Blood Balloon Induced by an Atrial Myxoma in the Heart

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A 75-year-old male with a left atrial (LA) mass was referred to our hospital. The patient had been healthy until 5 months prior, when dyspnea on exertion developed. A chest radiograph showed mild enlargement of the cardiac silhouette. An ECG showed sinus rhythm with P mitrale (Figure 1A). Transthoracic echocardiography (TTE) revealed a 5.4×3.9-cm hypoechoic tumor that had prolapsed through the mitral valve causing left ventricular inflow obstruction (Figure 1B; Movie I in the online-only Data Supplement). The tumor appeared to be soft with smooth surface and had a stalk originating from the interatrial septum. Transesophageal echocardiography (TEE) revealed dynamic smoke-like echoes, indicative of spontaneous echo contrast, inside the tumor (Figure 1C; Movie I in the online-only Data Supplement). M-mode showed multiple echoes and unique tumor behavior with subtle motion, in which the tumor rebounded into LA cavity twice during systole, producing an M-shaped signal (Figure 1D; Movie II in the online-only Data Supplement). These echocardiographic findings implied that the inside of tumor was filled with liquid, rather than clotted blood, giving it a blood-balloon–like appearance. Moreover, color Doppler revealed afferent flow entering the tumor (Figure 2A) and efferent flow draining from the tumor (Figure 2C). Both flows occurred predominantly during diastole (Figure 2B and 2D; Movie III in the online-only Data Supplement), suggestive of blood supply from the coronary artery. Enhanced chest CT confirmed the tumor prolapse and the entry jet into the tumor (Figure 3A). On MRI, the mass was well defined and encapsulated with a homogeneous internal structure, but it did not include a solid lesion (Figure 3B and 3C). Echocardiography, CT, and MRI showed no evidence of tumor invasion, such as inhomogeneity or thickness of the interatrial septum, or tumor extension into other chambers. Coronary angiography demonstrated the blood spurting and staining of the entire tumor, with filling from the left ventricular branch of the right coronary artery (Figure 3D). Interestingly, the tumor staining lasted for 30 s despite halting coronary injection of contrast medium (Movie IV in the online-only Data Supplement). Preoperatively, we suspected that this was an LA myxoma with intratumoral hemorrhage. The differential diagnosis of intracardiac cystic masses includes bronchial cysts, hydatid cyst, thrombus, cystic tumor of the atrioventricular node, intracardiac varices, closed interatrial septum aneurysm, and endocardial blood cyst.

The tumor was removed urgently. The broad attachment of the tumor to interatrial septum required a biatrial approach for tumor excision with pericardial patch reconstruction. An left ventricular branch of right coronary artery was ligated. Intraoperatively, the tumor was soft, with a thin wall that ruptured during tumor excision (Figure 4A and 4B), revealing the presence of liquid blood. As expected, we found a pin-hole entrance for coronary flow into the tumor (Figure 4B and 4C). Histologically, the tumor was composed primarily of myxoma cells and capillaries surrounded by a myxoid matrix (Figure 4D-i). Some bleeding was found in the matrix, suggesting capillary vulnerability. The tumor wall layer consisted mainly of myxoid material and myxoma cells (Figure 4D-ii). An LA myxoma filled with liquid blood was diagnosed. The patient had an uneventful postoperative course.

Intratumoral hemorrhage is encountered rarely in patients with a myxoma; this is the first report of a cardiac tumor with an appearance similar to a blood balloon.

Two causative factors underlie the formation of a blood balloon: the vulnerability of the feeding artery and an adequately sized rupture of the tumor wall. Rupture of the feeding artery vessel wall might cause bleeding within the tumor parenchyma and can induce rapid expansion of the tumor. In most cases, an increase in the intratumoral pressure inhibits further blood entry, resulting in the formation of a blood clot. However, in this case, partial rupture of the tumor wall prevented an increase in intratumoral pressure, further expansion, and the formation of a blood clot. The similarity of flow patterns in feeding and draining arteries indicated that the inside of the tumor acted as a passive conduit between right coronary artery and LA cavity, suggesting that the rupture balanced the feeding and draining of blood.
Characterization of the internal structure of the tumor is important for precise diagnosis. In this case, spontaneous echo contrast suggested a unique intratumoral environment consisting of liquid, but not clotted, blood. Moreover, the subtle tumor motion, which produced an M-shaped signal, was noteworthy. This phenomenon could be caused by the heterogeneity of the specific gravity of internal fluid contents.

Disclosures
None.

Figure 1. A, ECG suggesting left atrial (LA) enlargement. B, Transthoracic echocardiography (TTE) showing a large hypoechoic tumor protruding through the mitral valve (MV) orifice. C, On transesophageal echocardiography (TEE), an echolucent region was found near the base of the stalk (arrow). Note the dynamic smoke-like echoes inside the tumor. D, M-mode echocardiogram showed that the tumor rebounded into the LA cavity twice during systole, producing M-shaped signals (arrows). LA indicates left atrium.

Figure 2. On transesophageal echocardiography (TEE), color and pulse Doppler signals demonstrate afferent flow entering the tumor (A and B) and efferent flow draining from the tumor into the left atrial (LA) cavity (C and D). Note that both flow patterns are similar.
Figure 3. Spillage of contrast medium from feeding artery into the tumor on chest CT (A, arrow) and selective right coronary angiography (D, arrow). MRI showing the well-defined encapsulated mass in the left atrium (LA; B: short-axis view on the FIESTA cine sequence), and no evidence of tumor invasion (C: 4-chamber view on T2 black blood sequence).

Figure 4. A through C, Macroscopic view of the resected tumor. Note the thin tumor wall that ruptured during excision. The black arrows point to a pinhole entrance for coronary flow into the tumor (B and C).

D, The tumor histology; insets of the areas in the rectangles were obtained at higher magnification. i, Histological section of the stalk base showing stellate cells and capillaries surrounded by a myxoid matrix. ii, The encapsulated substance consists mainly of myxoid material and myxoma cells.
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