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CASE REPORT
Cardiovascular imaging

Acute type B aortic dissection following transcatheter mitral valve edge-to-edge repair: a case report

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Background Transoesophageal echocardiography is rarely reported as a possible cause of aortic dissection during the transcatheter edge-to-edge repair procedure. Herein, we present a case of type B aortic dissection following the transcatheter mitral valve edge-to-edge repair procedure, most likely related to the transoesophageal echocardiography probe.

Case summary A 68-year-old Chinese man complained of exertional dyspnoea lasting over 2 years and had been diagnosed with severe mitral regurgitation. He was admitted to our hospital for the treatment of severe mitral regurgitation with transcatheter edge-to-edge repair. One MitraClip XTR (Abbott Vascular) was successfully implanted under the guidance of active transoesophageal echocardiography, and the mitral regurgitation became trace. However, the patient complained of persistent back pain after the treatment, and computed tomography angiography revealed a type B aortic dissection in the descending aorta. After 2 weeks of unsuccessful conservative treatment, he successfully underwent endovascular stenting and was discharged from the hospital. The patient recovered well and remained event free during the 6-month follow-up.

Discussion Herein, we presented a rare complication following transcatheter mitral valve edge-to-edge repair that was most likely related to the transoesophageal echocardiography probe—type B aortic dissection. We postulated that repetitive flexion of the transoesophageal echocardiography probe led to compression-induced injury to the descending aorta wall at the mid-oesophageal level, which was the most probable aetiology of type B aortic dissection. Although this complication is rare, it is potentially fatal and therefore needs attention.

Keywords Transcatheter edge-to-edge repair • Transoesophageal echocardiography • Aortic dissection • Case report

ESC curriculum 4.3 Mitral regurgitation • 9.1 Aortic disease

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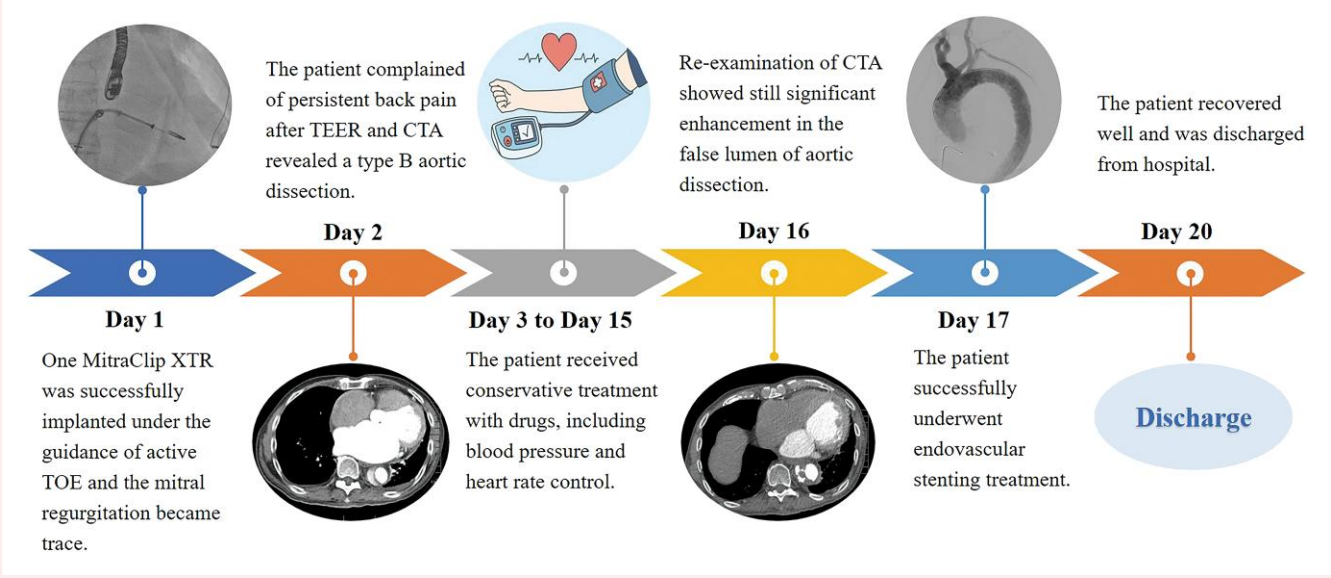
Learning points

- Transoesophageal echocardiography (TOE) plays an indispensable role in the transcatheter edge-to-edge repair (TEER) procedure. Although TOE is considered to be relatively safe, TOE-associated complications should be taken seriously.
- During the TEER procedure, the TOE probe needs to be adjusted and bent repeatedly in the middle of the oesophagus to obtain a clear image. However, the space in this area is relatively limited, and the probe may cause injury to the nearby descending aorta wall, especially the aorta with existing arteriosclerosis, which may cause aortic dissection.
- Timely identification of aortic dissection following TEER is crucial. Computed tomography angiography serves as an effective modality for diagnosing this complication. In cases of failed medical conservative treatment, prompt initiation of aortic repair is particularly warranted, especially for patients necessitating anticoagulation therapy.

Introduction

In the current era of transcatheter cardiac valve interventions, transoesophageal echocardiography (TOE) plays a crucial role in guiding and evaluating procedural outcomes by providing vital real-time information, particularly in the transcatheter edge-to-edge repair (TEER) procedure.[1,2] However, there is a growing body of literature reporting TOE-related complications,[2–4] such as oropharyngeal and oesophageal injury, gastroesophageal bleeding, and cardiovascular and respiratory complications, some of which may pose life-threatening risks. These complications related to TOE cannot be overlooked, especially in the context of transcatheter mitral valve repair due to the prolonged duration of these procedures.[2] Nevertheless, aortic dissection following TEER remains rare.

Summary figure



Case presentation

A 68-year-old Chinese man was admitted to our hospital for the treatment of severe mitral regurgitation (MR) by MitraClip (Abbott Vascular). He experienced exertional dyspnoea for more than 2 years and was diagnosed with chronic heart failure with reduced ejection fraction. He had no family history of cardiovascular disease but a medical history of hypertension, coronary atherosclerotic heart disease, persistent atrial fibrillation, and ischaemic stroke for 5 years. Despite the patient's blood pressure being effectively managed with medication and no discernible residual effects of the stroke, there was no amelioration in his symptoms of heart failure.

On physical examination, his blood pressure was 112/88 mmHg, heart rate was 111 b.p.m., and pulse rate was 82 b.p.m. Additionally, an enlarged heart and a grade 3/6 systolic murmur were noted upon auscultation of the mitral valve area.

Electrocardiography revealed atrial fibrillation, poor R-wave progression in V1–V4 leads, and ST-segment depression with T-wave inversion in V5–V6 leads (*Figure 1*). Transthoracic echocardiography (TTE) revealed overall cardiac enlargement, particularly in the left heart (notably the left atrium), severe MR, and moderate tricuspid regurgitation, accompanied by a decreased left ventricular ejection fraction (left atrial size: antero–posterior diameter: 58 mm, superior–inferior diameter: 72 mm, lateral diameter: 56 mm; left ventricular ejection fraction: 37%). Coronary angiography revealed 30% stenosis in the proximal and middle segment of anterior descending artery, 60% stenosis in the distal segment of left circumflex, and 50% stenosis in the middle segment of right coronary artery, with TIMI-3 flow. The pre-procedural computed tomography (CT) revealed cardiac enlargement and aortic atherosclerosis, with no evident signs of dissection.

After thorough consultation and extensive discussion by the multidisciplinary heart team, the patient was deemed to be at high surgical risk (his EuroScore II was 6.60%). Based on the patient's TTE findings and the

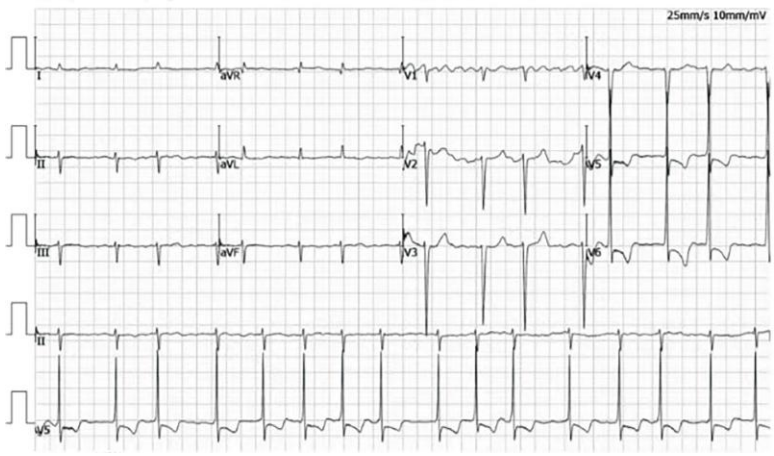


Figure 1 Electrocardiography showed atrial fibrillation, poor R-wave progression in V1–V4 leads, and ST-segment depression with T-wave inversion in V5–V6 leads.

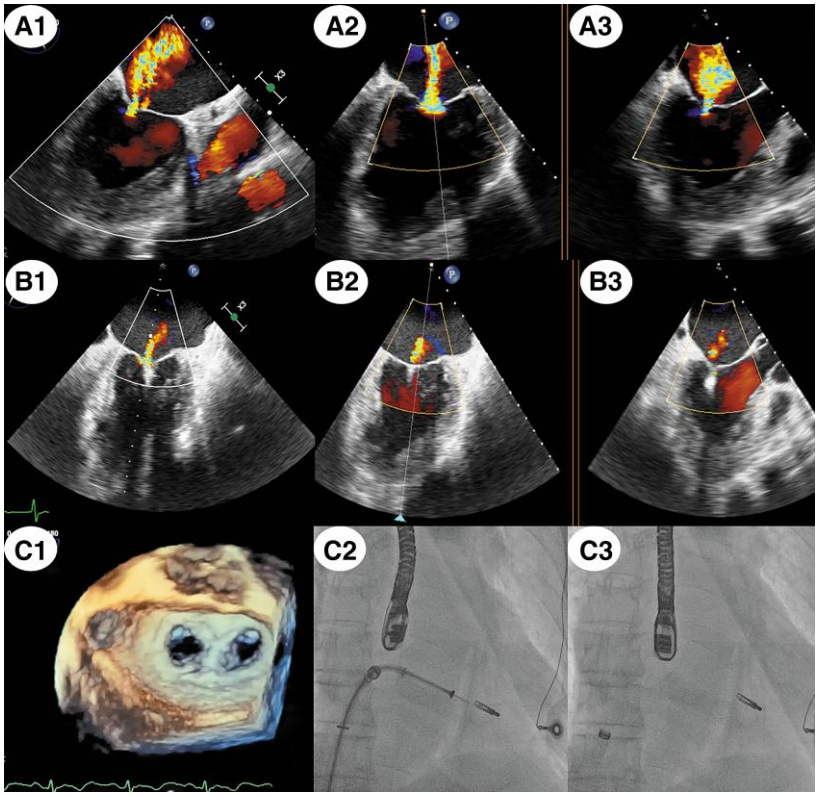


Figure 2 Transoesophageal echocardiography before transcatheter edge-to-edge repair indicated severe mitral regurgitation (*A1–A3*), while after transcatheter edge-to-edge repair, transoesophageal echocardiography showed a reduction of mitral regurgitation to a trace (*B1–B3*). 3D transoesophageal echocardiography showed the implanted clip in the A2/P2 region of the mitral valve (*C1*). X-ray showed one MitraClip was successfully implanted (*C2* and *C3*).

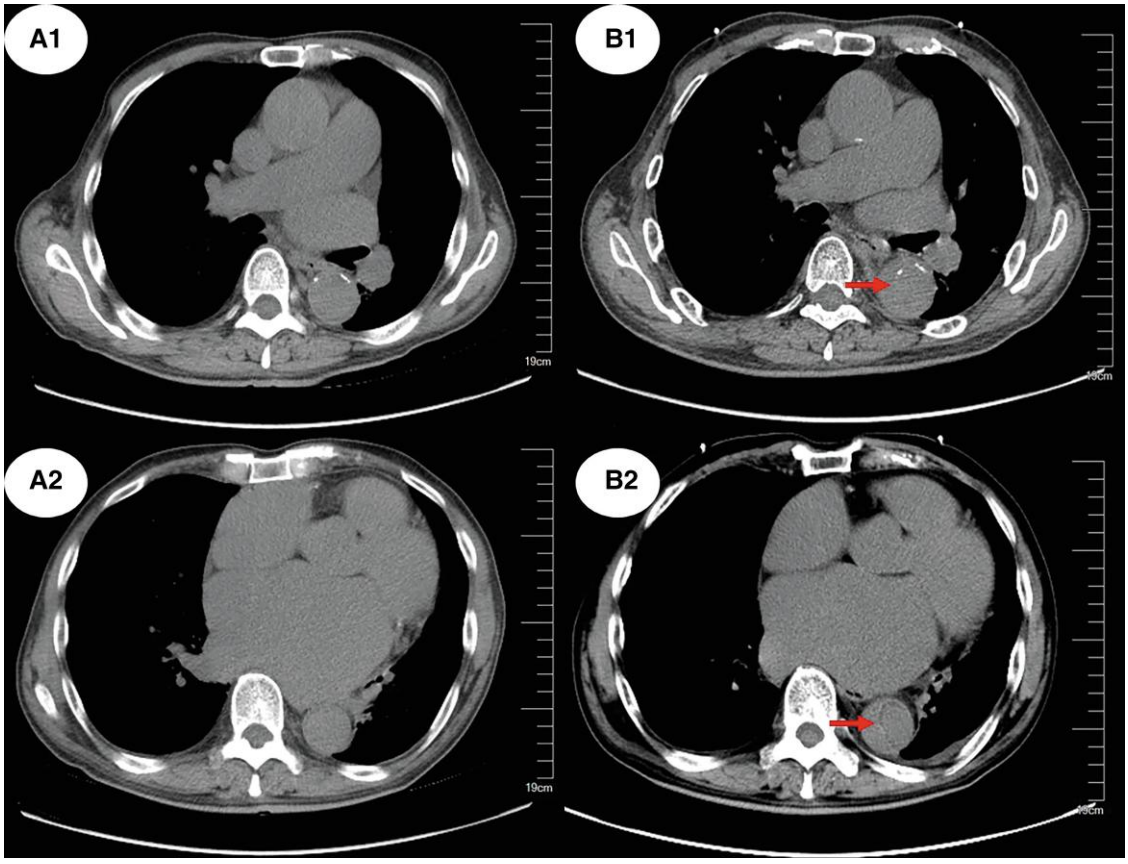


Figure 3 Computed tomography scan revealed a suspected aortic dissection (*B1* and *B2*), which was not found on pre-procedure computed tomography (*A1* and *A2*).

2021 ESC/EACTS guidelines,[5] transcatheter mitral valve TEER was recommended for the patient. Finally, the patient received TOE-guided mitral TEER, which took up to 2.5 h. During the 2.5 h procedure, the patient's haemodynamics remained stable. However, the TOE probe was repeatedly bent at the level of the left atrium to obtain a clear image to guide the operation. Finally, one MitraClip XTR was successfully implanted under the guidance of active TOE and the MR became trace (*Figure 2*). During the whole procedure, all operations were monitored by X-ray and TOE in real time, and no unexpected conditions were found. However, after extubation and recovery from anaesthesia, the patient complained of persistent back pain, and analgesic treatment was given; however, he still complained of back pain repeatedly. The day after TEER, the CT scan revealed a suspected aortic dissection (*Figure 3B1* and *B2*), which was not found on pre-procedure CT (*Figure 3A1* and *A2*). Subsequently, CT angiography (CTA) confirmed the diagnosis of type B aortic dissection in the descending aorta (*Figure 4A* and *B*). The dissection extends from the thoracic aorta to the upper abdominal aorta, with a rupture visible in the descending aorta, just at the mid-oesophageal level. Subsequently, the patient received conservative treatment with drugs, including blood pressure and heart rate control (sacubitril valsartan sodium tablets: 50 mg/bid, metoprolol tablet: 12.5 mg/bid). However, re-examination of CTA showed still significant enhancement in the false lumen of aortic dissection after a 2-week conservative treatment. Finally, he successfully underwent endovascular stenting treatment (*Figure 4C*) and was eventually cured and discharged. After discharge, the patient participated in a cardiac rehabilitation programme, resulting in the alleviation of heart failure symptoms and significantly improved medication adherence. At the 6-month follow-up, the patient recovered well and no further events were noted.

Discussion

According to the 2021 ECS guidelines,[5] TEER should be considered for surgical high-risk patients with severe MR and cardiac ultrasound indicating appropriate valve morphology. Previous data suggested that TEER for these patients was relatively safe with fewer complications.[6,7] The incidence of complications was reported as 8.5% in the USA.[8] Based on the literature review conducted by Maj *et al.*,[7] the acute complications included in-hospital mortality (0.0–3.4%), major bleeding incidents (3–7.4%), major vascular complications (0.0–1.4%), acute renal failure (4.8%), pericardial tamponade (0.0–1.0%), and ischaemic events such as myocardial infarction and pulmonary embolism (0.0–0.2%) and stroke (0.0–1.4%), as well as infective endocarditis. The occurrence of these complications was closely associated with the operator's level of experience and has a direct impact on the success rate.[8] However, aortic dissection as a rare complication following the TEER procedure has been sparsely documented in the literature.

In our case, the patient developed aortic dissection as an unexpected complication. The underlying causes of this unexpected complication were analysed as follows: (i) a chronic dissection? By comparing the pre- and post-procedure CT images, the possibility of chronic dissection can be excluded. (ii) Peri-operative blood pressure fluctuation

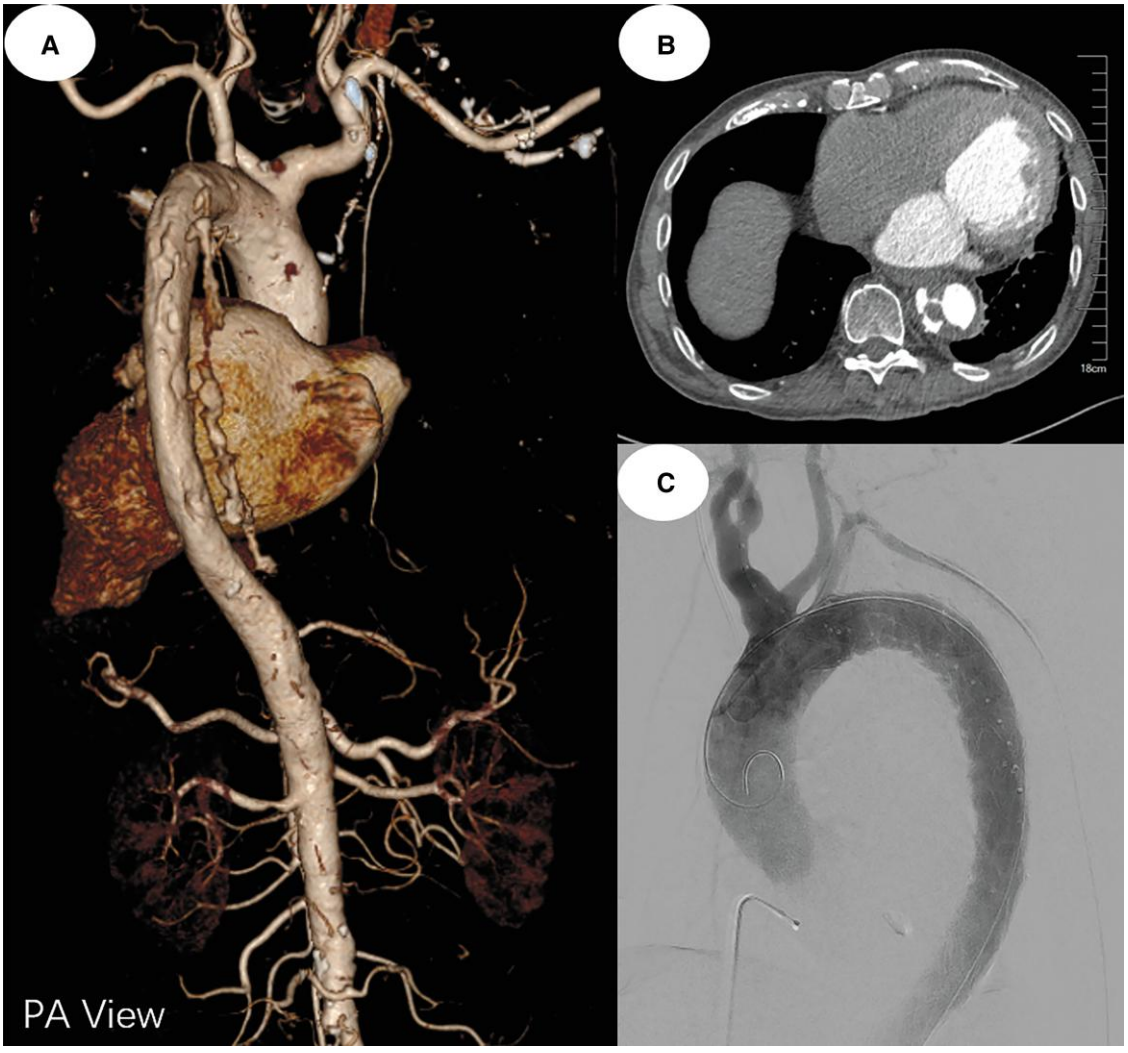


Figure 4 Computed tomography angiography after MitraClip implantation revealed an acute type B aortic dissection (*A* and *B*); the dissection extends from the thoracic aorta to the upper abdominal aorta, with a rupture visible in the descending aorta, just at the mid-oesophageal level (*A* and *B*); X-ray showed no exosmosis of contrast media after endovascular *stenting* treatment and the dissection disappeared (*C*).

promotes aortic dissection? It was assumed that the patient had a penetrating ulcer in the aorta before TEER, and drastic changes in peri-operative blood pressure led to the dissection. However, the haemodynamic stability during the procedure minimized this possibility. (iii) Accidental injury by interventional devices? The aorta could have been injured during the operation of the atrial septal puncture and devices in the left atrium. However, no unexpected conditions were found during the procedure, and no pericardial effusion was confirmed by post-procedure TTE, all of which suggest that the left atrial injury during the procedure was unlikely; otherwise, pericardial effusion usually forms first. (iv) Compression of the TOE probe by repeated bending resulted in aortic injury? The presence of significant atherosclerosis in the patient's aorta and the location of the rupture and extension of the aortic dissection at the level of the operating area of the TOE probe make it one of the most likely causes of this complication.

Post-TEER aortic dissection is rare. To our knowledge, only two articles (including three cases) have been reported so far.[9,10] Liu *et al.*[9] speculated that when adjusting the position and direction of the clip in left atrium, it may have been too close to the anterior wall of the aorta, resulting in inadvertent trauma and formation of small cracks, leading to the type A aortic dissection in their case. However, Morikawa *et al.*[10] suspected that compression by the TOE probe at the middle oesophagus in the limited space was the cause of the type B aortic dissection in their cases. In our case, the location of the rupture of the type B aortic dissection was similar to that reported by Morikawa *et al.*[10] Therefore, we speculated that the TOE probe was the most likely cause of this complication. In contrast to the case reported by Morikawa *et al.*,[10] CTA in our patient showed significant enhancement of the aortic pseudolumen after 2 weeks of conservative treatment, and he needed anticoagulant therapy due to persistent atrial fibrillation. Therefore, it was necessary to intervene with his aortic dissection. Finally, the patient successfully underwent endovascular stenting and was eventually cured and discharged.

During the TEER procedure, the TOE probe needs to be adjusted and bent repeatedly in the middle of the oesophagus to obtain a clear image. However, the space in this area is relatively limited, and the probe may cause injury to the nearby descending aorta wall, especially the aorta with existing arteriosclerosis, which could be the main cause of the aortic dissection in our case.

Transoesophageal echocardiography is rarely reported as a possible cause of aortic dissection during the TEER procedure. Although this complication is rare, it is potentially fatal; therefore, attention should be paid to it.

Lead author biography

Dr Ma is a cardiovascular interventional doctor and currently working in the Department of Cardiovascular, Shantou Central Hospital, Guangdong Province, PR China.

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Consent: The authors confirm that written consent for the submission and publication of this case report, including images and associated text, has been received from the patient in line with the Committee on Publication Ethics (COPE) guidelines.

Conflict of interest: None declared.

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Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

References

1. Flachskampf FA, Wouters PF, Edvardsen T, Evangelista A, Habib G, Hoffman P, et al. Recommendations for transoesophageal echocardiography: EACVI update 2014. *Eur Heart J Cardiovasc Imag* 2014;**15**:353–365.
2. Freitas-Ferraz AB, Rodés-Cabau J, Junquera Vega L, Beaudoin J, O'Connor K, Turgeon PY, et al. Transesophageal echocardiography complications associated with interventional cardiology procedures. *Am Heart J* 2020;**221**:19–28.
3. Freitas-Ferraz AB, Bernier M, Vaillancourt R, Ugalde PA, Nicodème F, Paradis J-M, et al. Safety of transesophageal echocardiography to guide structural cardiac interventions. *J Am Coll Cardiol* 2020;**75**:3164–3173.
4. Patel KM, Desai RG, Trivedi K, Neuburger PJ, Krishnan S, Potestio CP. Complications of transesophageal echocardiography: a review of injuries, risk factors, and management. *J Cardiothorac Vasc Anesth* 2022;**36**:3292–3302.
5. Vahanian A, Beyersdorf F, Praz F, Milojevic M, Baldus S, Bauersachs J, et al. ESC/EACTS guidelines for the management of valvular heart disease. *Eur Heart J* 2021;**2022**:561–632.
6. Schnitzler K, Hell M, Geyer M, Kreidel F, Münzel T, von Bardeleben RS. Complications following MitraClip implantation. *Curr Cardiol Rep* 2021;**23**:131.
7. Maj D, Jasińska-Gniadzik K, Kopiec T, Wieteska M, Gąsecka A, Rdzanek A, et al. Complications following transcatheter edge-to-edge mitral valve repair: personal experience and review of the literature. *Cardiol J* 2023;**30**:832–842.
8. Chhatriwalla AK, Vemulapalli S, Szerlip M, Kodali S, Hahn RT, Saxon JT, et al. Operator experience and outcomes of transcatheter mitral valve repair in the United States. *J Am Coll Cardiol* 2019;**74**:2955–2965.
9. Liu J, Zhu Z, Huang Y, Fang Z. Ascending aortic dissection during transcatheter edge-to-edge repair. *JACC: Cardiovasc Int* 2023;**16**:2915–2917.
10. Morikawa T, Hayashida A, Hiraoka A, Hirohata A. Acute type B aortic dissection during percutaneous mitral valve repair with MitraClip. *JACC: Cardiovasc Int* 2021;**14**:1613–1615.