

## Right ventricular pseudoaneurysm repair and fibrin pericardiectomy after a fall from height in a young male patient

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### ABSTRACT

Right ventricular pseudoaneurysms are rare in the literature. Patients may have complaints such as shortness of breath, fatigue, and palpitations, as well as signs such as ventricular arrhythmias and hypotension. In addition to a good physical examination and anamnesis, transthoracic echocardiography, transesophageal echocardiography, computed tomography, computed tomography angiography, magnetic resonance imaging, magnetic resonance angiography, scintigraphy, and ventriculography can also be used for diagnosis. The certain treatment of right ventricular pseudoaneurysms is surgical aneurysmectomy and repair. Herein, we present the diagnosis and management of a 32-year-old male patient with a right ventricular pseudoaneurysm, which was diagnosed 20 years after a fall from height.

**Keywords:** Aneurysm, blunt trauma, pericardiectomy, pseudoaneurysm, surgery, ventricular.

Right ventricular (RV) pseudoaneurysms are rare, particularly due to traumatic events, but could be fatal for patients.<sup>[1,2]</sup> Ischemic heart diseases are the most common reason; additionally, infections, previous cardiac operations, blunt traumas, pericardiocentesis, epicardial lead extraction, and transcatheter valve replacement are among other causes.<sup>[1-5]</sup> Right ventricular aneurysms are only encountered in 1 to 3% of all cardiac aneurysms in pathological series. In addition, most of these RV aneurysms occurred in the RV outflow tract due to prior congenital operations.<sup>[6]</sup> Ventricular aneurysms usually arise in the left ventricle, and there are few reports of RV pseudoaneurysms.<sup>[4,6]</sup> It is difficult to determine by physical examination as there is no typical sign for pseudoaneurysms. Ventricular arrhythmias, hypotension, shortness of breath, fatigue, and palpitation can be observed. In addition to a good physical examination and anamnesis, transthoracic echocardiography (TTE), transesophageal echocardiography, computed tomography (CT), computed tomography angiography (CTA), magnetic resonance imaging (MRI), magnetic resonance angiography (MRA), scintigraphy, and ventriculography can be useful for diagnosis. Although surgical treatment is required for large true cardiac aneurysms, pseudoaneurysms are frequently narrow-necked and usually can be percutaneously closed. Herein, we present the management of a

patient with an RV pseudoaneurysm and constrictive pericarditis, which was diagnosed 20 years after a fall from height.

### CASE REPORT

A 32-year-old male patient was admitted to our clinic with the diagnosis of an RV pseudoaneurysm. There was no significant comorbidity in the medical history except for a fall from the second floor when he was 12 years old. The patient had lost his consciousness after the event but was not admitted to any hospital. It was learned that the patient had complaints of fatigue and weakness for about one week after falling. Afterward, he continued his life without a complaint for 20 years; however, the patient had developed palpitation, fatigue, weakness, and shortness of breath in the last year. A 1.5×2.5 cm pseudoaneurysm with Doppler activity at the apex of the right ventricle and an ejection fraction of 45% was detected on TTE. The pericardium was thickened,

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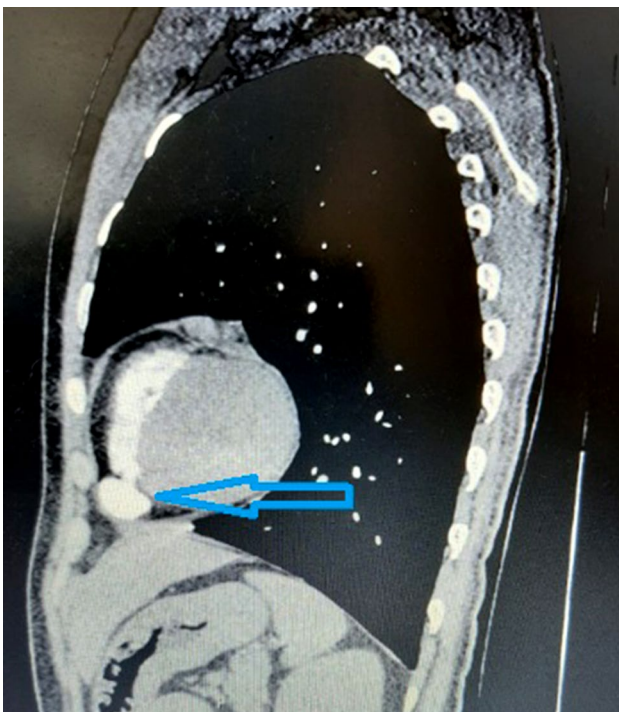
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and other TTE findings consistent with constrictive pericarditis were also present. The pericardium was fibrotic, thickened (more than 2 mm), and a ventricular septal diastolic shudder and respiration-related shift in the interventricular septum was present. Respiratory change in the mitral valve E/A (early to late diastolic transmitral flow velocity) was more than 25%. A coronary angiography was performed in another center, which was normal. Pulmonary arterial pressure, right heart chambers, and functions were normal. An aneurysmatic appearance of approximately 30×18 mm was observed at the RV apex with a narrow neck of approximately 2 to 3 mm in the CTA (Figure 1). The electrocardiogram was in sinus rhythm. Routine blood tests were completely normal. We started the operation with a median sternotomy approach. The pericardium completely consisted of a fibrinous structure (Figure 2). Aortic and right atrial cannulation was performed, but the cardiopulmonary bypass was not started. A complete pericardiectomy was done. Afterward, the primary repair was performed by excising the aneurysmatic tissue from the apex of the right ventricle by the off-pump procedure (Figure 3). A pathological

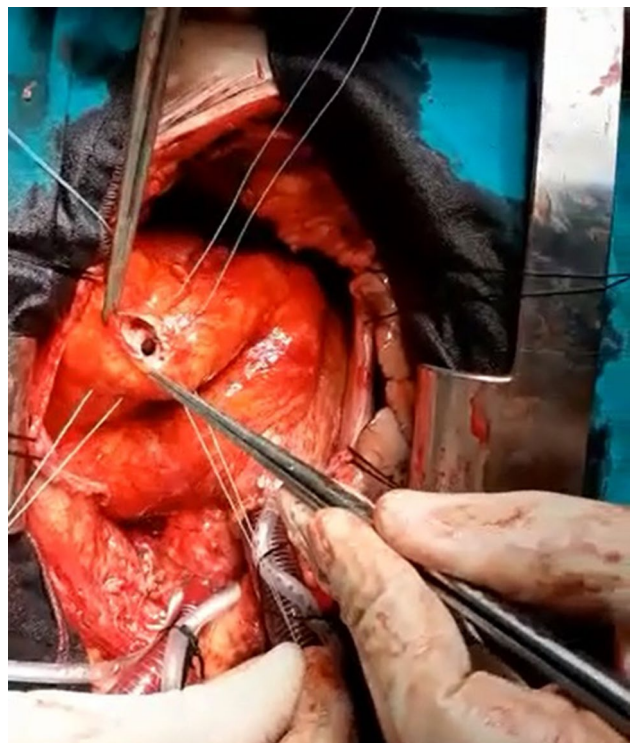
sample was taken from the pseudoaneurysm sac and pericardiectomy material. It was reported as fibrosis and compatible constrictive pericarditis (Figure 4).



**Figure 2.** The material extracted from fibrin pericarditis.

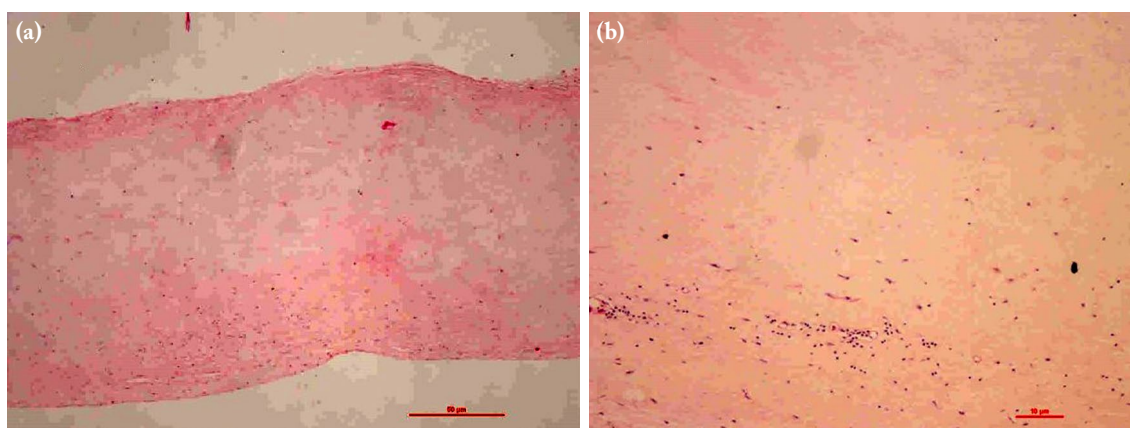


**Figure 1.** Computed tomography angiography image of the aneurysm emerging from the apex of the right ventricle with a thin neck.



**Figure 3.** Aneurysmal region at the apex of the right ventricle.





**Figure 4.** Hematoxylin & eosin-stained preparations of the pericardium revealing fibrosis and lymphocyte-dominant inflammation on light microscopy. No significant calcification was observed. **(a)** Thickened fibrotic pericardium (H&E, ×40). **(b)** Lymphocyte-dominated inflammation (H&E, ×100).

The patient was discharged on the seventh day without any complications, and there were no issues in a three-year follow-up.

## DISCUSSION

Loss of myocardial integrity is the main cause of cardiac rupture. Free intrapericardial rupture usually results in cardiac tamponade and death. If a cardiac rupture is not containing whole cardiac layers, pseudoaneurysm formation occurs.<sup>[2]</sup> Noninvasive tests such as two-dimensional echocardiography and, more recently, three-dimensional echocardiography may be useful for detecting Doppler activity, or the same can be accomplished by echocardiographic contrast. Transesophageal echocardiography could be more beneficial for the evaluation of posterior cardiac segments due to its increased sensitivity compared to TTE. Cardiac MRI and CT can be performed to assess the structural relationships of the cardiac aneurysms or pseudoaneurysms detected in the echocardiography.<sup>[2,4]</sup>

The majority of ventricular aneurysms occur in the left ventricle.<sup>[4]</sup> In addition, RV aneurysms are more frequently located in the RV outflow tract due to prior congenital heart operations.<sup>[4,7]</sup> While some of the RV aneurysms are clinically diagnosed, some of them are diagnosed postmortem, and most of these are pediatric cases.<sup>[8-11]</sup> While transmural infarcts, trauma, congenital, and cardiomyopathies are among the causes, some may be idiopathic.<sup>[12]</sup> Iatrogenic cases have also been reported.<sup>[13]</sup> A fatal

RV aneurysm case was reported in a patient who underwent transcatheter radiofrequency ablation for Wolff-Parkinson-White syndrome.<sup>[13]</sup> In addition, cases of RV aneurysm developing after postinfarct ventricular septal rupture have also been reported.<sup>[14-16]</sup> Cardiac pseudoaneurysms are treated with Amplatzer septal occluder devices and introduced under fluoroscopic and angiographic guidance.<sup>[4]</sup>

Diagnosis of constrictive pericarditis and its differentiation from restrictive cardiomyopathy is important but usually difficult. Transthoracic echocardiography is the initial and sometimes the only affordable test for the diagnosis of this condition. As per Hancock,<sup>[17]</sup> septal bounce, ventricular septal shift with respiration, and biatrial enlargement are the three basic signs of TTE in constrictive pericarditis. In our case, the ejection fraction of 45% was detected on TTE. The pericardium was fibrotic, thickened (more than 2 mm), and ventricular septal diastolic shudder and respiration-related shift were present in the interventricular septum. Respiratory change in the mitral valve E/A was more than 25%. Significant respiratory variation in mitral and tricuspid inflow velocities represents ventricular interdependence and is an important pathophysiologic feature in constrictive pericarditis.<sup>[18]</sup>

Right ventricular aneurysms may be isolated or may be accompanied by some congenital anomalies. A case of a double-chambered left ventricle-associated RV aneurysm and another case with hypertrophic cardiomyopathy associated with

RV aneurysm have been reported.<sup>[19,20]</sup> As with left ventricular aneurysms, the most common cause of an RV aneurysm is myocardial infarction. Aneurysm development time after myocardial infarction may take years, or it may develop within the first week. An RV aneurysm that developed on the sixth day postinfarction is available in the literature.<sup>[21]</sup> The most sensational study of RV aneurysms was done by Antonelli Incalzi et al.<sup>[22]</sup> In their study, they found the rate of aneurysm development in the right ventricle after acute myocardial infarction to be 8.8%. This rate represents a significant public health problem. Nonetheless, the incidence of aneurysms is lower in patients followed up after acute myocardial infarction in the clinic. Due to blunt traumas and aortic dissections, ruptures in the heart cavities and pseudoaneurysms can develop.<sup>[23]</sup> The symptoms of patients with an RV aneurysm are nonspecific and have a wide range. The most common symptoms are fatigue, shortness of breath, collapse, and palpitation.<sup>[24,25]</sup> Along with these, hypotension and hypotensive attacks may be the first signs.<sup>[26]</sup> It may manifest as syncope attacks due to malignant arrhythmias.<sup>[27]</sup> The most severe symptom in our patient was fatigue. Transthoracic echocardiography, transesophageal echocardiography, CT, CTA, MRI, MRA, and direct ventriculography are used in diagnosis.<sup>[1,28]</sup> In our case, TTE and CTA were utilized. Right ventricular aneurysms that cause ventricular dysrhythmias, heart failure, and pulmonary embolism are indicated for surgery.<sup>[6]</sup> In the treatment of pseudoaneurysms, aneurysmectomy or device closure can be performed.<sup>[23]</sup> Pseudoaneurysms requiring additional surgical procedures can be easily closed with open-heart surgery. In our patient, the ejection fraction was decreased due to constrictive pericarditis, and therefore, pseudoaneurysm repair was performed on a beating heart together with surgical pericardiectomy. Cardiac complications of injuries, such as blunt traumas and falling from heights, may not be noticed in the early period and manifest in the long term. Therefore, careful anamnesis of patients can provide some clues to the physicians. Rare diseases should also be kept in mind in young patients describing cardiac symptoms.

In conclusion, a detailed medical history and physical examination are crucial in cases with an atypical presentation and should not be overlooked.

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**Data Sharing Statement:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

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