CLINICAL VIGNETTE

An Interesting Case of Cardiomegaly

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Case Presentation

A 61-year-old male with history of atrial fibrillation, hypertension, transient ischemic attack, and metastatic melanoma presented for evaluation of cardiomegaly noted on recent surveillance chest imaging. He was receiving intratumoral injections of SD-101 in combination with pembrolizumab for melanoma treatment. The patient had a murmur as a child, and it resolved in his twenties. He had no childhood exercise limitations and denies current cardiac symptoms.

Transthoracic echocardiogram demonstrated severe right atrial and right ventricular enlargement with mildly reduced right ventricular systolic function. Left-sided chambers were normal and left ventricular systolic function was normal. The interatrial septum was noted to be aneurysmal. Color Doppler interrogation of the aneurysmal septum was suggestive of an atrial level shunt.

The patient was referred for transesophageal echocardiography to further evaluate the atrial level shunt. Interrogation of the aneurysmal septum demonstrated at least three separate, small secundum atrial septal defects consistent with a fenestrated atrial septal aneurysm. Color Doppler flow of the septum showed predominant left-to-right shunting.

Cardiac catheterization was performed to evaluate pulmonary pressures and quantify shunt fraction (ratio of pulmonary flow to systemic flow, Qp/Qs). Pulmonary artery pressures were normal. Shunt fraction was consistent with significant left-to-right shunting (Qp/Qs of 2.1:1).

The patient was referred to cardiac surgery for surgical repair. He underwent successful atrial septal aneurysm resection with pericardial patch repair, right and left-sided MAZE, and left atrial appendage closure.

Discussion

Right ventricular (RV) pathology may occur in response to a number of conditions, including a variety of primary myopathic processes. Examples include RV myocardial infarction, dilated cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy, and endomyocardial fibrosis.

Secondary processes that result in RV pathology are divided into conditions associated with RV pressure overload or RV volume overload. Conditions associated with RV pressure overload include primary or secondary pulmonary arterial hypertension, acute or chronic thromboembolic disease, pulmonary valve stenosis, or RV outflow tract obstruction. RV volume overload states can result from severe tricuspid or pulmonic regurgitation or atrial level shunts (includes atrial septal defects, partial anomalous pulmonary venous return and unroofed coronary sinus).

Atrial septal defects (ASD) are the second most common congenital heart malformation found in adults.[1] ASDs are classified by their anatomic locations and include primum, secundum, and sinus venosus defects.

ASDs that do not close in early childhood usually manifest by age 40 but may not be diagnosed until age 60 or older.[2-4] The most common initial manifestations include atrial arrhythmias, exercise intolerance, fatigue, dyspnea, and heart failure symptoms. Less frequent presentations include cerebral ischemic event due to paradoxical embolization, orthodeoxia-platypnea, pulmonary hypertension, Eisenmenger syndrome, or cyanosis. In some cases, cardiomegaly, as a result of right chamber enlargement, or pulmonary artery dilation may be incidentally noted on chest imaging in asymptomatic patients.

Echocardiography is the imaging modality of choice for the diagnosis of ASD. Secundum and primum ASDs can be visualized with two-dimensional transthoracic echocardiography (TTE). The addition of color Doppler imaging also helps to confirm the presence of an ASD. If two-dimensional TTE and color Doppler imaging do not confirm ASD, agitated saline contrast injection may aid in the diagnosis. Transesophageal echocardiography (TEE) can be used when a definitive diagnosis is not made by TTE. TEE also allows for estimation of ASD size and suitability for percutaneous closure.

The primary indication for closure of an atrial septal defect is the development of right-sided chamber enlargement with or without symptoms. It is also reasonable to consider closure in patients with paradoxical embolization or orthodeoxia-platypnea.[5]

Closure can be pursued by a surgical or percutaneous approach. The majority of patients with secundum ASDs are candidates for percutaneous transcatheter closure. Secundum defects that are >38mm in size and do not have an adequate rim of surrounding tissue are not amenable to percutaneous closure.

Primum and sinus venosus ASDs are not generally amenable to percutaneous repair and require surgical closure.

The secundum defects discovered in our patient were found in association with an atrial septal aneurysm. The difference between a redundant atrial septum and aneurysmal atrial septum has not been clearly defined. Most case studies of atrial septal aneurysms describe them as redundant, mobile septal tissue that oscillate into either atrium. Septal excursion of at least 10 to 15 mm is considered aneurysmal.[6-10] Atrial septal aneurysms are most commonly incidental echocardiography findings.

The clinical relevance of atrial septal aneurysms (ASA) remains unclear. They may be an isolated defect but are often associated with other structural abnormalities, such as PFO, ASD and mitral valve prolapse.[9-14] Some reports suggest a PFO is associated with 50% of ASA.[15] The reported frequency of ASDs with ASA ranges from 5-49%.[8,16] Mitral valve prolapse has been associated with ASA in 20.5% of patients with ASA.[9] There is also increased prevalence of ASA in patients with cerebral ischemic events. The exact mechanisms to explain the association between ASA and cerebral ischemic events has not been elucidated but may be related to its common association with PFO and ASD.[17-19]

Isolated atrial septal aneurysms generally do not require further evaluation or follow-up. An ASA that is associated with ASD may require closure if associated with a significant left-to-right shunt. Perforated aneurysms can be closed surgically or percutaneously, depending on morphology. A retrospective study of 50 patients with perforated ASAs demonstrated that those with one or two perforations were able to undergo successful percutaneous closure. The aneurysm morphology of the patients with multiple perforations was deemed unsuitable for percutaneous closure. These patients were all referred for surgical closure.[20]

Unexplained right-sided chamber enlargement should lead to investigation for an atrial level shunt. If an atrial level shunt is identified, then patients should be considered for percutaneous or surgical closure. TEE is crucial in order to identify defects that would be suitable for percutaneous closure. Those defects that are not amenable to percutaneous closure should be repaired surgically. Defect closure is necessary to prevent long-term sequelae from right ventricular volume overload.

REFERENCES

1. **Hoffman JI, Kaplan S.** The incidence of congenital heart disease. *J Am Coll Cardiol.* 2002 Jun 19;39(12):1890-900. Review. PubMed PMID: 12084585.
2. **Rostad H, Sörland S.** Atrial septal defect of secundum type in patients under 40 years of age. A review of 481 operated cases. Symptoms, signs, treatment and early results. *Scand J Thorac Cardiovasc Surg*. 1979;13(2):123-7. PubMed PMID:472671.
3. **John Sutton MG, Tajik AJ, McGoon DC.** Atrial septal defect in patients ages 60 years or older: operative results and long-term postoperative follow-up. *Circulation*. 1981 Aug;64(2):402-9. PubMed PMID: 6788403.
4. **Konstantinides S, Geibel A, Olschewski M, Görnandt L, Roskamm H, Spillner G, Just H, Kasper W.** A comparison of surgical and medical therapy for atrial septal defect in adults. *N Engl J Med*. 1995 Aug 24;333(8):469-73. PubMed PMID: 7623878.
5. **Warnes CA, Williams RG, Bashore TM, Child JS, Connolly HM, Dearani JA, del Nido P, Fasules JW, Graham TP Jr, Hijazi ZM, Hunt SA, King ME, Landzberg MJ, Miner PD, Radford MJ, Walsh EP, Webb GD.** ACC/AHA 2008 Guidelines for the Management of Adults with Congenital Heart Disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (writing committee to develop guidelines on the management of adults with congenital heart disease). *Circulation.* 2008 Dec 2;118(23):e714-833. doi:10.1161/CIRCULATIONAHA.108.190690. PubMed PMID: 18997169.
6. **Gondi B, Nanda NC.** Two-dimensional echocardiographic features of atrial septal aneurysms. *Circulation*. 1981 Feb;63(2):452-7. PubMed PMID: 6450005.
7. **Hauser AM, Timmis GC, Stewart JR, Ramos RG, Gangadharan V, Westveer DC, Gordon S.** Aneurysm of the atrial septum as diagnosed by echocardiography: analysis of 11 patients. *Am J Cardiol*. 1984 May 1;53(9):1401-2. PubMed PMID: 6711444.
8. **Hanley PC, Tajik AJ, Hynes JK, Edwards WD, Reeder GS, Hagler DJ, Seward JB.** Diagnosis and classification of atrial septal aneurysm by two-dimensional echocardiography: report of 80 consecutive cases. *J Am Coll Cardiol.* 1985 Dec;6(6):1370-82. PubMed PMID: 4067118.
9. **Mügge A, Daniel WG, Angermann C, Spes C, Khandheria BK, Kronzon I, Freedberg RS, Keren A, Denning K, Engberding R, et al.** Atrial septal aneurysm in adult patients. A multicenter study using transthoracic and transesophageal echocardiography. *Circulation*. 1995 Jun 1;91(11):2785-92. PubMed PMID: 7758185.
10. **Belkin RN, Waugh RA, Kisslo J.** Interatrial shunting in atrial septal aneurysm. *Am J Cardiol*. 1986 Feb 1;57(4):310-2. PubMed PMID: 3946220.
11. **Roberts WC.** Aneurysm (redundancy) of the atrial septum (fossa ovale membrane) and prolapse (redundancy) of the mitral valve. *Am J Cardiol*. 1984 Nov 1;54(8):1153-4. PubMed PMID: 6496343.
12. **Iliceto S, Papa A, Sorino M, Rizzon P.** Combined atrial septal aneurysm and mitral valve prolapse: detection by two-dimensional echocardiography. *Am J Cardiol*. 1984 Nov 1;54(8):1151-3. PubMed PMID: 6496342.
13. **Iliceto S, Antonelli G, Chiddo A, Rizzon P.** Two-dimensional echocardiographic recognition of an atrial septal aneurysm. *Int J Cardiol*. 1983;2(3-4):447-9. PubMed PMID: 6840914.
14. **Ong LS, Nanda NC, Falkoff MD, Barold SS.** Interatrial septal aneurysm, systolic click and atrial tachyarrhythmia--a new syndrome? Ultrasound Med Biol. 1982;8(6):691-3. PubMed PMID: 7164184.
15. **Silver MD, Dorsey JS.** Aneurysms of the septum primum in adults. *Arch Pathol Lab Med*. 1978 Feb;102(2):62-5. PubMed PMID: 579965.

16. **Zabalgoitia-Reyes M, Herrera C, Gandhi DK, Mehlman DJ, McPherson DD, Talano JV.** A possible mechanism for neurologic ischemic events in patients with atrial septal aneurysm. *Am J Cardiol.* 1990 Sep 15;66(7):761-4. PubMed PMID: 2399898.
17. **Pearson AC, Nagelhout D, Castello R, Gomez CR, Labovitz AJ.** Atrial septal aneurysm and stroke: a transesophageal echocardiographic study. *J Am Coll Cardiol.* 1991 Nov 1;18(5):1223-9. PubMed PMID: 1918699.
18. **Agmon Y, Khandheria BK, Meissner I, Gentile F, Whisnant JP, Sicks JD, O'Fallon WM, Covalt JL, Wiebers DO, Seward JB.** Frequency of atrial septal aneurysms in patients with cerebral ischemic events. *Circulation.* 1999 Apr 20;99(15):1942-4. PubMed PMID: 10208995.
19. **Mattioli AV, Aquilina M, Oldani A, Longhini C, Mattioli G.** Atrial septal aneurysm as a cardioembolic source in adult patients with stroke and normal carotid arteries. A multicentre study. *Eur Heart J.* 2001 Feb;22(3):261-8. PubMed PMID: 11161938.
20. **Ewert P, Berger F, Vogel M, Dähnert I, Alexi-Meshkishvili V, Lange PE.** Morphology of perforated atrial septal aneurysm suitable for closure by transcatheter device placement. *Heart.* 2000 Sep;84(3):327-31. PubMed PMID:10956300; PubMed Central PMCID: PMC1760966.

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