

Cartilaginous and Osseous Metaplasia in the Aortic Valve

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Citation

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Abstract

We are reporting an unusual case of cartilaginous metaplasia in the aortic valve of an elderly patient. The etiology and pathology of this uncommon finding are briefly reviewed.

INTRODUCTION

Cartilaginous metaplasia in the mammal aortic valve is an uncommon pathologic finding. To date, only a few cases have been reported in the English literature. We recently diagnosed such a case in an elderly patient who underwent aortic valve replacement because of severe valvular stenosis. Unlike the previous reported cases, we believe that this patient's chondrogenesis in the aortic valve is due to the typical "wear and tear" phenomenon.

CASE REPORT

An 81-year-old Caucasian male recently developed a knee injury, and was referred by his orthopedic surgeon for a complete evaluation of cardiovascular function before the knee operation.

Upon evaluation, the patient acknowledged marked limitations of exercise capacity secondary to his knee problem. The patient also noted that over the last six weeks, he had experienced significant shortness of breath with mild bilateral chest tightness even while walking on flat ground. However, his symptoms immediately resolved once taking a break and sitting down. The patient denied any syncope, pedal edema, orthopnea or paroxysmal nocturnal dyspnea. Past medical history was non-contributory. The patient was still keeping a reasonably active life as a drummer. A physical examination showed blood pressure 132/66 mmHg, pulse 94/min, respiration 20/min, and body weight 86 Kg. No jugular venous distention was noted. No bruits were heard. Bilateral carotid pulses were decreased. Chest examination revealed bilateral clear breath sounds. S1 was normal. S2 was not audible. Short high-pitched murmur of aortic stenosis was clearly audible with radiation to both carotids. No S4 or gallop could be heard. Abdomen was

unremarkable. Extremity evaluation was normal except marked for atrophy in the right lower limb. No edema was noted.

Electrocardiogram showed T-wave inversion on the aVL, V5 and V6. The electrocardiogram however, did not meet criteria for left ventricular hypertrophy. Echocardiogram revealed severe aortic stenosis with a valve area estimated to be 0.8 to 0.9 cm². Subsequent cardiac catheterization revealed a 90-99% proximal obstruction of the right coronary artery, a 70-80% ostial stenosis of the circumflex artery, a 50% lesion of the mid left coronary artery. The patient elected to undergo aortic valve replacement and coronary artery bypass surgery, and was discharged uneventfully 7 days after the procedures.

The three replaced aortic valve leaflets ranged in size from 2.8x1.5x0.3 cm to 2.9x1.7x0.5 cm. Multiple small solid nodules were presented on each leaflet. The specimen was submitted for decalcification before further histological evaluation.

Microscopically, the aortic valve showed extensive degenerative changes, which included multiple foci of calcification, bone metaplasia, and formation of hyaline cartilages (Figure 1). The largest focus of mature hyaline cartilage measures 2.1x0.2 cm, which was composed of unilacunated chondrocytes with small, but distinct nuclei embedded in semitranslucent matrix. There were no nuclear atypia or mitotic activity present (Figure 2). The cartilaginous foci are surrounded dense fibrous tissue. However, no acute or chronic inflammatory infiltration is noticed.

Figure 1

Figure 1: Low power view of the aortic valve, showing calcification and cartilage formation. (H&E, original magnification 20X)

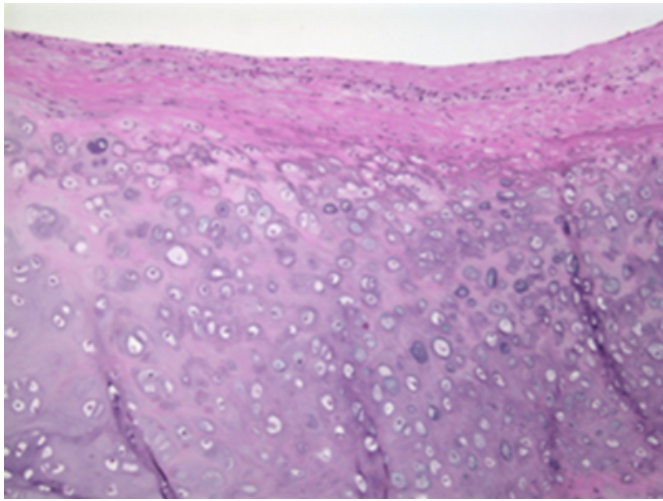
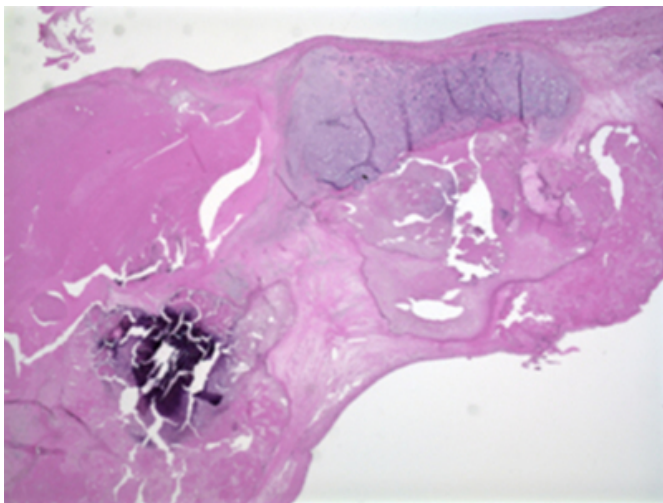


Figure 2

Figure 2: High power view of the aortic valve, showing mature hyaline cartilage composed of unilacunated chondrocytes. (H&E, original magnification 100X)



COMMENT

Unlike the avian, which constitutively contains hyaline cartilage in the cardiac valves,¹ cartilaginous metaplasia in the mammal aortic valve is an uncommon pathologic finding. To date, only a few cases have been reported in the English literature. Seemayer et al described a case of hyaline cartilage formation in the aortic valve of a 22-year-old man with endocarditis.² Groom and Starke reported cartilaginous metaplasia in the calcified aortic valve of a 49-year-old man.³ Most recently, Charokopos and colleagues depicted a case of cartilaginous and osseous metaplasia with bone marrow

formation in the aortic valve of a 40-year-old patient with giant cell aortitis.⁴

The mechanism of chondrogenesis in heart valves is still controversial. For years, heart valve disease has been believed to be a 'wear and tear' phenomenon, i.e., long lasting mechanical stress on the valves causing local damage with subsequent repair, resulting in calcification, osseous metaplasia and cartilage formation. In Syrian hamsters with high incidence of bicuspid aortic valves, cartilaginous metaplasia is quite common. When compared to animals with tricuspid aortic valves, chondrogenesis starts earlier in bicuspid individuals.⁵ This implies that cartilage formation in the aortic valve is a response to locally intense mechanical stimulation. However, recent research indicates that valvular bone and cartilage growth might be an actively regulated process rather than the conventionally believed aging process. Caira et al demonstrated that similar to an inflammatory process, high cholesterol can stimulate certain cells to reprogram into bone cells in the aortic valve and cartilage cells in the mitral valve.⁶

The previous reports of cartilaginous metaplasia in human aortic valve share a common feature, in that all patients were relatively young (mean age 37.14), and had an active inflammatory process going on in the aortic valves. These cases support the view that cartilage formation is related to the post-inflammatory response. In contrast, the patient we present in this case report is elderly (age 81), and has no clear inflammatory infiltrate in the aortic valve. We believe that the theory of chondrogenesis in this patient is due to the typical "wear and tear".

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