# Acute Onset Pulmonary Edema Due to Cusp Tear of A Bioprosthetic Mitral Valve: Case Report

## Mitral Biyoprotez Kapakta Yırtılma Sonrası Gelişen Akut Akciğer Ödemi

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**ABSTRACT** In this report we present a 35 years old female patient, who developed an acute onset pulmonary edema due to tear of one of the cusps of a bioprosthetic mitral valve. She had to be urgently reoperated to replace the aortic and the mitral valves. Her mitral valve had been replaced by a bioprosthesis in plan of a pregnancy. Echocardiography revealed a tear of one of the prosthetic cusps, which was also clearly visualized during surgery. The valve was excised to be replaced once more with a mechanical prosthesis. The clinical state rapidly improved and the patient was discharged on the 8th postoperative day. The advantage of low thrombogenicity in bioprosthetic valves should certainly be considered together with the poor long-term durability and the high chances of a reoperation especially in young patients. Bioprosthetic valves are preferred in all patients in whom anticoagulant use is contraindicated, or in women planning a pregnancy. These patients should carefully be monitored, and signs of early valve degeneration should not be missed. Young patients preferring bioprosthetic valves for replacement should also be informed in detail about the disadvantages of such prosthesis. Although mortality and morbidity rates of redo cardiac operations have been steadily decreasing, new anticoagulants should be developed to allow pregnancy with a mechanical valve, or use of low-molecular weight heparin regimens should be considered.

**Key Words:** Bioprosthesis; pulmonary edema

**ÖZET** Mitral biyoprotez kapakta yırtılma sonucu akut akciğer ödemi gelişen ve acil koşullarda reoperasyona alınarak mitral ve aort kapak replasmanı uygulanan 35 yaşında bir kadın olgu sunulmaktadır. Beş yıl önce hamilelik planı üzerine biyoprotez tercihi yapılmış olan olguda ekokardiyografide kapak kusplarından birinde yırtılma olduğu görülmüş, operasyonda da bu durum net olarak tespit edilmiş ve kapak eksize edilmiştir. Klinik durumu hızla düzelen hasta sekizinci gün sorunsuz olarak taburcu edilmiştir. Biyoprotez kapakların düşük trombojenite eğilimi ile ortaya çıkan avantaj, özellikle genç erişkinlerde dayanıklılık süresinin kısa olması ve tekrar operasyon problemi ile birlikte değerlendirilmelidir. Herhangi bir yaşta antikoagülan kullanımı kontrendike olan ya da hamilelik planlayan kadın hastalarda biyoprotez kapaklar tercih edilebilir. Bu hastalar sıkı takip altında olmalı ve kapak dejenerasyonuna ait erken bulgular gözden kaçırılmamalıdır. Biyoprotez kapak replasmanı isteyen genç hastalar bu kapakların dezavantajları konusunda ayrıntılı olarak bilgilendirilmelidirler. Her ne kadar reoperasyonlarda mortalite ve morbidite oranları giderek düşmekteyse de, mekanik kapakla güvenli bir hamilelik için yeni antikoagülasyon metodları geliştirilmeli, düşük molekül ağırlıklı heparinlerin hamilelikte kullanımı göz önünde bulundurulmalıdır.

**Anahtar Kelimeler:** Biyoprotezler; pulmoner ödem

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Structural valve deterioration is one of the main drawbacks of bioprosthetic valve prosthesis. Here we report o case presenting with acute onset pulmonary edema due to sudden detachment of one of the cusps of a mitral porcine bioprosthesis.

## CASE REPORT

A 35-year-old woman, who had her mitral valve replaced with a bioprosthesis via right mini-thoracotomy 5 years ago, was admitted to a local hospital, and was diagnosed as acute left heart failure. Echocardiography revealed severe mitral insufficiency due to mitral bioprosthetic structural deterioration, moderate aortic insufficiency and preserved left ventricular function with increased pulmonary arterial pressure. The patient was transferred to our hospital for further evaluation and treatment.

She described dyspnea on exertion in the last ten months and at last she had experienced syncope. On arrival she was tachycardic (110/min), hypotensive (85/35 mmHg systolic/diastolic blood pressures), and cyanotic with a loud precordial systolic murmur. Dopamine was infused, and high volume nasal oxygen (12 lt/min) was administered. Transthoracic echocardiogram revealed a hyperdynamic left ventricle with preserved function and severe mitral regurgitation due to rupture of the bioprosthetic cusp neighboring the anteroseptal zone. She also had moderate aortic insufficiency and a mean pulmonary arterial pressure of 40 mmHg.

The patient was operated approximately 18 hours after the onset of symptoms. Transesophageal echocardiogram confirmed the cusp tear of the mitral bioprosthesis (Figure 1) and moderate aortic insufficiency. Midline sternotomy was performed and cardiopulmonary bypass was instituted. The patient was cooled to 28 °C. Myocardial protection consisted of an initial dose of antegrade and intermittent retrograde blood cardioplegia. The mitral valve was exposed through a standard left atriotomy. There was mild calcification of the valve leaflets and a ruptured cusp neighboring the anteroseptal zone (Figure 2).

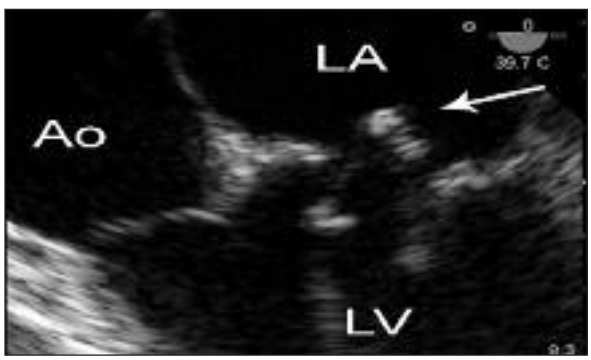


**FIGURE 1:** Transesophageal echocardiography showing the torn cusp of the bioprosthetic valve at the mitral position prolapsing into the left atrium as a flail leaflet. Ao: Ascending aorta, LA: Left Atrium, LV: Left Ventricle, Arrow: Flail prolapsing segment of the mitral cusp.

**FIGURE 2:** Intraoperative exposure of the mitral bioprosthesis. The cusp located in the inferior anteroseptal position has been almost totally detached from its annular junction.

The Hancock porcine bioprosthesis was excised and a 27mm bileaflet mechanical valve was replaced with teflon-pledgeted sutures. Aortic valve was exposed through a standard oblique aortotomy and a 21 mm bileaflet mechanical valve was replaced with teflon-pledgeted sutures. The patient was weaned off cardiopulmonary bypass on the first attempt with moderate dose of dopamine. She was extubated on the 21st postoperative hour. The inotropic support was discontinued within two days and the patient was transferred to the ward in the 3rd day. The postoperative course was uneventful, and the patient was discharged in good condition on the 8th day.

## DISCUSSION

Biological valvular prostheses are produced mainly from porcine aortic valves or bovine pericardium, and lately from equine pericardium. There are bioprosthetic valves produced from equine pericardium with self expending thermoplastic nitinol-made ring feasible for suturless implantati-

**FIGURE 3:** The excised mitral porcine bioprosthesis. Note the calcifications at the tip, and the detached annular attachment of the cusp.

on. Structural valve deterioration is the most prominent disadvantage of bioprosthetic valves.[1,2] The durability of porcine bioprosthesis in the mitral position is less than in the aortic position. The more rapid deterioration of the mitral bioprosthesis may be due to higher ventricular systolic pressures against the mitral cusps, as compared with the diastolic pressures resisted by aortic bioprosthetic leaflets. The deterioration occurs in a few years in children and in young patients, and only gradually over years in old patients. From this aspect, the durability of bioprosthetic valves is directly proportional to age.[3]

Patients at any age in sinus rhythm who wish to avoid anticoagulation, and young women who desire to have children may prefer a bioprosthesis. In patients over age 70 with sinus rhythm, bioprosthesis may be preferred, since these valves tend to deteriorate slower in older patients.[4]

The patient was 30 years old at the time of the first operation. She was operated through a right mini-thoracotomy and wanted to have a second child. Two years after the operation she had an uneventful pregnancy and gave birth to a healthy child.

Structural valve deterioration in bioprosthetic valves start with calcification of the valvular elements. Calcification is the major contributory factor of clinical failure especially of glutaraldehyde-fixed bioprosthetic valves. This calcification process is initiated within residual membranes and organelles of the nonviable connective tissue cells that have been devitalized by glutaraldehyde pretreatment. The mechanism involves reaction of calcium containing extracellular fluid with membrane associated phosphorus, causing calcification of devitalized cells. Various pretreatment methods of bioprosthetic valves are being applied with different chemicals. There are experimental studies showing that some additional modifications such as sodiumbisulfate, procyanidins and neomycin fixation leads to inhibition of calcification in bioprosthetic valves.[5-7]

The excised bioprosthesis in our case had minimal calcification and a cuspal tear resulting in severe regurgitation (Figure 3).

Reoperation after structural valve deterioration is one of the important reasons of mortality in patients with bioprosthetic valves.[8] The results are related to the conditions that lead to emergency surgery, such as acute heart failure, acute pulmonary edema, and sudden malfunction of a prosthetic valve.

## CONCLUSION

The patients with bioprostheses must be followed closely to detect the early signs of deterioriation. It must be recognized that repeat operations may be necessary and thus meticulous closure of the pericardium at the first operation must be performed. Young patients preferring bioprosthetic valves for replacement should also be informed in detail about the disadvantages of such prosthesis. Although mortality and morbidity rates of redo cardiac operations have been steadily decreasing, new anticoagulants should be developed to allow pregnancy with a mechanical valve, or use of low-molecular weight heparin regimens should be considered.

Bioprosthetic valves have the advantage of low thrombogenicity. But this advantage may be outweighed by the poor long–term durability and the higher chances of a repeat operation, especially in young adults.

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