Commentary: A high index of suspicion for coronary problems after congenital heart surgery is critical

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Disclosures: Authors have nothing to disclose with regard to commercial support.

Received for publication Oct 1, 2019; revisions received Oct 1, 2019; accepted for publication Oct 1, 2019; available ahead of print Nov 7, 2019.

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J Thorac Cardiovasc Surg 2020;159:1966-7

0022-5223/\$36.00

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<https://doi.org/10.1016/j.jtcvs.2019.10.001>

Recently, a preteen patient who had undergone a complex arterial switch operation with a Lecompte maneuver as an infant underwent bioprosthetic pulmonary valve implantation and bilateral pulmonary artery plasties in our unit. The case was done on fibrillatory arrest with mild body hypothermia so as to not to have to dissect out the posteriorly located aortic root for crossclamping. The surgery was uneventful, including separation from cardiopulmonary bypass and extubation in the operating room. In the intensive care unit, she had nonspecific ST-segment changes that required escalating doses of pressors and were thought to be due to the imperfect myocardial protection afforded by the fibrillatory arrest, as opposed to cold cardioplegic arrest. An echocardiogram obtained in the early hours showed depressed left ventricular (LV) function with preserved right ventricular function. A repeat echocardiogram 2 hours later showed further decrease in LV function. She remained in hemodynamically stable condition. She was taken to the catheterization laboratory, where near complete occlusion of the left main coronary by the anterior bioprosthetic valve tip (Figure 1) was diagnosed. The patient was then taken to the operating room, where the bioprosthetic valve was reinserted in a different orientation. Her LV function did not improve significantly. A repeat catheterization showed widely patent left main coronary artery. At 3 postoperative months, the patient is clinically free of symptoms, but her LV function remains significantly depressed.

The study described in this issue of the *Journal* by Goldsmith and colleagues¹ of the Boston Children's team is an important contribution to the management of patients like the one described here. It is a retrospective analysis of 34 patients who had coronary artery obstruction after congenital heart surgery between 2000 and 2016. We learn that acute coronary obstruction occurs in about 0.25% of cardiopulmonary bypass cases. (This is likely an underestimate, however, because the patients included here all had

Pulmonary valve prosthesis tip impinging on the left main coronary artery.

Central Message

Coronary problems have to be actively thought out and dealt with promptly in cases of atypical postoperative course, even after operations that did not involve the coronary arteries.

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angiographic confirmation, and there are likely undiagnosed patients who die or have major complications without angiographic confirmation of coronary obstruction.) The most common procedures associated with acute coronary obstruction were the Norwood procedure, the arterial switch operation, and aortic valve repair or replacement. Nearly 80% of patients required mechanical circulatory support, and 56% died or were listed for heart transplantation, a pretty sobering statistic. Patients with hypoplastic left heart syndrome specifically were at higher risk of death or transplant. Finally, Goldsmith and colleagues¹ found that a threshold of 15 hours between the sentinel event and diagnosis in the cardiac catheterization laboratory was predictive of the composite outcome of death or listing for transplantation (89% vs 23%). In addition, each hour of “delay in diagnosis” conferred an incremental risk of the composite end point (when the patient failed to wean from cardiopulmonary bypass, as happened with 38% of patients, this was taken as the sentinel event). In plain English, this means that coronary events have to be first and foremost on the surgeon's mind when trying to elucidate postoperative instability or an atypical postoperative course. In fact, according to our own personal experience, coronary issues should always be in the top 3 leading diagnoses when dealing with a patient in unstable condition, even when the surgery had nothing to do with the coronary arteries. Every minute counts, because myocardium is

FIGURE 1. Pulmonary valve prosthesis tip impinging on left main coronary artery.

dying. On a side note, as also mentioned by Goldsmith and colleagues,¹ a completion angiogram done in a hybrid operating room or with a high-quality C arm can help save the time it takes to transport the patient to the catheterization laboratory and then back to the operating room. Finally, a minor but no less interesting point made was that a sizable portion of this cohort with demonstrable coronary ischemia had only “nonspecific ST-segment” changes on postoperative electrocardiography. One thus should never invoke the absence of specific electrocardiographic changes as a reason to dismiss coronary ischemia.

Within this discussion, congenital heart operations can be categorized as posing higher risk for coronary events (arterial switch, Norwood, aortic valve repair or replacement, coronary unroofing, anomalous left coronary artery from the pulmonary artery, even mitral surgery [circumflex coronary artery] or pulmonary valve implantation [left main] coronary artery) or lower risk (septal defects, cavopulmonary shunts, Fontan operations). It is probably fair to say that in the first group, coronary events are much more on the surgeon’s mind, whereas in the second group, they are typically not. This study demonstrates nicely this sort of biased thinking and shows that when the index surgery included a planned coronary artery surgical procedure (coronary transfer, manipulation, ostial plasty, unroofing or marsupialization), there was *improved* transplant-listing free survival relative to patients who had coronary events after operations that did not involve the coronary arteries.

Although anatomic problems (sutures, clips, kinking, etc) were the most common cause of acute coronary artery occlusion in 80% of cases, another interesting finding was that thrombosis was the cause in 26%. Thrombosis is potentially treatable without surgery, and this further highlights the need for prompt diagnosis and treatment.

In summary, Goldsmith and colleagues¹ demonstrate that, irrespective of primary diagnosis or operation, when the postoperative course does not follow the expected trajectory, a high index of suspicion must always be maintained for acute coronary problems. In addition, they showed that prompt action yields better outcomes.

Reference

1. Goldsmith MP, Allan CK, Callahan R, Kaza AK, Mah DY, Salvin JW, et al. Acute coronary artery obstruction following surgical repair of congenital heart disease. *J Thorac Cardiovasc Surg.* 2020;159:1957-65.e1.