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Acquired Left Ventricular to Right Atrial Shunt (Gerbode′s Defect) after Aortic Valve Replacement: Case Report

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ABSTRACT

Background: Left ventricular to right atrial (LV—RA) shunt is an unusual type of ventricular septal defect (VSD). Acquired LV—RA shunts may be due to complications of cardiac operation, endocarditis, trauma or myocardial infarction. A previous cardiac operation is the most common cause. The diagnosis of LV—RA communication is not easy, and it should be remembered in patients who do not recover normally. Diagnosis can be confirmed with ultrasound or magnetic resonance image (MRI) or multi-slice CT. Surgical correction is usually the treatment of choice, but closing the communication percutaneously should be considered as an option.

Objective: Aim of this case presentation was to show the clinical scenario of a rare post-operative complication (after aortic valve replacement).

Patient and methods: Male patient aged 35 years, during hospital admission in the CCU post-operative after aortic valve replacement was complaining of dyspnea, orthopnea, paroxysmal nocturnal dyspnea and by echocardiographic examination revealed Gerbode defect, not improved by modification of medical treatment necessitating cardio-thoracic surgery consultation who recommend conservative treatment and follow up if the patient still symptomatic surgical repair versus percutaneous closure could be done.

Conclusion: Acquired left ventricular to right atrium shunt (Gerbode′s defect) can result from septal trauma after valve replacement, infective endocarditis, or myocardial infarction. In addition to the usual causes of cardiac decompensation following aortic valve surgery, one should consider the possibility of a left-to-right shunt secondary to an iatrogenic left ventricular-right atrial communication, particularly if either septal trauma or extensive valvular calcification was encountered during the surgical procedure.

Keywords: Acquired left ventricular, Right atrial shunt, Gerbode′s defect, Aortic valve replacement.

INTRODUCTION

Communication between left ventricular (LV) and right atrial (RA) is rare hazardous complication for the patient after valve replacement as symptoms may be ignored or may mislead the diagnosis. This is a rare type of acquired form of ventricular septal defect (VSD), that may result from complications of cardiac surgery such as valve replacements [(1)] or closure of VSD [(2)], endocarditis [(3)], trauma [(4)], or myocardial infarction [(5)]. Diagnosis of this rare defect is challenging, but can be confirmed with ultrasound or magnetic resonance imaging (MRI) [(6)]. The treatment of choice is surgical correction of the defect however successful trans-catheter closures have been reported [(1)].

Lack of improvement following aortic valve surgery is usually attributed to one of the following: perivalvular leaks, prosthetic dysfunction, uncorrected associated valve disease, or myocardial disease. Lack of improvement may be as a result of an iatrogenic left ventricular-right atrial shunt inadvertently produced during aortic valve replacement or other aortic valve surgery[(1)].

Aim of this case presentation was to show the clinical scenario of a rare post-operative complication (after aortic valve replacement), which is acquired left ventricular to right atrium shunt (Gerbode ′s defect). Also, to know when to suspect this complication during early postoperative period and how to confirm the diagnosis by trans-thoracic and trans-esophageal echocardiography.

Anatomy:

The tricuspid valve is located approximately 15 mm below the mitral valve. A thin part of the septum between them may be ruptured in case of injury and create a direct shunt from LV into RA. Such a complication can result from cardiac surgery [(1)], endocarditis [(3)], trauma [(4)], or myocardial infarction [(5)]. Anatomically, the defect may be above (type I), below the tricuspid valve (type II) or a combination of these two (type III) [(7)] **(Fig. 1).**

In the two latter cases, a perimembranous septal defect accompanies a second defect located in the tricuspid valve, usually in its septal leaflet. The tricuspid valve may have a cleft, widened commissural space, perforation or other malformations [(7)]**.** A case of abnormal chordae, which cause a regurgitation of the tricuspid valve, has also been described [(8)]**.**

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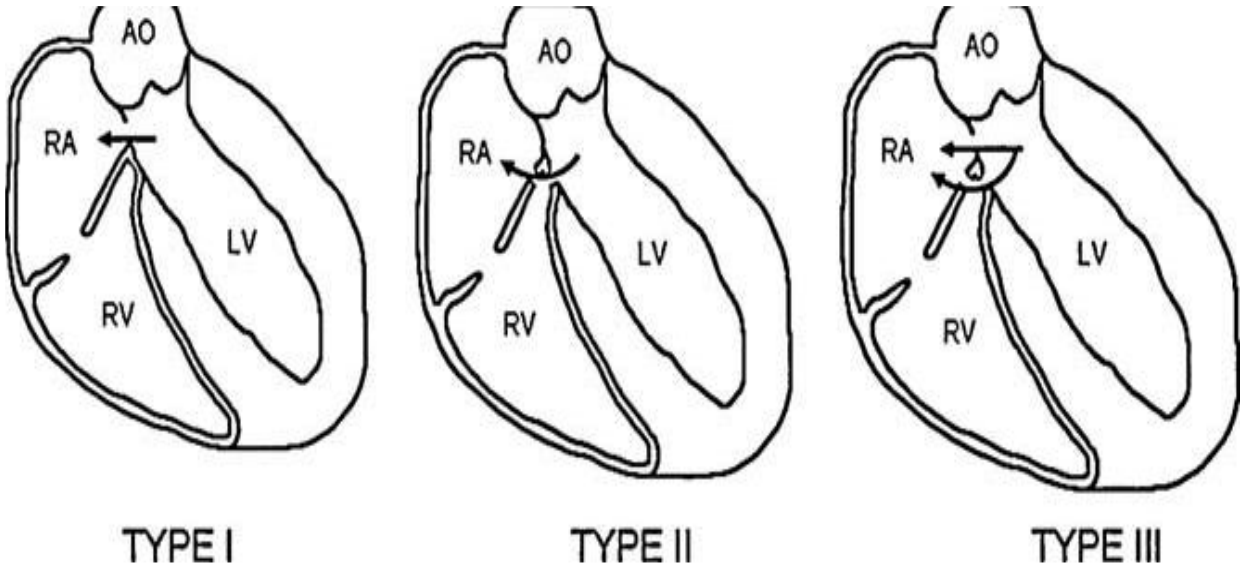

Figure (1): Types of LV—RA shunt. In type I LV—RA defect resides above tricuspid valve, in type II bellow tricuspid valve. Type III is the combination of both types I and II LV—RA shunts. AO: aorta, RA: right atrium, RV: right ventricle, LV: left ventricle [(7)].

Case presentation:

Male patient aged 35 years admitted to the intensive care unit after aortic valve replacement in October 2016. On the 3rd day after operation he stared to complain of dyspnea, orthopnea and paroxysmal nocturnal dyspnea, blood pressure was normal 130/80 mmHg, HR 90 BPM, neck veins examination denote elevated JVP, cardiac examination parasternal heave, pan-systolic murmur on the left sternal border grade 4/6, loud P2, chest examination was unremarkable, X ray chest was done as no pleural effusion, and normal cardiothoracic ratio, also laboratory investigation as CBC, renal and liver function were in normal range apart from WBC was mildly elevated 11000/cc,

Echocardiographic examination (trans thoracic and trans esophageal) (figures 2-8) was done to assess aortic valve function and to exclude post-operative complication and revealed dilated LA, normal LV dimensions and systolic function, normal diastolic function normal prosthetic valve function, no pericardial effusion, mild tricuspid regurgitation with pulmonary artery systolic pressure 58 mmHg. also left to right shunt from the LV to RA (Gerbode defect) through a defect measuring 0.5 cm, ma systolic pressure gradient through the defect was 66 mmHg, several measurements were needed to be sure about the result as both jets (TR jet and left to right shunt jet) are close to each other.

Five clues to help identify Gerbode's defect: Atypical jet direction, Persistent shunt flow during diastole, Lack of left ventricular flattening, Absence of left ventricular hypertrophy, and Normal diastolic pulmonary artery pressures (estimated from PI velocity).

While transthoracic echo is sensitive for detecting shunts, TEE is the better choice to distinguish whether the communication is directly from the LV to RA or via the septal leaflet of Tricuspid valve.

Cardiothoracic surgeon recommend conservative treatment and follow up, if still symptomatic surgical repair of percutaneous closure also recommend multi-slice CT for confirmation of the diagnoses, CT confirmed the diagnosis and percutaneous closure of the defect was done successfully without residual shunt in Aswan cardiac center

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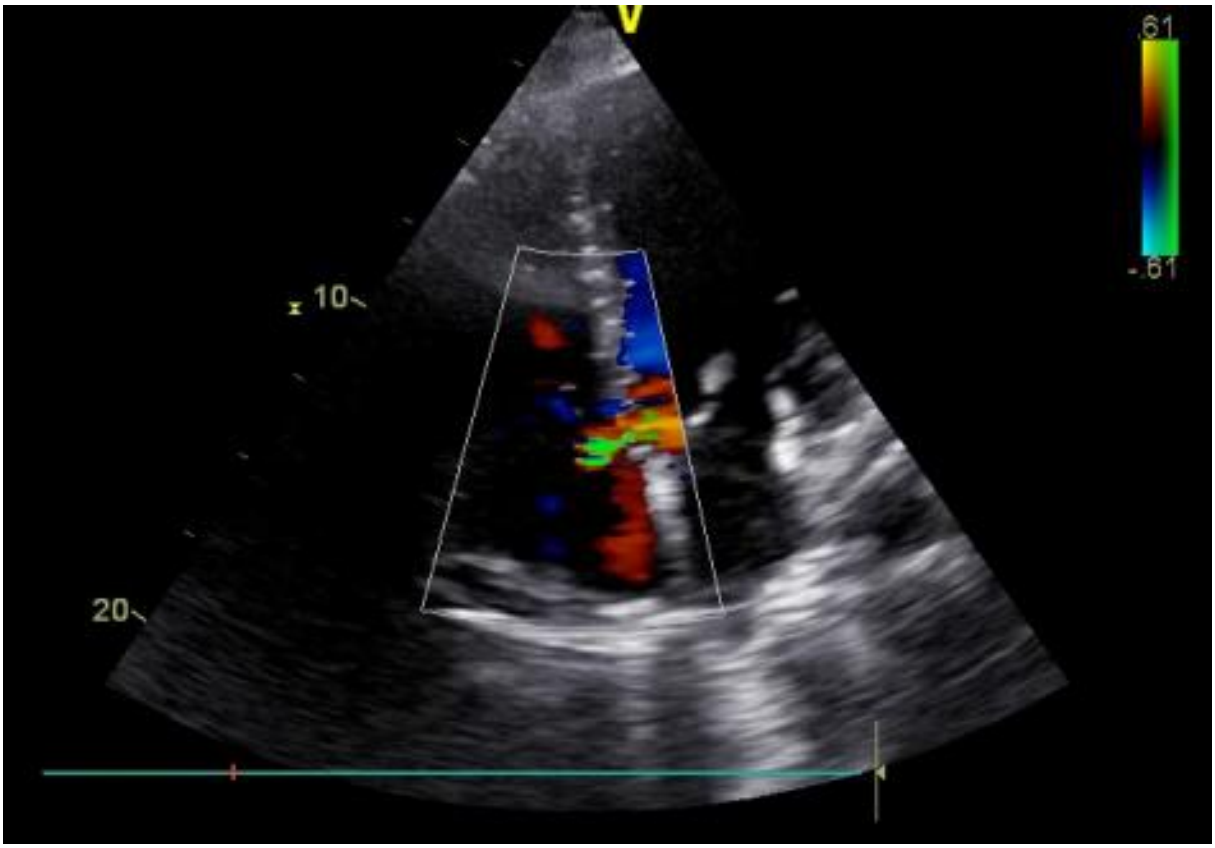

Figure (2): Trans thoracic echo, apical 4 chamber view show LV –RA shunt.

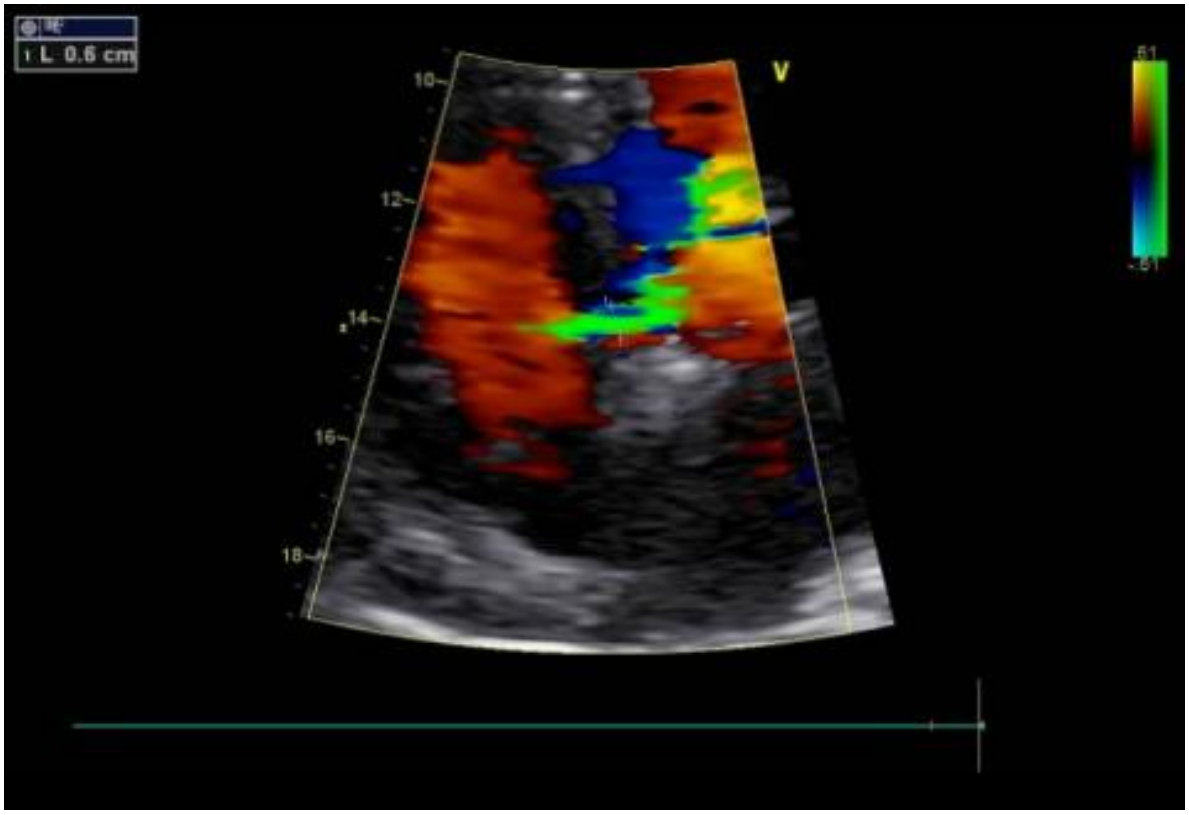

Figure (3): Trans thoracic echo, apical 4 chamber view with zoom, show LV –RA shunt with defect about 0.6 cm.

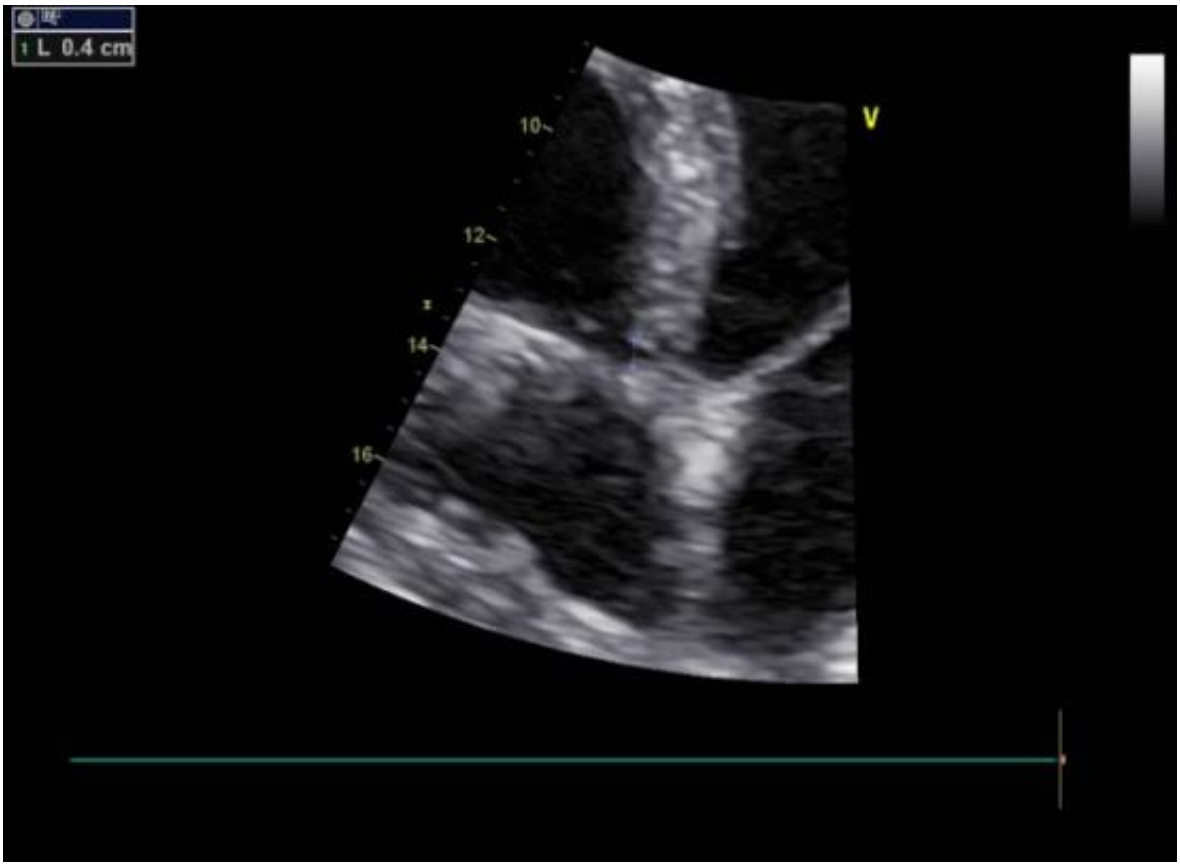

Figure (4): Trans thoracic echo, apical 4 chamber view with zoom, with defect about 0.4 cm between LV and RA.

Figure (5): Trans thoracic echo show TR jet.

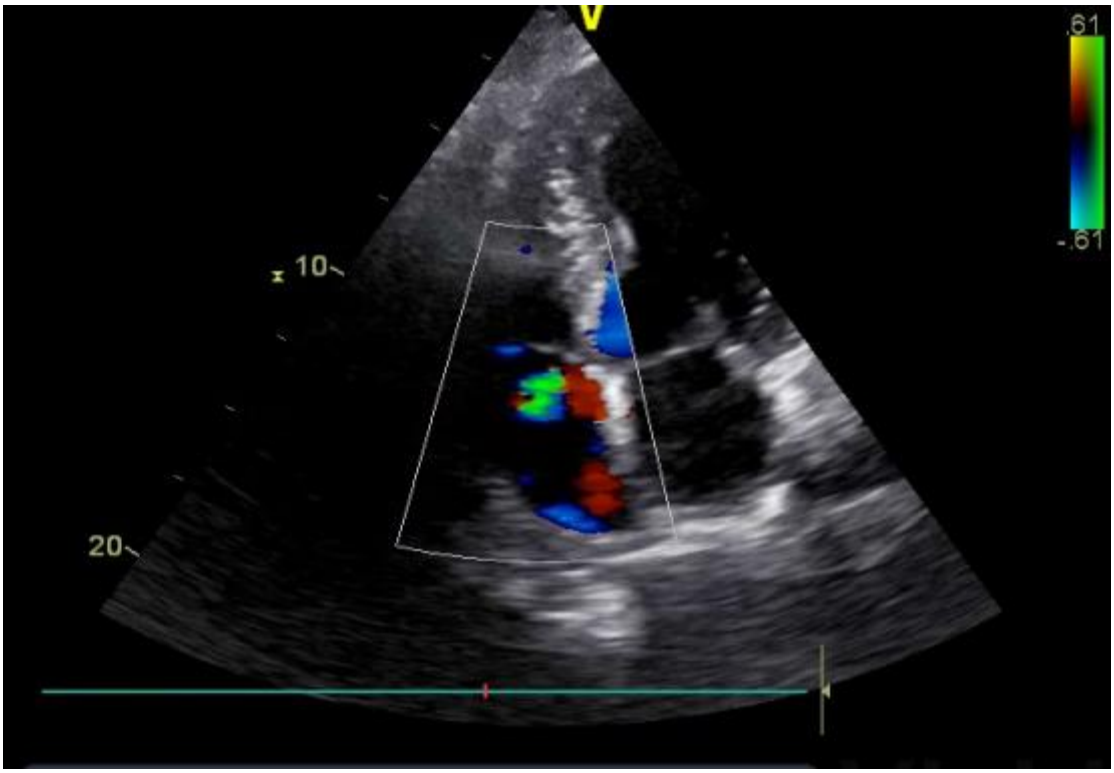

Figure (6): Trans- thoracic echo show flow from the LV to RA.

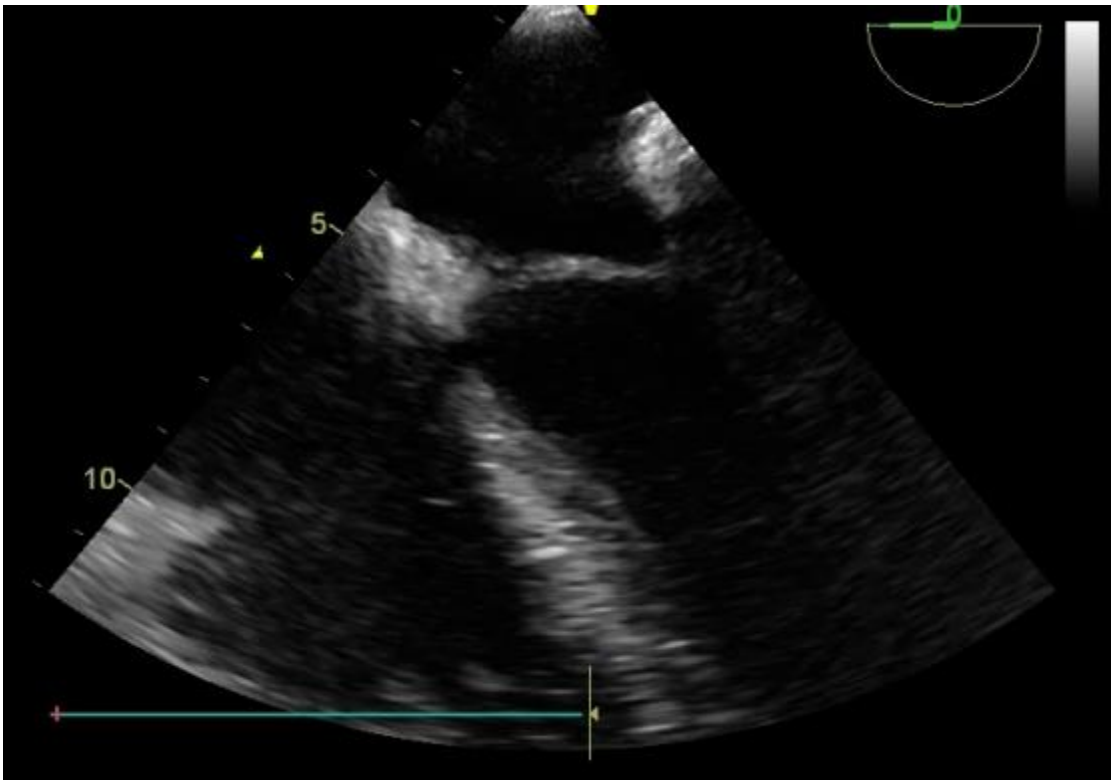

Figure (7): Trans- esophageal echo septal defect between LV and RA.

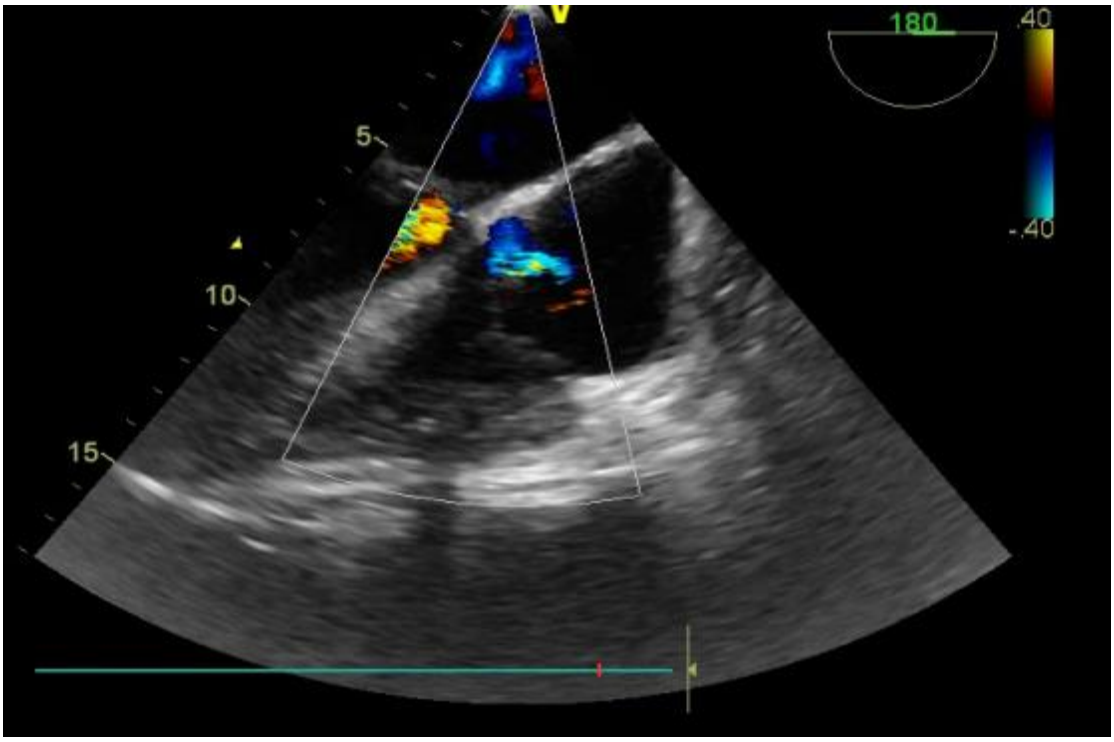

Figure (8): Trans- esophageal echo with flow seen from the LV to the RA seen during systole and diastole.

DISCUSSION

Acquired LV—RA shunts are rare. It is likely that the number of acquired defects increases over time because of the increasing rate of cardiac valve operations in the ageing population [(9)]. The diagnosis of LV—RA communication is not always easy, but a very careful echocardiography or MRI may give the correct diagnosis. When the shunt is mixed with tricuspid regurgitation, the flow might lead to misdiagnosis of pulmonary hypertension [(7)].

A murmur of LV—RA shunt is typical for VSD. This information, added to echocardiographic findings, together with enlarged RA, and in most cases increased jugular vein pressure, should keep one alert to the possibility of this rare shunt. Most of significant LV—RA shunts have previously been closed surgically. However, shunts acquired after surgery are challenging. Re-operation is always a risk, and after previous excessive debridement of calcification, the correction of a shunt may be very demanding. These communications can be closed safely with a device, as shown by **Tehrani *et al.*** [(7)].

Juha *et al.* [(10)] reported six successful cases. Five of these cases were done after one or more mitral valve operations, and one after VSD repair. All reported LV—RA shunts were type I defects. Other types of defects would have been very difficult to close with a device because of the close vicinity of the tricuspid valve. Three communications were closed with Amplatzer duct occluders, one with VSD and two with atrial septal defect (ASD) occluders.

A non-significant shunt was detected postoperatively in four out of six procedures. There were no major complications. In addition, reports exist on nine congenital LV—RA shunts that have been closed successfully with a device [(11)].

The percutaneous method seems feasible for centers that manage complex trans-catheter procedures. In experienced hands, a catheter-based procedure with shorter hospital stay would be even safer than surgery [(10)].

Although rare, endocarditis is the second most common reason for acquired LV—RA shunt. The shunt is easy to miss in endocarditis patients, who have fever and septicemia. The general symptoms may mask a new shunt. With echocardiography the shunt will not be missed if the possibility of a communication is kept in mind. These communications must be operated, because percutaneous devices cannot be inserted during infection [(10)].

The conduction system lies within the membranous septum. Therefore, it is not surprising that infection or laceration of this area damages conduction. Different degrees of atrioventricular block could found [(12, 13, 14)].

CONCLUSION

A high jet detected in the right atrium with uncertain origin and course has to appeal to additional diagnostic techniques including trans-esophageal echocardiography, cardiac catheterization, multi-slice CT, or cardiac magnetic resonance imaging for

differential diagnoses. Small restrictive shunts are preferred with conservative treatments, high-risk patients are candidates of interventional therapy, and the patients with unstable hemodynamics warrant an open heart surgery. Careful operative maneuver, good control of intra-cardiac infection, preservation of heart function, etc., are mandatory for the prevention of the development of an acquired LV-RA shunt.

In addition to the usual causes of cardiac decompensation following aortic valve surgery, one should consider the possibility of a left-to-right shunt secondary to an iatrogenic left ventricular-right atrial communication, particularly if either septal trauma or extensive valvular calcification was encountered during the surgical procedure.

List of abbreviation:

LV: Left ventricle
RA: Right atrium
VSD: Ventricular septal defect
MRI: Magnetic resonance imaging
AO: Aorta
RA: Right atrium
HR: Heart rate
BPM: Beat per minute
JVP: Jugular venous pressure
TEE: Trans-esophageal echo
PI: Pulmonary incompetence

REFERENCES

1. **Cabalka A, Hagler D, Mookadam F *et al.* (2005):** Percutaneous closure of left ventricular-to-right atrial fistula after prosthetic mitral valve rereplacement using the amplatzer duct occluder. Catheter Cardiovasc Interv., 64:522—7.
2. **Trehan V, Ramakrishnan S, Goyal N (2006):** Successful device closure of an acquired gerbode defect. Catheter Cardiovasc Interv., 68:942—5.
3. **Inoue H, Iguro Y, Kinjo T *et al.* (2009):** Acquired left ventricular—right atrial communication and severe aortic valve regurgitation caused by infective endocarditis. Thorac Cardiovasc Surg., 57:54-6.
4. **Venkatesh G, Lonn E, Holder D *et al.* (1996):** Acquired left ventricular to right atrial communication and complete heart block following nonpenetrating cardiac trauma. Can J Cardiol., 12:349—52.
5. **Jobic Y, Verdun F, Guillo P *et al.* (1997):** Postinfarction atrioventricular septal rupture. J Am Soc Echocardiogr., 10:680—4.
6. **Tehrani F, Movahed M (2007):** How to prevent echocardiographic misinterpretation of gerbode type defect as pulmonary arterial hypertension. Eur J Echocardiogr., 8:494-7.
7. **Riemenschneider T, Moss A (1967):** Left ventricular—right atrial communication. Am J Cardiol., 19:710—8.
8. **Komai H, Naito Y, Fujiwara K *et al.* (1996):** An unusual variation of left ventricular-right atrial communication. Surg Today, 26:825—7.
9. **Jackson D, Murphy G, Stewart S *et al.* (1979):** Delayed appearance of left-to-right shunt following aortic valvular replacement. Report of two cases. Chest, 75:184-6.
10. **Juha P, Narayanswami S, Eero J *et al.* (2011):** Acquired left ventricular-right atrium shunts. European Journal of Cardio-thoracic Surgery, 39: 500-506.
11. **Arora R, Trehan V, Kumar A *et al.* (2003):** Transcatheter closure of congenital ventricular septal defects: experience with various devices. J. Interv Cardiol., 16:83-91.
12. **Velebit V, Scho¨neberger A, Ciaroni S *et al.* (1995):** ‘‘Acquired’’ left ventricular-to-right atrial shunt (gerbode defect) after bacterial endocarditis. Tex Heart Inst J., 22:100-2.
13. **Alphonso N, Dhital K, Chambers J *et al.* (2003):** Gerbode’s defect resulting from infective endocarditis. Eur J Cardiothorac Surg., 23:844—6.
14. **Louagie Y, Charles S, Marchandise B *et al.* (1982):** Pneumococcal aortic valvar endocarditis with atrio-ventricular perforation. J Cardiovasc Surg., 23:338-43.