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The Spectrum of Cardiovascular Lesions Requiring Intervention in Adults After Kawasaki Disease

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ABSTRACT

OBJECTIVES The aim of this study was to characterize the range of management issues raised by adults with cardiovascular sequelae from Kawasaki disease (KD) in childhood.

BACKGROUND Aneurysms resulting from vascular inflammation associated with KD in childhood may remain clinically silent until adulthood. Adults with large aneurysms, unstable angina, or myocardial infarction following KD in childhood present unique challenges to interventional cardiologists and cardiothoracic surgeons.

METHODS In an observational study of adults with histories of KD in childhood, data were collected regarding the medical histories and outcomes of 154 adult KD patients, of whom 21 underwent either percutaneous interventions or surgery.

RESULTS Of the 21 subjects with interventions, 11 had been diagnosed with KD in childhood, and 10 had histories of KD-compatible illnesses. Seventeen subjects were asymptomatic until experiencing acute cardiovascular symptoms: acute myocardial infarction (n = 12), angina (n = 2), end-stage congestive heart failure requiring cardiac transplantation (n = 1), and claudication (n = 2).

CONCLUSIONS Cardiovascular complications in these subjects illustrate the following points: 1) even small to moderate-sized aneurysms that "normalize" on echocardiography in childhood can lead to stenosis and thrombosis decades after the acute illness; 2) coronary interventions without intravascular ultrasound may result in clinically significant underestimation of vessel luminal diameter; 3) failure to assess the extent of calcification may lead to suboptimal procedural outcomes; and 4) patients with symptomatic peripheral aneurysms may benefit from endarterectomy or resection. Interventional cardiologists should be aware of the potential challenges in treating this growing population of adults. (J Am Coll Cardiol Intv 2016;9:687–96) © 2016 by the American College of Cardiology Foundation.

Information on the extent of cardiovascular disease in adults following Kawasaki disease (KD) in childhood is only now emerging, despite the fact that Tomisaku Kawasaki described his first pediatric patients more than 45 years ago (1). System dynamic models suggest that by 2030, 1 in every 1,600 adults in the United States will have had KD (2). Despite the efficacy of high-dose intravenous immunoglobulin in preventing coronary artery damage, approximately 5% to 7% of treated patients will develop coronary artery pathology with the attendant risk for thrombosis or stenosis later in life (3,4). With current U.S. Census Bureau projections of a U.S. population of 360 million by 2030 and 78% of the

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ABBREVIATIONS AND ACRONYMS

CABG = coronary artery bypass graft

IVUS = intravascular ultrasound

KD = Kawasaki disease

LAD = left anterior descending coronary artery

MI = myocardial infarction

PCI = percutaneous coronary intervention

PTCA = percutaneous transluminal coronary angioplasty

RCA = right coronary artery

population 18 years and older, there will be 175,000 adult KD patients, of whom 12,000 will have coronary aneurysms (5).

Autopsy and cardiac catheterization studies have established that the diagnosis of KD may be missed in childhood, and important cardiovascular damage may remain silent until adulthood, when thrombosis or critical coronary artery stenosis results in an acute ischemic event (6,7). Because the etiology of KD remains unknown, there is no specific diagnostic test, the acute illness is self-limited, and the physical signs and laboratory findings mimic other childhood illnesses, pediatric patients will continue to be misdiagnosed. This has created a population of young adults with significant cardiovascular damage who are unaware of their antecedent KD and risk for acute coronary syndromes or myocardial infarction (MI). No systematically collected data are available to inform physicians on the natural history of KD decades after the initial illness in childhood.

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To address this issue, the San Diego Adult KD Collaborative study was initiated as a longitudinal, observational study of young adults with childhood histories of KD. The present series focuses on the lessons learned from the subset of subjects who experienced challenging cardiovascular sequelae that required either catheter-based or surgical interventions.

METHODS

As of July 1, 2014, the San Diego Adult KD Collaborative study had enrolled 154 young adults (>15 years of age) in a longitudinal study of the cardiovascular sequelae of KD. A subset of patients who lived locally or were able to travel to San Diego underwent cardiac imaging with computed tomographic calcium scores. Computed tomographic angiography was performed on the subset of subjects with clinical indications such as a history of cardiovascular abnormalities or a positive calcium score. Of the 154 subjects, 63 (40.9%) were originally diagnosed with KD in childhood and followed by 1 of the coauthors (J.C.B.) and were designated as cohort 1. This group of unselected subjects followed since disease onset can inform us about the natural history of KD. These 63 subjects had been followed for a mean of 18.0 years (range: 6.7 to 30.1 years), and 8 had aneurysms. The remaining 91 subjects (cohort 2), of whom 30 had aneurysms, were diagnosed with KD elsewhere and were referred by their physicians or self-referred for participation in the study. Thus, cohort 2 was likely biased toward subjects with more severe outcomes who might be more likely to seek participation in a study. Overall, 21 subjects (1 from cohort 1 and 20 from cohort 2) had undergone percutaneous interventional or surgical cardiovascular procedures and are included in this report. The demographic and clinical features of the study population are summarized in **Table 1**. The study was approved by the Institutional Review Board at the University of California, San Diego. All parents gave written informed consent for the participation of subjects younger than 18 years, and subjects gave written assent or consent as appropriate.

RESULTS

Of the 21 subjects who underwent interventions, 11 were diagnosed with KD in childhood, while 10 were retrospectively determined to have had KD (**Figure 1**). Of the 11 patients who were diagnosed in childhood, 9 were recognized to have coronary artery aneurysms at the time of their initial illness, and 2 (#13 and #20) were thought to have only coronary artery dilation that resolved. Eight of the 11 subjects diagnosed in childhood with aneurysms were followed by cardiologists, and only 1 (#1) had an acute cardiovascular event that was treated with an emergent intervention. Three of 11 subjects were not followed longitudinally, and 1 (#20) required emergent percutaneous coronary intervention (PCI) with stenting, 1 (#13) required emergent bypass surgery for critical stenosis in the left main coronary artery, and 1 (#11) ultimately required cardiac transplantation for ischemic congestive heart failure. Of the 10 subjects without diagnoses of KD in childhood, presumed diagnoses of KD were made at the time of their acute presentation with either angina (n = 1) or acute MI (n = 9).

PCIs. Eight subjects presented with acute cardiac symptoms and underwent emergent percutaneous transluminal coronary angioplasty (PTCA) (**Table 2**). Of these 8 subjects, 6 did not have diagnoses of KD in childhood, while 2 subjects (#11 and #20) had been diagnosed with KD but subsequently released from care. Antegrade flow was established by PTCA in 6 of the 8 subjects (**Figure 2**). In 1 subject (#14), organized thrombus of the right coronary artery (RCA) prevented passage of the angioplasty catheter. In another subject (#11), passage of the angioplasty catheter through a tight stenosis in the left anterior descending coronary artery (LAD) led to cardiac arrest. Heavy calcification in the arterial wall precluded angioplasty of the vessel, and the subject ultimately