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Coronary Artery Thromboembolism and Unexpected Death in Childhood and Adolescence

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ABSTRACT: Two cases of unexpected death in childhood and adolescence associated with coronary artery thromboembolism are reported involving a 6-year-old girl with acute rheumatic fever and left ventricular vegetations, and an 18-year-old adolescent with Down syndrome and congenital heart disease. Although coronary artery thromboembolism is rarely reported in childhood or adolescence, these cases demonstrate that careful examination of the coronary arteries during pediatric autopsy may be helpful in determining factors contributing to death, even at quite young ages. This is particularly so in the presence of predisposing cardiac pathology.

KEYWORDS: pathology and biology, unexpected death, childhood, coronary artery embolism, rheumatic fever, congenital heart disease

Cardiac disease is a significant cause of sudden unexpected death in childhood. However, while most cases of fatal cardiac disease in adults are due to coronary atherosclerosis with thrombosis, the spectrum of causes is different in the pediatric age group. The most common forms of cardiac disease that may result in sudden death in children and adolescents are myocarditis, hypertrophic cardiomyopathy, aortic outflow obstruction, Kawasaki disease and cyanotic congenital heart disease with pulmonary outflow obstruction [*1,2*]. We report two cases of unexpected death associated with coronary artery thromboembolism in a six-year-old girl and in an 18-year-old adolescent, respectively, both of whom suffered from severe underlying cardiac disease.

Case Reports

Case 1

A six-year-old Aboriginal girl was found unexpectedly dead in her home following several days history of fever with occasional episodes of vomiting. Apart from occasional crepitations in her chest on auscultation at the beginning of her illness, the physical examination had been unremarkable. Her past medical history included scabies, episodic diarrhea and upper respiratory tract infections. Her birth history was unremarkable. A day before death she had complained of chest pain and diarrhea. Urine dipstick analysis showed marked proteinuria and urine culture revealed a mixed bacterial growth consisting predominantly of *Escherichia coli.* She died unexpectedly four days after the onset of symptoms.

At autopsy the body was that of a young Aboriginal girl weighing 16 kg. There was pulmonary edema and congestion with a heart weight of 121 grams (N = 62 to 112 gms). The left ventricular myocardium appeared pale and the posterior mitral valve leaflet was thickened with an eroded surface. Inferiorly, there was a friable pale brown mural thrombus. The left anterior descending coronary artery contained a possible thromboembolus. Several small infarcts were noted on the cortical surfaces of both kidneys.

Histological examination revealed a diffuse myocarditis involving all four cardiac chambers. The mixed inflammatory infiltrate was composed of lymphocytes, histiocytes and neutrophils and was most prominent in a perivascular location with extension into the adjacent edematous interstitial tissue. Associated with this inflammatory infiltrate was frequent myocyte necrosis. In addition, several areas containing Aschoff nodules with scattered Anitschkow myocytes characteristic of acute rheumatic fever were found in perivascular and subendocardial locations. Aggregates of fibrin and acute inflammatory cells adherent to the endocardium were seen within the cardiac chambers. Occluding thromboemboli were found within branches of the left anterior descending coronary artery (Fig. 1). Death was attributed to acute rheumatic fever with myocarditis and thromboembolic occlusion of the left anterior descending coronary artery.

Case 2

A 18-year-old adolescent with Down syndrome and a complete atrioventricular canal defect with associated Eisenmenger complex was admitted to the Adelaide Children's Hospital with worsening cardiac failure. On admission she was hyponatremic, and so diuretics were ceased and fluid restriction was commenced. Her condition improved and she returned home apparently well. However, soon after discharge she became increasingly short of breath and developed central and peripheral cyanosis. Her blood pressure was 90/50 and electrocardiogram was suggestive of myocardial infarction. She died one day later.

An autopsy limited to her chest was performed. The body was that of a white female with typical stigmata of Down syndrome. Cyanosis of the lips and a mild degree of clubbing were noted in the fingers and toes. The pleural cavity was occupied by a massively enlarged heart (combined heart and lungs wt. = 2544 g) and there were numerous pleural adhesions between the chest wall and the

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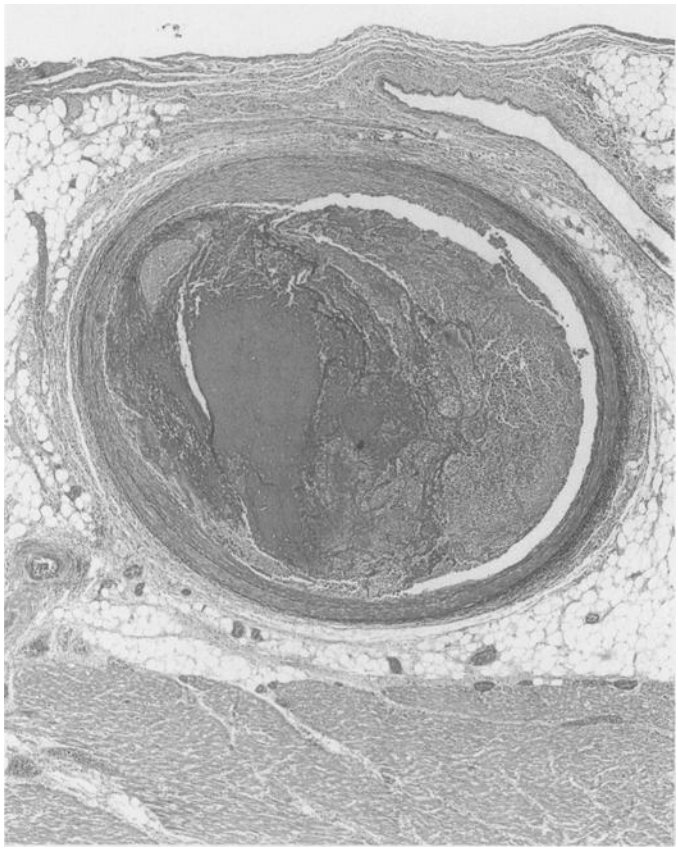

FIG. 1—*Section from the left anterior descending artery in a six-year-old girl with acute rheumatic fever demonstrating an occluding thromboembolus (Hematoxylin & eosin × 30).*

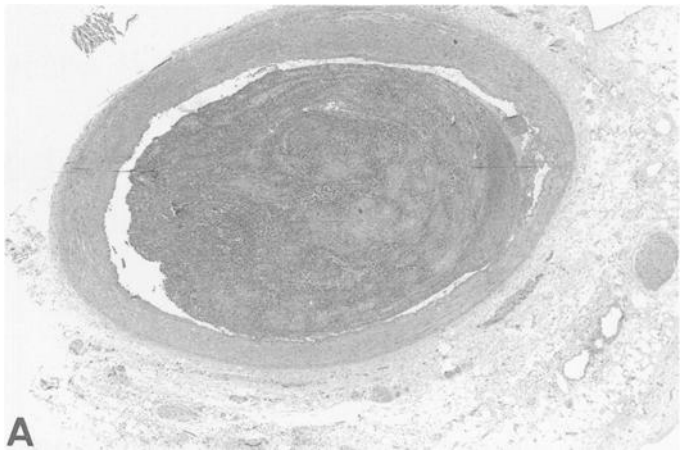

FIG. 2A—*Section from the left anterior descending artery in an 18-year-old adolescent with cyanotic congenital heart disease demonstrating an occluding thromboembolus (Hematoxylin & eosin × 30).*

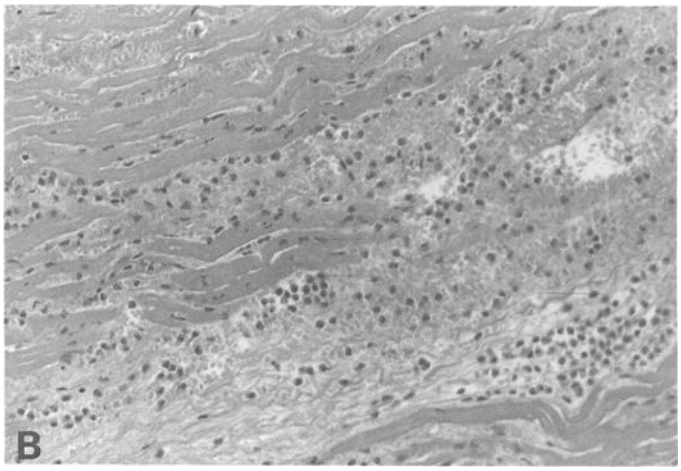

FIG. 2B—*Area of acute myocardial infarct in the above patient demonstrating separation of necrotic myocytes by interstitial hemorrhage and infiltrating neutrophils (Hematoxylin & eosin × 160).*

right lower lung lobe. The pericardial sac was thickened and adherent to the base of the heart and great vessels. A large perimembranous defect (30 mm) was noted in the ventricular septum and there was massive biventricular and biatrial dilatation and hypertrophy. In addition, the atrioventricular and semilunar valves were thickened and of abnormal morphology. The pulmonary outflow tract was dilated and the ductus arteriosus was patent. Organizing thrombus was present in the dilated auricle of the right atrium and sectioning of the left anterior descending artery revealed an occluding thromboembolus. The myocardium revealed mottling in the anterior-apical portion of the left ventricle. The lungs were congested and edematous, and numerous pulmonary thromboemboli were noted with associated infarcts particularly in the right lower lobe.

Histological examination of the antero-apical portion of the left ventricle showed an acute myocardial infarct of approximately 24 to 48 hours duration with established coagulative necrosis of myocytes, interstitial edema and a neutrophilic inflammatory infiltrate. Serial sections confirmed thromboembolus within the left anterior descending artery and its marginal branch (Fig. 2). Sections of the lungs revealed numerous pulmonary arterial thromboemboli with varying degrees of organization and accompanying areas of fibrosis in keeping with previous pulmonary infarction. The smaller intrapulmonary arteries showed changes of Grade II pulmonary hypertension with medial hypertrophy and intimal proliferation of small muscular pulmonary arteries. Death was attributed to acute myocardial infarction due to thromboembolic occlusion of the left anterior descending artery in a patient with a complete atrioventricular canal defect.

Discussion

Coronary artery abnormalities and disease are rare causes of unexpected death in the pediatric age group. An example is Kawasaki disease in which there is vasculitis of the coronary arteries with resultant aneurysm formation and superimposed occluding thrombi [*3*]. This may result in myocardial infarction and sudden and unexpected death many years after the acute vasculitis has resolved [*4*].

Congenital anomalies of the coronary arteries may involve both right and left coronary arteries and can also result in sudden death due to compromise of blood flow within the abnormally placed vessels [*5*]. Mechanisms involving reduction in blood flow include acute angles of arterial takeoff from the aorta, external compression from the pulmonary artery and aortic adventitia, intraluminal valvelike ridges and stretching of aberrant coronary arteries as they course around the aorta [*6*].

Occlusion of the coronary arteries by embolic material is an uncommon problem in the pediatric age range [7,8]. One of the reported causes in childhood is left ventricular mural thrombi or valvular vegetations in association with myocarditis [9], however, theoretically any cause of left ventricular thrombus formation could result in thromboembolic material passing into the coronary circulation. This would include congenital heart disease as was present in Case 2, infective endocarditis and iatrogenic disease including catheterization [10].

Although it is difficult to determine precisely the contribution of the various pathological findings to the lethal episodes in these two patients, the presence of coronary artery thromboemboli were regarded as a significant finding in each case. As well as carefully examining the coronary ostia and tracing the course of the coronary arteries in cases of unexpected death in childhood and adolescence, it is therefore important to cross-section major vessels and take samples for histological assessment so that the possibility of detecting significant coronary artery pathology is maximized. This is particularly so when congenital or acquired cardiac disease or left ventricular thrombi are found at autopsy.

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