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Is “good neurologic outcome” following cardiac arrest good enough?

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Survival from pediatric cardiac arrest, particularly in-hospital cardiac arrest, has significantly improved over the past 25 years from 10% in the 1980’s to approximately 45% in recent studies (1, 2). Out of hospital cardiac arrest survival has improved for select age groups from 2% up to 9% (3). Due to historically poor survival outcomes, the focus of these last decades has been on improving survival to hospital discharge. This has been accomplished by increased focus on early recognition of the arrest and high-quality cardiopulmonary resuscitation (CPR). Classification of neurologic outcome at discharge is typically reported based on the Utstein-style recommended Pediatric Cerebral Performance Category (PCPC) and the Glasgow-Pittsburgh Cerebral Performance Category (GPCPC), both gross scales of neurologic functioning (4–6). Until recently, resuscitation scientists have not had the luxury of looking at long-term survival or neurologic outcomes due to lack of survivors. Furthermore, due to the small number of survivors available for retrospective evaluation, quantification of their post-arrest neurologic dysfunction and its impact on overall quality of life has been challenging.

Van Zelle et al. usher in an important new era in pediatric cardiac arrest research by assessing health status and health-related quality of life (HR-QoL) metrics through patient and parent surveys, rather than retrospective assignment of PCPC categories (7). To our knowledge, this is the first study to not only report on the long-term health status of children after cardiac arrest, but also to include parental perceptions of their child’s post-arrest HR-QoL. The authors found that cardiac arrest survivors had a significantly lower health status compared to an age-matched normative population. The attributes included in the health status measure were vision, hearing, speech, ambulation, dexterity, emotion, cognition and pain. HR-QoL measures were also lower for cardiac arrest survivors in the domains of general, physical, and emotional health when rated by their parents, but no different than normative data when rated by children themselves. Interestingly, the family cohesion of

cardiac arrest survivors was higher compared to the normative data, and parents reported that they themselves had better physical, mental, and social functioning compared with normative data. It is unclear how to explain these later results, although the authors hypothesize “response shift” and “post-traumatic growth” as possibilities, highlighting that unfavorable outcomes are not as black and white as the objective data we use.

We applaud the authors for tackling the challenge of moving beyond traditional outcome scales and providing thought-provoking data that allow us to appreciate and re-examine the complexities of determining neurologic outcome and its impact on quality of life after acute brain injury. Defining outcomes after cardiac arrest is challenging at best, and is impacted by the timing of the assessment after the cardiac arrest, and the patient’s residual chronic medical conditions, neurologic function, and quality of life. The limited studies that report on the long-term outcomes of children following cardiac arrest have variable follow-up times and outcome measures. Van Zelle et al. assessed patients at approximately 5.6 (1.8, 11.9) years following cardiac arrest. A previous study showed 86% of discharge survivors alive at 5 years and 77% alive at 20 years, but did not report on neurologic function at those times (8). In a separate study, while almost 50% of patients died in the first year after hospital discharge, 84% of those alive at 1 year had a PCPC score of 1 or 2 (normal or mild deficit) (9).

While the PCPC categories are informative and provide objective metrics for comparing outcomes between populations, overall it is a coarse tool. Van Zelle et al. did not report PCPC categories, so it is not possible to determine what percentage of their patients with lower health status or HR-QoL would have been classified as having a good or poor neurologic outcome by that metric. While only 6 out of 47 survivors had “neurological impairments” defined by mental or physical disabilities, cerebral palsy, or epilepsy, up to 16 patients required ongoing rehabilitation therapies, had permanent behavioral or emotional changes, or required special education in school. These data highlight the difficulty in defining the long-term impact of brain injury from cardiac arrest. The components of the health status scale used by van Zelle et al. also raise important considerations relating to specific neurologic functions such as hearing, dexterity, and emotion which may not be accounted for in categorical scales like PCPC, but can have a profound impact on education, self-care, and quality of life.

Understanding the long-term implications of cardiac arrest survival is critical. As intensivists, this outcome information is essential for families when discussing prognosis and long-term outcome expectations early after cardiac arrest. The data reported by van Zelle and colleagues draw attention to some of the challenges parents face when caring for children with brain injury, and guide us to address how lower HR-QoL scores can be used to improve the long-term medical and psychological care for these patients and their families. We must remember that these data were obtained from a single European tertiary care center, where both normative quality of life data and post-arrest quality of life data may not be reflective of societal norms in other cultures. Further research is needed to help qualify and quantify the short- and long-term health status and HR-QoL deficiencies appreciated after cardiac arrest, and determine which therapies or services are most crucial to optimize recovery for patients and their family.

Advances in resuscitation science have substantially improved survival after cardiac arrest and now present us with an opportunity to conduct large prospective trials examining the long-term neurologic outcomes, including health status indices and HR-QoL measures, of children after cardiac arrest in a comprehensive way. These outcome data will be essential to improve the prognostic information provided to families by clinicians and serve as a foundation as new neuroprotective and neurorestorative therapies are introduced and vetted through clinical investigations.

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