International Cardiovascular Forum Journal 13 (2018)
DOI: 10.17987/icfj.v13i0.482

# Atriogenic Flow Across a Restrictive Subaortic VSD: a Sign of Stiff Left Ventricle

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## Highlights

Atriogenic Lt-Rt shunt across a ventricular septal defect is an uncommon finding, but reflects a stiff left ventricular cavity with raised end-diastolic pressure. These findings explain the left atrial enlargement and supraventricular arrhythmia. Thus, those shunts should be considered as safety valves to release the raised left sided pressure into the low pressure right ventricle.

**Keywords:** Ventricular septal defect, atriogenic flow

**Citation:** Islam M, Fernandes G, Li W, Henein MY. Atriogenic Flow Across a Restrictive Subaortic VSD: a Sign of Stiff Left Ventricle. International Cardiovascular Forum Journal 2018;13:28-29, DOI: 10.17987/icfj.v13i0.482

## Introduction

A 34 year old Asian man presented to the local cardiology outpatient clinic with symptoms of palpitations and pre-syncope but denied any history of blackout, other cardiac symptoms or family history for cardiac disease. He works in a factory in a profession that involves heavy weight lifting.

The patient was referred to Luton and Dunstable hospital, UK, having been found to have cardiomegaly on chest x-ray and reporting a previous history of undetermined cardiac surgery as a child. He denied any history of smoking or consuming alcohol.

On examination, pulse was 92bpm and blood pressure was 120/75 mmHg. Heart sounds were normal and a pansystolic murmur was heard all-over the precordium with maximum intensity at the left para-sternal border.

A chest x ray showed enlarged left atrium but the rest of the structures were normal.

A 12 lead ECG showed right bundle branch block.

A 24 hour ECG holter monitor revealed a short run of supraventricular tachycardia at a rate of 200 beat/min lasting for 13 beats.

Full blood picture and electrolytes were all normal.

Transthoracic echocardiogram showed a small sub-aortic ventricular septal defect (VSD) (Figure 1) with predominantly systolic left-right (Lt-Rt) shunt at a peak pressure drop of 99 mmHg preceded by an atriogenic Lt-Rt shunt at a peak velocity of 1.2 m/s (Figure 2). Left ventricular (LV) cavity size was normal and ejection fraction was maintained at approximately 60%. LV filling showed a dominant early diastolic component with a peak late diastolic (atrial) flow velocity of 0.4 m/s (Figure 2). The left atrium was slightly dilated but the right heart was normal in size and function.

This case shows an uncommon Lt-Rt atriogenic shunt across a small subaortic VSD in a young patient with no overt LV systolic dysfunction. Normally, up to the age of 50, the atrial contribution to LV filling is significantly less than that caused by LV suction in early diastole. With advanced age and collagen deposition that causes slow relaxation, LV pattern reverses and the atrial contribution to LV filling becomes predominantly atriogenic. According to textbook teaching, VSD flow is always systolic with high velocities in patients with a restrictive (small) shunt. The unusual finding of atriogenic flow across the VSD in this patient, with a velocity two fold that of LV filling is consistent



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ISSN: 2410-2636

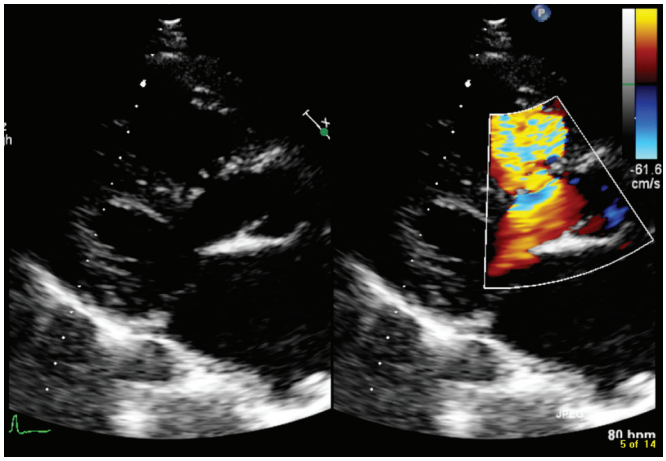


**Figure 1**. Figure 1: Parasternal long axis view showing a small subaortic VSD (left) with Lt-Rt shunt on colour Doppler (right). Notice the enlarged left atrium.

with a stiff cavity and raised end-diastolic pressure which results in redirection of the atriogenic flow to the low pressue right ventricle during atrial systole. It also explains the history of atrial arrhythmia which results from atrial enlargement and this may explain the unstable myocardial function. Although we did not have any documented explanation for the history of pre-syncope, we think an episode of atrial fibrillation could easily explain it. Thus identifying atriogenic flow across a restrictive VSD should add to a better explanation of the patient's symptoms and the extent of disturbed cardiac physiology. It should also play an important role in guiding optimum management and argues against shunt closure since the VSD is in effect acting as a safety valve for decompressing the high left atrial pressure into the right heart.

## Declarations of interest

The authors declare no conflicts of interest.

## Acknowledgements

The authors state that they abide by the "Requirements for Ethical Publishing in Biomedical Journals" [1].

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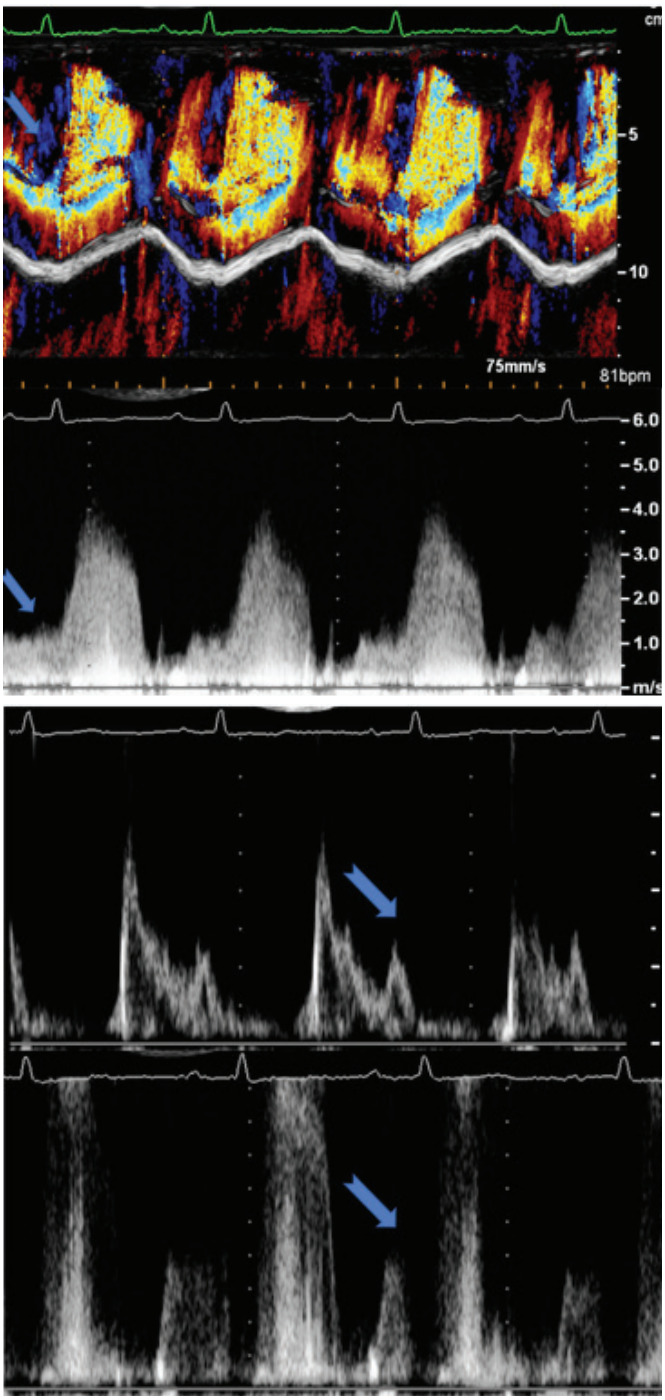


**Figure 2**. Figure 2: A composite of colour M-mode and continuous wave Doppler of the blood flow across the VSD (left panel) and pulsed wave velocities of LV filling and trans VSD flow (right). Notice the atriogenic flow in the 4 recordings and the velocity difference between those of LV filling and VSD on the right.