Mitral Paravalvular Abnormal Tunnel with Mitral Regurgitation Caused by Anterior Chest Trauma

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We here present the case of a 35-year-old man with mitral valve paravalvular abnormal tunnel with mitral regurgitation caused by anterior chest trauma. The abnormal tunnel is between left ventricular and left atrial. We sutured the tunnel with a patch from the left atrial side. Meanwhile, we performed the mitral valve annuoplasty because of the mitral regurgitation accompanied. The postoperation and the 12th month follow up were uneventful.

Keywords: mitral paravalvular abnormal tunnel, chest trauma, mitral regurgitation

Introduction

Paravalvular regurgitation was often caused by paravalvular leakage of artificial valve, but seldom occurred in natural valve. It is also quite rare that abnormal tunnel between left atrium and ventricle secondary to laceration of the conjunction of mitral annulus and left heart wall. We introduce a successful treatment of this kind of abnormal tunnel by means of suturing with a patch.

Case Report

A 35-year-old man got injured on his anterior chest by accident 6 months ago. Later, he was admitted to a local hospital for cough and chest tightness, and diagnosed as tracheal trauma, right-sided multiple rib fractures, myocardial contusion and mitral insufficiency, all of which were improved after drug treatments. He was then referred to our hospital for further treatment. Formal physical examination did not show cardiac abnormality. The patient had normal vital sign, stable breath rate, pulse rate at 96 beats/min, apical systolic murmur with Grade III/6, and no edema of lower extremity. EKG: left ventricular hyper-voltage and conduction block in left bundle branch. Chest radiographs: lung with extravasated blood, left atrial enlargement, and CTR is around 58%.

2-D transthoracic color Doppler cardiac ultrasonography demonstrated left atrial diameter enlargement, normal left ventricular diameter, mild to moderate mitral valvular eccentric regurgitation; and an abnormal tunnel at anterolateral mitral commissure and lateral mitral annulus was observed, through which enormous left ventricular blood flow back to left atrium. The ventricular side was 9 mm in diameter and the atrial side was 10 mm in diameter.

Real-time 3-D transesophageal echocardiography (RT3D-TEE) demonstrated that the mitral valve annular partly changed and an abnormal oval tunnel was observed at lateral mitral annulus (interior to left auricle), diameter of which was 15 mm. Myocardial laceration was demonstrated as shape in an inversed triangle (Fig. 1). The diagnosis was mitral valve paravalvular abnormal tunnel (between left ventricular and left atrial) with mitral regurgitation caused by anterior chest trauma.

The surgery was undergoing cardiothoracic bypass through median incision, incising the interatrial groove to revealing the left atrial and mitral valve structure. During the operation, it was found that mitral annulus was enlarged; mitral valve leaflet, chordae tendinae and papillary muscle remained normal. Part of
mitral annulus (interior to left auricle) separated from the conjunction with the lateral wall, and the rupture adjacent to myocardium was observed at the base of lateral left ventricular wall, which formed an abnormal tunnel between left atrium and ventricle. Diameter of the tunnel was 15 and 8 mm at left atrial side and left ventricular side respectively, with smooth tunnel wall. The surgical method was mitral valve annuoplasty with 28 mm Carpentier-Edward Physio annuloplasty ring and a patch was sutured at the left atrial side of the abnormal tunnel. The water injection test to left ventricular shown no mitral regurgitation. Postoperative ultrasonography shown the abnormal tunnel disappeared. The position of artificial mitral annulus and sutured patch revealed no regurgitation shown by color Doppler cardiac ultrasonography. Also no tunnel regurgitation or mitral insufficiency was detected at the 12th month follow up.

**Discussion and Conclusion**

Paravalvular regurgitation was often caused by paravalvular leakage of artificial valve, and seldom occurred in natural valve. The hemodynamic change caused by mitral regurgitation remains the same, whether is induced by mitral valve incompetence or not. A series of symptoms can be induced by chronic or acute regurgitation caused overload during left ventricular diastole, even to left heart failure.

Cardiac valve and valvular injury after blunt chest trauma is an uncommon clinical entity. The injury of mitral apparatus often includes rupture of papillary muscle, chordae tendinae or valve leaflet tear, while it is quite rare that abnormal tunnel between left atrium and ventricle secondary to laceration of the conjunction of mitral annulus and left heart wall. We searched the literature and only found 2 case reports. The possible mechanism of mitral valve and its adjacent tissue injury caused by chest blunt trauma is: when the heart is under the fragile phase of a cardiac cycle (isovolumic contraction phase or late diastolic phase), rapid pressure increment can induce the rupture of mitral valve leaflet, chordae tendinae and papillary muscle, even the laceration of mitral annulus and ventricular wall conjunction when the pressure in heart exceeds 320 mmHg. Traumatic mitral regurgitation caused by mitral apparatus injury is usually acute onset, and mitral valve repair or replacement is often needed by emergency operation since acute left heart failure can be caused by huge amount of blood flowing from left ventricle to left atrium during systole. On the contrary, two patients previously reported and the patient in this report did not show acute left heart failure when trauma occurred, though severe paravalvular regurgitation did exist. The difference between these two situations is likely to be relevant with following factors: local rupture is usually small at the beginning of trauma, gradual increment of tension at the paravalvular tissue where rupture occurs combined with enlargement of left atrium and ventricle will be finally observed while the clinical symptoms improves. And also deteriorating mitral regurgitation can be found in this case.

Ultrasonography is the most common and sensitive examination method to diagnose intracardial malformations. RT3D-TEE with ordinary 2-D echo can provide high quality mitral image of the lesion of mitral valve and its adjacent structure. As the same image as surgical view shown, the RT3D-TEE clearly provides the 3-D structure of the lesion before operation for surgeon to determine proper treatment. In this case, the color Doppler shown the regurgitation was originated from abnormal tunnel and the closure of mitral leaflet, respectively. The RT3D-TEE, however, not only revealed the information about the size and position of this abnormal paravalvular tunnel (the relationship between the mitral valve and left auricle) but also offered the result of left ventricle wall damage.
It is rare that the abnormal tunnel (between the left atrial and left ventricular) with mitral regurgitation is caused by trauma. Surgical paravalvular rupture repair with mitral valve annuoplasty is the most effective method to treat such cardiac trauma. Previous patients also had operations. Our patient have good outcome after operation with no paravalvular regurgitation and no mitral valve regurgitation by ultrasonographic follow-up. Nowadays, there is still no case report about the pure or hybrid percutaneous treatment of this kind of mitral paravalvular abnormal tunnel coexisted with mitral valve repair surgery.

Disclosure Statement

In this article, we have used a 28 mm Carpentier-Edward Physio annuloplasty ring in mitral valve repair surgery. We state that we have no financial or other interest in the manufacture or distribution of this device.

References