Incremental utility of Live/Real time three-dimensional transesophageal echocardiography in diagnosis of a unique type of subaortic membrane: a case report

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Introduction

Discrete subaortic membranes are rare congenital abnormalities which may cause hemodynamic consequences secondary to left ventricular outflow obstruction. It may present as an isolated abnormality or may accompany other congenital abnormalities such as ventricular septal defects and bicuspid aortic valve (BAV). Two dimensional (2-D) and recently three dimensional (3-D) echocardiography is used in diagnosis and estimation of the severity of the stenosis in this clinical entity. In this report, we used 3-D echocardiographic examination to identify the anatomical properties of a unique type of subaortic membrane extending to the left ventricular posterolateral wall associated with BAV.

Case Report

Twenty-nine year-old man who had undergone valvulotomy for congenital aortic stenosis (AS) due to BAV 10 years ago was admitted to our clinic with rest dyspnoea. Blood pressure was normal (110/68 mm Hg), heart rate was high (110 beats per minute) and a harsh systolic murmur at the left upper sternal border was heard at auscultation. Other system examinations were normal. Electrocardiography revealed left ventricular hypertrophy and sinus rhythm. Chest X-ray and laboratory parameters were also normal. Two-dimensional transthoracic echocardiography (2-D TTE) revealed concentric left ventricle (LV) hypertrophy with an interventricular septum (IVS) diastolic diameter of 1.6 cm. At the junction of muscular and membranous IVS, an echodense fibrous structure compatible with a discrete subaortic membrane was seen (Fig. 1A, B). In colour Doppler examination, a diastolic turbulent flow through left ventricular outflow tract (LVOT) was established. Continuous wave (CW) Doppler examination showed a maximal gradient of 86 mm Hg and a maximal velocity of 4.64 m/sec with a mean gradient of 48 mm Hg over LVOT. Pulsed wave (PW) Doppler examination failed to show a significant gradient over the membrane or mitral subvalvular area. There was mild tricuspid regurgitation with an estimated pulmonary artery systolic pressure of 35 mm Hg and mild mitral regurgitation.

Two dimensional transesophageal echocardiography showed an echodense subaortic membrane and a thick fibrotic band beneath mitral valve reaching left ventricular posterolateral wall (Videos 1, 2). However, 2-D imaging did not yield adequate visualization of this structure in multiple echocardiographic planes. Thus, 3-D TEE was performed on Philips (Andover, MA) iE33 imaging system and X7-2t live 3-D TEE transducer. Area of the membrane was measured using the area tool of two dimensional quantification (2-DQ) plug-in of QLAB software,

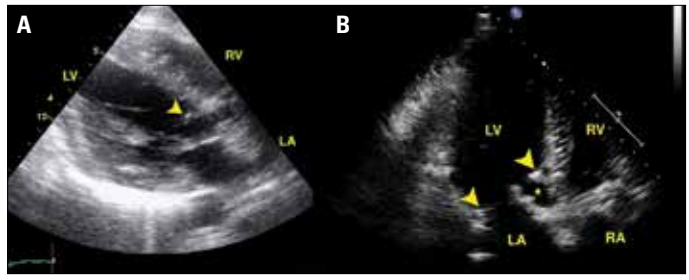

Figure 1. Parasternal long axis, and apical five chamber views of 2D TTE. (A) Yellow arrow points to the part of the membrane attaching to junction of LVOT and basal septum, and seen as a hyperechogenic ridge. (B) Yellow Arrow tips point to the trajectory of the membrane LA, LV, RA and RV are for left atrium, left ventricle, right atrium and right ventricle, respectively. Asterisk shows LVOT

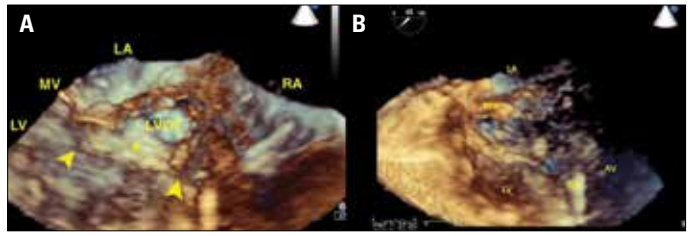

Figure 2. (A). Uncropped full-volume RT 3D TEE dataset showing the membrane from the aortic side. The membrane is attached to the posterior aspect of LVOT and extends to the LV posterolateral wall. (B) Uncropped full-volume RT 3D TEE dataset showing the membrane from the ventricular side

IVS - interventricular septum; LA - left atrium; LV - left ventricle; MV - mitral valve; RA - right atrium. Asterisk depicts the membrane

on en face 3-D views of the opening, in cropped full volume datasets, with a method used in measuring areas of secundum type atrial septal defects defined in a previous study (1). Planar area of LVOT and orifice area of the aortic valve were measured using 2-DQ plug-in of QLAB software. Three dimensional TEE examination revealed that the subaortic membrane was in continuity with posterior LV wall beneath mitral valve (Fig. 2A, B, Video 3). The lateral edge of the membrane was attached to LV posterolateral wall, adjacent to posterior mitral leaflet. Area of the membrane measured by the method stated above was 3.21 cm^2. Area of LVOT and orifice area of the aortic valve was 1.94, and 0.61 cm^2, respectively. According to these findings, we concluded that the membrane did not cause LVOT obstruction.

The patient was operated due to symptomatic severe regurgitation and stenosis over the aortic valve. Aortic valve was bicuspid and the leaflets were deformed and degenerated secondary to valvotomy operation. Whereas, the surgeon could not visualize the laterally extending segment of the membrane and could only perform partial resection of the medial side of the membrane. A 21 mm sized Carbomedics mechanical prosthetic valve was implanted via aortotomy. Postoperative TTE showed normally functioning mechanical aortic prosthesis with a maximal gradient of 35 mm Hg and a mean gradient of 20 mm Hg. Membrane was still evident in the subaortic region and beneath the mitral valve. The patient was discharged with warfarin therapy and his follow-up 6 months after was uneventful free of any cardiac symptoms.

Discussion

Discrete subaortic membrane is the most common reason of subaortic stenosis (SAS). This condition is either isolated or concurs with

a muscular narrowing, leading to a tunnel shaped left ventricular outlet. The prevalence of discrete subvalvular membrane in adults has been reported as 6.5% by Oliver et al. (2). Ventricular septal defect (14.9%), aortic coarctation (12.7%) and bicuspid aortic valve (2.2%) may accompany this anomaly (2). A case of SAS associated with Gerbode type defect has also been reported (3). The clinical course of SAS is generally progressive. A CW Doppler derived peak instantaneous gradient of more than 50 mm Hg is considered severe and subsequent aortic valve damage and aortic regurgitation may develop in time (4). Suspicion of discrete subaortic stenosis arises either when the membrane is seen directly as an echodense structure, or when increased transaortic gradients are detected with morphologically normal aortic valves. However, in some patients only the associated heart diseases may be diagnosed and treated during childhood whereas SAS may remain undiagnosed till adulthood.

Valvar, supravalvar or subvalvar pathologies should be investigated in case of presence of high LVOT gradients. In differential diagnosis of subaortic obstruction, discrete subvalvar membranes, tunnel-like obstruction, hypertrophic cardiomyopathy, accessory mitral valve, anomalous chordal or papillary muscle insertion into the septum, accessory endocardial cushion tissue should be considered. If there are more than one possible obstructive lesions in the LVOT, as in our case, it may be impossible which one is the dominant lesion that causes the increased velocities. In this situation, calculation of the areas of the anatomical structures may be required which can be done with 3-D echocardiographic imaging (5, 6). In addition, investigation of the orientation of the accessory tissues and relation of these structures with surrounding cardiac structures is important in differential diagnosis of rare congenital abnormalities, such as in our case. To our opinion, the membrane defined in this report is unique because it is attached to the posterior aspect of the LVOT and also to the posterior LV wall. It does not extend anteriorly to the anterior mitral valve, thus does not cause a gradient on the LVOT. In addition, it has no anatomical relation with the mitral valve which rules out the diagnosis of accessory mitral valve.

Conclusion

In this report, we defined a unique type of subaortic membrane accompanied by BAV. Real time 3-D TEE was used to identify the anatomical properties and hemodynamic consequences of the membrane. The areas of the membrane, LVOT and aortic valve were successfully measured using 3-D images and the primary pathology was shown to be confined to the aortic valve which was replaced by a mechanical prosthetic valve.

Video 1. Two-dimensional TEE image in long-axis showing the membrane originating from the interventricular septum extending laterally

Video 2. Two-dimensional TEE image showing the membrane beneath the mitral valve as a thick chord extending laterally

Video 3. Video of the cropped full volume RT 3-D TEE dataset showing relation of the left atrium (LA), left ventricle (LV) and aorta (AO) to the membrane (Asterisk, tips of the yellow arrows point to septal and lateral sides of the membrane

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Successful treatment of a pulmonary embolism with low dose prolonged infusion of tissue typed plasminogen activator in a 37 year old female in early postoperative period

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Introduction

Deep vein thrombosis is life threatening disease which may cause pulmonary embolism (PE) (1). Thrombolytic therapy (TT) is indicated in patients with massive PE (1). Herein we reported a case of massive PE, associated with proximal deep vein thrombosis extending into the right atrium, in patient with recent major internal bleeding and hysterectomy operation that was successfully treated with low dose prolonged infusion of tissue type plasminogen activator.

Case Report

A 37-year-old woman was admitted to our clinic with dyspnea and chest pain. She had hysterectomy due to uterus rupture 6 days ago. On physical examination she was pale, afibrile and dyspnea. Her blood pressure was 85/45 mm Hg, heart rate was 112 beats/min and oxygen saturation was 86% at room air. She had mild respiratory difficulty. Her jugular veins were distended and lung fields were clear.