

CARDIAC IMAGING QUIZ

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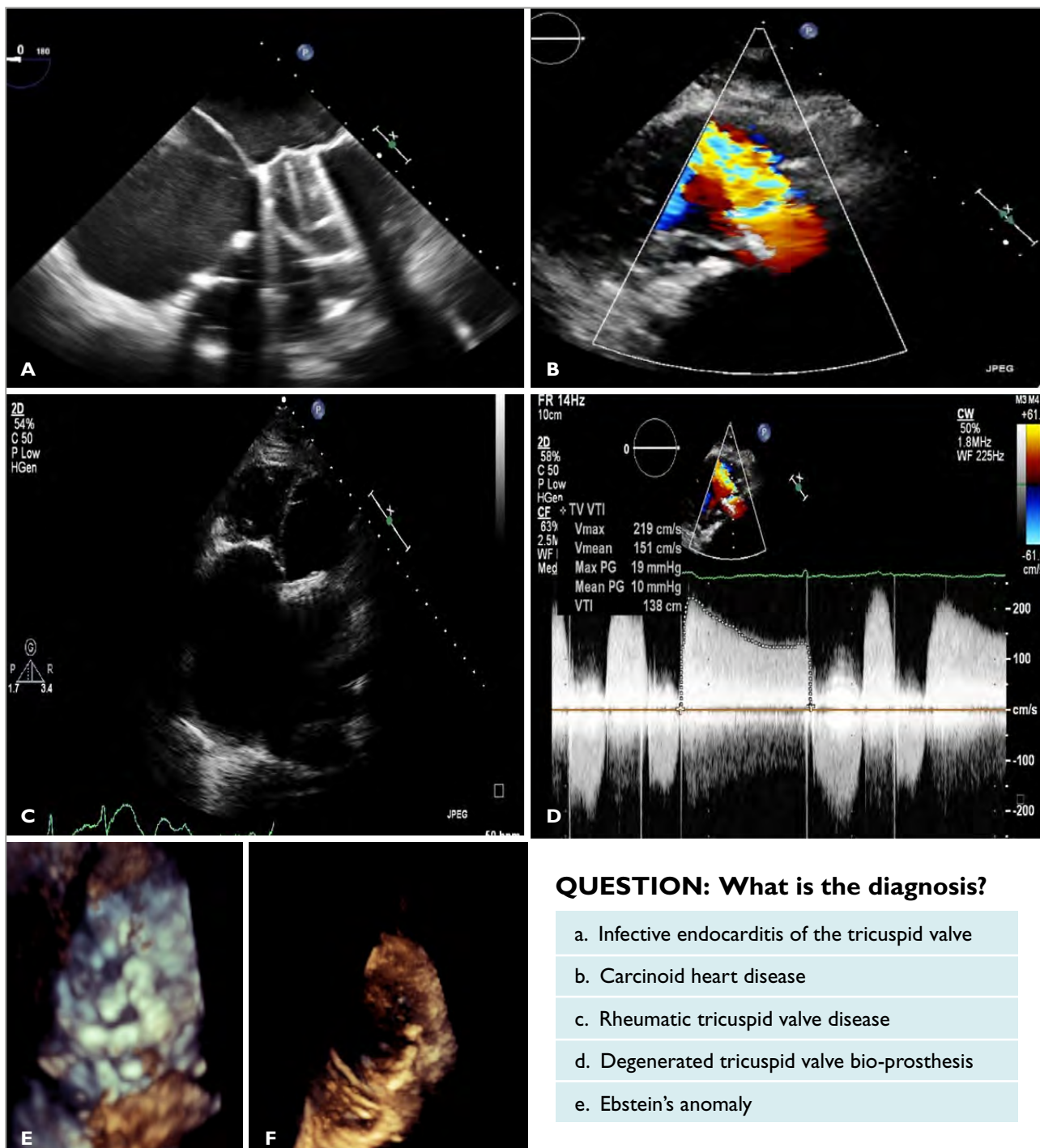
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ANSWER

D. Degenerated tricuspid valve bio-prosthesis.

These images belong to a 57-year-old female who had previous mitral valve replacement (MVR) and tricuspid valve (TV) replacement for rheumatic heart disease (RHD). She presented with signs and symptoms suggestive of right heart failure and atrial fibrillation.

The top panel on the left (mid trans-oesophageal view) shows a markedly enlarged right atrium (RA) with bioprosthetic tricuspid valve (prominent ring visible) and metallic bi-leaflet mitral valve (Image A). The image on the right is the right ventricle (RV) inflow view depicting convergence zone across the TV on colour flow imaging suggestive of significant stenosis (Image B). The middle panel shows the markedly enlarged RA in the apical 4-chamber view with echo drop out of the interatrial septum due to presence of metallic mitral valve prosthesis (Image C). The continuous wave Doppler shows a significant gradient of 10mmHg across the TV prosthesis and presence of tricuspid regurgitation (Image D). The bottom panel shows three-dimensional (3D) imaging of the TV bio-prosthesis, the valve is severely calcified with limited opening (Image E). The 3D image on the right emphasises the thickened chordae secondary to RHD of the TV in the RV inflow view (Image F).

TV replacement (TVR) is a relatively rare surgical procedure, typically performed on patients with severe structural or advanced functional problems in their tricuspid valve.⁽¹⁾ As a result, those undergoing TVR often have a high-risk profile, with many having previously undergone TV repair and facing complications such as RV dysfunction. TVR is linked to high mortality and morbidity rates, with operative mortality ranging from 5% - 50%. A systematic review and meta-analysis compared the clinical outcomes of mechanical vs. biological prostheses for TVR.⁽¹⁾ The study found that mechanical valves had a higher risk of thrombotic events but showed a non-significant trend towards lower 30-day mortality. Bioprosthetic valves, on the other hand, demonstrated better durability and a lower risk of thrombotic complications. Another study compared the long-term results of mechanical and biological prostheses in patients who underwent isolated or combined TVR.⁽²⁾ The findings suggested that biological prostheses might be a better choice for patients without Ebstein's anomaly, especially in isolated TVR, due to a lower incidence of valve thrombosis and bleeding.

On echocardiography, differentiating a native tricuspid valve with annuloplasty from a bioprosthetic valve primarily involves visual inspection of the valve structure and surrounding tissue, noting the presence of a ring or prosthesis, and assessing valve motion and regurgitation patterns.⁽³⁾ Assessment of prosthetic valve is much more complex than native valve.⁽⁴⁾ Differentiating native valves from prosthetic valves can be challenging as often just an annular ring may be present in native valve repair as well as bioprosthetic implanted valves. Acoustic shadowing may obscure clear differentiation and hide important information. Native tricuspid valves have characteristically unequal leaflet areas whereas bioprosthetic valves often have uniform leaflets. Disease processes may make this distinction difficult with leaflet size and excursion variability. A mean gradient of >5mmHg across a bioprosthetic TV is suggestive of significant stenosis.⁽⁵⁾ Current guidelines support the use of multimodality imaging in assessment of prosthetic valve.⁽⁶⁾

Degeneration of a structural valve is an irreversible process characterised by gradual degenerative changes in the prosthesis, such as growth of pannus, fibrosis of leaflets and calcification, disintegration of the connective tissue, and appearance of perforations and rupture.⁽⁷⁾ Structural valve deterioration is a result of multiple complex and poorly understood mechanisms such as immune rejection and valve tissue remodeling as in atherosclerosis.

Due to the problem of TV bio-prosthesis degeneration and high risk associated with repeat surgery, the Edwards SAPIEN valve has been successfully used for valve-in-valve implantation in the tricuspid position. This procedure is considered feasible and safe, with good mid-term outcomes.⁽⁸⁾ The Edwards SAPIEN valve may become the preferred prosthesis for such procedures in the future. Percutaneous tricuspid valve balloon valvuloplasty has been performed in patients deemed high risk for surgery with severe tricuspid bio-prosthesis stenosis with variable success in limited case studies.⁽⁹⁾

Conflict of interest: none declared.

REFERENCES

1. Abdul Qadeer M, Abdullah A, Noorani A, et al. Tricuspid valve replacement with mechanical vs. biological prostheses: A systematic review and meta-analysis. *J Cardiothorac Surg*. 2024;19:636. <https://doi.org/10.1186/s13019-024-03014-0>.
2. Peng Liu, Dong-Sheng Xia, Wei-Hua Qiao, et al. Which is the best prosthesis in an isolated or combined tricuspid valve replacement? *European Journal of Cardio-Thoracic Surgery*. 2021;59(1):170-179. <https://doi.org/10.1093/ejcts/ezaa273>.
3. Agricola E, Asmarats L, Maisano F, et al. Imaging for tricuspid valve repair and replacement. *Cardiovascular Imaging*. 2021;14(1):61-111.
4. Sordelli C, Severino S, Ascione L, Coppolino P, Caso P. Echocardiographic assessment of heart valve prostheses. *J Cardiovasc Echogr*. 2014;24(4):103-113. <https://doi.org/10.4103/2211-4122.147201>. PMID: 28465917; PMCID: PMC5353566.
5. Lin G, Bruce CJ, Connolly HM. Diseases of the tricuspid and pulmonic valves. In Otto CM, Bonow RO, eds. *Valvular Heart Disease*. 4th ed Philadelphia: Elsevier. 2014;375-395.
6. Graham F, Dobbin S, Sooriyakanthan M, Tsang W. Evolving standards in prosthetic heart valve assessment with cardiovascular imaging: Key changes in the 2024 American Society of Echocardiography Guidelines. *Structural Heart*. 2024;100372.
7. Ovcharenko EA, Glushkova TV, Kutikhin AG. Degeneration of bioprosthetic heart valves: update 2020. *Journal of the American Heart Association*. 2020;9(19):018506.
8. Hoendermis ES, Douglas YL, van den Heuvel AFM. Percutaneous Edwards SAPIEN valve implantation in the tricuspid position: case report and review of literature. *EuroIntervention*. 2012;8(5):628-633. <https://doi.org/10.4244/EIJV8I5A95>.
9. Bozbaş H, Asfour M, Çelebi AS, Amasyalı B, Onuk BE, Aybek T. Successful balloon valvuloplasty in a patient with severe bioprosthetic tricuspid valve stenosis: Case report. *J Updates Cardiovasc Med*. 2023;11(3):123-126. <https://doi.org/10.32596/ejcm.galenos.2023.2022-04-028>.