Can we prevent poor outcomes for children who require long intensive care stays or early reoperations?

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The article in this issue of the *Journal* by Namachivayam and colleagues¹ retrospectively reviews the long-term survival and functional outcomes of 116 children with prolonged (>28 days) stay in the intensive care unit (ICU) after cardiac surgery between 1997 and 2012. The incidence of prolonged ICU stay was significantly greater in the more recent years, which was attributed to an increased population of children with hypoplastic left heart syndrome. Their long-term outcomes were poor, with 74% survival to ICU discharge and only 51% survival at 3 years. Among those who survived hospitalization, early reoperations, mainly for residual lesions and univentricular repair, were predictors of mortality at 3 years. The 3-year survival among those who required early reoperations was 58%, compared with 81% among those who did not ($P = .01$ by log-rank). Among survivors, 36% had either moderate or severe disability and 13% had poor quality of life.

This is the first large-scale study reporting long-term survival and functional data of children with long stays in the ICU of children after cardiac surgery, for which Namachivayam and colleagues¹ are to be congratulated. More knowledge of the various aspects of the care process of these patients and the different factors associated with results would help us to guide the care of these patients with the goal of improving outcomes. The need for early unplanned reoperation, mostly for residual lesions, negatively affected the long-term survival. One could assume that the prolonged ICU stay of these patients could be a surrogate for poor physiology related to residual lesions that necessitated corrective reoperations. Recent data on surgical technical performance scores in pediatric cardiac surgery^{2,3} showed that inadequate technical scores, as defined by the presence of significant residual lesions or the need for reintervention, were associated with both longer ICU stay and poor long-term survival. This is described by a "technical imperative," defined as an absolute rule whereby it is imperative to leave the operating room

with a good or, better yet, an optimal technical result. While this study of Namachivayam and colleagues¹ did not use technical performance scores, their predictors of long-term survival, such as the need for early reoperations, are essentially surrogates for inadequate technical performance scores and could be used to categorize patients at risk for poor outcomes.

Another tool for the surveillance of postoperative patients in the ICU at high risk for poor outcomes is the Pediatric Risk of Mortality III score at admission to the ICU, which has been found to be associated with poor technical performance scores and outcomes,⁴ or even better the newer Pediatric Index of Cardiac Surgical Intensive Care Mortality Risk Score for Pediatric Cardiac Critical Care, which has shown better discrimination for mortality.⁵

Further research into the causes of long ICU stay after cardiac surgery would allow us to intervene and prevent the long-term poor outcomes in this population as well as to counsel the parents appropriately regarding the long-term implications of a complicated and lengthy postoperative ICU stay.

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Central Message

Incidence of children requiring prolonged intensive care after cardiac surgery has increased. Long-term outcomes are poor, especially with univentricular repair and the need for early reoperations.

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