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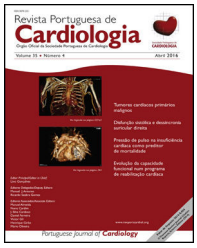

EDITORIAL COMMENT

# Risk prediction for adverse events in pediatric acute myocarditis: Are we there yet?

## Previsão de risco de eventos adversos na miocardite pediátrica aguda: estamos lá?

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Myocarditis, defined as an ''inflammatory disease of the heart muscle which is diagnosed by established histological, immunologic, and immune-histological criteria'',[1] has a variable clinical presentation. As such, an accurate diagnostic criterion is a topic of ongoing debate.[2–4] Further complicating our clinical approach is the lack of clear consensus regarding accurate risk prediction of adverse events following acute myocarditis, especially in the pediatric population. This educational gap requires correction for good clinical care of our patients.

In adults, the following independent risk factors have been utilized to develop a risk prediction model for in-hospital mortality in myocarditis: creatinine clearance <60 ml/min, age ≥50 years, ventricular tachycardia, a New York Heart Association (classification ≥3, male gender, and a troponin T level ≥50 μg/L.[5] Other studies have described immunohistological signs of inflammation, and lack of beta-blocker therapy as risk factors. However, histology and/or viral genome detection have not been recognized as predictors of a poor outcome.[6] Studies evaluating cardiac magnetic resonance imaging as a potential prognostic tool in patients with myocarditis describe an association between the presence of midwall late gadolinium enhancement (LGE) in the antero-septal segments and a higher mortality rate, compared with absent LGE or other LGE patterns.[7] However, such studies in the pediatric population are rare. A recent publication evaluating early predictors for poor outcomes in pediatric myocarditis suggested that the presence of left ventricular ejection fraction <30% on echocardiography at admission was the major predictor of a poor outcome. In addition, the authors concluded that younger age, a prolonged course of the disease, and N-terminal pro-brain natriuretic peptide levels could help to identify these high-risk patients.[8] In the specific population of children with acute fulminant myocarditis requiring intensive care unit admission, fever, arrhythmia, shock, higher inotrope score, need for ventilation, acidosis, acute kidney injury, transaminitis, and multiorgan dysfunction were associated with increased mortality.[9]

Krasic et al. aimed to describe the risk factors associated with adverse outcomes in pediatric myocarditis in their publication.[10] The authors defined adverse events as death or development of dilated cardiomyopathy. In their retrospective study design with a cohort of 62 patients, the authors concluded that the factors associated with a poor outcome were younger age, female gender, signs/symptoms of heart failure, polymerase chain reaction positive myocarditis and worse ventricular function by echocardiogram. Risk prediction for the development

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of adverse events following acute myocarditis remains the 'Holy Grail.' As the authors duly noted, there is a high percentage of adverse outcomes following acute myocarditis during the in-hospital stay and also in the follow-up period. In addition, dilated cardiomyopathy following acute myocarditis remains a leading cause of heart transplantation in the pediatric population.[10] Treatment for acute myocarditis is also an area of active research and there have been changes in recommendations in the recent past. While intravenous immunoglobulin (IVIG) was commonly used in the past, recent pediatric studies that have suggested some benefit, were also fraught with bias.[11,12] In the paper by Krasic et al., it is noteworthy that only 25% of patients received IVIG and of those, seven developed dilated cardiomyopathy and three died. The sample size in this study is not large enough to comment on efficacy and/or safety with intervention. Most pediatric studies remain limited to retrospective analyses with small patient numbers. While these studies provide an insight into the factors which may lead to an adverse event in a patient with acute myocarditis, they do not permit development of prospective risk-prediction models/scoring systems which may help determine the patients with the greatest need and best suited for initiation of earlier supportive and appropriate monitoring/therapy. An example of a disease process which has received significant attention in terms of risk prediction model development is hypertrophic cardiomyopathy.[13,14] The studies which have permitted development of such risk models have been large, multicenter observational studies with over 500 enrolled patients. Similar large scale studies are essential to enable the development of accurate models for acute myocarditis and dilated cardiomyopathy. Collaboration between multiple international centers may allow us to achieve this goal in the not so distant future.

## Conflicts of interest

The author has no conflicts of interest to declare.

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