ABSTRACT

Williams–Beuren syndrome is a multisystem genetic disorder caused by hemizygous deletion on chromosome 7q11.23, encompassing about 28 genes including the elastin gene, ELN. Cardiovascular abnormalities are frequent and are related to elastin insufficiency. These abnormalities include supravalvular aortic stenosis (SVAS) in 70% of cases, pulmonic valve stenosis, and renal artery stenosis. Definitive therapy for supravalvar aortic stenosis consists of surgical correction of the arteriopathies. Outcomes after surgical correction of SVAS depend on the extent of the arteriopathy and the presence of other associated lesions. We present a case of a 4-year-old boy, with Williams–Beuren syndrome with an SVAS. The patient was assessed with computerized tomography angiography to determine the extent of the aortopathy before surgical intervention.

Key words: Aortopathy, cardiac computerized tomography angiography, supravalvular aortic stenosis, surgical intervention, Williams–Beuren syndrome

INTRODUCTION

Williams–Beuren syndrome (WS) is a multisystemic genetic disorder, characterized by distinct facial features, cardiovascular anomalies, idiopathic hypercalcemia, neurodevelopmental, and behavioral problems (Table 1).\(^1,2\)

Deletion at chromosome band 7q11.23 involving the elastin gene (ELN) is responsible for these findings.\(^3\) Elastin arteriopathy is generalized and any artery may be affected. Abnormalities involve local and/or diffuse stenosis of the medium-sized and large-sized arteries, most commonly supravalvular aortic stenosis (SVAS) and/or the pulmonary arteries. SVAS should always suggest the probability of WS.\(^1,3\) Cardiovascular disease accounts for early mortality in WS.

CASE REPORT

A 4-year-old boy with confirmed WS was referred with a heart murmur.

Past medical history revealed a birth weight of 2.7 kg with no perinatal complications. Family history was insignificant. Examination revealed typical facial features of WS (Figure 1). Growth parameters were: weight 16 kg (40 percentile) and length 95 cm (20th percentile).

Blood pressure was 94/76 mmHg in the left leg. Cardiovascular examination showed normal pulses, no ventricular enlargement, and a Grade 3/6 aortic stenosis murmur but no pulmonary stenosis murmur. No renal bruits were heard.

Electrocardiogram revealed sinus tachycardia with a rate of 166/bpm. There was no significant ventricular...
hypertrophy. Chest radiography showed normal heart size and lung perfusion.

Transthoracic echocardiogram [Figures 2 and 3] confirmed SVAS with peak instantaneous gradient 70 mmHg and nonsignificant peripheral pulmonary artery stenosis (PPS). No clear views of head and neck vessels were reported.

He was referred to cardiothoracic surgeons for surgical repair. A computerized tomography angiography (CTA) to assess the extent of the aortopathy before surgery was requested.

The CTA was performed using the Somatom Siemens force with 0.48 mSv and DLP of 34. Nongated thoracic angiography protocol (flash) was used proceeded by premonitoring at the ascending aorta using 70 kV and 52 mAs. Twenty milliliters of Visipaque 320 contrast was used. Images were reconstructed and then analyzed using Syngvia software (Syngo.via MI Reading VB10B, Company Siemens, from Erlangen Germany).

The CTA scan showed the ascending and descending thoracic aorta to be small in size [Figures 4-7] compared to the pulmonary trunk and branches. There was concentric thickening of the ascending aorta wall with SVAS and tubular narrowing at the sinotubular junction (0.7 cm) extending to the brachiocephalic trunk. The neck vessels revealed a bovine type arch.

Table 1: Clinical manifestations of Williams syndrome
“Elfin” facies
Supravalvular aortic stenosis or other vascular anomalies
Hypertension
Cognitive profile consisting of impaired cognition and development accompanied by a friendly, social personality
Short stature
Endocrine abnormalities including hypercalcemia, diabetes mellitus, and subclinical hypothyroidism
Genitourinary abnormalities include congenital anomalies of the kidney and urinary tract, nephrolithiasis due to hypercalciuria, and dysfunctional voiding
Auditory, dental, gastrointestinal, genitourinary, musculoskeletal, neurologic, ophthalmologic, and dermatologic abnormalities

Figure 1: Facial features

Figure 2: Echocardiogram. Long axis view with aortic valve (large arrow) and severe supravalvular aortic stenosis with turbulent blood flows (small arrow)
Figure 3: Echocardiogram continuous wave Doppler recording in ascending with peak instantaneous gradient = 73 mmHg

Figure 4: Computerized tomography angiography. Severe supravalvular aortic stenosis (SVAS) measuring 7mm above normal aortic valve (large arrow) and coronary origins

Figure 5: Computerized tomography angiography. Hypoplastic aorta ascenders versus normal pulmonary artery size (large arrow)

He was scheduled for surgical intervention that would involve extensive SVAS correction up to level and including origins of the head and neck vessels.

DISCUSSION

Cardiovascular abnormalities (CVAs) in WS are common. CVAs were observed in 91% in patients with WS. Seventy-five percent had SVAS.\(^1\) In another study, CVAs were found in 86% (SVAS in 73% [isolated in 48%], peripheral pulmonary artery stenosis [PPS] in 42%, and mitral valve prolapse in 22%).\(^3\)

Other less common CVAs include stenosis of other mid-size arteries such as renal arteries, coronary arteries, and abdominal and thoracic aorta.\(^1,2\)

Figure 6: Computerized tomography angiography with three-dimensional reconstruction. Anterior view with severe hypoplasia of ascending aorta (large arrow)
About 20% of patients with WS will require surgical or transcatheter interventions for CVAs by 15 years of age.\cite{8,9}

The extent of these arteriopathies varies widely and needs to be fully documented before surgical intervention. Surgery is most commonly undertaken for SVAS, as transcatheter balloon angioplasty has been ineffective.\cite{8,9}

Patients will be initially evaluated with echocardiography, but this is limited in its ability to characterize the coronary arteries, complex aortic anatomy, and distal pulmonary arteries.

Conventional angiography was traditionally used to evaluate patients with WS. Hemodynamic in addition to anatomic information provided can be obtained. However, aside from its invasive nature, it is more likely to require sedation or general anesthesia, which adds additional risk.\cite{10}

Cardiovascular CTA is an excellent imaging modality for these purposes. It is superior in providing accurate information for planning, navigation, and noninvasive assessment of the secondary arterial changes in WBS, i.e., visualization of the proximal coronary arteries, allowing for the identification of the relationship of the coronaries to the SVAS.\cite{10}

Current cardiovascular CTA technologies expose patients to less radiation exposure than conventional angiography with the effective dose for the CTA to be 0.76 mSv compared with 13.4 mSv for the catheterization group ($P = 0.0001$).\cite{10}

Figure 7: Computerized tomography angiography with three-dimensional reconstruction. Posterior view with arch hypoplasia without coarctation of the aorta with bovine type head and neck vessels branching pattern
In most circumstances, using the combination of echocardiography and cardiovascular will provide all information needed for further management.

CONCLUSION

Computerized tomography (CTA) is a useful, accurate, and noninvasive modality to determine the extent of the aortopathy in patients with WS and should be performed routinely before the intervention. The reduction in scan time and radiation dose with the use of the most recent CT scanners makes it the current the modality of choice in WS.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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