



Kasuistika | Case report

Minimally invasive left thoracotomy and prosthetic valve mini skirt for recurrent mitral paravalvular regurgitation

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SOUHRN

I po náhradě chlopní protézou se lze setkat s paravalvulárním leakem. V případě významného paravalvulárního leaku s doprovodnými symptomy nebo hemolýzou je nutno místo leaku uzavřít. V literatuře byla popsána řada operačních postupů včetně katetrizačních intervencí i hybridních metod pro řešení paravalvulárního leaku. Popisujeme minimálně invazivní levou thorakotomii, která může zajistit uzavření recidivujícího paravalvulárního leaku u pacienta, u něhož se již popáté prováděla operace na otevřeném srdci.

Při této chirurgické metodě se provádí minimálně invazivní levostranná thorakotomie, při níž se našitím kusu protetického materiálu (bovinního perikardu nebo umělého materiálu) s použitím prolenu vytvoří jakási „mini skirt“ kolem komerčně dostupné chlopně a chlopeč se standardním způsobem umístí do prstence. Po usazení chlopně v anulu se provede sutura protetického materiálu kolem celé stěny srdeční síně, aniž by došlo k uzavěru ústí plicních žil. Zdá se, že tato strategie představuje vhodné řešení některých paravalvulárních leaků v blízkosti všech životně důležitých struktur. Při tomto postupu není nutno vyvíjet tah na rigidní anulus ani využívat přilehlou životně důležitou tkáň v okolí anulu mitrální chlopně. Domníváme se, že tato chirurgická metoda je přínosná a představuje další užitečnou metodu, která by se měla stát součástí možných postupů při řešení podobných případů.

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ABSTRACT

Paravalvular leaks still occur following prosthetic valvular replacement. When the paravalvular leaks are significant and causing symptoms or hemolysis, they require closure. Numerous operative techniques, including transcatheter interventions, hybrid approach are described in the literature to treat paravalvular leaks. We describe a minimally invasive left thoracotomy surgical technique that can secure closure of recurrent mitral paravalvular leak in a patient undergoing open-heart surgery for the fifth time.

This surgical technique involves the minimally invasive left thoracotomy, sewing a piece of prosthetic material (bovine pericardium or synthetic material) to create a mini skirt around the commercially available valve by using prolene and placing the valve in the annulus in standard manner. After seating the valve in to the annulus, the prosthetic material is sutured all around in the atrial wall without occluding the pulmonary vein orifices. This strategy seems to offer a good solution to the clinical problem of some paravalvular leaks that lie within the vicinity of all vital structures. In this way there is no need to pull rigid annulus or incorporate adjacent vital tissue around the mitral annulus. We believe, this surgical technique is beneficial and represents an additional useful strategy for the surgeon's armamentarium.

Keywords:

Left thoracotomy

Minimally invasive

Mini skirt

Mitral valve

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Introduction

Despite, improvement in valve designs and refinement of surgical techniques, paravalvular leaks still occur. A poor surgical technique, annular calcification, and endocarditis have been implicated as risk factors for the development of paravalvular leaks [1]. Indications for the closure of paravalvular leaks include symptomatic heart failure and hemolytic anemia [1]. Surgical repair of the paravalvular leak is associated with a better long-term survival when compared to conservative therapy [2]. The choice of operation involves repair of the leak or re-replacement of the valve and depends on the surgical findings related to the etiology, condition of the native mitral annulus, location and size of the leak, and surgical exposure [3]. Either repair of the leak or re-replacement of the valve poses a technical challenge as failure rates could be up to 35% [3]. Many surgical techniques have been described earlier to treat mitral paravalvular leaks, including direct suturing, use of patches, and incorporation of healthy full thickness autologous tissue [3,4] and use of prosthetic materials around the prosthetic valve [5].

Clinical case

A 67-year-old man with a history of recent mitral valve replacement fourth time was admitted with decompensated heart failure, hemolytic anemia requiring blood transfusions and renal failure. He also had a history of type II diabetes mellitus, hypertension, and ischemic heart disease. Laboratory tests showed hemoglobin 8.7 g/dl (normal range, 14–18 g/dl), white blood cell count 22.94 K/ μ l (normal range, 4.8–10.8 K/ μ l), creatinine 2.81 mg/dl (normal range, 0.67–1.17 mg/dl), and lactate dehydrogenase 5133 U/l (normal range, 230–480 U/l). Transesophageal echocardiography revealed significant mitral paravalvular leak (Fig. 1). He was referred to our department for surgical operation after failed conservative management. His previous cardiac operations include mitral valve replacement (MVR) with the mechanical valve and vein graft to the obtuse marginal coronary artery by midline sternotomy for ischemic mitral regurgitation and single vessel coronary artery disease respectively. Ten years later he had MVR with the mechanical valve for significant paravalvular leaks and aortic valve replacement (AVR) with the mechanical valve for severe aortic insufficiency by a redo midline sternotomy. A year later he had redo MVR (Bioprosthetic) for significant paravalvular leaks by a redo midline sternotomy and two years later he underwent redo MVR (Bioprosthetic) for significant mitral paravalvular leaks by a right thoracotomy.

Operative technique

We approached the mitral valve as described by Saunders et al. [6]. The patient was placed in right lateral decubitus position and used One-Lung ventilation technique. Transesophageal echocardiography (TEE) was performed to assess the leak. A left posterolateral mini-thoracotomy incision 8 cm was made in the sixth intercostal space, and

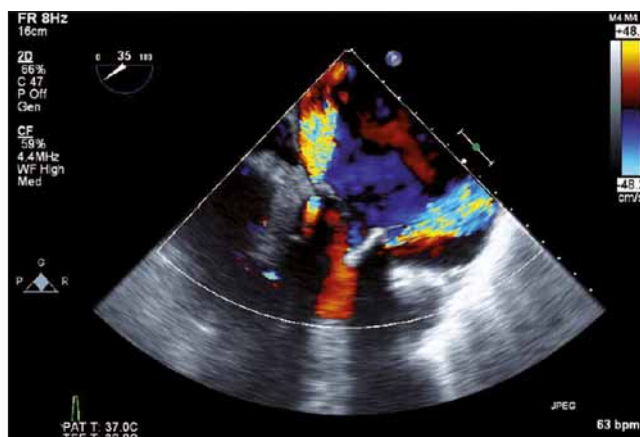


Fig. 1 – Preoperative transesophageal echocardiography showing a significant mitral paravalvular leak.

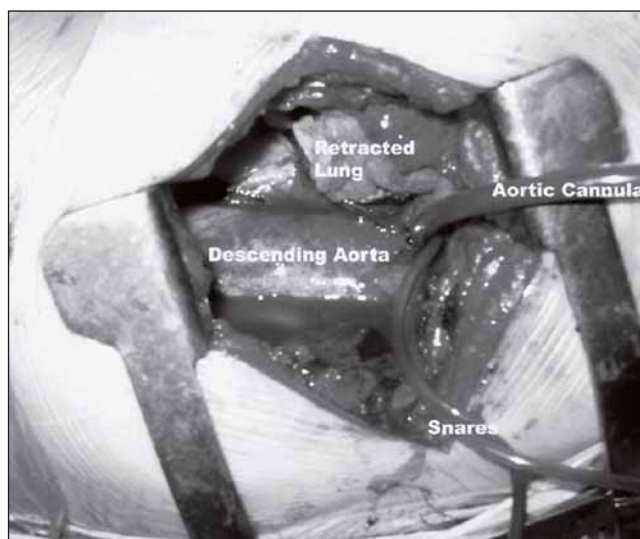


Fig. 2 – Left posterior mini thoracotomy with direct descending aortic cannulation. Figure courtesy of Saunders et al. [6].

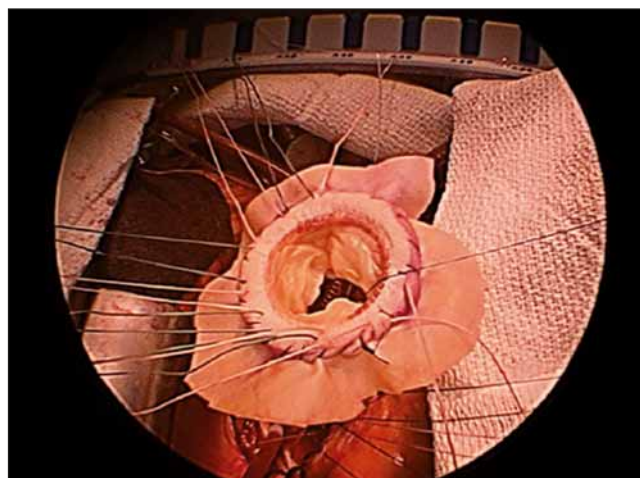


Fig. 3 – Mini skirt. Bovine pericardium is fashioned as a skirt and sewn to the sewing ring of the mitral prosthesis by using prolene suture. Standard annular valve sutures are then taken through the sewing ring. (Medtronic Mosaic porcine tissue valve is shown).

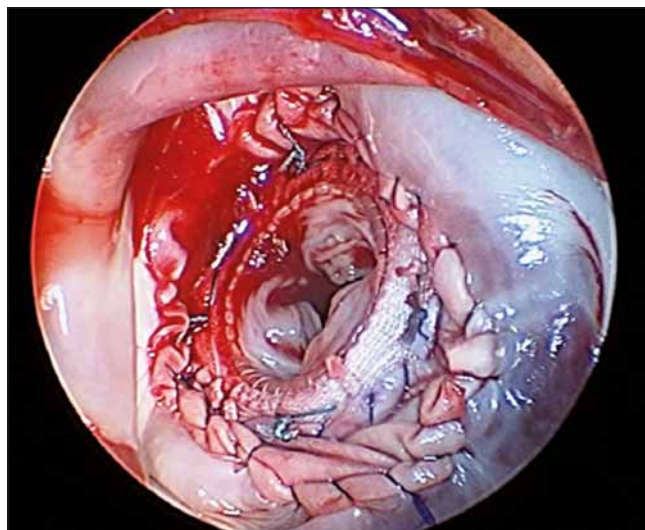


Fig. 4 – The valve is seated, and then skirt is sewn to the left atrium with prolene suture.

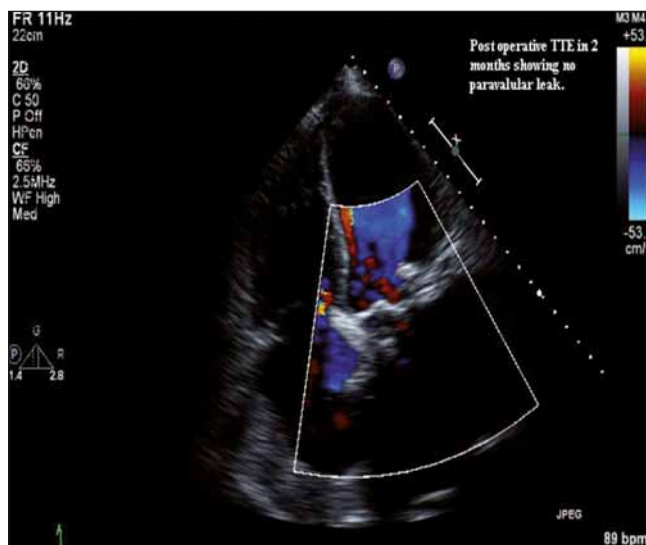


Fig. 5 – Postoperative transthoracic echocardiography at 2 months showing no mitral paravalvular leak.

the lung was retracted inferiorly to expose the heart. Fig. 2 shows the incision and typical exposure of the descending aorta for direct cannulation. Direct descending aortic arterial cannulation Edwards 20 French soft flow (Edward Life Sciences, Irvine, CA 92614) was used. Femoral venous cannulation by long venous (Estech Rapid Flow, Estech, San Ramon, CA 94583) with vacuum-assisted venous drainage was used. The pericardium was opened posterior to the phrenic nerve and retracted with retention sutures, and native myocardium perfused by cold fibrillation (22–25 °C). The left atrium was opened along the base of the left atrial appendage. Intra-atrial retractors were positioned by using a self-retaining retractor, providing exposure of the mitral valve operative field was flooded with CO₂. All the options to seal the paravalvular leaks were reviewed and we decided to replace the valve. The previous prosthetic valve was removed with

by extreme gentle manner by removing all the sutures. The mitral annulus was defined and standard pledged 2-0 Ethibond Excel (Ethicon, Inc., Somerville NJ 08876) placed all around the annulus in interrupted manner. As our patient had rigid mitral annulus, all the surgical techniques described before to prevent paravalvular leaks found to be not suitable. We tailored and sworn a bovine pericardium (Vascu-Guard, Synovis, Life Technologies, St. Paul, MN 55114) as a skirt around the sewing ring of the new porcine 27 mm valve (Mosaic Bioprosthesis, Minneapolis, MN 55432) by using 4-0 Prolene suture (Ethicon, Inc., Somerville, NJ). Annular sutures are then placed in a typical fashion through the sewing ring (Fig. 3) and the valve is seated. A running suture then can be used to sew the free edge of the skirt to the left atrium with a care not to occlude the pulmonary vein orifices (Fig. 4). After the mitral procedure, the left atrium was closed in 2 layers with 3-0 Prolene sutures (Ethicon, Inc., Somerville, NJ). Deairing was achieved through a transvalvular vent placed through the atriotomy and optionally via a needle placed in the left ventricular apex. Valvular function, myocardial performance, and intracardiac deairing were monitored with TEE. Post-operative follow-up echocardiogram at two months revealed no paravalvular leak (Fig. 5).

Discussion

Prosthetic valve replacement is associated with an ongoing long-term morbidity and mortality, irrespective of the etiology. Requirement for anticoagulation, paravalvular leaks, valve thrombosis, embolism, structural degeneration, pannus formation, and endocarditis are all continuous hazards that may need intervention even many years after the initial operation [2]. Reoperation for paravalvular leakage after MVR is usually indicated in symptomatic patients with large leaks and in those requiring blood transfusions for persisting hemolysis. Either repair of the leak or re-replacement of the valve poses a technical challenge as failure rates could be up to 35% [3]. Many surgical techniques have been described earlier to treat mitral paravalvular leaks, including direct suturing, use of patches, and incorporation of healthy full thickness autologous tissue [3,4] and use of prosthetic materials around the prosthetic valve [5]. We present here an additional effective surgical technique a surgeon could use in recurrent re-operative situation in mitral position, which involves the minimally invasive left thoracotomy, sewing a piece of prosthetic material (bovine pericardium or synthetic material) to create a mini skirt around the commercially available valve by using prolene and placing the valve in the annulus in standard manner. After seating the valve in to the annulus, the prosthetic material sutured all around in the atrial wall without occluding the pulmonary vein orifices [5]. This simple strategy seems to offer a good solution to the clinical problem of some paravalvular leaks that lie within the vicinity of all vital structure. In this way there is no need to pull rigid annulus or incorporate adjacent vital tissue around the mitral annulus. We believe, this surgical technique is beneficial and represents an additional useful strategy for the surgeon's armamentarium.

Conflict of interest

All authors have no conflicts of interests.

Funding body

None.

Ethical statement

Authors state that the research was conducted according to ethical standards.

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