Left atrial intramural hematoma: the main role of echocardiography

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Abstract

Left atrial intramural hematoma (LAIH) is an uncommon entity for which a timely diagnosis is critical for decision making. Cardiac surgical or catheter-based procedures are potential causing factors. Though cardiac computerized tomography and magnetic resonance are highly accurate diagnostic modalities, their role is limited by the lack of widespread availability. The present clinical case illustrates the diagnostic features of LAIH that can be obtained using echocardiography at the bedside in critically ill patients. We report a case of LAIH, that followed a catheter ablation procedure and was complicated by cardiac and cerebral ischemia. Cardiac surgical management was required.

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ABSTRACT Left atrial intramural hematoma (LAIH) is an uncommon entity for which a timely diagnosis is critical for decision making. Cardiac surgical or catheter-based procedures are potential causing factors. Though cardiac computerized tomography and magnetic resonance are highly accurate diagnostic modalities, their role is limited by the lack of widespread availability. The present clinical case illustrates the diagnostic features of LAIH that can be obtained using echocardiography at the bedside in critically ill patients. We report a case of LAIH, that followed a catheter ablation procedure and was complicated by cardiac and cerebral ischemia. Cardiac surgical management was required. KEYWORDS intramural hematoma, left atrial dissection, radiofrequency ablation, cardiac surgery.

Left atrial intramural hematoma (LAIH) has been defined as a disjunction within the wall of the left atrium (LA) that creates a new chamber with or without direct communication with the true LA cavity [1]. LAIH is a rare complication related to any cardiac interventions, including both surgical and catheter-based ones, involving manipulation of the LA [2]. Recently, the number of cases of LAIH complicating interventions of transvenous radiofrequency ablation (TRA) has been increasing [3]. Spontaneous cases are also described [2,3]. The disjunction within the wall forms a large cavity between the endocardium and the epicardium of the LA, causing obliteration of the left atrial cavity and resultant hemodynamic impairment, which in most cases requires immediate surgical intervention. In contrast, LAIH without hemodynamic instability can often be managed non-operatively with satisfactory outcomes [2]. Although computerized tomography (CT) and magnetic resonance (MR) have a crucial diagnostic role, they are not widespread everywhere. Instead, echocardiography is a diagnostic tool available in any setting, even at bedside in critically ill patient. We present useful diagnostic features of LAIH obtained by echocardiography as well long term follow up findings.

CLINICAL CASE: A 47-years-old man had recurrent attacks of atrial tachycardia that did not resolve upon treatment with multiple anti-arrhythmic drugs. His medical history was unremarkable except for arterial hypertension. A TRA was scheduled. Three electrocatheters were initially placed via right femoral vein into the right heart; a non-fluoroscopic navigation system (CARTO3(R); Biosense-Webster Inc., Irvine, CA, USA) was used for three-dimensional reconstruction of right atrial anatomy and activation during atrial tachycardia; a single trans-septal puncture (TSP) was performed under fluoroscopic guidance and a SL1 sheath (St. Jude Medical Inc., Saint Paul, MN, USA) was introduced into the LA, through which a 4pole, 3.5 mm irrigation tip ablation catheter (Navistar ThermoCool; Biosense Webster Inc., Irvine, CA, USA) was also introduced. After three-dimensional reconstruction of LA anatomy and activation during atrial tachycardia, TRA was carried out with a Stockert RF generator with power limited to 35 W in the anterior and 20 W in the posterior LA regions. A bolus of 8000 IU (100 mg/kg) Heparin was given just after the TSP, and activated clotting time was maintained at 250-350 seconds throughout the procedure. There was no complication during the procedure. A few hours later, the patient showed dysarthria and right arm hyposthenia. Brain-CT scan ruled out hemorrhagic lesion, showing ischemic lesion in the territory of the left middle cerebral artery. Transthoracic echocardiography (TTE) demonstrated a very large LA mass adherent to posterior wall (fig.1) and connected to interatrial septum by a pedunculated stalk (fig. 2), causing a partial ventricular inflow tract obstruction. The mass seemed to move in synchrony with left atrial wall (video 1), without independent movement. In addition, it penetrated the atrio-ventricular groove and it displaced anteriorly the posterior mitral leaflet (video 2). Furthermore, there was a thickening of the LA walls in areas far from the mass, close to the aortic wall (fig. 3). All of these findings suggested the diagnosis of LAIH. Furthermore, TTE showed posterior wall motion abnormalities (video 3) and electrocardiogram showed a Q wave and T wave inversion on inferior leads, so the patient underwent a coronary angiography that revealed normal coronaries. Because of both the partial ventricular inflow tract obstruction and the thromboembolic complications (brain and myocardial ischemia), the patient underwent a cardiosurgical procedure. Intraoperative transesophageal echocardiography (TEE) demonstrated the huge dimension of the mass, involving almost the entire LA (video 4) and confirmed the thickening of the left atrial walls in areas far from the mass, close to the aortic wall (fig.4). Surgical findings documented the presence of an intramural atrial hematoma which was partially evacuated relieving the left ventricular inflow obstruction. The patient's neurologic deficits resolved and he was discharged about 10 days after TRA. During the follow up, there was a slow progressive reduction of the dimensions of the lesion that, three years later, was almost completely reabsorbed (video 5).

DISCUSSION: LAIH is a rare but potentially catastrophic complication related to TRA [2], although it may occur after cardiac interventions involving manipulation of the LA [2] and also spontaneously [1]. The full spectrum of its pathogenesis, management and definitive diagnostic criteria are not well established [4]. LAIH begins with an initial insult to the left atrial endocardium with entry of pressurized blood to create a dissection within the left atrial wall [2]. LAIH due to TRA may be caused by either a steam-pop effect [5] or the creation of an endocardial flap of the left atrial wall due to a stiff wire manipulation [2]. In our case it is likely that the damage to the left atrial wall occurred during TSP, rather than during the standard mapping or through ablation catheters. Regarding the management, indication for surgery should be based on the clinical presentation, including the degree of hemodynamic impairment and the extent of the left atrial dissection [3]. In our case both the partial ventricular inflow tract obstructions and the thromboembolic events supported the surgical approach. Regarding the diagnostic approach, wherever possible, multimodality investigation, using CT or MR, is useful for an accurate diagnosis: MR enables a tissue characterization [6-7], CT guarantees excellent spatial resolution [8]. However, in an emergency setting, a multimodality diagnostic approach with CT scan and MR is often not practical; instead, echocardiography (transthoracic and/or transesophageal) allows to make differential diagnosis with pericardial hematoma and mostly with LA thrombosis requiring a different therapeutic approach. The following are key elements for the diagnosis of the LAIH in echocardiography:

- Synchronous motion of an inhomogeneous mass with LA walls (video 1,2);

- Atrio-ventricular groove infiltration and anterior displacement of posterior mitral leaflet in posterolateral LAIH (video 1,2);

- LA thickening in areas far from the mass (close to the aortic wall) (fig. 3-4).

These features suggest that the lesion is within the LA wall and not simply 'leaning' on it (as in the case of a thrombus or a myxoma) or on its outer side (pericardial hematoma). The false peduncle (fig. 5) represents the point in which the TSP induces hematoma formation. The use of TEE for precise guidance of TSP may be a method to mitigate the risk of this complication [9]. We did not perform TEE for organizational issues. Faletra et al showed how the use of an imaging guide may avoid complications related to inappropriate puncture sites. When the catheter is against the fossa ovalis and the interventional cardiologist applies pressure, the site of the puncture may be identified by the "tenting" seen in two dimensional TE images. Since TEE is usually performed before TRA in order to exclude left atrial appendage thrombi, the interatrial septum could be evaluated to suggest a TEE-guided TSP, especially in high-risk patients (i.e., those with a previous transseptal crossing failure or severe kyphoscoliosis, septal aneurysm, or aortic root dilation) [9].

CONCLUSION: LAIH is a rare complication of cardiosurgical and transcatheter procedures. For the diagnosis, it is important both to suspect it and to be aware of its imaging features. The echocardiographic reported keys can help to make the differential diagnosis and the optimal therapy. Intraprocedural TEE, during TRA, can help to prevent intramural hematoma.

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Figure Legends:

- fig. 1: Parasternal long-axis view reveals irregular and disomogeneous left atrium mass adherent to posterior wall. Ao: aorta. LAIH: left atrial intramural hematoma. LV: left ventricle. RV: right ventricle.
- fig. 2: Parasternal short-axis view reveals left atrium mass connected to interatrial septum by a pedunculated stalk. AoV: aortic valve. LAIH: left atrial intramural hematoma. RA: right atrium. RV: right ventricle.
- fig. 3: Parasternal long axis view reveals the thickening of the left atrium in areas far from the mass (*arrow*). Ao: aorta. LAIH: left atrial intramural hematoma. LV: left ventricle. RV: right ventricle.
- fig. 4: Midesophageal long axis view reveals the thickening of the left atrium in areas far from the mass (*arrow*). Ao: aorta. LAIH: left atrial intramural hematoma. LVOT: left ventricle outflow tract. RV: right ventricle.
- fig. 5: Parasternal short axis shows the false peduncle originating from interatrial septum (*arrow*). AoV: aortic valve. LAIH: left atrial intramural hematoma. RA: right atrium. RV: right ventricle.

Embedded Video:

- Video 1: Parasternal long-axis view underlines synchronous motion of the mass with left atrial walls.
- Video 2: Simultaneous multiplane transthoracic echocardiographic images show atrio-ventricular groove infiltration and anterior displacement of posterior mitral leaflet.
- Video 3: Parasternal short-axis view shows akinesia of the infero-posterior wall.
- Video 4: Midesophageal long-axis view demonstrates the huge dimension of the mass, involving almost the entire left atrium.
- Video 5: Simultaneous multiplane transthoracic echocardiographic images prove the reduction of the dimensions of the lesion after three years' follow up.









