Commentary: Postoperative time to arrest—A new metric?

Syed Murfad Peer, MD, and Can Yerebakan, MD

From the Department of Cardiovascular Surgery, Children's National Heart Institute, The George Washington University School of Medicine and Health Sciences, Washington, DC.

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Address for reprints: Can Yerebakan, MD, Children's National Health System, The George Washington University School of Medicine and Health Sciences, 111 Michigan Ave NW, Washington, DC 20010 (E-mail: cyerebakan@childrensnational.org).

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Syed Murfad Peer, MD (left), and Can Yerebakan, MD (right).

Central Message

Postoperative cardiac arrest after congenital heart surgery: How much does its timing tell us?

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Refinement in surgical techniques, advances in cardiopulmonary bypass technology, and better perioperative cardiac critical care have led to continuous improvement in outcomes for patients undergoing congenital heart surgery.¹ Today, most congenital cardiac surgical procedures have a surgical mortality of less than 5%.² The risk of adverse events such as postoperative cardiac arrest, however, although low, has not been eliminated.

In this issue of the *Journal*, Dagan and colleagues³ investigate the association between timing of in-hospital cardiac arrest and postoperative mortality.³ A retrospective chart review of pediatric patients undergoing congenital heart surgery during a period of 9 years at the Royal Children's Hospital in Melbourne, Australia, was conducted. Dagan and colleagues³ report a 4.2% incidence of postcardiotomy in-hospital cardiac arrest. The timing of arrest was within 12 hours after surgery in 38% of the patients, in 12 to 48 hours in 19% of the patients, and later than 48 hours in 43% of the patients. Multivariable analysis revealed the timing of cardiac arrest to affect the outcomes adversely. Patients who had a cardiac arrest occur later than 48 hours after surgery had an 86% decrease in survival. Comparing the 2 groups of patients who had a cardiac arrest between 12 and 48 hours after surgery and later than 48 hours after surgery, it appears that the incidences of cardiac tamponade, residual lesions, and need for extracorporeal cardiopulmonary resuscitation (E-CPR) were similar. The incidence of low cardiac output state was higher among patients who had arrest occur 12 to 48 hours after surgery; however, survival was significantly lower in patients who had arrest occur later than 48 hours after surgery. Although all the patients who had in-hospital cardiac arrests occurring within 48 hours were resuscitated in the intensive care unit, about 23% of the patients who had arrest occur later than 48 hours after surgery had been shifted out of the intensive care unit. E-CPR was needed by 50% of the patients who had arrest occur later than 48 hours after surgery. Although further details about E-CPR location and protocol have not been

provided, these data do raise the question of efficacy of E-CPR in a non-intensive care unit setting. Although E-CPR does provide a final safety net in salvaging patients with reversible causes of cardiac arrest, it has significant implications on the overall outcome.⁴

Not many studies have looked at the association between timing of postoperative arrest and survival in patients undergoing congenital heart surgery. With significant reduction in surgical mortality, the focus now has shifted to the effective use of health care resources and the optimization of long-term outcomes, that is, neurodevelopment and quality of life after congenital heart surgery. A low-risk and straightforward surgical repair could indeed be complicated by a postoperative adverse event such as a cardiac arrest, which may be challenging to predict with standard algorithms. One of the interesting findings of this study is that cardiac tamponade was the cause of cardiac arrest in about one-third of the patients. This underscores the importance of maintaining active vigilance to rule out and treat preventable causes of late cardiac arrests, which carry a considerably lower survival according to this study. It is obviously of utmost importance to rule out significant residual lesions and subsequent postoperative problems before patients can be safely transferred to the unit. The use of simple diagnostic tools, such as bedside echocardiography, at postoperative admission to the intensive care unit, as indicated during the intensive care stay and at discharge, may prevent some of the late arrests on the ward.

Today, more patients with complex cardiac and extracardiac anomalies are being offered cardiac surgical repair worldwide. Despite the increased risk profile, there is an expectation of an excellent outcome in every case. More resources need to be directed toward risk stratification, preventive strategies, and treatment protocols aimed at the reduction and effective treatment of postoperative cardiac arrests. In the future, artificial intelligence and big data analytics could provide us with sophisticated software and tools for the accurate prediction of a postoperative cardiac arrest.^{5,6}

Dagan and colleagues³ are to be congratulated for their transparent presentation of their less favorable outcomes and for their excellent analysis, which should trigger further studies on this topic.

References

1. Khairy P, Ionescu-Ittu R, Mackie AS, Abrahamowicz M, Pilote L, Marelli AJ. Changing mortality in congenital heart disease. *J Am Coll Cardiol*. 2010;56:1149-57.
2. Jacobs JP, Mayer JE Jr, Pasquali SK, Hill KD, Overman DM, St Louis JD, et al. The Society of Thoracic Surgeons congenital heart surgery database: 2019 update on outcomes and quality. *Ann Thorac Surg*. January 11, 2019 [Epub ahead of print].
3. Dagan M, Butt W, d'Udekem Y, Namachivayam SP. Timing of in-hospital cardiac arrest after pediatric cardiac surgery: an important metric for quality improvement and prognostication? *J Thorac Cardiovasc Surg*. 2019;157:e401-6.
4. Werho DK, Pasquali SK, Yu S, Donohue J, Annich GM, Thiagarajan RR, et al; ELSO Member Centers. Epidemiology of stroke in pediatric cardiac surgical patients supported with extracorporeal membrane oxygenation. *Ann Thorac Surg*. 2015;100:1751-7.
5. Gupta P, Gossett JM, Kofos D, Rettiganti M. Creation of an empiric tool to predict ECMO deployment in pediatric respiratory or cardiac failure. *J Crit Care*. 2019; 49:21-6.
6. Sanchez-Pinto LN, Luo Y, Churpek MM. Big data and data science in critical care. *Chest*. 2018;154:1239-48.