the patient’s New York Heart Association Functional status to assign a score of 1 to 40. Further screening including BNP alone, BNP with echocardiography, and specialist referral is recommended for scores 11–20, >20, or abnormal additional screening, respectively (O. Ibekwe et al., 2023). Based on the PIRRAAT score and test results, patients can be placed in one of 5 RV function risk categories to optimize resource allocation and early response to decompensation of RV function. A second scoring system, the POQI9 RV Risk Score, considers the stress of the planned surgery on the RV, graded from 0 to 2, added to the patients RV function risk category to generate a score from 1 to 7 (Arora et al., 2024). This score is designed to guide planning for the level of anesthetic monitoring and potential treatment resources to optimally care for the patient in the perioperative period.

Although these recommendations and scoring systems have immense potential to improve patient outcomes, they are just a starting point for increasing recognition of risks for RVD and RVF and minimizing compounding insults during the perioperative period. There is much work yet to be done to optimize care for these patients and the first step is to establish a consensus definition of RV dysfunction and failure. Identification and validation of biomarkers and optimal modalities in this population will allow for improved recognition of RVD and RVF. Standardized definitions and testing modalities would also allow for the optimization of current medical therapies and more robust investigation of new therapies for the prevention and treatment of perioperative RV dysfunction. Again, while the scoring systems proposed have potential to improve patient outcomes, validation against usual standard practice in various practice settings and patient groups is needed. A renaissance of Swan-Ganz catheter use, both inside and outside of the ICU, for early recognition of venous congestion caused by RVD and RVF could lead to early identification of the decompensating RV and has potential to improve patient outcomes when used in appropriately selected patients. PA catheters may also improve mechanical circulatory support allocation for the failing RV and guide de-escalation of support after recovery as ECMO and percutaneous devices like the Impella RP become more widely available, but additional research into optimal timing and patient selection is needed (Arora et al., 2024). Finally, the establishment of centers with advanced capabilities to care for a failing RV and a referral network to these centers should be considered to improve access to expert care for patients in refractory shock from RV failure.

The POQI-IX group has created evidence-based, easily digestible, and effective publications to improve the identification and management of perioperative

RV dysfunction. Additional research, validation of risk scores, and coordination of care amongst hospital systems are potential starting points to further improve care for patients in the perioperative period. These endeavors should be prioritized, as further advancements have the potential to decrease healthcare costs and improve patient outcomes and quality of life.

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Authors' contributions

Contributions included in manuscript file.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Competing interests

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