SAS Journal of Surgery
Abbreviated Key Title: SAS J Surg
ISSN 2454-5104
Journal homepage: https://www.saspublishers.com

OPEN ACCESS

Cardiovascular

Tricuspid Valve Repair with Bovine Pericardium: A Case Report and Review

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DOI: 10.36347/sasjs.2024.v10i07.006 | **Received:** 18.05.2024 | **Accepted:** 26.06.2024 | **Published:** 06.07.2024

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Abstract **Case Report**

The correction of tricuspid regurgitation following left-sided valvular surgery is of paramount importance. If valve leaflet lesions are also present, it poses a therapeutic challenge. In this article, we report the case of a patient who underwent tricuspid valve repair using bovine pericardium to address severe tricuspid valve regurgitation following two left-sided valve surgeries. This case demonstrates that bovine pericardium allows a wider selection of repair options in tricuspid surgery.

Keywords: Tricuspid regurgitation, repair, patch, bovine pericardium.

INTRODUCTION

Tricuspid regurgitation (TR) poses a significant public health challenge, with a prevalence of moderate to severe tricuspid valve regurgitation reaching as high as 0.55% [1]. Additionally, the incidence of long-term significant TR following left-sided valve surgery (LSVS) is estimated to be around 27% [2], Tricuspid valve (TV) surgery consists mainly in treating valve incompetence by suture annuloplasty or implantation of prosthetic rings.

When compared to valve replacement, repairing the tricuspid valve offers notable advantages due to its slower blood flow rate, reducing the risk of thrombosis associated with mechanical valves and minimizing the need for intense, long-term anticoagulation therapy. However, the durability of bioprosthetic valves in the tricuspid position is often suboptimal.

Synthetic materials, while strong and durable, have limitations in terms of flexibility and biocompatibility, and can eventually trigger fibrotic reactions, particularly in intracardiac applications. In recent years, pericardial tissue, whether autologous or heterologous, has gained popularity in both adult and congenital cardiac surgeries for repairing various intra- and extracardiac defects [3, 4].

Thus, this article reports the case of a patient who underwent Tricuspid valve repair with bovine pericardium for severe tricuspid valve regurgitation after left-side valve surgery (LSVS).

CASE REPORT

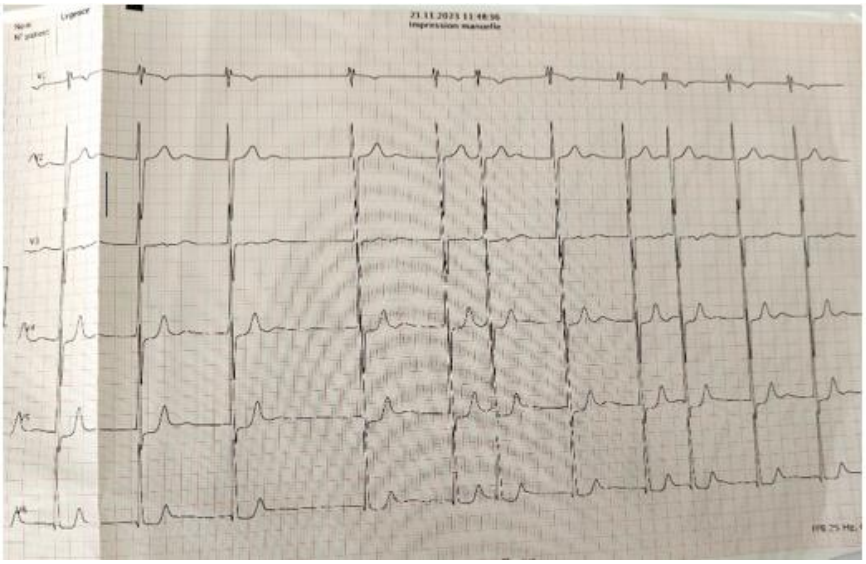
Patient information

Mrs. Y. L., 58-year-old women with cardiovascular risk factors including age and menopause, has a medical history of mitral valve replacement in 2000 for mitral stenosis, and aortic valve replacement combined with tricuspid valve repair using a ring in 2011 for aortic stenosis and tricuspid regurgitation. She was diagnosed with dyspnea stages II and III of the NYHA.

Preoperative findings

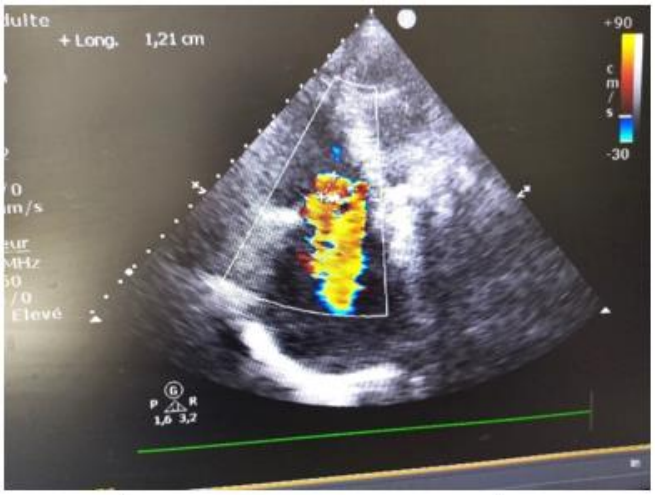
During clinical examination, Mrs. Y. L. was conscious, well-oriented in time and space, with a general condition corresponding to stage 2 of the WHO Performance Status. Cardiovascular examination revealed irregular heart sounds as well as a systolic murmur in the tricuspid area. Peripheral pulses were perceived symmetrically, without signs of right-sided heart failure such as lower limb edema, hepatomegaly, or jugular vein distention. Auscultation of the lungs revealed normal vesicular breath sounds in both pulmonary fields without rales.

The electrocardiogram (ECG) showed atrial fibrillation with a heart rate of 88 beats per minute *(Fig 1)*. Transthoracic echocardiography (TTE) confirmed significant tricuspid regurgitation, along with a non-dilated left ventricle with good function (ejection fraction of 60%) and well-functioning aortic and mitral prostheses without stenosis or paravalvular leak, the right ventricle (RV) is dilated with a basal diameter of 49 mm and limited systolic function, indicated by an S wave of 9 cm/s and a TAPSE of 18 mm. The tricuspid annulus is also dilated, measuring 42 mm (Fig 2).



The ECG shows a rhythm in atrial fibrillation, a heart rate of 88 bpm.

Figure 1: Electrocardiogram



Preoperative TTE showing double jet tricuspid regurgitation.

Preoperative TTE showing a dilated tricuspid annulus

Figure 2: Transthoracic echocardiogram

Perioperative results

Mrs. Y. L. was prepared for surgery and underwent a vertical median sternotomy under general anesthesia and in dorsal decubitus position. Right ventricular dilatation was observed after pericardiotomy. Extracorporeal circulation was established with a femoral arterial cannula and two laced cava cannulas. Cardiac arrest was achieved using crystalloid cardioplegia. We did not perform the surgery on a beating heart because it was necessary to have a bloodless operative field to ensure optimal repair of the valvular lesions.

Following right atriotomy, the tricuspid valve was exposed and examined, revealing a rheumatic tricuspid valve with a shredded and retracted septal

leaflet, a dilated tricuspid annulus, and partial dehiscence of the two horns of the prosthetic tricuspid ring (Fig 3). The procedure consisted of enlarging the septal tricuspid leaflet with a bovine patch associated with reinsertion of the prosthetic ring. A bulb test is performed to ensure proper sealing of the tricuspid valve (Fig 4).

The patient was transferred to the intensive care unit after surgery and extubated at 7 hours. Her postoperative course was uneventful, except for a hemoglobin drop to 7 g/, necessitating a red blood cell transfusion. She was subsequently removed from drainage on the second day and transferred from the intensive care unit to the clinical sector on the third day.

An echocardiographic follow-up was performed on days 1 and 8 postoperatively, confirming the tightness of the tricuspid valve and showing a grade I regurgitation.

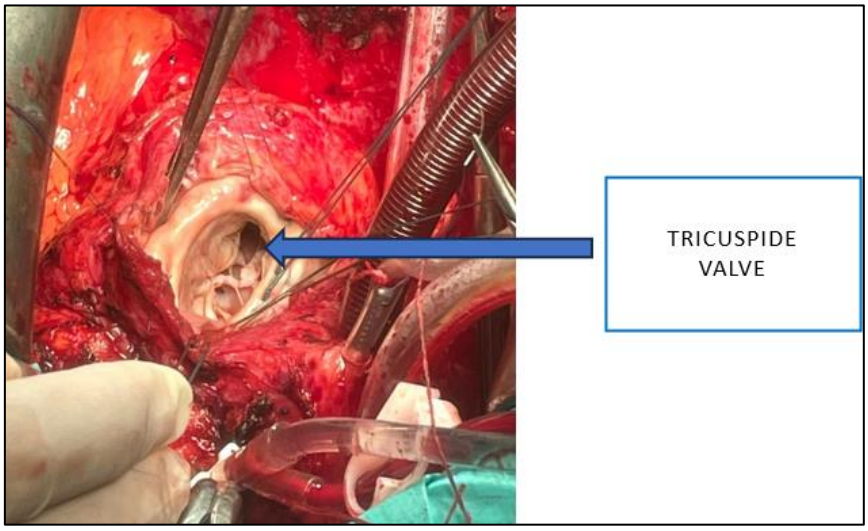


Figure 3: Per operative image showing a shredded and retracted septal leaflet of tricuspid valve

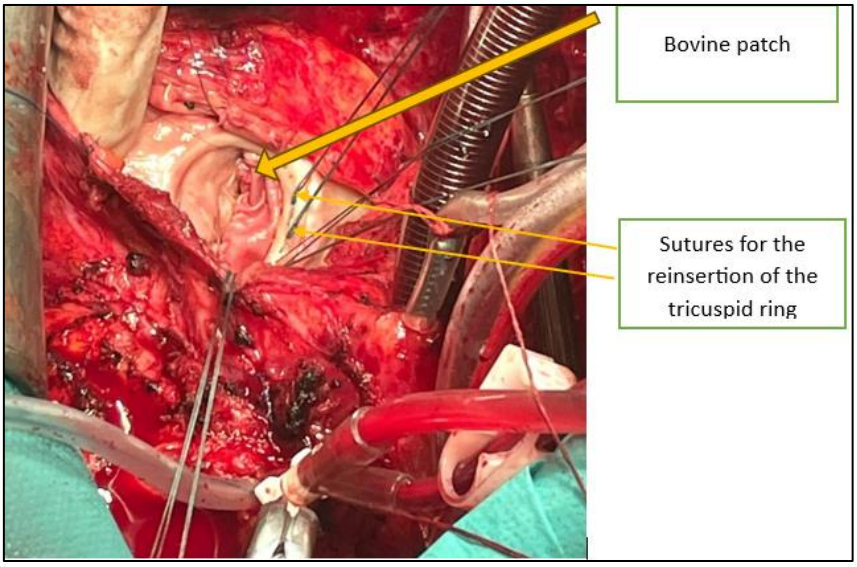


Figure 4: Per operative image showing the tricuspid valve after repair

DISCUSSION

Isolated TR after LSVS for rheumatic heart disease (RHD) is a special type and accounts for the majority [5, 6].

Based on the ACC/AHA guidelines for heart valve disease management (2020), tricuspid valve surgery may be contemplated for patients experiencing severe TR that doesn't respond to medical treatment. It's also an option for asymptomatic patients with severe TR showing signs of right ventricular dilation or systolic dysfunction. Early intervention is recommended to prevent irreversible right ventricular dysfunction and organ failure [7].

Valve repair in the tricuspid valve position offers significantly more advantages compared to valve replacement.

Implanting a ring alone in tricuspid valvuloplasty does not yield satisfactory results, necessitating further valve leaflet augmentation to restore normal coaptation [8].

As early as 1949, Templeton and Gibbon replaced a TV leaflet with a patch of pericardium shaped to reproduce also chordal attachments [9].

Pericardium can be utilized in TV annuloplasty, producing excellent medium-term outcomes, De La Zerda *et al.*, reported the stability of this procedure up to a maximum of 7 years following TV repair in 59 patients, with no instances of failure [10]. The optimal material for leaflet augmentation remains a topic of debate.

There is an article that compares the medium- and long-term results of tricuspid valve repair using bovine pericardium (BP) and expanded polytetrafluoroethylene (ePTFE) patches for leaflet augmentation. The study aims to assess the durability of these two materials. The study concludes that leaflet patch enlargement can be safely utilized in tricuspid valve repair. However, BP patches carry a risk of reduced flexibility and stiffness of movement, while ePTFE patches pose a risk of calcification [11].

In additional studies, it was observed that autologous or heterologous pericardium treated with glutaraldehyde as a leaflet patch experienced patch degeneration or calcification [12, 13].

Conversely, the EPTFE patch demonstrated effective performance in reconstructing the right ventricular outflow tract, with no apparent long-term issues such as stenosis, calcification, or pulmonary embolism [14, 15].

CONCLUSION

Tricuspid valve repair offers more advantages compared to valve replacement or ring annuloplasty alone in patients diagnosed with functional tricuspid regurgitation preoperatively, as organic leaflet lesions are often found during surgery. There are many types of patches used with excellent medium-term results, but with some complications such as calcification or stiffness of movement.

Tricuspid valve repair with a bovine patch allows a wider possibility of repair in the case of rheumatic tricuspid diseases.

REFERENCES

1. Topilsky, Y., Maltais, S., Medina Inojosa, J., Oguz, D., Michelena, H., Maalouf, J., ... & Enriquez-Sarano, M. (2019). Burden of tricuspid regurgitation in patients diagnosed in the community setting. *JACC: Cardiovascular Imaging*, *12*(3), 433-442.
2. Kwak, J. J., Kim, Y. J., Kim, M. K., Kim, H. K., Park, J. S., Kim, K. H., ... & Park, Y. B. (2008). Development of tricuspid regurgitation late after left-sided valve surgery: a single-center experience with long-term echocardiographic examinations. *American Heart Journal*, 155, 732–737.
3. David, T. E. (1998). The use of pericardium in acquired heart disease: a review article. *The Journal of heart valve disease*, *7*(1), 13-18.
4. Pires, A. C., Saporito, W. F., Leão, L. E. V., Forte, V., Cardoso, S. H., & Ramaciotti, O. (1999, March). Bovine pericardium used as a cardiovascular patch. In *The heart surgery forum*, 2(1), E60-E69.
5. Song, H., Kim, M. J., Chung, C. H., Choo, S. J., Song, M. G., Song, J. M., ... & Song, J. K. (2009). Factors associated with development of late significant tricuspid regurgitation after successful left-sided valve surgery. *Heart*, *95*(11), 931-936.
6. Shiran, A., & Sagie, A. (2009). Tricuspid regurgitation in mitral valve disease: incidence, prognostic implications, mechanism, and management. *Journal of the American College of Cardiology*, *53*(5), 401-408.
7. Otto, C. M., Nishimura, R. A., Bonow, R. O., Carabello, B. A., Erwin III, J. P., Gentile, F., ... & Toly, C. (2021). 2020 ACC/AHA guideline for the management of patients with valvular heart disease: executive summary: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Journal of the American College of Cardiology*, *77*(4), 450-500.
8. Pettinari, M., Bertrand, P., Van Kerrebroeck, C., Vandervoort, P., Gutermann, H., & Dion, R. (2016). Mid-term results of leaflet augmentation in severe tricuspid functional tethering. *European Journal of Cardio-Thoracic Surgery*, *50*(3), 504-508.
9. Templeton, J. Y., & Gibbon Jr, J. H. (1949). Experimental reconstruction of cardiac valves by venous and pericardial grafts. *Annals of Surgery*, *129*(2), 161-176.
10. David, J., Cohen, O., Marelli, D., Esmailian, F., Hekmat, D., & Laks, H. (2008, February). Tricuspid valve repair using autologous pericardium annuloplasty in adults. In *The Heart surgery forum*, *11*(1), E4-E8.
11. Xiao, S., Wang, Q., Fang, D., Wang, Z., Ke, Y., Zhang, Z., ... & Huang, H. (2024). Application of Bovine Pericardium and Expanded Polytetrafluoroethylene Patches in Tricuspid Valvuloplasty after Cardiac Surgery. *Reviews in Cardiovascular Medicine*, *25*(5), 188.
12. Igarashi, T., Matsushima, S., Shimizu, A., Ehrlich, T., Karliova, I., & Schäfers, H. J. (2020). Bicuspidization and annuloplasty provide a functioning configuration to the unicuspid aortic valve. *The Annals of thoracic surgery*, *110*(1), 111-119.
13. Schoen, F. J., & Levy, R. J. (2005). Calcification of tissue heart valve substitutes: progress toward

understanding and prevention. *The Annals of thoracic surgery*, *79*(3), 1072-1080.

14. Miyazaki, T., Yamagishi, M., Maeda, Y., Taniguchi, S., Fujita, S., Hongu, H., & Yaku, H. (2018). Long-term outcomes of expanded polytetrafluoroethylene conduits with bulging sinuses and a fan-shaped valve in right ventricular outflow tract reconstruction. *The Journal of Thoracic and Cardiovascular Surgery*, *155*(6), 2567-2576.
15. Patukale, A., Daley, M., Betts, K., Justo, R., Dhannapuneni, R., Venugopal, P., ... & Alphonso, N. (2021). Outcomes of pulmonary valve leaflet augmentation for transannular repair of tetralogy of Fallot. *The Journal of Thoracic and Cardiovascular Surgery*, *162*(5), 1313-1320.