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Case Report

Perioperative Application of Transesophageal Echocardiography in Left Atrial Appendage Occlusion in an Elderly Patient with Mirror-Image Dextrocardia and Atrial Fibrillation

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Mirror-image dextrocardia is non-life-threatening but not commonly diagnosed in the clinic. With the internal organs reversed, most of the patients with mirror-image dextrocardia have no clinical symptoms if the dextrocardia is not combined with other intracardiac malformations. Mirror-image dextrocardia is often discovered during other physical check or performing other examinations. In the present study, we reported a successful closure of a left atrial appendage in an 84-year-old patient with mirror-image dextrocardia with atrial fibrillation under the guidance of transesophageal echocardiography (TEE). Detailed perioperative steps of patient procedure description and TEE monitoring were described in this report.

1. Introduction

Mirror-image dextrocardia, the most common form of cardiac malposition, refers to the dextrocardia with situs inversus, L-loop ventricles, and inverted great arteries resulting from situs inversus with a concordant L-bulboventricular loop [1]. As the mirror view of a normal heart, its visceral position is opposite to the normal. While some studies reported that about 40-50% of mirror-image dextrocardia patients have other cardiac malformations [2], other patients have normal cardiac structures.

Atrial fibrillation is the most common type of tachyarrhythmia. Thromboembolism is one of the most severe complications of atrial fibrillation; the most clinically evident thromboembolic event is ischemic stroke. Although long-term administration of oral anticoagulants can prevent embolism, some patients are still facing the risk of bleeding, anticoagulation taboo, and thromboembolism even under the anticoagulation treatment, which is the major indication for left atrial appendage occlusion [3].

2. Case Report

The 84-year-old female patient had a history of hypertension for 10 years. The patient was diagnosed with cerebral infarction and atrial fibrillation 2 years ago, with the symptoms of dizziness, palpitations, and chest tightness followed by loss of speaking and fatigue. Treatments including antiarrhythmia and hypertension treatment (β-blocker, calcium channel blocker), anticoagulation (aspirin and warfarin), cholesterol treatment (atorvastatin), and neuronutrition supplementation (vitamin B) were prescribed to the patient before administration, and the symptoms were partially relieved after treatment. One year ago, the patient went to the outpatient office claiming for lower left limb fatigue and repeatedly falling and then diagnosed as cerebral infarction, constant atrial

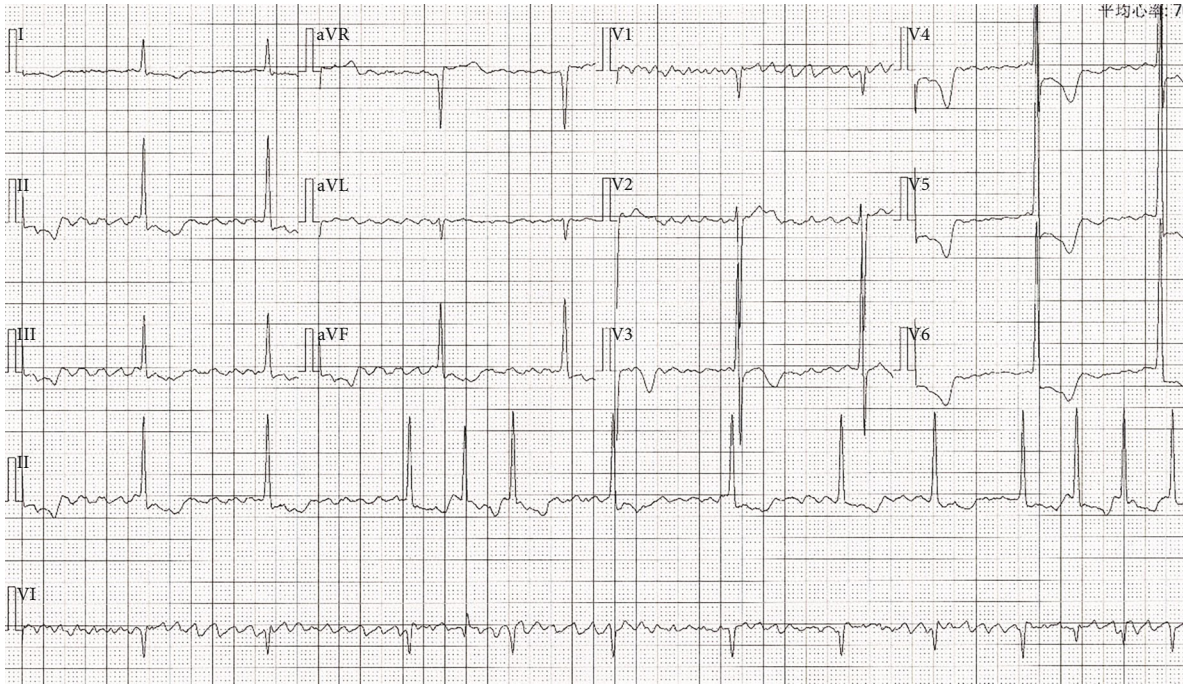
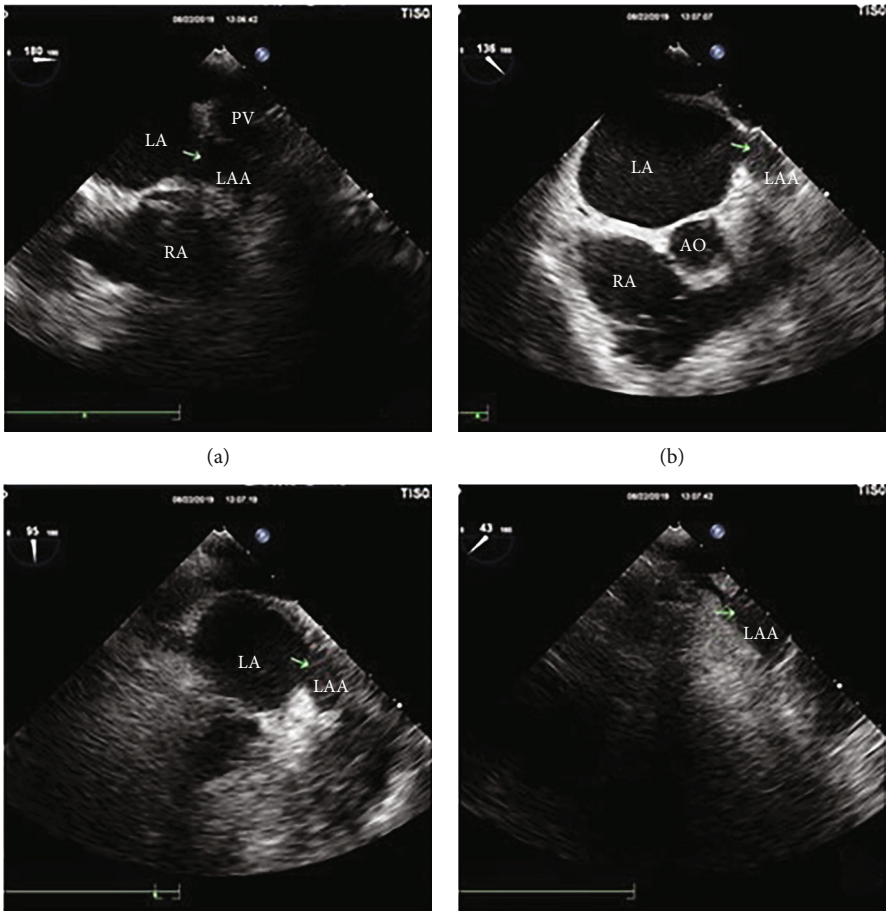


Figure 1: Electrocardiogram. No visible P waves and an irregularly irregular QRS complex showed atrial fibrillation.



(a) (b)

(c) (d)

Figure 2: Transesophageal echocardiography (TEE) images before the operation. Transesophageal echocardiography images demonstrated no existing thrombus in the left atrial appendage before the operation.

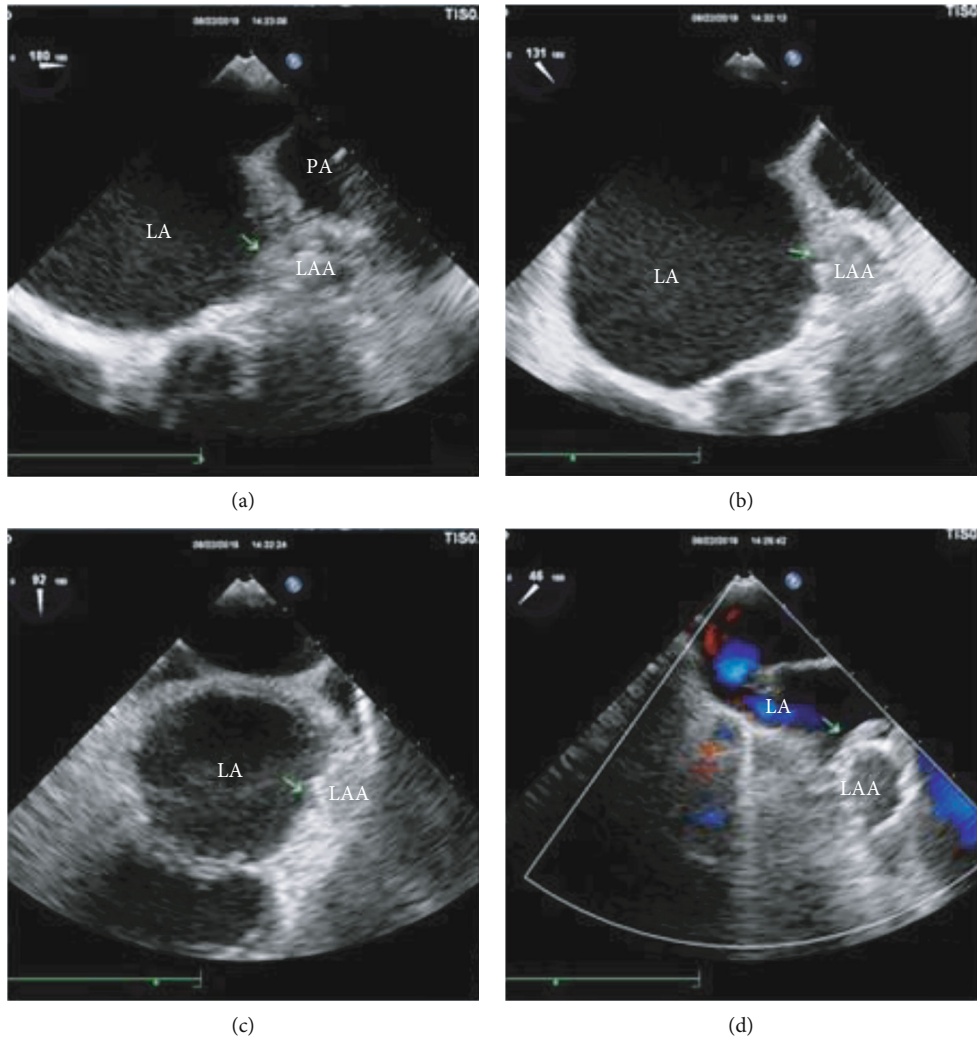


Figure 3: Transesophageal echocardiography (TEE) images after the operation. TEE showed the left atrial appendage from four different angles (the green arrow points to the ostium of the left atrial appendage).

fibrillation, hypertension, and lower left limb deep vein thrombosis. The patient continued taking the prescribed medication during the long-term treatment before this time of hospitalization. Holter monitoring and electrocardiogram (EKG) results showed atrial fibrillation (Figure 1). Transthoracic echocardiography (TTE) suggested a diagnosis of mirror-image dextrocardia. The diameters of the patient's left atrium and right atrium were significantly enlarged; the CHA2DS2-VAS score was 6, and the HAS-BLED score was 4. All the test results indicate a left atrial appendage occlusion.

Therefore, after evaluating the risk and potential benefit, we decided to perform left atrial appendage occlusion in the patient. Before the operation, a TEE examination was conducted to determine whether thrombus had developed in the left atrial appendage. It is noted that during the examination, it should be kept in mind that the TEE images of this patient are completely mirror symmetrical to the corresponding images of a normal person. The TEE result demonstrated that no thrombus existed in the left atrial appendage before the operation (Figure 2).

During the operation, general anesthesia was given to the patient. The TEE probe was inserted smoothly through the esophagus, and the diameter of the ostium and the depth of the left atrial appendage were measured from four different angles. The measurement was the following: 19×20 mm at the 180° angle, 14×20 mm at the 135° angle, 14×16 mm at the 90° angle, and 15×19 mm at the 45° angle. After that, the positions of interatrial paracentesis were located at 120° and 70° under the guidance of TEE, respectively. After the successful paracentesis of the atrial septum, angiography imaging showed that the left atrial appendage was cauliflower type. Then, a 21 mm watchman occluder was selected to occlude the left atrial appendage successfully. No residual shunt was left shown by angiography. After the placement of the occluder, TEE was used to observe the location of the occluder two-dimensionally and three-dimensionally. The result showed that the occluder was well embedded. The compression ratio of the occluder was measured from four different angles separately and the positioning (Figure 3). No residual shunt was observed from all angles by color Doppler ultrasound.

3. Discussion

During the examination, the TEE probe should be rotated slightly to the right side of the patient since the patient had mirror-image dextrocardia. Keeping in mind that the TEE images of this patient were completely mirrored symmetrical to the TEE images of a normal person, the angles at which the left atrial appendage was observed by TEE should also be axisymmetric to the angles that apply to a normal person. Therefore, when observing the internal structure of the left atrial appendage, in this case, the angle pointer of the probe chip should be rotated clockwise, from 180° to 45°, and the internal structure of the left atrial appendage should be scanned continuously and meticulously. Consequently, the TEE images displayed at the 180° angle, in this case, mirror represented the corresponding images at 0° angle for a normal person. Likewise, the images displayed at 135°, 90°, and 45°, in this case, mirror represented the images taken at 45°, 90°, and 135°, respectively. When guiding the paracentesis of the atrial septum during the operation, the TEE angle to the long axis of the atrial septum was about 70°, and it is also axisymmetric to the corresponding angle for a normal person. Furthermore, the images of the short axis of the atrial septum were taken at 120° approximately.

4. Conclusion

In routine clinical practice, TEE is not only used to determine the existence of thrombus in the left atrium and left atrial appendage before left atrial appendage occlusion but also used to screen if the patient's condition meets the indications for left atrial appendage occlusion. Furthermore, TEE could also be used to guide and monitor the procedures during the operation and to be used in the follow-up checkup after the operation. Thus, it is obvious that the TEE examination plays an important role in managing patients before, during, and after surgeries [4]. During the operation, TEE could provide clinicians and surgeons with reliable measurements of the left atrial appendage such as diameter and depth, guide the paracentesis of atrial septum during operation, observe the position of the placed occlude, and calculate the compression ratio, through which to guarantee the success of the surgery. For some special patients, including patients with mirror-image dextrocardia, a higher level of sonographer's technique and experience is required to perform the TEE due to the differences of the operational method and observation compared to those of a normal person, even if the position and the internal structure of the patient's heart have been determined in advance.

Abbreviations

TEE: Transesophageal echocardiography
EKG: Electrocardiogram.

Data Availability

The data that support the findings of this study are included in this manuscript, and the original files are available from the corresponding authors upon reasonable request.

Ethical Approval

The First Clinical Medical College of Lanzhou University ethics committee approved the research and confirmed that all research was performed in accordance with relevant guidelines and regulations.

Consent

The patient signed an informed consent prior to image collection. All the authors and the institution consented to publish.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Authors' Contributions

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us. L.Z. and M.B. carried out the study; L.Z. wrote the manuscript with support from M.B.; Z.Z., A.D., J.X., and G.J. fabricated the analysis; M.B., Z.Z., and A.D. helped supervise the project.

Supplementary Materials

Supplement Figure 1: normal echocardiography images. Normal echocardiography images show normal LAA. Supplement Figure 2: echocardiography-guided IAS puncture. Echocardiography-guided IAS puncture (A: mirror-image dextrocardia; B: normal). Supplement video 1-6: the consecutive video represents the IAS puncture and LAA scanning; https://drive.google.com/drive/folders/1jpqAMH7mXkfSWT4WcCOY-FE57YVoTSiP?usp=sharing. *(Supplementary Materials)*

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