

CASE REPORT

Severe Supravalvular Aortic Stenosis Accompanied With Multiple Peripheral Pulmonary Artery Stenoses: a Delayed Diagnosis in an Adult Patient

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ABSTRACT

We present a case of a 28-year-old male with delayed diagnosis of a severe supravalvular aortic stenosis accompanied with peripheral pulmonary artery stenosis and increased right ventricular pressure. The patient had been diagnosed at the age of three with pulmonary artery hypertension of idiopathic origin. The correct diagnosis was made by transthoracic echocardiography and magnetic resonance imaging.

INTRODUCTION

Congenital aortic stenosis accounts for 5-10% of all congenital cardiac defects occurring more frequently in males.¹ The most common type of the stenosis is valvular (85%), while the subvalvular (10%) and supravalvular (5%) types are rare.² Although most patients may be asymptomatic and difficult to detect, the typical cardiac murmur rarely goes unnoticed during physical examination. Then the echocardiogram usually establishes the diagnosis. However, on a rare occasion the true diagnosis can initially be missed and delayed until adulthood. We herein present such a case, whereby supravalvular aortic stenosis was misdiagnosed and the correct diagnosis was only detected when the patient was 28 years old.

CASE REPORT

A 28-year-old male patient was referred to our hospital for a routine transthoracic echocardiogram. The patient after catheterization at the age of three years had been diagnosed to have idiopathic pulmonary hypertension. Since then, serial Doppler echocardiograms had confirmed the previous diagnosis of pulmonary hypertension. His sister, three years older than him, had supravalvular aortic stenosis (SVAS), diagnosed and treated as an infant, while his father had died suddenly at the age of thirty years of unknown cause. His mother reported that he had a quite normal infantile development with no social problems. He was 1.70 meters tall with muscular hypertrophy due

ABBREVIATIONS

SVAS = supravalvular aortic stenosis

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to daily isotonic physical exercise during the past seven years. His arterial pressure was found to be 130/90 mmHg in the right arm and 120/90 mm Hg in the left arm. Heart auscultation revealed the presence of a harsh systolic ejection murmur of 5 over 6 intensity at the second right intercostal space.

Transthoracic 2-D echocardiogram revealed a left ventricle of normal size with mild hypertrophy and normal contractility with ejection fraction of 65%. The right ventricle was also of normal size with hypertrophy of the free wall. All valves were without anatomic lesions with normal opening and closure. The aortic root, the ascending aorta, and the aortic arch were of normal size without isthmus stenosis. However, at the left parasternal long axis view thickening of the aortic wall at the aortic sinotubular junction was observed (Figure 1). In this area a turbulence flow by color Doppler was detected. At the apical four – chamber view, continuous wave Doppler echocardiography showed severe tricuspid regurgitation graded 2-3+/4+. The systolic pressure of the right ventricle estimated by Bernoulli equation was 70 mmHg. At the apical 5- chamber view, continuous wave Doppler echocardiography showed a maximum gradient of 100 mmHg through the aortic valve (Figure 2). Thus, the diagnosis of severe SVAS with concomitant increased right ventricular systolic pressure was documented.

The patient was also submitted to magnetic resonance angiography of the pulmonary circulation, which was performed with a high-resolution three-dimensional free-breathing technique, with diaphragmatic navigator respiratory gating and prospective slice correction and confirmed the above mentioned findings. At a distance of 25 mm cranially to the aorta, there was a distinct thickening of the aortic wall causing severe narrowing of the vessel and a high velocity systolic jet through it (Figure 3). The coronary arteries were normally originating from the Valsalva sinuses. The main pulmonary

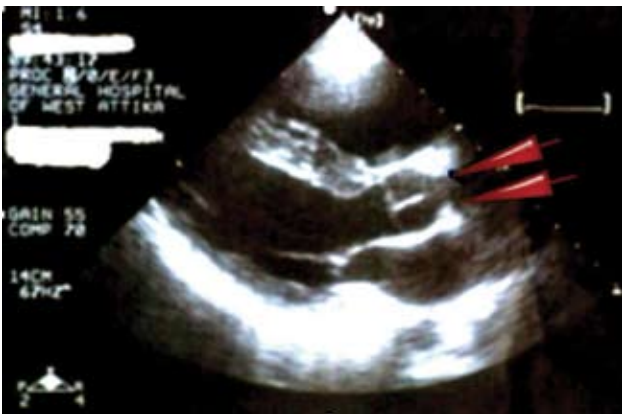


FIGURE 1. Left parasternal long axis view: a concentric thickening of the aortic wall approximately at the aortic sinotubular junction (arrows) was observed.

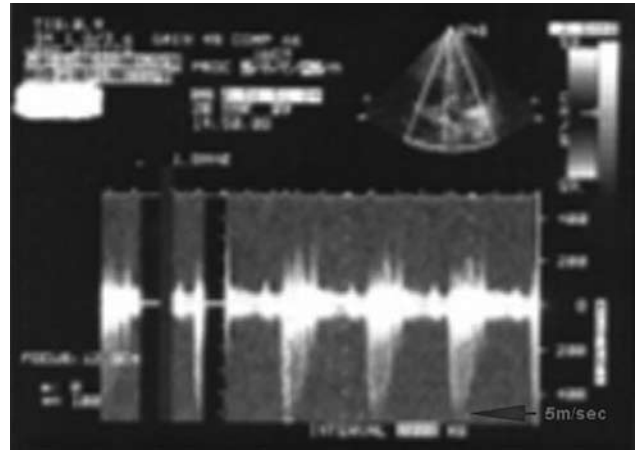


FIGURE 2. Apical 5- chamber view, CW Doppler echocardiography: a max gradient of 100mmHg through the aortic valve was detected. The arrow shows that the maximum velocity is just over 5 m/sec.

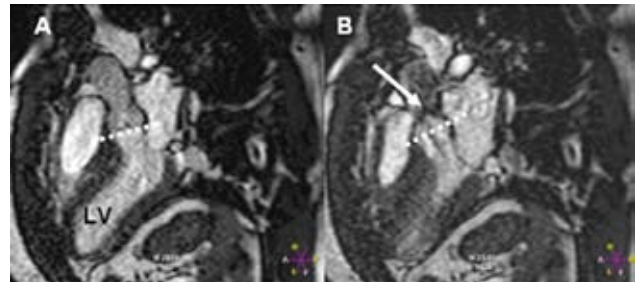


FIGURE 3. Diastolic (A) and systolic (B) frames from a cine study obtained along the left ventricular outflow tract, demonstrating a systolic flow-void jet (arrow) at the root of the aorta, 25 mm cranially to the plane of the aortic valve (dotted lines). LV= left ventricle.

artery and the right and left pulmonary arteries were of normal size with no stenosis. However there were severe concentric stenoses at the origin of the upper and lower branches of the right pulmonary artery and at the origin of the lower branch of the left pulmonary artery (Figure 4). The patient was diagnosed to have congenital severe SVAS, with concomitant distal pulmonary artery stenoses which caused increased right ventricle systolic pressure. Thus, the diagnosis of pulmonary hypertension due to increased pulmonary vascular resistance was refuted and the patient was referred to a cardiothoracic surgeon for surgical correction of the underlying pathology.

DISCUSSION

Congenital SVAS is a rare genetic, inherited or sporadic

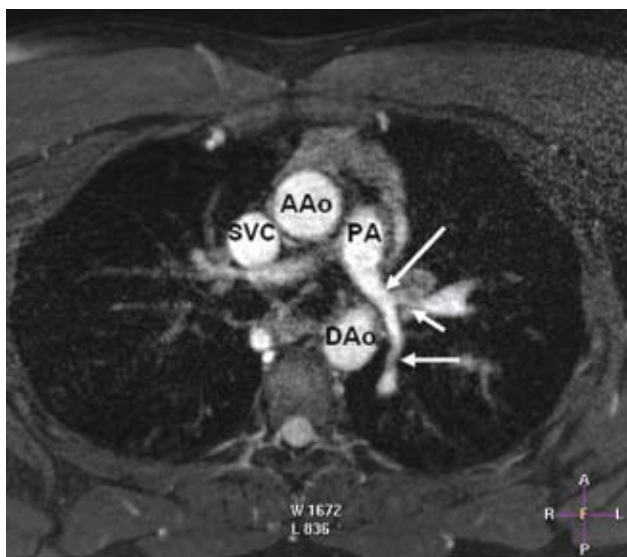


FIGURE 4. Transverse bright blood image obtained with a high-resolution three-dimensional free-breathing technique, with diaphragmatic navigator respiratory gating and prospective slice correction. The arrows demonstrate focal stenoses of the 1st and 2nd order branches of the left pulmonary artery. AAO= ascending aorta, SVC=superior vena cava, DAAo= Descending aorta, PA= pulmonary artery.

disease. When associated with specific facial characteristics and mental retardation it is known as Williams's syndrome. The coexistence of a peripheral pulmonary artery stenosis defines the Williams-Beuren syndrome.²⁻⁴ The pathology of the congenital SVAS has been attributed to a chromosomal microdeletion at locus 7q11.23 involving actually 28 genes. The best-explored gene within this region is the elastin gene. It is noteworthy that arterial stenosis has been linked to haploinsufficiency of this gene. The great systemic arteries which contain much elastin in the media are the most affected, causing conditions such as supravalvular aortic stenosis, diffuse or localized stenoses of the entire aorta, the renal and the mesenteric arteries, pulmonary artery stenosis, and coronary artery disease. The inherited disease is of autosomal dominant type and is not associated with non-vascular abnormalities. The sporadic form is usually associated with specific physical features such as elfin face, short nose, and small widely spaced teeth, infantile hypercalcemia, behavioural disorders such as hyper kinetic syndrome, hyperacusis and hypersociability and specific neurocognitive features such as moderate mental retardation with quite well-preserved language skills. On rare occasions, as reported by De Rubens Figueroa J et al,⁵ in the sporadic forms of SVAS cardiovascular abnormalities such as atrial and ventricular defects and bicuspid aortic valve exist.

Recently, Pham PP et al⁶ reviewed 242 individuals with Williams's syndrome and associated cardiovascular lesions.

Their patients were submitted to 292 catheterisations and 143 operations. One hundred and six patients had both an operation and a catheterisation. The three main cardiovascular anomalies were SVAS (169), pulmonary artery stenosis (130), and coarctation or aortic arch hypoplasia (32). There were a total of 15 deaths. The mortality rate was highest at 15% (12 of 80 patients) in the group with the combination of supravalvular aortic stenosis and pulmonary artery stenosis with 5 deaths occurring during catheterization and 7 at surgery. They concluded that children with Williams syndrome and bilateral outflow tract obstruction have statistically and clinically significantly higher mortality associated with catheterization or surgery.

Regarding the progression of the SVAS, Hickey EJ et al⁷ reported that many children, particularly those with Williams syndrome show regression of supravalvular stenosis without intervention. Children who undergo operation have high left ventricular outflow tract gradients and smaller left ventricular outflow tract z scores that do not improve over time. Increased risk of operation was associated with higher baseline high left ventricular outflow tract gradients. They observed that in the cases of absence of Williams's syndrome surgical intervention alters the natural course of SVAS. They found that left ventricular outflow tract obstruction is relieved and does not recur, and ascending aortic dimensions progressively increase towards normal values.

Scott DJ et al⁸ recently reviewed the outcomes of congenital SVAS repair. Of 25 primary SVAS repairs, there were 10 all-autologous slide aortoplasties and 15 prosthetic patch aortoplasties. The prosthetic patch group included the Doty technique (n=9), patch-augmented slide aortoplasty (n=3), modified Brom technique (n=1), interposition graft (n=1), and two-sinus patch with transverse arch augmentation (n=1). There was 1 early and 1 late death. The cumulative survival for all patients was 96% at 5 and 10 years. Event-free survival did not differ between groups. There were 2 late reoperations (both were prosthetic patch patients with bicuspid aortic valve: 1 with recurrent aortic valve stenosis and 1 with aortic insufficiency). Bicuspid aortic valve was the only risk factor for reoperation. Three patients weighing less than 10 kg with diffuse disease underwent attempted slide aortoplasty: 2 required patch augmentation and 1 had a recurrent gradient in less than 1 year postoperatively. They concluded that no specific technique of SVAS repair was superior to the rest. Additionally they observed that slide aortoplasty is not recommended for small patients with diffuse disease.

Of particular interest is the fact⁹ that sudden death in association with sedation and anaesthesia during operation of patients with congenital SVAS and peripheral pulmonary artery stenosis (the majority of whom had Williams-Beuren syndrome), is not rare. The biventricular hypertrophy that accompanies the supravalvular stenosis increases myocardial oxygen consumption and compromises oxygen delivery. In ad-

dition, these patients often have direct, multifactorial compromise of coronary blood flow. Consequently, patients with this syndrome are inherently at the risk of developing myocardial ischemia. This is particularly true in the setting of procedural sedation and anaesthesia. Thus, recommendations as to preoperative assessment and management of these patients are needed. In the case of surgically treating only the SVAS, the coexistent pulmonary hypertension, though relatively well tolerated in daily life, could have caused right ventricular failure at the postoperative period, thus leading to a high mortality rate. Experience of balloon dilation of peripheral pulmonary artery stenosis in Williams syndrome is limited. Geggel RL¹⁰ et al published their experience from 134 dilations during 39 procedures in 25 patients. They found that mortality occur early. Moreover they observed that despite successful dilation of distal pulmonary arteries, there was only a modest initial hemodynamic improvement, mainly because of persistent central pulmonary artery obstruction. A serial approach of distal dilations followed by surgical repair of proximal obstruction may be a rational and successful therapy.¹⁰

In our patient transthoracic echocardiography contributed significantly in the correct diagnosis and quantification of SVAS in an adult patient in whom diagnosis had long eluded until he became an adult, which is a rather rare case. The gradient across the SVAS which is usually a fixed lesion can be accurately assessed by continuous wave Doppler.¹¹ Furthermore in this case it has been proved that magnetic resonance imaging can not only offer sufficient imaging quality to diagnose structural heart disease, but is the most powerful non invasive, non-involving ionising radiation tool for diagnosis of extracardiac vascular pathology. In our patient the complete diagnosis had been missed for years, probably because the harsh systolic murmur had been mistaken as a murmur of tricuspid insufficiency.

Delayed diagnosis of SVAS at the age >20 years is very rare. Park et al¹² have reported a relevant case of delayed diagnosis of SVAS in a 29-year-old woman with Williams's syndrome. In that case magnetic resonance imaging in combination with multislice computed tomography demonstrated the coexistence of SVAS and a peripheral pulmonary artery stenosis with concomitant pulmonary hypertension. The message from the case we present must be that despite the fact that modern imaging modalities are significant tools in everyday clinical practice, thorough clinical approach is of great value and must never be neglected. Moreover, this case exemplifies

the limited training of adult cardiologists to congenital heart disease, a group of diseases that we are going to deal with quite frequently due to advances in cardiothoracic surgery.

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