

Not All Elevated Transaortic Gradients Are Valvular: Triple Discrete Subaortic Membranes Mimicking Severe Aortic Stenosis

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Case Report

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Abstract

Subaortic fibrous membranes are a rare but significant source of fixed left ventricular outflow tract obstruction. Although it is typically diagnosed in childhood, the membrane can remain clinically silent for years and present in adulthood, most likely due to secondary aortic valve failure. We report a case of a 48-year-old obese woman known to have recently diagnosed hypertension, who presented for progressive dyspnea on minimal exertion over the past four months. Serial echocardiograms revealed inconsistent findings but mainly suggested moderate to severe calcified aortic stenosis except for one report of possible subaortic membrane with minimal aortic regurgitation. Surgical exploration revealed three discrete subaortic fibrous membranes within the left ventricular outflow tract, which to our knowledge, is exceedingly rare, localized calcification and moderate to severe aortic regurgitation. Complete membranectomy and mechanical aortic valve replacement were performed, and the post-operative course was satisfactory. This case highlights the diagnostic difficulty of distinguishing valvular from subvalvular obstruction in adults with increased transaortic gradients. It also emphasizes the importance of repeat imaging and careful intraoperative assessment when there is a discrepancy from preoperative imaging findings.

Introduction

Subaortic fibrous membranes are a rare but significant cause of fixed left ventricular outflow tract (LVOT) obstruction. It is usually diagnosed during childhood, but some cases may present in adulthood when exertional symptoms or secondary aortic valve failure occur [Devabhaktuni et al., 2018; Oliver et al., 2001]. Prolonged exposure to high-velocity, turbulent flow can accelerate aortic cusp injury and lead to progressive left ventricular hypertrophy [Massé et al., 2018]. As such, cardiologists and cardiac surgeons should remain aware of the possibility of adult presentation of subaortic fibrous membranes, as this can transform subvalvular disease into combined LVOT obstruction and aortic valve pathology [Devabhaktuni et al., 2018].

Subaortic membranes have been extensively described in the literature involving a single obstructive lesion [Massé et al., 2018]. To our knowledge, reports describing three discrete subaortic membranes are uncommon. Their presence complicated the diagnosis and hemodynamic assessment. We report this finding in a 48-year-old female with discordant preoperative echocardiograms and associated severe aortic regurgitation requiring surgical resection and mechanical valve replacement.

Case presentation

We present a case of a 48-year-old obese female, non smoker, non alcoholic, with recently diagnosed hypertension. She presented for a four-month history of dyspnea on minimal exertion with increasing intensity. There was no reported syncope, chest pain, palpitations, orthopnea, or edema. On physical exam, she was found to have a systolic crescendo-decrescendo murmur at the right sternal border of the second intercostal space.

Before the presentation, the patient had three echocardiograms done by three different physicians in three different centers, with conflicting findings (Fig. 1). The first one performed two months prior to presentation revealed severe aortic stenosis with a calcified and bicuspid aortic valve with a surface of 1 cm² and a mean gradient of 43 mmHg. The second echocardiogram, done nine days later, showed severe calcified aortic stenosis with a surface area of 0.98 cm² and a mean gradient/max of 28/46 mmHg, with difficulty counting cusps and minimal regurgitation. The patient underwent a CT angiography two weeks later, which showed no abnormal findings. Finally, the patient underwent an echocardiogram approximately one month prior to presentation, which showed a triple-cusp valve with localized calcifications of the non-coronary cusp and a subaortic membrane causing subvalvular aliasing, a mean gradient of 22 mmHg, and microregurgitation.

The diagnosis was complicated by inconsistent echocardiogram findings across multiple centers. Earlier studies suggested severe aortic stenosis, however follow-up imaging revealed a subaortic membrane, which raised suspicion for mixed valvular and subaortic obstruction. This dissonance prior to surgery was likely due to the presence of multiple subaortic membranes at a proximity to the actual valve cusps.

Median sternotomy was performed. After initiation of the cardiopulmonary bypass and aortic cross-clamping, transverse aortotomy was performed to expose the diseased aortic valve and subvalvular region (Fig. 2). Inspection revealed three discrete subaortic fibrous membranes within the LVOT, which were identified and excised. Aortic valve replacement with a mechanical prosthesis was necessary due to the extent of damage in the valve.

Post-operative recovery was satisfactory and uneventful. The patient was transferred to the cardiac surgery intensive care unit in stable condition and extubated the same day. Anticoagulation therapy was initiated after the implantation of the mechanical valve. The patient was discharged on postoperative day 5. Serial follow-ups revealed an uneventful recovery.

Discussion

Subaortic fibrous membrane (SFM) is a discrete form of subaortic stenosis characterized by a fibrous or fibromuscular ridge in the left ventricular outflow tract (LVOT) [Devabhaktuni et al., 2018; McGregor et al., 2019]. It is frequently diagnosed in the pediatric population, and diagnosis in adults can be difficult since the clinical and hemodynamic profile can overlap with calcific valvular aortic stenosis (AS) [Hatab et al., 2023]. This case highlights a critical clinical pearl: not all elevated transaortic gradients originate from the valve itself.

The presence of a physical barrier in the LVOT is the primary mechanism of obstruction in SFM. This increases the resistance to blood flow in systole [Devabhaktuni et al., 2018], which creates a high-velocity jet causing a significant pressure gradient. The turbulence and high-velocity jet often subject the aortic valve leaflets to repetitive mechanical stress, causing progressive secondary valve trauma, thickening, and eventually aortic regurgitation [Brauner et al., 1997; Massé et al., 2018]. This dual

pathology can further complicate the clinical picture and overestimate the severity of valvular stenosis [Rana et al., 2018].

The clinical presentation of SFM is indistinguishable from that of severe valvular AS: both include exertional dyspnea, syncope, and a systolic ejection murmur [Devabhaktuni et al., 2018]. A high Doppler gradient can easily be detected on transthoracic echocardiography (TTE) [Arockiam, 2025], but the thin, discrete nature of the membrane makes it difficult to visualize, especially in adult patients with poor acoustic windows (due to obesity, scarring, hyperinflated lungs, etc) or those with comorbid valvular calcification.

One of the key diagnostic features is having a significant discrepancy between the Doppler-derived gradient and the visual appearance of the aortic valve. If the valve leaflets appear thin, mobile, and show normal excursion despite a peak velocity exceeding 4 m/s, the clinician must search for a subvalvular or supra-avalvular cause [Rana et al., 2018].

Accurate localization of the obstruction is necessary for surgical planning. While TTE is the screening tool of choice, Transesophageal Echocardiography (TEE) with 3D reconstruction is preferred for definitive diagnosis [Rana et al., 2018]. 3D TEE allows for a more precise visualization of the membrane's extent, its distance from the aortic annulus, and its relationship with the mitral valve. In complex cases, Cardiac MRI can provide additional anatomical detail of the LVOT and the degree of myocardial hypertrophy, though its sensitivity for very thin membranes may be lower than that of TEE [Arockiam et al., 2025].

The management of symptomatic SFM is primarily surgical. Unlike valvular AS, where transcatheter aortic valve implantation (TAVI) or surgical valve replacement (SAVR) are standard, membranectomy remains the primary treatment for SFM. If the aortic valve is structurally normal, a successful membranectomy can restore normal hemodynamics and spare the patient from a lifelong prosthetic valve and its required long-life anticoagulation [Brauner et al., 1997].

However, in older adults where SFM and valvular AS coexist, a multidisciplinary team must weigh the risks of surgical resection against transcatheter options. While TAVI is not a treatment for SFM, it has been successfully performed in patients with dual-level obstruction where the valvular component was dominant, and the surgical risk was prohibitive [Assiri et al., 2025].

Clinicians should suspect subvalvular membranes in any patient presenting with an elevated transaortic gradient with a contradictory normal valve morphology. Integration of 2D and 3D TEE is helpful to avoid misclassifying subvalvular obstruction as an isolated valvular disease. This ensures that the patient receives the appropriate surgical or transcatheter intervention [Rana et al., 2018].

The presence of three discrete subaortic membranes made our case diagnostically complex and was the likely culprit behind the variability among echocardiographic studies. Subaortic membranes can generate turbulent, high-velocity flow within the LVOT, resulting in a high transaortic gradient, which can

be misinterpreted as valvular aortic stenosis when a subvalvular lesion cannot be clearly visualized [Devabhaktuni et al., 2018; Arockiam et al., 2025]. Additionally, chronic hemodynamic stress from the subvalvular jet is implicated in progressive aortic valve injury, leaflet thickening, calcifications, and eventually secondary valvular dysfunction [Massé et al., 2018; Brauner et al., 1997]. Our patient had three coexisting subvalvular membranes, and a mildly calcified valve, which obscured the true mechanism of obstruction and may explain the discordant preoperative interpretations of the valve morphology and stenosis severity. This case illustrates how complex subvalvular anatomy can mask the presence of discrete subaortic stenosis and underscores the importance of comprehensive multimodal imaging when clinical and echocardiographic findings are inconsistent [Arockiam et al., 2025; Rana et al., 2018].

The diagnosis was also complicated by the patient's age, since this is usually a pediatric diagnosis. This case illustrates the importance of suspecting subvalvular membranes regardless of age when there is discordance in echocardiographs. In such complex cases, comprehensive multimodal imaging such as 2D and 3D TEE as well as cardiac MRI are important in establishing the diagnosis [Arockiam et al., 2025; Rana et al., 2018].

Conclusion

This case demonstrates that triple subaortic fibrous membranes can present in adulthood and masquerade as severe valvular aortic stenosis, creating diagnostic uncertainty. The presence of multiple subvalvular lesions was the likely culprit behind discordant echocardiographic findings and created diagnostic uncertainty. Clinicians should consider subvalvular pathology when transaortic gradients are incongruent with valve morphology, and clinicians must seek multimodality imaging when diagnostic uncertainty persists. Early recognition is essential to guide appropriate surgical planning and optimize patient outcomes.

Declarations

Competing interest

No competing interest

Ethics' approval and consent to participate

Patient written informed consent was obtained after proper explanation and information about the goals of the study and the anonymity of the information and images used.

Consent for publication

Patient gave her written informed consent for her personal, clinical data and any potentially identifying images related to this case, to be published in this report, after proper explanation and information about the publication and its goals.

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Author Contribution

M.B.G. wrote, edited and prepared figures T.A. edited, coordinated and finalised the article S.A. handled literature review and previous data collection G.T. moderated and reviewed the article

Acknowledgements

Not applicable

Data Availability

All relevant data supporting the findings of this study are included within the article.

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Figures

Date	Investigation	Finding
7/10/2025	Echocardio #1	Severe aortic stenosis with mean gradient of 43 mmHg
16/10/2025	Echocardio #2	Severe aortic stenosis, mean gradient of 28 mmHg, with minimal regurgitation
31/10/2025	CTA	No abnormal findings
12/11/2025	Echocardio #3	Subaortic membrane, tricuspid valve, mean gradient 22 mmHg, micro regurgitation

Figure 1

Chronological summary of echocariograph findings

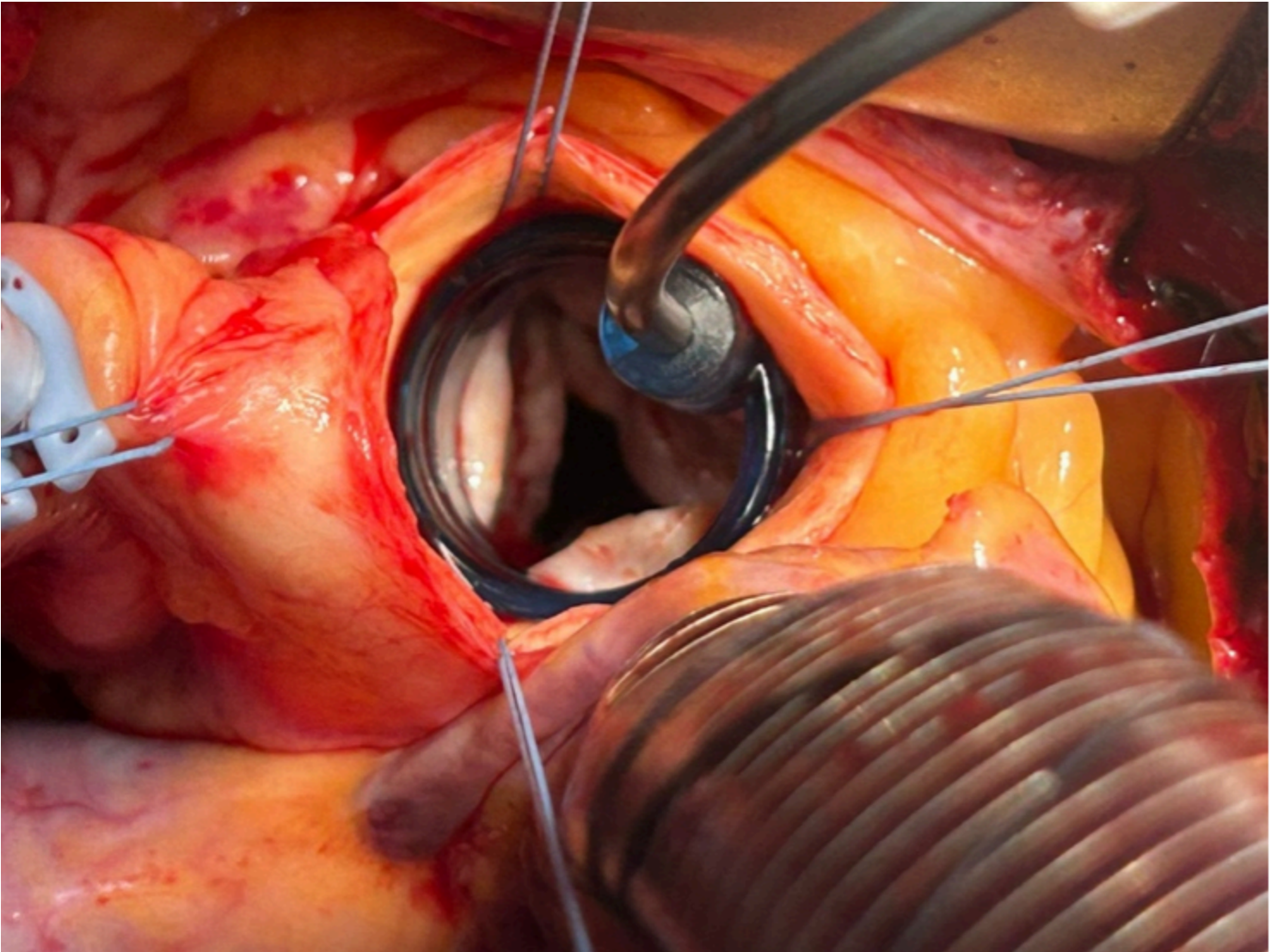


Figure 2

Intraoperative view of the aortic valve