An electrophysiological and anatomical space-occupying lesion: Lipomatous hypertrophy of the interatrial septum in a patient presenting with atrial tachycardia

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Introduction

Lipomatous hypertrophy of the interatrial septum (LHIS) rarely causes clinical sequelae and is often reported as an incidental finding on cardiac imaging. Arrhythmia is an unusual complication of LHIS, although other tumors have been reported to cause arrhythmias by mass effect or tissue invasion.[1] We present an unusual case of atrial arrhythmias associated with a large atrial mass that was subsequently confirmed to be LHIS.

Case report

A 62-year-old woman was referred to our institution for management of symptomatic paroxysmal atrial tachycardia (AT). One month prior, the patient underwent electrical cardioversion for atrial flutter. The patient had early recurrence of an AT and persistent symptoms despite antiarrhythmic medications including sotalol, metoprolol, and amiodarone. Symptomatic tachy-brady syndrome limited further dose escalation. A previous computed tomography (CT) scan had shown significant lipomatous hypertrophy of the atrial septum, approximately 4.6 cm in its largest diameter with compression of the superior vena cava (SVC). A transthoracic echocardiogram showed a normal left ventricular ejection fraction and no other significant abnormality.

An electrophysiology study (and ablation) was performed using electroanatomical mapping (CARTO; Biosense Webster, Irvine, CA). Transseptal access was obtained via patent foramen ovale (PFO) using fluoroscopy. Activation mapping of the left and right atrium was performed. Multiple ATs were readily induced. Multiple foci were ablated, from the right atrium, SVC, and septum. Subsequently a more stable atrial flutter developed with proximal-to-distal coronary sinus activation (tachycardia cycle length was 250 ms) (Figure 1). Electroanatomical mapping demonstrated an electrophysiological and anatomical space occupying lesion posteroseptally above the PFO (Figure 2). A focal origin (or microreentry) was thought the most likely mechanism of many of the atrial arrhythmias owing to early activation at a small focus with apparent passive conduction through both atria, and successful termination with focal ablation at the early site for many of the right atrial arrhythmias. Some

KEY TEACHING POINTS

- Clinicians must consider primary cardiac tumors in the differential diagnosis in the assessment and management of difficult-to-treat cardiac arrhythmias.
- Cardiac imaging including transesophageal echocardiography, cardiac computed tomography, or magnetic resonance imaging better characterizes atrial cardiac masses compared to transthoracic echocardiography.
- Lipomatous hypertrophy of the interatrial septum is characterized by nonencapsulated excessive epicardial fat deposition in the septum secundum that spares the fossa ovalis.

KEYWORDS Atrial flutter; Atrial tachycardia; Cardiac mass; Catheter ablation; Diagnostic technique
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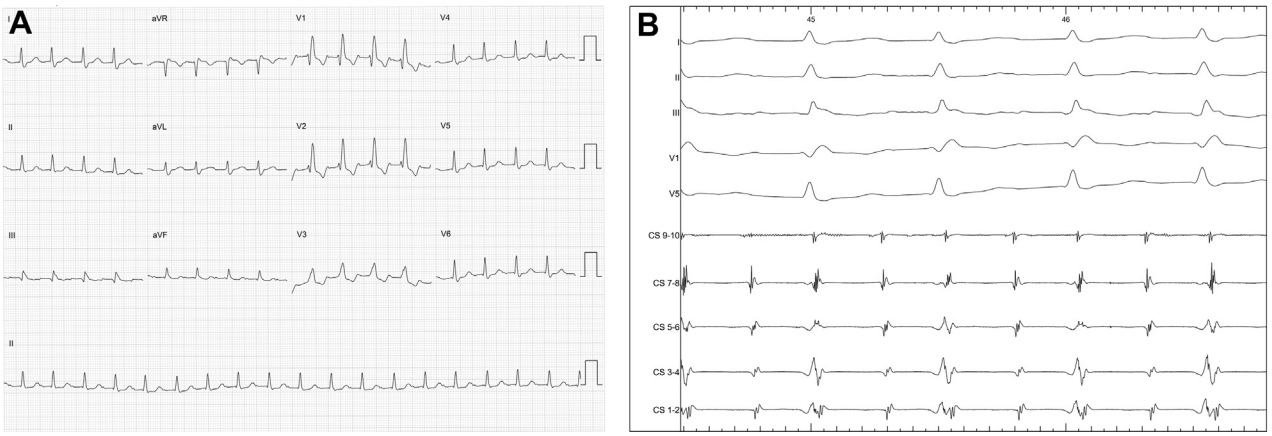

Figure 1 Twelve-lead electrocardiogram and intracardiac electrocardiogram. **A:** Electrocardiogram of atrial flutter with right bundle branch block. **B:** Intracardiac electrocardiogram of atrial flutter.

of the persisting arrhythmias were entrained from both the right and left atrium, suggesting macroreentry but a large portion of the cycle length was missing and appeared to be within the lipoma, where mapping was not accessible. Despite extensive ablation the tachycardia remained inducible with the activation map showing a reentrant circuit around the atrial mass with likely epicardial components. The patient was cardioverted to sinus rhythm.

The patient underwent transesophageal echocardiography, CT, and cardiac magnetic resonance (MR) imaging to better characterize the cardiac mass. A well-circumscribed soft tissue mass was seen in the posterolateral segment of the interatrial septum and measured 45 × 40 mm. There was 80% effacement of the SVC. There was sparing of the fossa ovalis and the CT and MR signal characteristics were consistent with fat (Figure 3).

After multidisciplinary assessment and discussion with the Heart Team, epicardial and more extensive endocardial ablation was thought unlikely to suppress all the arrhythmias. Further, there was concern for SVC obstruction in the long term. The patient's preference was to pursue a surgical approach. Excision of the mass and biatrial cryoablation was performed. The mass was excised along with approximately 30% of the right atrial free wall. The interatrial septum was reconstructed using a double patch technique and each limb was used to reconstruct the left and right atrium, including the free wall. The mass was sent for histopathologic assessment, which demonstrated expansion of the

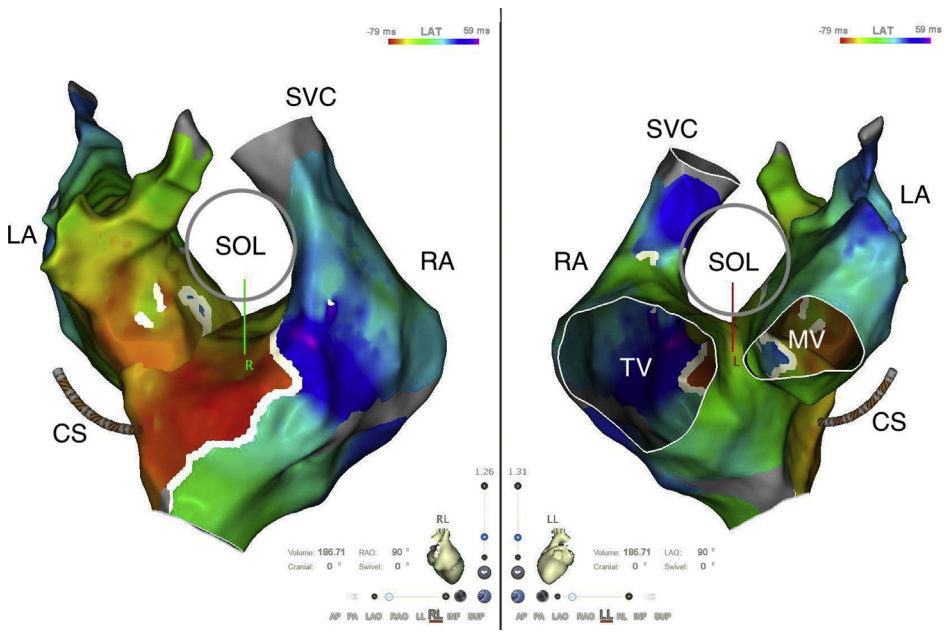

Figure 2 Left and right atrial activation map (CARTO; Biosense Webster, Irvine, CA). Electroanatomical space-occupying lesion (SOL) posteroseptally above the patent foramen ovale as denoted by an absence of electroanatomical mapping. CS = coronary sinus; LA = left atrium; MV = mitral valve; RA = right atrium; SVC = superior vena cava; TV = tricuspid valve.

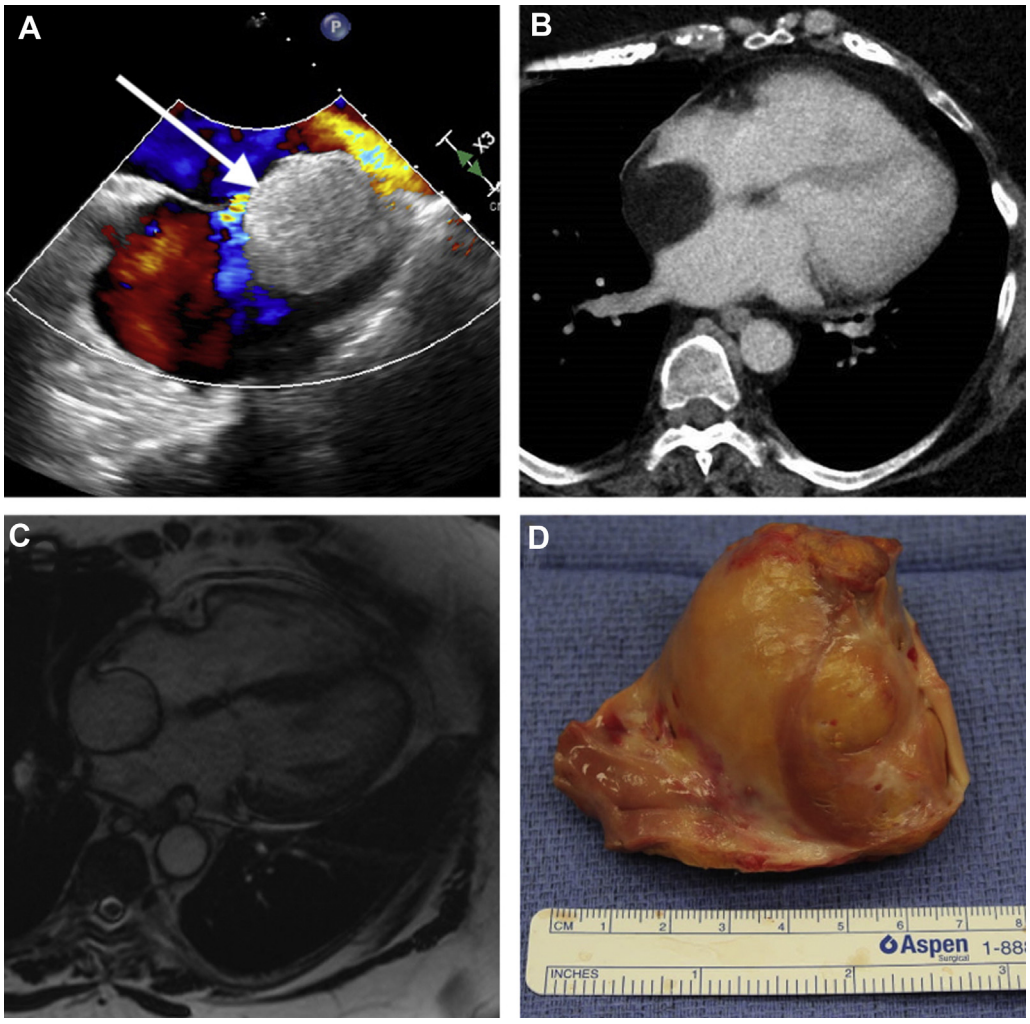

Figure 3 Transesophageal echocardiogram, computed tomography, cardiac magnetic resonance imaging, and resected cardiac mass. **A:** Transesophageal echocardiogram demonstrated a well-defined interatrial cardiac mass with sparing of the fossa ovalis indicated by the *white arrow*. Patent foramen ovale with left-to-right atrial shunt on color Doppler. **B:** Computed tomography showed a non-enhancing interatrial cardiac mass with a radiological appearance consistent with fat. **C:** Cardiac magnetic resonance imaging showed a well-circumscribed interatrial cardiac mass with signal characteristics similar to fat. **D:** Resected cardiac mass.

myocardium by a proliferation of adipocytes without a well-defined capsule, in keeping with a diagnosis of LHIS.

The postoperative period was complicated by pericardial effusion causing tamponade and was drained surgically via a subxiphoid approach. Dual-chamber pacemaker implantation was performed for tachy-brady syndrome postsurgery. There were no other postoperative sequalae. During 6 months of follow-up, the patient has had no recurrence of atrial flutter but has had some paroxysmal atrial fibrillation, rate controlled with metoprolol.

Discussion

LHIS predominantly occurs in women and is associated with obesity and increasing age.[2] Its incidence is not known owing to its usually asymptomatic and benign course. Previously reported cases comprise mostly autopsy studies and incidental findings on imaging or at surgery. LHIS has been defined as fatty infiltration with greater than 2 cm thickness in the interatrial septum and hourglass appearance on imaging with sparing of the fossa ovalis. Histologically, these lesions are characterized by non-encapsulated excessive epicardial fat deposition in the septum secundum.[3] In contrast, lipomas are encapsulated and do not infiltrate the myocardium.

LHIS has been reported to be associated with atrial arrhythmias with an increasing incidence of greater septal thickness.[4] Clinically significant symptoms are usually related to SVC obstruction and surgical management has been limited to case reports.[5–7] In 1 case with medically refractory atrial flutter, surgical resection and patch reconstruction resulted in termination of atrial flutter with no recurrence at 2-year follow-up.[5] Recurrence of fat deposition after surgical resection has not been reported.

Asymptomatic LHIS does not require surgery and can be accurately diagnosed with advanced imaging techniques. Transthoracic echocardiography has limited diagnostic utility, as the atrial septum is a far-field structure but is useful for assessing for secondary effects such as atrial compression or dilatation. Transesophageal echocardiography can clearly demonstrate the origin of the mass and whether there is

sparing of the fossa ovalis, which has been reported to be pathognomic of this condition. Imaging characteristics on CT and MR imaging are sufficient to avoid histological confirmation.[2,4,8] On contrast-enhanced CT images, LHIS is a non-enhancing, smooth, well-marginated mass with an appearance similar to subcutaneous fat. On MR imaging, LHIS similarly is a well-defined mass with a high signal intensity on T1-weighted images, characteristic of fat, and there is no late gadolinium enhancement.

Conclusion

This patient had multiple atrial arrhythmias refractory to endocardial ablation associated with extreme LHIS. Advanced multimodal cardiac imaging can accurately diagnose these cardiac masses. Surgical excision is typically reserved for obstructive symptoms, given the benign natural history of this condition.

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