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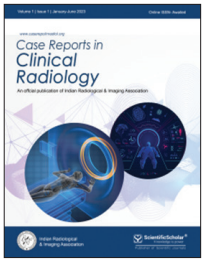

Case Report

Left ventricular false tendons: Unseen or overlooked?

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ABSTRACT

Left ventricular false tendons are cord like fibromuscular bands seen commonly in the left ventricle and attach septum to free wall. Described as early as in late 1800s, their functional significance is still not well established. We present the imaging findings in a 13-year-old boy who presented with failure to thrive. Echocardiography and cardiac CT showed the presence of aortic valve thickening, sub-aortic membrane, and patent ductus arteriosus with the left ventricular false tendon.

Keywords: Left ventricular false tendons, Cardiac CT angiography, Aortic valve, Mitral valve

INTRODUCTION

The left ventricular false tendons or aberrant ventricular bands are cord like fibromuscular filaments that are seen in the left ventricle (LV) and attach interventricular septum to free wall, but, have no attachment to mitral valve.[1-3] Various terms have been used to describe these bands: Musculi transversi, intracardiac strings, and aberrant fibrous bands.[3] These structures were first identified and described by a British anatomist and surgeon, Sir William Turner, in the year 1893. Despite early identification, their functional significance is yet to be established. A recent study found that these structures are seen in more than half of population, considering them as normal anatomical variants. These false tendons are also seen in animal hearts.[1] Compared to bands in the right ventricle, which are muscular, the left ventricular bands are more fibrous. The prevalence of ventricular bands is same in structurally normal and malformed hearts.[2]

CASE REPORT

A 13-year-old boy presented with failure to thrive and cough. There was no history of fever or shortness of breath. On examination, the child was thin built and had a loud ejection systolic murmur in the left precordium. Chest radiograph [Figure 1a] showed cardiomegaly with pulmonary plethora indicating intracardiac left to right shunt. Transthoracic echocardiography showed aortic valve leaflet thickening with nodularity (suggesting a possible infective vegetation) which was causing aortic regurgitation and stenosis. A patent ductus arteriosus with the left to right shunting was seen. Cardiac computed tomography [Figure 2] confirmed the aortic valve thickening and patent ductus arteriosus. In addition, an eccentric thin sub aortic membrane and a thick intracavitary muscular band were seen. The muscle band (6 mm thickness) was arising from both papillary muscles and showed attachment to anteroseptal segment [Figure 2]. The child underwent aortic valve repair with excision of the sub-aortic membrane and ligation of the patent ductus arteriosus. Histopathological examination of the excised valvar tissue confirmed

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the presence of infective vegetations with inflammatory and fibrotic changes in the valve. (Post operative chest radiograph: Figure 1b)

DISCUSSION

The developing LV is formed from two distinct myocardial layers, that is, an outer condensed layer and an inner less compact layer. Of these two layers, the left ventricular false tendons have been hypothesized to develop from inner non-compacted trabeculated layer.[1,3] False tendons usually run from ventricular septum to papillary muscle and free wall.

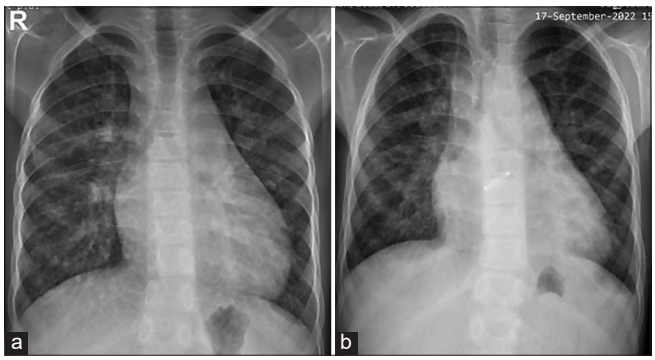

Figure 1: Frontal chest radiograph: Pre-operative (a) showing cardiomegaly with pulmonary plethora indicating an intracardiac left to right shunt, post-operative (b) showing the prosthetic aortic valve.

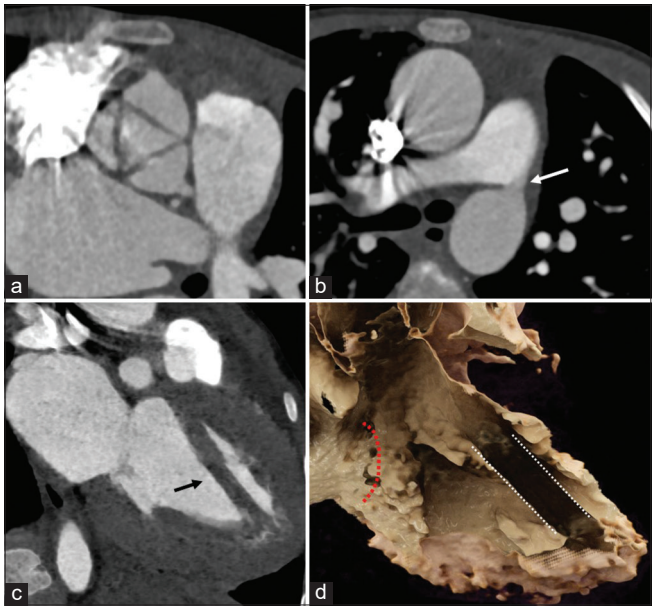

Figure 2: Contrast-enhanced cardiac computed tomography images: (a) Showing thickened aortic valve leaflets, (b) showing patent ductus arteriosus (marked in white arrow), (c) showing the left ventricular false tendon, and (d) showing the left ventricular false tendon (marked by white dashed lines) in relation to the mitral valve (marked by red dashed line).

Thickness of these false tendons vary and they might be as thick as 3 mm. Varying amount of fibrous and myocardial tissue, coronary vessels, and Purkinje fibers is seen in these bands. Based on their attachment, they are divided into five groups [Table 1].[1,4]

Although described as early as 1890s, by far, little is known about the significance of these bands in cardiac function. Their frequent identification in patients after the advent of echocardiography, re-established interest in these bands, to identify any relationship with various cardiac pathologies, if, at all any exist.

Some researchers have proposed that LV false tendons limit post-infarction adverse myocardial remodeling, by physical as well as humoral mediated mechanisms secreting atrial natriuretic peptide (that impedes cardiac fibrosis). It has also been observed that by attaching to mitral papillary muscles, transversely oriented 2 (mid-cavity) false tendons may limit mitral valve deformation, hence, reduce mitral regurgitation.[1,5]

Since conduction fibers may be present in these false tendons, patients may present with arrhythmias and premature ventricular complexes. They are also commonly mistaken for intracavitary masses on echocardiography.[2] These false tendons may rarely also cause subaortic stenosis mechanically, as well as, by increasing flow turbulence in LV outflow. The flow turbulence may promote fibrosis resulting in formation of a discrete sub-aortic membrane.[1]

These tendons are less commonly seen in echocardiography, than in autopsy specimens. Off-axis imaging is required to visualize these tendons. Longitudinally arranged fibers can be seen in apical long axis, whereas, transversely oriented fibers are best appreciated in apical four chamber and short axis views. False tendons are taut in diastole and relax in systole. They should not be confused with thrombus, wall thickening, or papillary muscles. Features helpful in differentiating include echo-free space on both side of tendons and systolic laxity.[1,3] On cross-sectional imaging, these are seen as thin muscular fibers running within the LV lumen. Multiplanar reconstruction in CT and MRI along various reformatting techniques helps in their easy identification.[2]

Table 1: Classification of the left ventricular false tendons based on attachment.[1]

Type 1	Fibers run from posteromedial papillary muscles to ventricular septum
Type 2	Fibers attach anterolateral papillary muscles to posteromedial papillary muscles
Type 3	Fibers courses between anterolateral papillary muscles to ventricular septum
Type 4	Fibers connect ventricular septum to free wall
Type 5	Fibers runs from LV free wall to LV free wall

CONCLUSION

Left ventricular bands are common and may have significant physiological and pathological significance. Further studies are needed to understand their functional role in ventricular remodeling.

TEACHING POINTS

1. Ventricular false tendons are cord like structures that are commonly seen in the left ventricle.
2. Cross sectional imaging can be used for accurate demonstration of intracardiac anatomy.

MCQs

1. Muscle bands are most commonly seen in which of the following cardiac chambers
    a. Left atrium
    b. Left ventricle
    c. Right atrium
    d. Right ventricle

Answer Key: b

2. The left ventricle develops from
    a. Sinus venosus
    b. Bulbus cordis
    c. Primitive ventricle
    d. Primitive atrium

Answer Key: c

3. Which of the following tissue groups in NOT present in ventricular false tendons
    a. Lymphatic tissue
    b. Myocytes
    c. Fibrous tissue
    d. Neural tissue

Answer Key: a

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

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