Case Report
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Dynamic Multidetector CT Findings of Left Atrial Myxomas Causing Mitral Valve Obstruction[1]

승모판 폐쇄를 일으킨 좌심방 점액종의 역동적 다절편 CT 소견[1]

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We report multidetector row CT (MDCT) findings of two left atrial myxomas causing mitral valve obstruction and dyspnea of patients. Cardiac MDCT showed well-defined left atrial masses attached to the interatrial septum and shifting of tumors into the left ventricle causing mitral valve obstruction during diastole in a 37-year-old male and in a 69-year-old female. Also, we observed intratumoral hemorrhage in the second case. Myxomas were resected and the patients were discharged without dyspnea.

Index terms
Tomography, X-Ray Computed
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INTRODUCTION

Myxoma is the most frequent primary cardiac neoplasm. The clinical signs and symptoms may be non-specific. Myxomas occur most frequently in the left atrium. A typical myxoma is a well defined mass which shows a lower attenuation than that of intracavitary blood (1). An atypical myxoma with internal hemorrhage shows high attenuation and contrast filled tumor. If myxomas grow bigger, it is more likely that they shift into the left ventricle during diastole via the mitral valve, thereby causing mitral valve obstruction. We report CT findings of two left atrial myomxas causing mitral valve obstruction.

CASE REPORT

Case 1

A 37-year-old man was admitted to our hospital due to exertional dyspnea for one month. Physical examination revealed diastolic murmur and an electrocardiogram showed atrial fibrillation. Vital signs were stable and a blood analysis including cardiac biomarkers was within normal limits. Chest radiographs showed cardiomegaly and engorged pulmonary vasculatures in the upper lungs (Fig. 1A). The patient underwent a transthoracic and transesophageal echocardiography. Also, a 64-slice multidetector CT (MDCT) with electrocardiography (ECG)-gating (Light speed VCT XTe, GE healthcare, Milwaukee, USA) was performed to evaluate intra and extracardiac abnormalities. Transthoracic and transesophageal echocardiographies showed a left atrial tumor that attached to the atrial septum and projected into the left ventricle (Fig. 1B). The multi-phased images of the cardiac MDCT scan on systole and diastole showed a left atrial tumor protruding into the left ventricle (Fig. 1C, D). This mass caused mitral stenosis and may have evoked dyspnea. The CT scans showed an

irregular marginated left atrial mass about 8.4 × 6.3 × 4.4 cm which abutted the inter-atrial septum with left atrial enlargement. The mass showed hypoattenuation relative to intra-atrial blood. There was no significant stenosis in the coronary arteries (not shown) and the mass was radiologically diagnosed as cardiac myxoma.

The patient underwent surgery for excision of the atrial mass. The intra-operative specimen consisted of several gelatinous lumps. The endocardium was attached to the mass, measuring 2.0 × 1.0 cm. The external surface of the mass was vaguely lobulated, smooth, and glistening. Further, the mass was soft and partly friable (Fig. 1E). A typical myxoma was proven pathologically.

After a tumorectomy, extertional dyspnea disappeared and the patient was discharged without complication.

Case 2

A 69-year-old woman who presented with dyspnea for one year and aggravated dyspnea for the last 3 months was referred to our hospital. She had hypertension and has been taking medication for this condition for the last 3 years. Upon physical examination, there were no remarkable findings. An electrocardiogram showed a normal sinus rhythm. Furthermore, blood analyses including cardiac biomarkers were within normal range. A chest radiograph showed no abnormality. The patient underwent a transthoracic echocardiography which showed a left atrial cystic mass. The transthoracic echocardiography showed that the atrial mass was attached to the inter-atrial septum and was compacted above the mitral annulus (Fig. 2A). A conventional coronary angiography represented hypervascular tumor stains (Fig. 2B) with the feeder

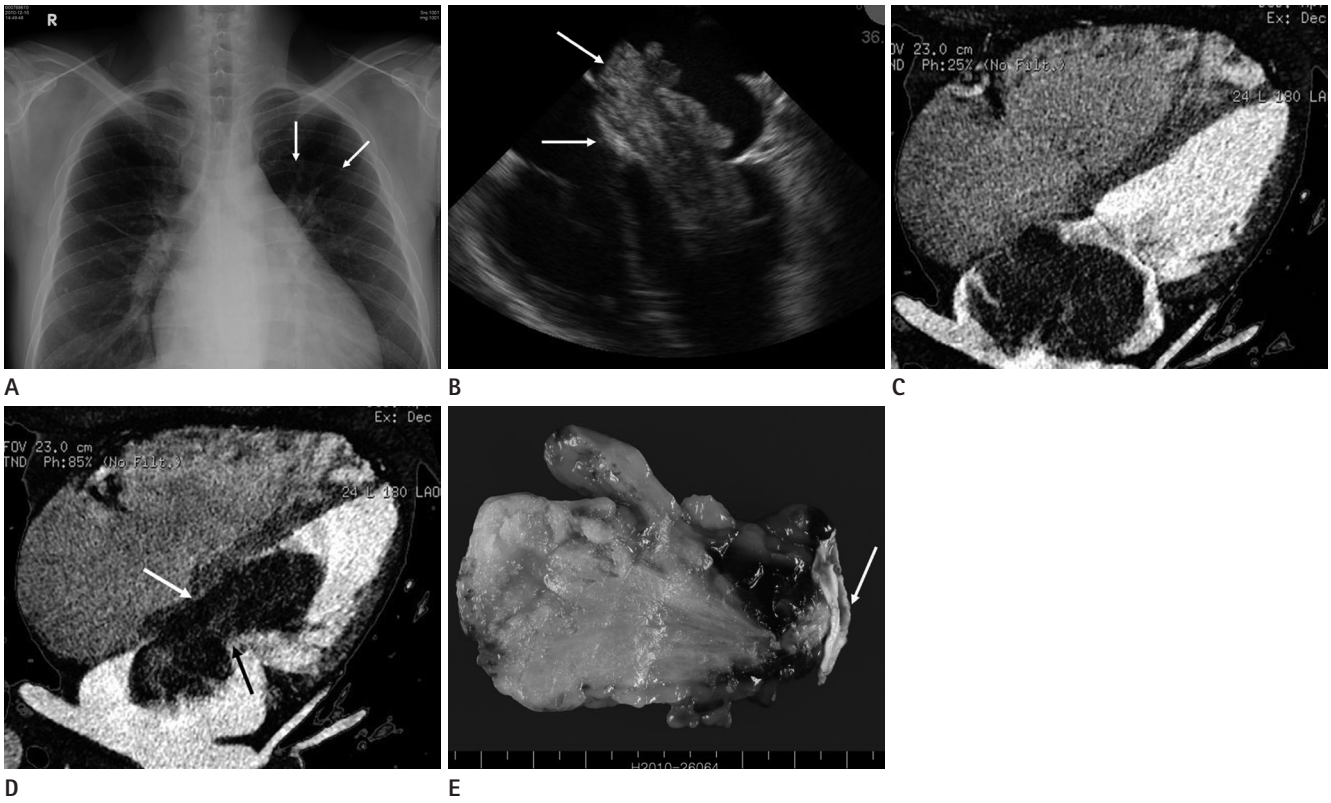

Fig. 1. A 37-year-old man with typical myxoma.
Chest radiograph **(A)** showed cardiomegaly and pulmonary vascular redistribution in the upper lungs (arrows).
Four-chamber view of transesophageal echocardiography **(B)** shows a left atrial tumor which was attached to inter-atrial septum and prolapsed into the left ventricle. The mass caused mitral valve obstruction.
Four-chamber cardiac MDCT scans **(C, D)** show an irregularly marginated left atrial mass abutting the inter-atrial septum with left atrial enlargement. The mass showed areas of hypoattenuation relative to intra-atrial blood.
In systole **(C)**, the mass is confined in the left atrium.
However, in diastole **(D)**, the left atrial mass protrudes into the left ventricle via the mitral valve making waist of the mass (arrows).
Intraoperative specimen **(E)** shows several gelatinous lumps, measuring 6.5 × 5.0 × 4.5 cm. A piece of white endocardium is seen to be attached to the mass (arrow) and the external surface of the mass is smooth and glistening.

originating from left circumflex artery (LCX). Subsequently, CT was performed using a 16-slice MDCT with ECG-gating (Sensation 16; Siemens Medical Solution, Erlangen, Germany) for evaluation of mass morphology. A MDCT scan showed a 4-cm sized well demarcated mass attached to the inter-atrial septum; the mass included mixed low-density and enhancing portions. Coronary CT angiography showed an anomalous feeder arising from the LCX (Fig. 2C). The dot-like enhancements were seen in the center of the low density region and represented intratumoral vessels (Fig. 2D, E). The CT scan at the end-diastole (atrial contraction) showed a compacted mass within the atrium, which narrowed the atrioventricular tract (Fig. 2E).

The patient underwent resection of the mass and the gross specimen appeared as a whitish ovoid mass. The external surface was described as lobulated, whitish myxoid, and firm. For the section, the inner component of the mass was soft and whitish myxoid with hemorrhagic areas which showed a glistening cut surface and prominent vascular structures (Fig. 2F). Atypical hemorrhagic myxoma was proven. The patient fully recovered and discharged without dyspnea.

DISCUSSION

Cardiac myxoma is the most common benign neoplasm of the heart and is found in the left atrium (75% of cases). Typi-

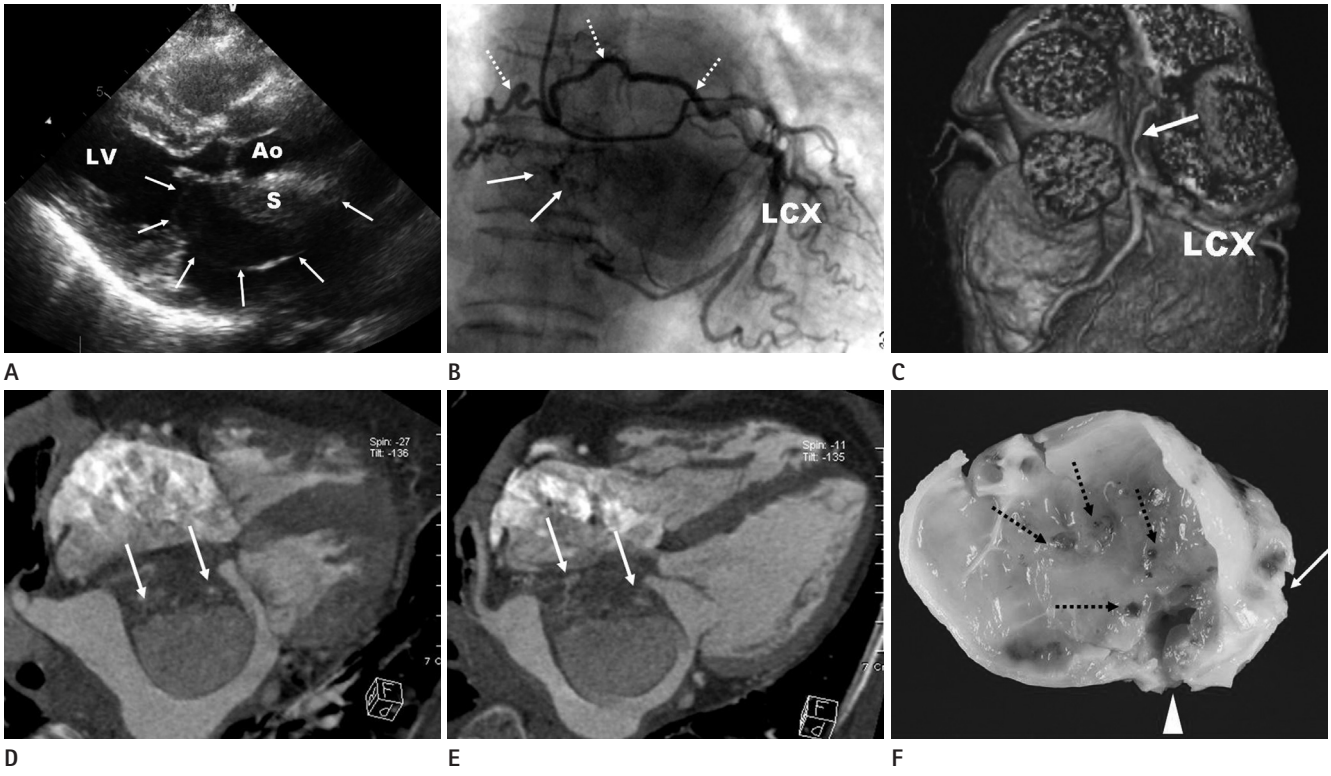

Fig. 2. A 69-year-old woman with atypical myxoma with intratumoral hemorrhage.
Parasternal long-axis 2D echo image **(A)** at end-diastole shows the protruded cystic mass (arrows) with a solid portion (S) abutting inter-atrial septum. 'Ao' and 'LV' mean aorta and left ventricle, respectively.
The coronary angiography **(B)** shows hypervascularity in the tumor (arrows).
The feeder (dotted arrows) originated from the left circumflex artery (LCX). Also, a volume-rendering image of CT **(C)** shows a feeder arising from LCX (arrow).
Four-chamber images of MDCT scans at end-systole **(D)** and end-diastole **(E)** show a well demarcated cystic mass attached to interatrial septum and includes mixed low attenuated (more septal portion) and hyperenhanced (more intraatrial portion) portions.
The center of the more hypoattenuated portion show dot-like enhancements which are suspected of having vascular structures (arrows). A more compact mass within left atrium is seen at end-diastole **(E)**.
A photo of the gross specimen **(F)** show a whitish ovoid mass measuring 5.0 x 4.0 x 1.5 cm. A piece of white endocardium is seen to be attached to the mass (arrow). The external surface is lobulated, whitish myxoid, and firm. On section, the inner component of the mass is soft and whitish myxoid with hemorrhagic areas (arrow head), a glistening cut surface, and prominent vascular structures (dotted arrows).
Note.—LCX = left circumflex artery, MDCT = multidetector row CT

cally, the findings consist of a well-defined mass with relatively low attenuation compared to enhancing intra-cardiac blood (1). Myxomas can mimic thrombi, radiologically and Myxomas are significantly larger than thrombi. The location of a thrombus usually depends on the underlying heart disease, and may occur in any of the heart's chambers. LA thrombi most often originate from the appendage, while myxomas most often originate from the fossa ovalis. The shapes of myxomas are usually polypoid, but can be villous. Similarly, thrombi are also usually polypoid (2). Atypical findings of cardiac myxomas are low-attenuation lesions within the mass which suggest thrombus, as seen in our case. The dot-like enhancements which suggest the presence of vasculature are seen in the center of thrombus. In our case, we had differential diagnoses including a hemorrhagic cyst with active bleeding, myxoma with degenerative hemorrhagic cyst, hemorrhagic metastasis, and sarcoma with internal hemorrhage. Sometimes, we should distinguish myxomas from sarcomas involving the heart. Angiosarcomas tend to occur in the right atrium and involve the pericardium. Other sarcomas affect the left atrium more frequently. Malignant fibrous histiocytomas usually occur from the posterior wall of the left atrium and may invade the pulmonary veins (3). Myxosarcomas are a rare form of primary malignant tumors. It is very difficult to differentiate myxosarcomas from myxomas. Myxosarcomas show local recurrences, involving the pulmonary artery, pericardium or pleura and distant metastases, and the brain (4).

Most patients with large myxomas in the left atria present symptoms consistent with the classic triad of obstructive cardiac and embolic signs, or constitutional and systemic manifestations. The most common symptoms are dizziness, dyspnea, palpitation, and pulmonary edema, which are related to mitral valve obstruction. In our cases, the patients complained of dyspnea. Systemic emboli that may occur in any vascular beds lead to a variety of signs and symptoms (5).

In cases with large left atrial myxomas causing mitral valve obstructions, radiographs exhibit left atrial enlargement and pulmonary venous hypertension with pulmonary vascular redistribution and interstitial edema. If the myxoma is small and does not cause valvular obstruction, a chest radiograph may show normal findings (1). Transthoracic and transesophageal echocardiographies have a high sensitivity and specificity for the diagnosis of cardiac myxomas. Tumors manifest as spherical masses attached to the endocardial surface with occasional internal hypoechoic areas, speckled echogenic foci, and frondlike surface projections. Prolapse across the atrioventricular valve during diastole may also have been demonstrated. Doppler echocardiography can be used to evaluate associated valvular regurgitation or stenosis (6). In conventional coronary angiography, tumor vascularities such as clusters of small and tortuous vessels arising from the coronary arteries can be seen (7). CT scans with contrast enhancement usually demonstrate well-defined spherical or ovoid intracavitary masses with lobular contours. Tumors show lower attenuations than those of unopacified blood (8). Heterogeneous attenuation of the tumor is a common finding and this is related to hemorrhage, necrosis, cyst formation, fibrosis, calcification, or ossification (9). In our second case, we observed heterogeneous attenuation in the myxoma due to intratumoral hemorrhage. Cardiac CT with ECG-gating provides functional information such as obstruction of the mitral valve by multiphase images and detailed anatomical information on the coronary arteries.

For the treatment of typical and atypical myxomas causing mitral valve stenoses, surgical resections are requested due to the potential life-threatening sequelae of cardiac myxoma such as emboli and acute symptoms of valvular obstruction. Surgical excisions are safe and show good prognoses (10).

In conclusion, cardiac MDCT with ECG-gating enables the diagnosis of cardiac myxomas that cause mitral stenosis.

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승모판 폐쇄를 일으킨 좌심방 점액종의 역동적 다절편 CT 소견[1]

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저자들은 승모판 폐쇄증과 호흡곤란을 유발한 좌심방 점액종 2예의 다절편 CT 영상을 보고하고자 한다. 37세 남자와 69세 여자 환자에서 심장 다절편 CT로 심방중격에 연결된 경계가 좋으며 이완기에 좌심실로 돌출되어 승모판 협착을 일으키는 종괴를 볼 수 있었다. 또한, 점액종 1예에서 종괴 내 출혈을 볼 수 있었다. 점액종은 제거되었고 환자들은 모두 호흡곤란증세가 사라진 후 퇴원하였다.

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