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Commentary: Time is muscle

Christoph Haller, MD

Postoperative coronary artery complications are rare but dire events after repair of congenital heart disease. In this issue of the *Journal*, Goldsmith and colleagues¹ present an important study on postoperative angiography in patients with coronary artery obstruction. The authors identified all pediatric patients with postoperative obstructive coronary artery lesions on angiography over a time span of more than 15 years. They assessed the timing of angiography and subsequent intervention relative to the sentinel event at which a significant deviation from the clinical course raised the suspicion of coronary artery compromise and identified delay as a risk factor for death or transplantation listing. The study nicely delineates that early diagnosis and intervention are crucial to prevent death or persistent myocardial dysfunction. Patients with hypoplastic left heart syndrome had an increased risk of death or listing for transplantation.

In patients with congenital heart surgery, we frequently perform complex procedures that involve coronary arteries either directly or that are at risk of compromising coronary perfusion indirectly. If myocardial blood flow is impaired, the consequences are usually devastating and mandate swift action. However, in congenital cases, the invasive diagnostic armamentarium is commonly used more conservatively compared with adult patients with acquired coronary artery lesions. Echocardiography provides excellent imaging of the proximal coronary arteries and can frequently rule out major obstruction. Invasive angiography, especially in very small patients, also comes with procedural risk, such as peripheral vascular complications, severe arrhythmia, and injury of the heart or great vessels, although the procedure can be considered safe.² The options to intervene for coronary artery lesions can be limited. The study by Goldsmith and colleagues disproves a conservative approach, clearly highlighting the importance of maintaining a low threshold of suspicion for

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CENTRAL MESSAGE

Early detection of impaired myocardial blood flow is crucial and should lower the threshold for invasive diagnostic investigation.

coronary artery lesions and for early diagnostic confirmation thereof.

The severity of myocardial dysfunction in the study population is reflected by a 79% incidence of extracorporeal membrane oxygenation (ECMO) support at the time of catheterization and a mortality of 41% before hospital discharge. We have previously shown that early cardiac catheterization in patients on ECMO improves outcomes despite the relatively high procedural morbidity.³ Clinical decision making for or against coronary angiography in patients with clear signs of myocardial dysfunction and a high likelihood of an underlying coronary artery lesion is unequivocal; however, decision making is more complex after cardiac procedures that carry a low risk for coronary artery compromise and in patients with atypical clinical signs that are not easily attributed to coronary malperfusion alone. This study offers only a limited view on a patient population that was selected based on the presence of the coronary artery lesion itself.

Two aspects remain to be investigated further to guide clinicians in determining when to aggressively push for invasive coronary artery imaging and when to ward off a potentially unnecessary and harmful procedure. An analysis of echocardiographic imaging of the coronary arteries compared with coronary angiography is needed to define whether normal echocardiography results are sufficient to rule out coronary morbidity. Furthermore, the study population should be expanded to include all postoperative coronary angiographies irrespective of the confirmation of coronary artery lesions and to thoroughly describe the risk profile of the procedure. Both of these aspects would

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complete the picture and define risks and benefits more precisely.

Goldsmith and colleagues are clearly building the case for early diagnostic coronary angiography in patients with suspicion for myocardial ischemia after congenital cardiac surgery. Despite the poor outcome of coronary artery obstruction, it is encouraging that the majority of lesions were anatomic and amenable to intervention. Similar to the proven benefit of early intervention in adults with myocardial infarction,⁴ it is time to strengthen the old paradigm of “time is muscle” in pediatric patients as well.

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Commentary: Survival after coronary injury—it's about time

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In this issue of the *Journal*, Porras and colleagues¹ present the largest retrospective series of this era from a single institution analyzing acute coronary artery obstruction (CAO) following congenital heart disease surgery. It is noteworthy that out of 13,370 patients with congenital heart disease (CHD) who underwent open heart surgery requiring cardiopulmonary bypass (CPB), only 37 were found to have acute postoperative CAO. Out of these, 34 were analyzed. Although this represents a very small number from such a large population, the consequences of acute postoperative CAO remain devastating, with 79% of the patients requiring extracorporeal membrane oxygenation (ECMO) support at the time of cardiac catheterization, 59% experiencing a composite outcome of mortality or listing for transplantation, and a 41% mortality rate at discharge. Despite these humbling statistics associated with acute postoperative CAO, the authors validate the importance of early recognition and intervention.

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CENTRAL MESSAGE

Survival after postoperative coronary artery obstruction for congenital heart disease is dependent on timely recognition and intervention.

In their analysis, patients who experienced the foregoing composite outcome had significantly longer (more than double to almost triple) sentinel event to catheterization times, as well as significantly longer times from sentinel event to intervention. Furthermore, it is interesting to note that in their review, 65% of the operative notes raised no coronary concerns. Perhaps this is why a sentinel event, as defined by the authors, served as the starting point from which to measure the time to catheterization and intervention.

Our experience with acute postoperative CAO at the King Faisal Specialist Hospital and Research Center anecdotally mirrors the experience of the authors. The vast majority of such complications, although infrequent, have been associated with operations in which there has been direct technical

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