Left ventricular pseudoaneurysm following atrioventricular groove rupture after mitral valve replacement

Miha Antonic, Anze Djordjevic, Tamara Mohorko, Rene Petrovic, Robert Lipovec and Peter Juric

Abstract
Left ventricular pseudoaneurysm is a partial cardiac rupture, contained by the surrounding pericardium that maintains communication with the left ventricular lumen. Whereas most cases of left ventricular pseudoaneurysms are related to myocardial infarction (loss of myocardial integrity), only a handful are associated with valve surgery. We present a female patient, who was admitted for elective mitral valve replacement. After the implantation of the mechanical valve, we encountered a rupture of the atrioventricular groove. After 3 months, a left ventricular pseudoaneurysm was found and the patient was reoperated. The valve was explanted and the inspection of the annulus and previously implanted pericardial patch revealed a loosened stitch on the inferior (ventricular) side. The defect was reinforced with additional stitches and the valve was reimplanted. In conclusion, we report an unusual case with two serious complications after mitral valve replacement – atrioventricular groove rupture and left ventricular pseudoaneurysm.

Keywords
False aneurysm, heart rupture, mitral valve, heart valve prosthesis implantation

Date received: 6 March 2018; accepted: 14 December 2018

Introduction
Left ventricular (LV) pseudoaneurysm is a partial cardiac rupture, contained by the surrounding pericardium that maintains communication with the LV lumen. It remains open to discussion how to appropriately distinguish LV pseudoaneurysms from true aneurysms that are defined by discrete thinning of the ventricular wall (<5 mm) and usually require elective surgical intervention. On the other hand, pseudoaneurysms tend to rupture more easily and, although successful ‘wait and see’ approaches have been described, the diagnosis itself calls for an immediate response resulting in emergency surgeries in most cases. It was suggested that an orifice-to-pseudoaneurysm diameter ratio of 0.5 using two-dimensional echocardiography should be the margin when deciding between pseudoaneurysms and true aneurysms. Whereas most cases of LV pseudoaneurysms are related to myocardial infarction (loss of myocardial integrity), only a handful are associated with valve surgery and they tend to be subannular in location. It has been estimated that significant LV pseudoaneurysms occur in 0.8% of cases after mitral valve replacement (MVR), which is about eight times more often than that after myocardial infarction. We report our experience with a patient with an LV pseudoaneurysm after MVR.

Case report
A 49-year-old female with history of progressing symptoms of dyspnoea, fatigue and dizziness (New York Heart Association (NYHA) class III) was admitted for MVR due to severe combined mitral valve stenosis and insufficiency. Preoperative echocardiography revealed rheumatic chorial shortening and severe mitral leaflet and anulus calcifications with a preserved LV function of 60%. Coronary angiography showed normal coronary arteries. At the time of surgery, the valve was not assessed suitable for repair. An

Department of Cardiac Surgery, University Medical Centre Maribor, Maribor, Slovenia

Corresponding author:
Miha Antonic, Department of Cardiac Surgery, University Medical Centre Maribor, Ljubljanska 5, 2000 Maribor, Slovenia. Email: miha.antonic@guest.arnes.si
MVR was performed using a SJM® (St. Jude Medical, Inc., Saint Paul, MN) mechanical valve of size 29. The valve was implanted using everted interrupted pledgeted polyester sutures. After excision of the calcified posterior leaflet, only moderate calcifications of the posterior annulus were encountered. At that time, surgical decalcification was not considered necessary. The pattern and extent of the calcifications allowed the sutures to be placed without decalcification of the annulus. After weaning from the cardiopulmonary bypass, bleeding was encountered from the inferolateral side of the left ventricle, in the area of the atrioventricular groove. Cardiopulmonary bypass was immediately reinstituted and the valve explanted. A tear in the mitral annulus in the region P1/P2 was encountered. The tear was repaired with a bovine pericardial patch and the valve reimplanted. The patient was successfully weaned from the cardiopulmonary bypass. Postoperative course was uneventful and the patient was discharged home on postoperative day 11. After 3 months, the patient was readmitted because of fever and elevated white blood cell count. A transthoracic echocardiogram was suspicious for an ‘intrapericardial abscess’. Further evaluation, including transeosophageal echocardiography (TEE), computed tomography (CT) and magnetic resonance imaging (MRI) scan, revealed a $25 \times 35 \times 15 \text{ mm}^3$ pseudoaneurysm in the inferoposterior side of the heart with a 10-mm communication neck with the left ventricle (Figures 1 and 2). The patient was scheduled for the second surgery. The valve was explanted and the inspection of the annulus and previously implanted pericardial patch revealed a loosened stitch on the inferior (ventricular) side. The defect was reinforced with additional stitches and the valve was reimplanted. The lateral side of the heart and the pseudoaneurysm itself were not dissected free due to tight adhesions. An intraoperative TEE showed that the connection between the pseudoaneurysm and the left ventricle was closed (Figures 3 and 4). The postoperative course was uneventful and the patient was discharged home.

**Figure 1.** MRI scan – pseudoaneurysm (white arrow).

**Figure 2.** 3D reconstruction of a CT scan – clearly visible pseudoaneurysm ($24 \times 14 \times 38 \text{ mm}^3$).
discharged home on postoperative day 12. She is doing well after 1-year follow-up.

Discussion

There are numerous complications described and known after MVR, such as thromboembolisms, structural valve degeneration, endocarditis, paravalvular leaks, conduction pathway irregularities and haemorrhage. One of the most devastating origins of massive haemorrhage is LV wall rupture, which was originally divided into three categories: type 1 is a rupture at the posterior atrioventricular groove; type 2 is a rupture at the base of the papillary muscle; and type 3 is a rupture between the above-mentioned structures.10,11 Sersar and Jamjoon12 added two additional types: type 4 that is not associated with the atrioventricular groove, but with the lateral wall; and type 5 is a rupture of the LV outflow tract. According to this classification, our patient is a type 1 representative. Both internal (from the endocardial) and external (from the epicardial site) surgical techniques are possible to repair LV pseudoaneurysms. The preferred approach in type 1 is the internal one, whereas in types 2 and 3 the defect is mainly in the myocardium and could therefore be managed via the external route.13 There are certain disadvantages for either of the techniques. Residual postoperative pseudoaneurysms are more common after the external repair, which is in turn less aggressive and commonly without the use of extracorporeal circulation (ECC). ECC is mandatory for internal repair. Although sometimes inevitable, valve removal and intraventricular rupture repair are associated with high mortality (65%–100%).12,14 Both techniques are not time dependent, usable for early onset (still in the operating room) or delayed (hours after the initial surgery) rupture.15 We opted for the internal surgical scenario through a resternotomy with valve removal and intraventricular enforcement with sutures. No pseudoaneurysm resection was performed. Successful cases, where a similar LV pseudoaneurysm was resolved through a left thoracotomy in the fifth intercostal space, were reported.16,17 Interestingly, some authors reported various degrees of damage to the left circumflex artery (LCX), which could result in myocardial infarction to the lateral wall,13,18,19 but we have not noticed any ST line dynamics during in-hospital stay or at follow-up. Although valve removal and intraventricular rupture repair are associated with high mortality, we successfully repaired the LV pseudoaneurysm with excellent postoperative results.

Conclusion

We presented a post-MVR complication that is quite uncommon and could potentially be lethal. Our treatment method is well established, but could lead to serious adverse effects. Even though internal repair is more aggressive, excellent outcome was achieved.

Declaration of conflicting interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Ethical approval
Our institution does not require ethical approval for reporting individual cases or case series.

Funding
The author(s) received no financial support for the research, authorship and/or publication of this article.

Informed consent
Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article.
References

1. Jung HS, Chung WB, Yang KS, et al. A case of left ventricular pseudoaneurysm in the left atrioventricular groove after mitral valve replacement. *J Cardiovasc Ultrasound* 2010; 18(4): 157–160.

2. Bisoyi S, Dash AK, Nayak D, et al. Left ventricular pseudoaneurysm versus aneurysm a diagnosis dilemma. *Ann Card Anaesth* 2016; 19(1): 169–172.

3. Sanisoglu I, Duran C, Sagbas E, et al. A left ventricular pseudoaneurysm due to mitral valve replacement. *Eur J Cardiothorac Surg* 2005; 27(4): 713.

4. Gatewood RP and Nanda NC. Differentiation of left ventricular pseudoaneurysm from true aneurysm with two dimensional echocardiography. *Am J Cardiol* 1980: 46(5): 869–878.

5. Frances C, Romero A and Grady D. Left ventricular pseudoaneurysm. *J Am Coll Cardiol* 1998; 32(3): 557–561.

6. Yeo TC, Malouf JF, Oh JK, et al. Clinical profile and outcome in 52 patients with cardiac pseudoaneurysm. *Ann Intern Med* 1998; 128(4): 299–305.

7. Sakai K, Nakamura K, Ishizuka N, et al. Echocardiographic findings and clinical features of left ventricular pseudoaneurysm after mitral valve replacement. *Am Heart J* 1992; 124(4): 975–982.

8. Alapati L, Chitwood WR, Cahill J, et al. Left ventricular pseudoaneurysm: a case report and review of the literature. *World J Clin Cases* 2014; 2(4): 90–93.

9. Namboodiri N, Dora SK, Thomas B, et al. Subannular left ventricular pseudoaneurysm following mitral valve replacement. *J Cardiothorac Surg* 2008; 3: 28.

10. Treasure RL, Rainer WG, Strevey TE, et al. Intraoperative left ventricular rupture associated with mitral valve replacement. *Chest* 1974; 66(5): 511–514.

11. Miller DW, Johnson DD and Ivey TD. Dose preservation of the posterior chordae tendinae enhance survival during mitral valve replacement. *Ann Thorac Surg* 1979; 28(1): 22–27.

12. Sersar SI and Jamjoon AA. Left ventricular rupture post mitral valve replacement. *Clin Med Cardiol* 2009; 3: 101–113.

13. Lanjewar C, Thakkar B, Kerkar P, et al. Submitral left ventricular pseudoaneurysm after mitral valve replacement: early diagnosis and successful repair. *Interact Cardiovasc Thorac Surg* 2007; 6(4): 505–507.

14. Min SK, Sir JJ, Nah JC, et al. Successful resection of a giant left ventricular pseudoaneurysm developed later after mitral valve replacement. *J Korean Med Sci* 2010; 25: 1080–1082.

15. Cheng LC, Chiu CS and Lee JW. Left ventricular rupture after mitral valve replacement. *J Cardiovasc Surg* 1999; 40(3): 339–342.

16. Ono M and Wolf RK. Left ventricular pseudoaneurysm late after mitral valve replacement. *Ann Thorac Surg* 2002; 73(4): 1303–1305.

17. Suda H, Ikeda K, Doi K, et al. Successful repair of left ventricular pseudoaneurysm after mitral valve reoperation under hypothermic circulatory arrest. *Jpn J Thorac Cardiovasc Surg* 2003; 51(1): 18–20.

18. Masoumi MA and Saedi MR. Delayed left ventricular rupture following mitral valve replacement. *Iranian Heart J* 2004; 5(4): 57–60.

19. Prashanth P, Mukhaini M and Maddali MM. Intramyocardial dissecting haematoma causing cardiac tamponade: an unusual complication after mitral valve replacement surgery. *Ann Card Anaesth* 2009; 12(1): 79–80.