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Case report

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

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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.

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

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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/μl (normal range, 4.8–10.8 K/μl), 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

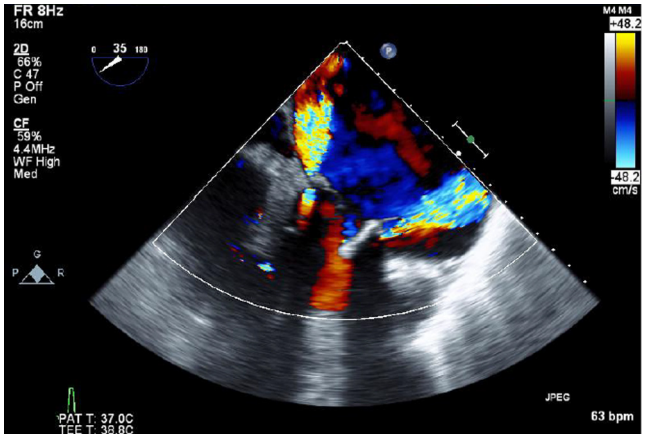

Fig. 1 – Preoperative transesophageal echocardiography showing a significant mitral paravalvular leak.

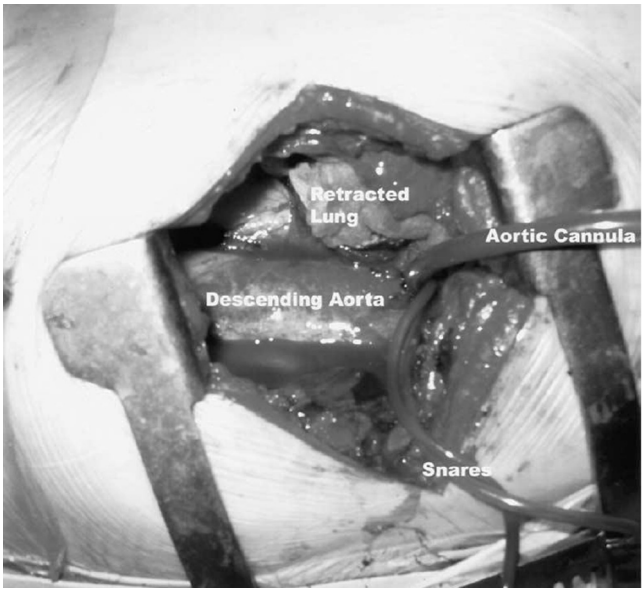

Fig. 2 – Left posterior mini thoracotomy with direct descending aortic cannulation.
Figure courtesy of Saunders et al. [6].

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 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 CO_2. 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

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