Case Report
Volume 14:05, 2024

Journal of Clinical Case Reports

ISSN: 2165-7920

Open Access

Streamlined One-stop Surgical Management for an Older Patient with Dextrocardia and Atrial Fibrillation: A Case Report

Cui Zhenyu*, Han Suxia and Xiang Yan

Shanghai Pudong New Area People's Hospital, Pudong, Shanghai, China

Abstract

Dextrocardia, a rare congenital heart defect, becomes exceedingly unusual when accompanied by Atrial Fibrillation (AF). With the advancements in AF-related guidelines, anticoagulation therapy has become increasingly important. Lifelong oral anticoagulants remain imperative after successful AF ablation. Percutaneous Left Atrial Appendage Occlusion (LAAO) is an efficacious and secure strategy for averting AF-related thromboembolic incidents, thereby confirming the progressive suitability of the one-stop approach of AF ablation + LAAO. Cryoablation, favoured for its short procedural duration and enhanced tolerability, is particularly advantageous for older patients with AF, facilitating a streamlined procedure under local anaesthesia. However, the presence of abnormal anatomical structures presents challenges to this technique. This study describes a case of successful cryoablation + LAAO performed under Intracardiac Echocardiography (ICE) guidance in an elderly patient with dextrocardia and AF, providing a reference for the treatment of AF in patients with ectopic anatomy.

Keywords: Dextrocardia • Atrial fibrillation • Cryoablation • Streamlined left atrial appendage occlusion • Intracardiac echocardiography

Introduction

Dextrocardia, a congenital disease (1 in 10,000–12,000), and Atrial Fibrillation (AF) (1%–2%) are two rare conditions, and the simultaneous occurrence of the two is especially rare [1]. Pulmonary Vein Isolation (PVI) serves as the cornerstone of AF ablation therapy, while percutaneous Left Atrial Appendage Occlusion (LAAO) is a preventative measure against AF-related thromboembolic events [2]. Conventional LAAO requires general anaesthesia and Trans-Oesophageal Echocardiography (TEE) guidance, with cardiac surgery and extracorporeal circulation as a backup in emergent situations. Nonetheless, the accumulation of experience and advancement in medical device technologies has reduced the surgical risks associated with LAAO. Consequently, practices such as general anaesthesia and TEE, in some cases, may elevate patient risk and increase the time and cost of surgery and recovery. Evidence derived from clinical trials has demonstrated the safety and efficacy of LAAO under X-ray guidance, with a subset of clinicians accumulating extensive experience globally in streamlined LAAO approaches. However, the adoption of one-stop surgery in patients with dextrocardia remains scarcely documented. The presence of abnormal anatomical structures poses additional challenges to this technique, potentially increasing the risk of complications during transseptal puncture, PVI and LAAO.

Case Presentation

Patient information: Female, 88 years old

Diagnoses: Newly diagnosed AF; dextrocardia; coronary atherosclerotic heart disease; heart function, New York Heart Association Class II; stage 3 hypertension indicating very high risk; renal and hepatic dysfunction; personal history of colon cancer; and history of gastrointestinal bleeding.

Chief complaint: Chest discomfort for half a day

Post-admission electrocardiogram findings revealed AF with a rapid ventricular rate but normal troponin I levels. Echocardiography showed a left atrial diameter of 48 mm, left ventricular ejection fraction of 52%, calcification of the mitral valve posterior leaflet ring with mild mitral regurgitation, and mild tricuspid and aortic regurgitation.

F CHA2DS2-YASc score: congestive heart failure, 1 point; hypertension, 1 point; age, 2 points; and female sex, 1 point, totalling 5 points, which indicates the need for anticoagulation intervention.

HAS-BLBD score: renal and hepatic function abnormalities, 1 point each; history of bleeding, 1 point; age, 1 point; and aspirin use, 1 point, totalling 5 points, which indicates a high bleeding risk. Treatment with low-molecular-weight heparin was administered for anticoagulation (Figures 1 and 2).

Coronary angiography revealed the heart with dextrocardia, with coronary angiogram showing right-dominant circulation; Left Anterior Descending Artery (LAD): proximal stenosis 95%; left circumflex artery: mid-segment stenosis 30%; right carotid artery: irregular wall, proximal stenosis 30%. A 2.5 × 19 mm Firebird2 drug-eluting stent was implanted in the proximal segment of the LAD (Figure 3).

Following percutaneous coronary intervention, the patient presented with episodes of rapid ventricular rate AF accompanied by chest discomfort. Given the patient's high HAS-BLBD score, which indicated a significant bleeding risk from oral anticoagulation, advanced age and renal insufficiency, a

Figure 1. Mirror-image electrocardiogram shows an atrial fibrillation rhythm with an average ventricular rate of 139 beats per minute, extensive anterior wall leads to ST segment depression and aVR leads to ST segment elevation.

***Address for Correspondence:** Cui Zhenyu, Shanghai Pudong New Area People's Hospital, Pudong, Shanghai, China, E-mail: 616366039@qq.com*

Received: 04 October 2024, Manuscript No. jccr-24-149567; **Editor assigned:** 07 October 2024, PreQC No. P-149567; **Reviewed:** 18 October 2024, QC No. Q-149567; **Revised:** 24 October 2024, Manuscript No. R-149567; **Published:** 31 October 2024, DOI: 10.37421/2165-7920.2024.14.1623

decision was made to proceed with Intracardiac Echocardiography (ICE) to rule out left atrial appendage thrombosis, followed by AF cryoablation + LAO under ICE guidance.

The patient, exhibiting dextrocardia and situs inversus totalis, underwent procedural access through the right femoral vein for the insertion of 9F and 14F sheaths to facilitate the operation of the ICE catheter, cryo-sheath and left atrial appendage occlusion delivery system. The 6F and 7F sheaths were inserted into the left femoral vein for the quadripolar and decapolar electrodes, respectively (Figures 4 and 5).

The Digital Subtraction Angiography (DSA) system was set to mirror mode. Guided by both DSA and ICE, a successful transseptal puncture was performed at a 45° angle on the left on DSA (Figure 6)

Because of the patient's unique anatomical considerations arising from dextrocardia, a Johnson & Johnson adjustable bend coronary sinus electrode, which was designed for typical cardiac geometries, could not be navigated into the patient's coronary sinus. Consequently, it was positioned in the conventional right atrium (actually the patient's left atrium) for atrial potential monitoring (Figure 7).

Right superior pulmonary vein ablation

The right superior pulmonary vein exhibited a flat anterior course. The Achieve catheter was advanced to the opening of the branch. Contrast injection performed balloon inflation revealed retention of the contrast agent at the pulmonary vein orifice. The Achieve catheter was then retracted into the balloon and re-advanced to form a loop at the pulmonary vein orifice. The sheath was not anchored to the balloon, but the axis was acceptable, after which cryoablation was performed.

A single 180-s ablation strategy was implemented after observing a Time To Isolation (TTI) of 32 s and the temperature drop to −43 ℃ in 60 s with a satisfactory cooling curve (Figure 8).

Right inferior pulmonary vein ablation

The Achieve catheter was advanced to the lower branch of the right inferior pulmonary vein, and the sheath was bent to align with the inferior branch. Following balloon inflation, the sheath was advanced to form a hockey stick shape, ensuring coaxial alignment. Contrast injection showed significant retention of the contrast agent in the superior and inferior branches. The Achieve catheter was slightly retracted to visualise the PVP. Cryoablation was performed because the sheath was not anchored to the balloon.

Figure 2. Pulmonary DR indicating the patient has dextrocardia.

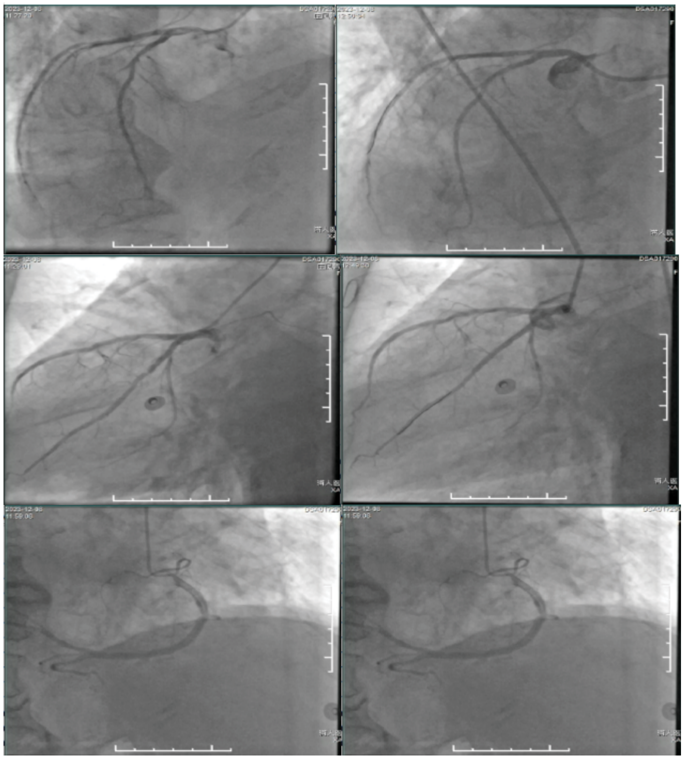

Figure 3. A and B) Comparison of severe stenosis in the proximal and mid-segments of the left anterior descending artery before and after percutaneous coronary intervention from a mirror-image liver position, **C and D)** Comparison from a mirror-image right shoulder position and **E and F)** Images showing no significant stenosis in the right coronary artery.

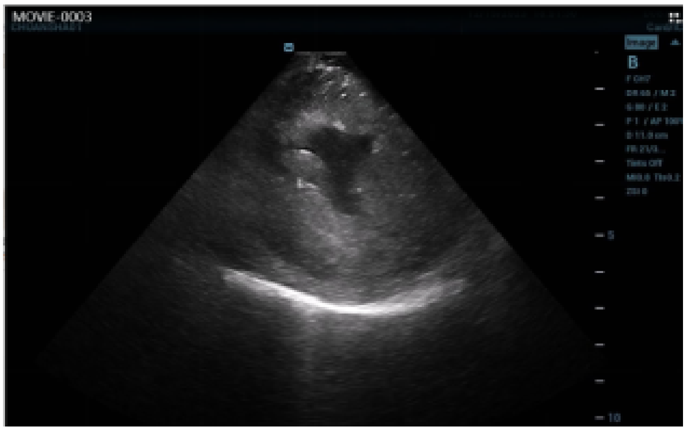

Figure 4. Preoperative intracardiac echocardiography revealing the absence of pericardial effusion.

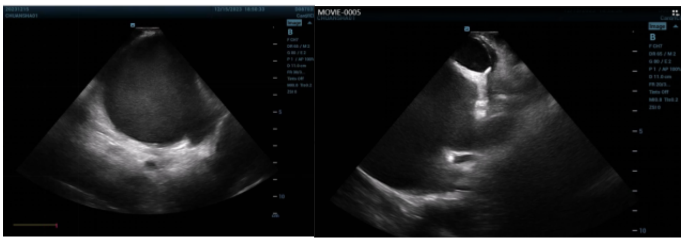

Figure 5. A) Intracardiac Echocardiography (ICE) exploration of the right atrial septum, verifying the absence of a thrombus in the left atrial appendage orifice. **B)** ICE exploration of the right ventricular outflow tract, verifying the absence of a thrombus within the left atrial appendage body.

A single 180-s ablation strategy was adopted after observing TTI of 18 s and the temperature drop to −43 ℃ at 60 s with a satisfactory cooling curve (Figure 9).

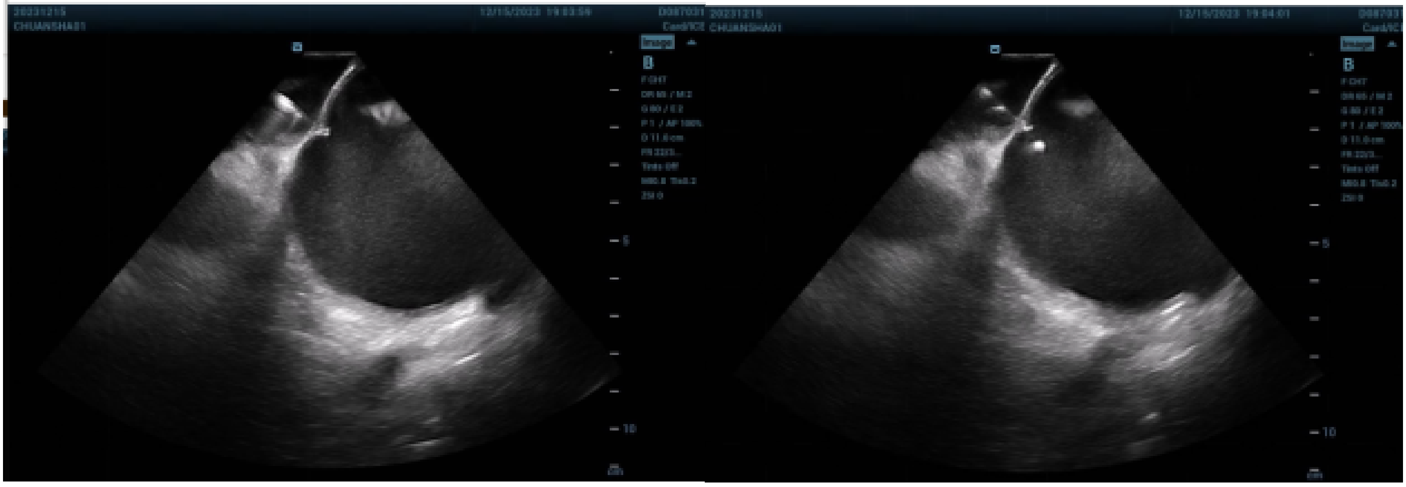

Figure 6. Images taken during the intracardiac echocardiography-guided transseptal puncture. **A)** Septal tenting caused by the needle tip, **B)** Image of the needle tip penetrating the septum into the left atrium.

Figure 7. A) Right pulmonary vein angiography, **B)** Left pulmonary vein angiography.

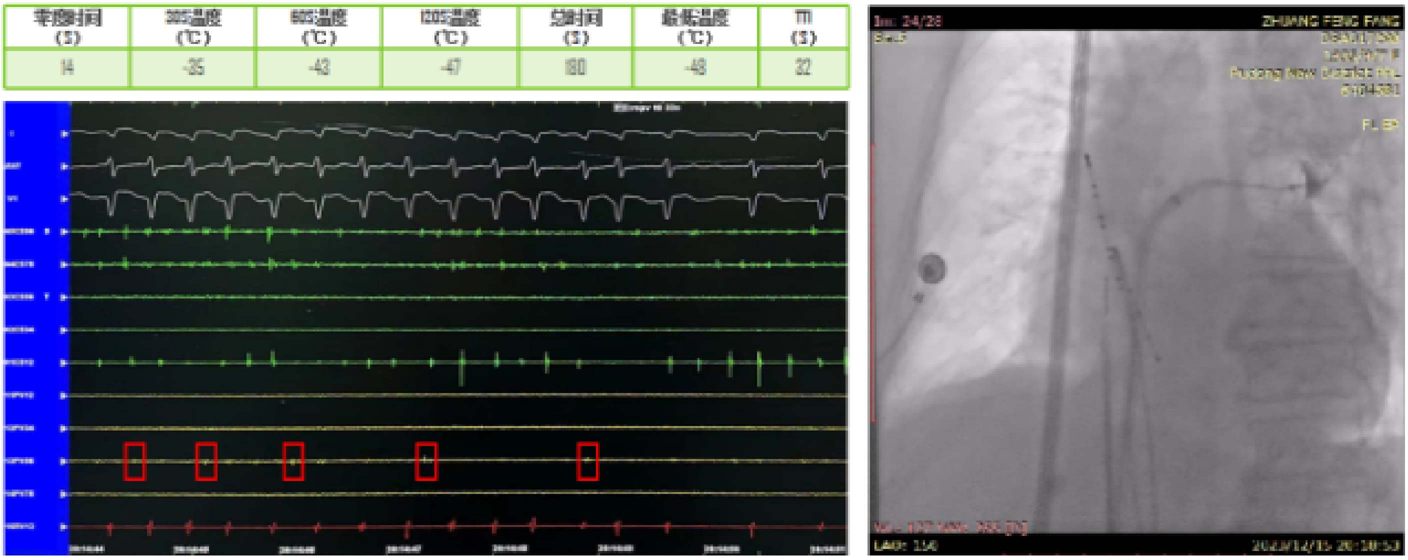

Figure 8. A) Elimination of electrical activity in and **B)** Occlusion of the right superior pulmonary vein.

Left superior pulmonary vein ablation

The left superior pulmonary vein exhibited an upwards course. The Achieve catheter was advanced into the upper branch, followed by balloon inflation. Subsequently, the sheath was slightly bent and the entire system was advanced forward. The contrast agent was retained at the pulmonary vein orifice and branches, as demonstrated by contrast injection. The potential of the PVP was identified upon slight retraction of the Achieve catheter. Optimal alignment along the axis was attained based on the linear indication formed by the distal MARK of the sheath; thus, cryoablation was performed.

A single 180-s ablation strategy was adopted after observing a TTI of 37 s and the temperature drop to −45 °C at 60 s with a satisfactory cooling curve (Figure 10).

Left inferior pulmonary vein ablation

The Achieve catheter was advanced to the opening of the lower branch. The balloon was retracted below the sheath's bending point, and the sheath was fully angled to align with the lower branch. The sheath was withdrawn while advancing the balloon, and tension on the Achieve catheter was controlled to prevent the balloon from being ejected. After inflation, the sheath was retracted to occlude the branch. Contrast injection revealed contrast agent retention within the branch. No PVP potentials were detected. The sheath was rotated clockwise towards the posterior wall to form a loop with the distal MARK, indicating optimal alignment and cryoablation was performed. A single 180-s ablation strategy was performed after observing the temperature drop to −41 °C at 60 s with a satisfactory cooling curve. Following ablation, the Achieve catheter was retracted to the orifice without performing PVP detection (Figures 11-13).

Experience: In patients with dextrocardia undergoing cryoablation, setting DSA imaging to mirror mode aligns the pulmonary vein configuration images with that of a patient with levocardia. While manipulating the sheath for elevation and angulation mirrors that in patients with levocardia, the approach for anterior and posterior axial movements is inverted. In DSA images, the left actually shows the right pulmonary vein; turning clockwise moves it forward, whereas turning anticlockwise moves it backward. Similarly, the right actually shows the left pulmonary vein; turning clockwise moves it backward, whereas turning anticlockwise moves it forward.

Left atrial appendage occlusion

Angiography and measurements of the left atrial appendage were performed at the left 30°/head 20° and left 30°/foot 20° positions (Figure 14).

The mirror position was used as the working position to release the left atrial appendage occlude (Figure 15).

Angiography of the left atrium at both the left 30°/head 20° and left 30°/foot 20° positions confirmed effective occlusion by the left atrial appendage occlude (Figure 16).

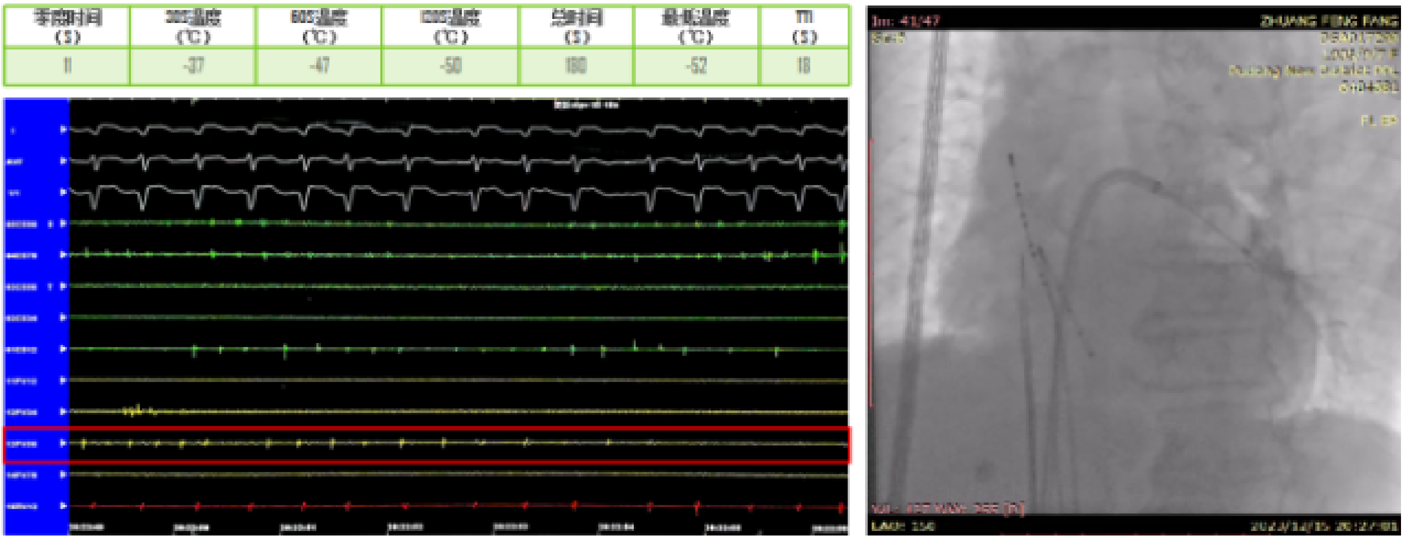

Figure 9. A) Elimination of electrical activity in and **B)** Occlusion of the right inferior pulmonary vein.

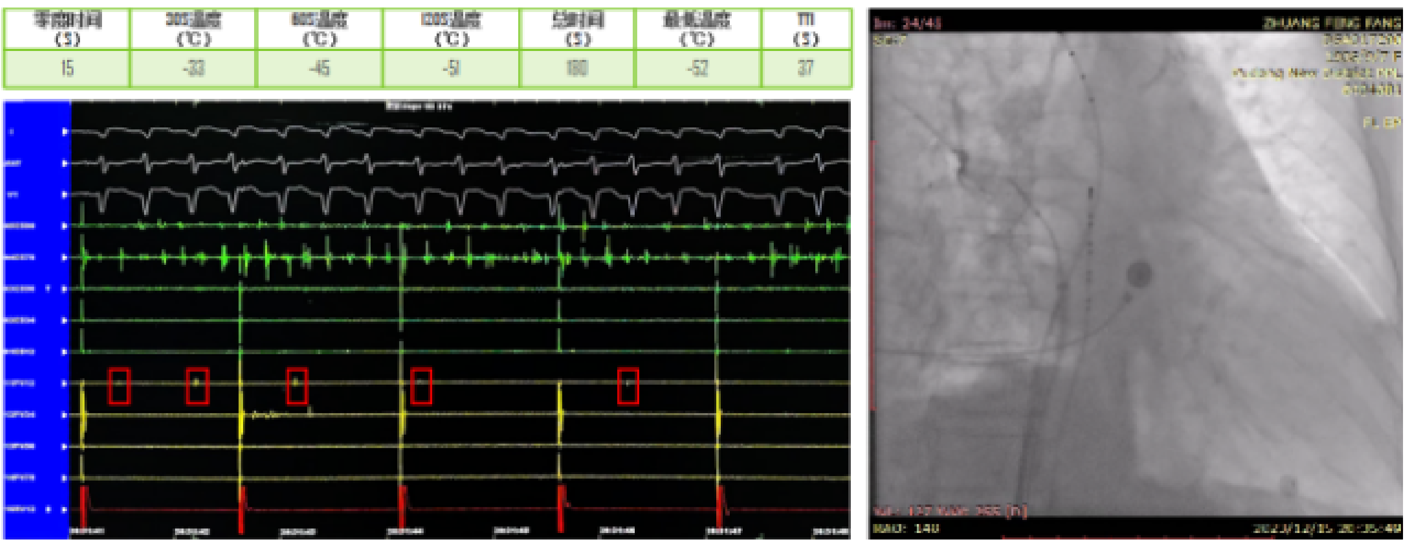

Figure 10. A) Elimination of electrical activity in and **B)** Occlusion of the left superior.

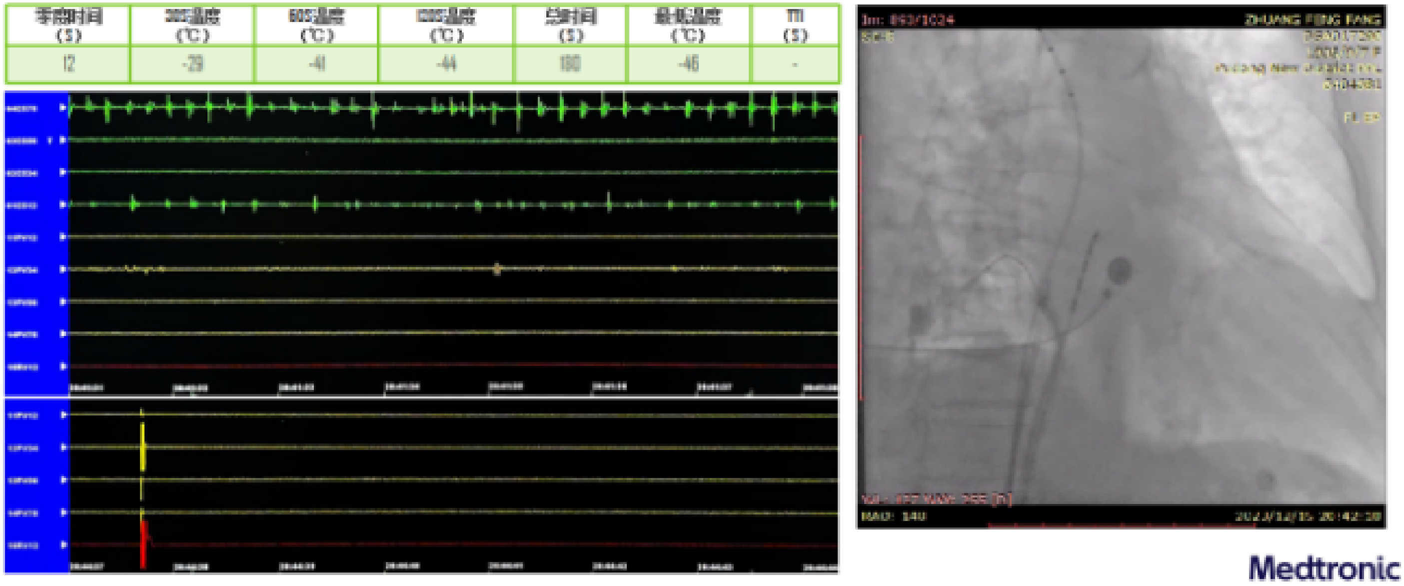

Figure 11. **A)** Elimination of electrical activity within and **B)** Occlusion of the left inferior pulmonary vein.

部位	零度时间（S）	30S温度（℃）	60S温度（℃）	120S温度（℃）	总时间（S）	最低温度（℃）	TTI（S）
RSPV	14	-35	-43	-47	180	-48	32
RIPV	11	-37	-47	-50	180	-52	18
LSPV	15	-33	-45	-51	180	-52	37
LIPV	12	-29	-41	-44	180	-46	-

Figure 12. Ablation records for all four pulmonary veins.

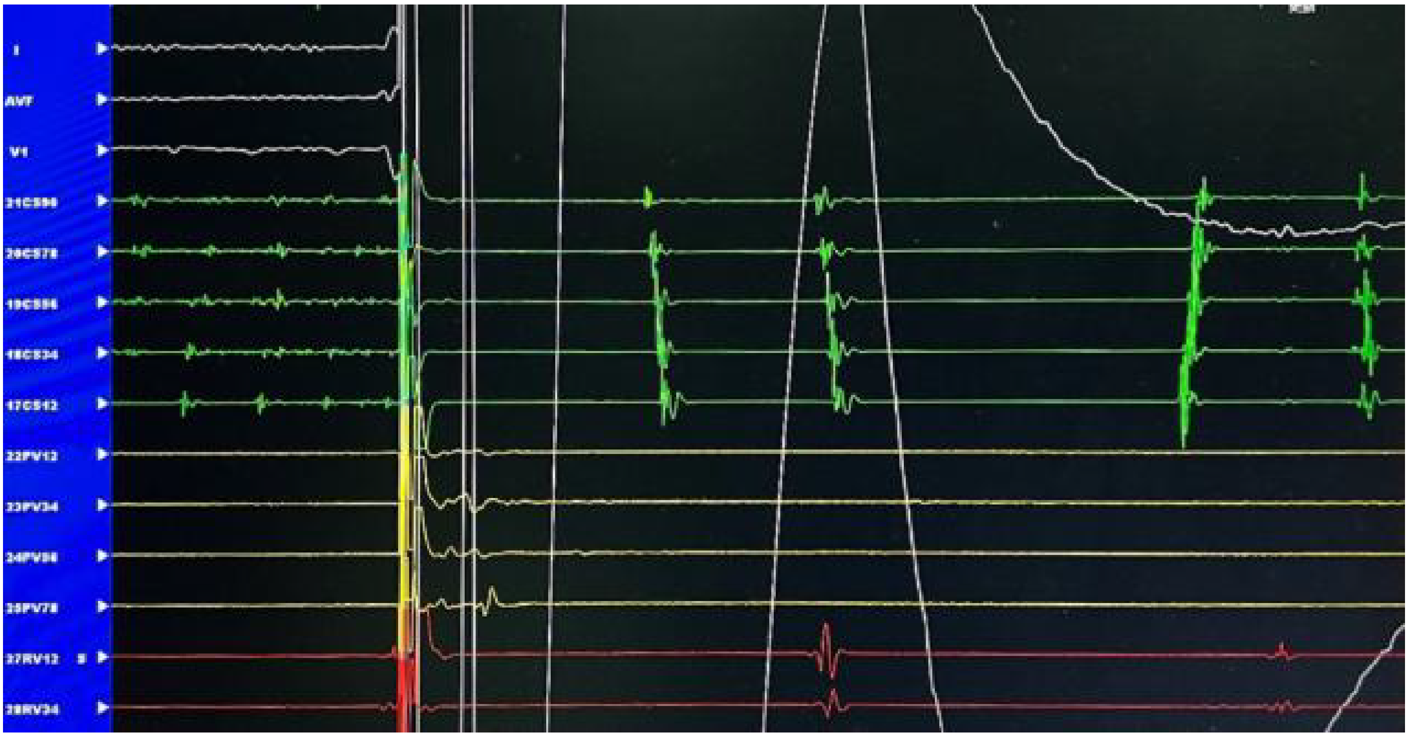

Figure 13. Restoration to sinus rhythm after cardioversion.

Tugging on the occluder disc is performed to test the stability of the occlude (Figure 17).

Given the patient's distinctive cardiac anatomy and to minimise risk, ICE was not performed to traverse the septum for left atrial exploration; instead, it was used to explore the occlusion status of the left atrial appendage occluder at the right atrial septum, which was satisfactory (Figure 18).

Postoperative routine ICE exploration of the pericardium indicated no pericardial effusion (Figure 19).

Procedure concluded.

Postoperative electrocardiography check-up: The sinus rhythm was well maintained (Figure 20).

Discussion

Dextrocardia is rare in the general population [3] and may significantly affect significant extracardiac anomalies [4-6]. In general, the incidence of AF in individuals with dextrocardia mirrors that in the general populace. Nonetheless, the modified cardiac structure in dextrocardia can pose challenges for cardiologists during cardiac interventional procedures. Although PVI cryoablation [7-9] and left atrial appendage occlusion [1,10] have

Figure 14. A) Angiography of the left atrial appendage at the left 30°/head 20° position; **B)** the angiography at the left 30°/foot 20° position.

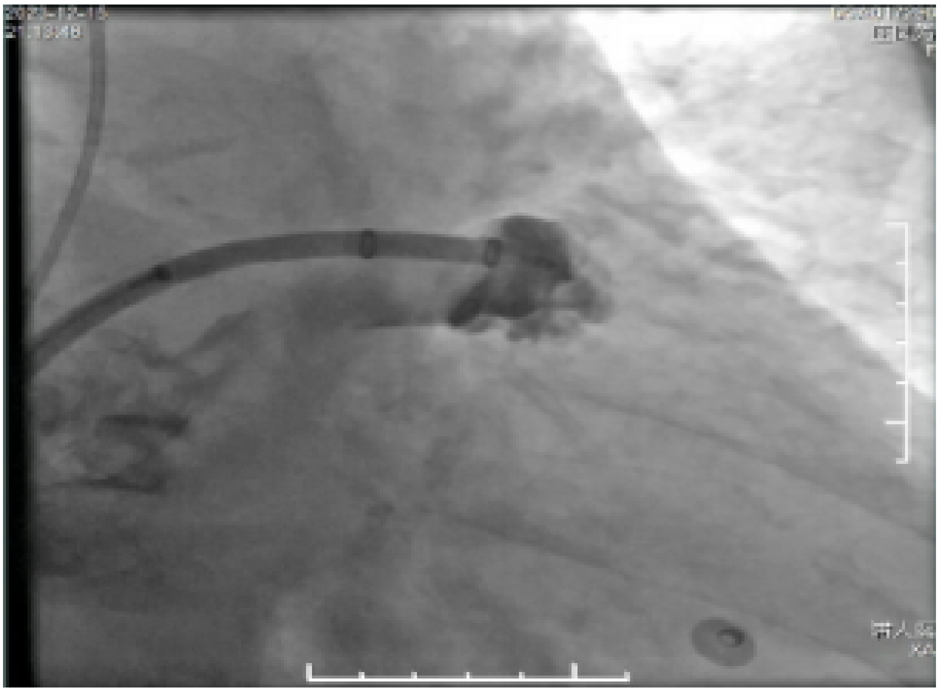

Figure 15. Angiography at the left 30°/foot 20° position shows the correct placement of the occluder disc.

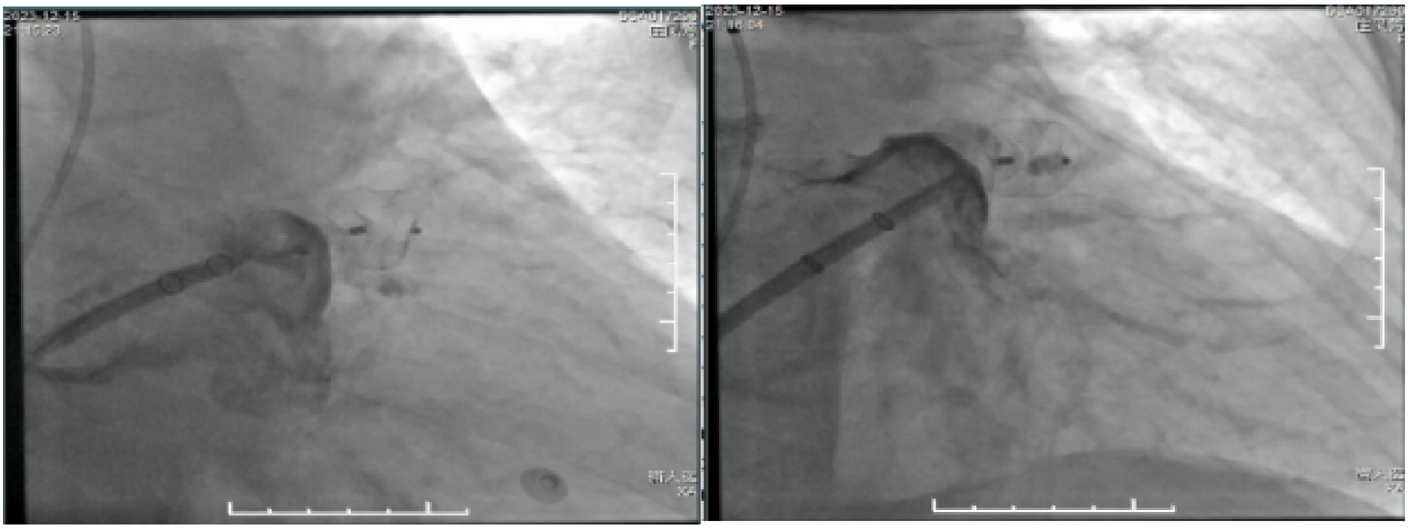

Figure 16. A) Effective occlusion by the occluder disc at the left 30°/head 20° position, **B)** effective occlusion at the left 30°/foot 20° position, following the position, anchor, seal, size principle.

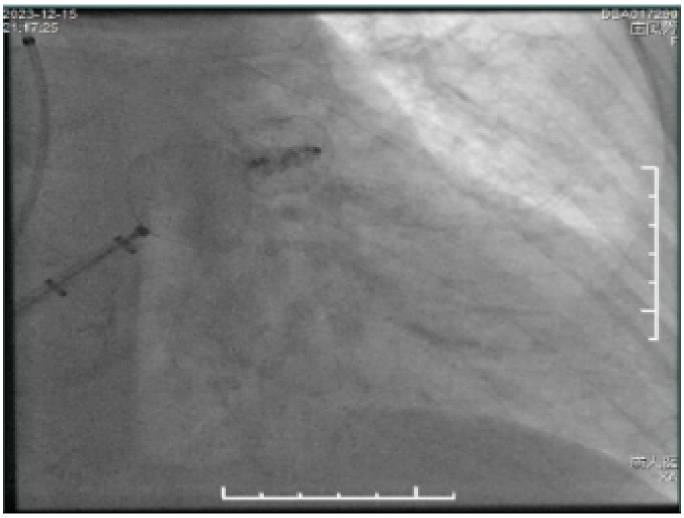

Figure 17. Tug test assessing the stability of the occluder disc.

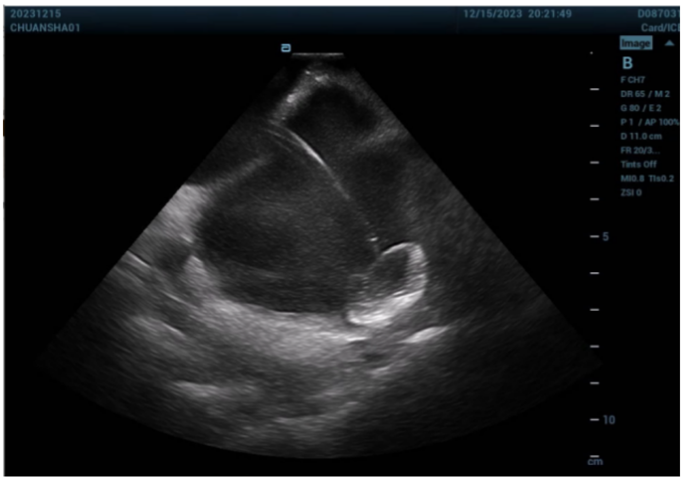

Figure 18. Intracardiac echocardiography imaging revealing good positions of the occluder and outer discs.

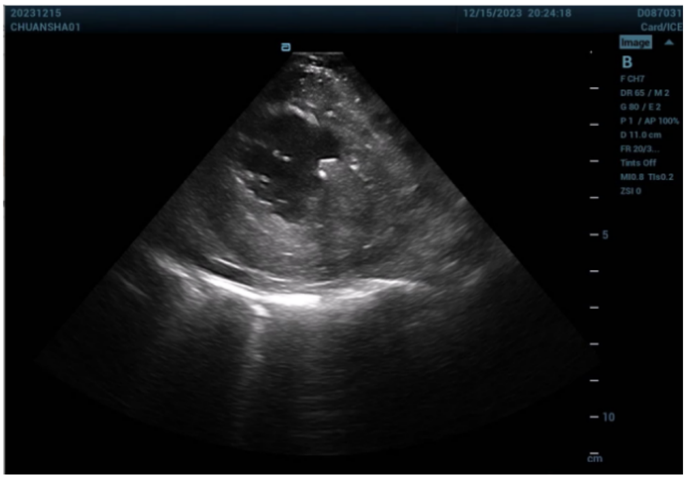

Figure 19. Following the procedure, a final ICE exploration indicates no pericardial effusion.

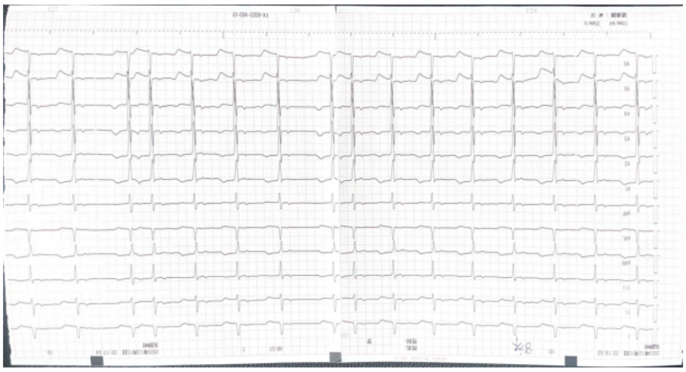

Figure 20. Postoperative electrocardiography check-up indicates sinus rhythm.

been reported in patients with dextrocardia and AF, reports on a one-stop surgical approach for this population are scarce.

This study describes the case of an elderly female patient with AF and concurrent coronary artery disease. The patient experienced significant myocardial ischemia and chest discomfort during episodes of rapid ventricular rate AF, indicating an urgent need for AF cardioversion. Given the patient's high HAS-BLED score, which indicates a high bleeding risk, the use of oral anticoagulants was restricted, making LAAO a clear necessity. Catheter ablation has been proven effective in AF treatment, with PVI serving as the foundational technique. Cryoballoon ablation has recently emerged as a novel ablation method and has become one of the standard techniques for achieving PVI. The PROTECT AF and PREVAIL studies have obtained evidence on the protective role of LAAO in preventing thromboembolic events in patients with AF, particularly those with elevated CHA2DS2VASc and HAS-BLED scores, indicating considerable risks associated with long-term oral anticoagulation, which ultimately makes LAAO as the preferred treatment option [2,11]. Accumulating operator experience in percutaneous transcatheter LAAO has significantly increased the procedural success rate up to 98% [12,13]. Conventional LAAO necessitates general anaesthesia and TEE guidance, with backup cardiac surgery and extracorporeal circulation for handling emergent situations. Nonetheless, the accumulation of experience and advancement in medical device technologies has reduced the surgical risks associated with LAAO. Consequently, practices such as general anaesthesia and TEE may increase patient risk in certain contexts, prolonging the duration and increasing the cost associated with surgery and recovery. Evidence from clinical trials has demonstrated the safety and efficacy of LAAO under X-ray guidance. More experienced centres now routinely implement a streamlined LAAO procedure. In the present case, the patient successfully underwent a streamlined percutaneous cryoablation and LAAO under ICE guidance. This case demonstrates the feasibility and safety of performing streamlined PVI cryoablation and LAAO for patients with dextrocardia and AF under continuous ICE guidance. The use of ICE facilitated a safe transseptal puncture process and determined the optimal puncture location. Accurate anatomical positioning of the anomalous pulmonary vein ostia and left atrial appendage was achieved through DSA. The mirror mode on DSA visually aligned the pulmonary vein and left atrial appendage anatomy with that of a normal heart, albeit with completely reversed operational directions and DSA gantry angles. However, the decapolar electrode, designed solely to conform to the shape of the coronary sinus of a normal heart, could not be inserted into the coronary sinus but was instead placed within the atrial system of the venous system to record atrial points. Fortunately, the reliance on coronary sinus potentials for PVI cryoablation is minimal. Thus, atrial potentials could be used to substitute coronary sinus potentials for monitoring the correlation between the pulmonary vein and atrial potentials during the procedure. Because of the hospital's lack of experience in ICE-guided transseptal puncture into the arterial system atrium *via* the right atrial septum, the patient's advanced age and multiple comorbidities, the occlusion performance of the left atrial appendage occluder was not evaluated using routine ICE at four angles after implantation. Instead, DSA and venous system septal ultrasound were jointly performed for assessment according to the PAST principle. The procedure yielded favourable results, with the patient maintaining sinus rhythm after cardioversion. Furthermore, early postoperative myocardial oedema phase AF recurrence was effectively maintained *via* the administration of half a tablet of sotalol daily for three months. Following conversion to sinus rhythm, the patient's arrhythmogenic cardiomyopathy was sufficiently controlled, cardiac function markedly improved, and exercise tolerance was significantly enhanced compared with baseline. A follow-up TEE or pulmonary vein CTA at 45 days postoperatively confirmed the complete endothelialisation of the left atrial appendage occluder. Thus, oral anticoagulants were discontinued, and medication was switched to oral dual antiplatelet therapy for 6 months, followed by long-term aspirin therapy, thereby substantially reducing the risk of bleeding [14-16].

Conclusion

In conclusion, intraoperative real-time ultrasound guidance is pivotal for successful transseptal puncture. Adapting to the reverse operation procedures *via* the image inversion function of the DSA system is crucial for the successful treatment of dextrocardia by cryoablation and LAAO. These insights have also been emphasised in other percutaneous cardiac interventions for dextrocardia, including catheter ablation for paroxysmal focal AF. Therefore, a broader spectrum of cardiac diseases with concurrent anomalous anatomies can be effectively treated under real-time ultrasound guidance.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Xu, Jizhe, Gaxue Jiang, Lu Zhang and Zixian Chen, et al. "Successful percutaneous left atrial appendage occlusion for atrial fibrillation in a patient with mirror-image dextrocardia: A case report." *BMC Cardiovasc Disord* 22 (2022): 20.
2. Fuster, Valentin, Lars E. Rydén, David S. Cannom and Harry J. Crijns, et al. "Acc/aha/esc 2006 guidelines for the management of patients with atrial fibrillation: A report of the american college of cardiology/american heart association task force on practice guidelines and the european society of cardiology committee for practice guidelines (writing committee to revise the 2001 guidelines for the management of patients with atrial fibrillation): Developed in collaboration with the european heart rhythm association and the heart rhythm society." *Circulation* 114 (2006): e257-e354.
3. Bohun, Claudine M., James E. Potts, Brett M. Casey and George GS Sandor. "A population-based study of cardiac malformations and outcomes associated with dextrocardia." *Am J Cardiol* 100 (2007): 305-309.
4. Friedman, W. F. "Congenital heart disease in infancy and childhood." Heart Disease (2001): 1505-1591.
5. Friedman, William F. and John S. Child. "Congenital heart disease in the adult." Harrison Principles of Internal Medicine (1998): 1300-1308.
6. Maldjian, Pierre D. and Muhamed Saric. "Approach to dextrocardia in adults." *AJR Am J Roentgenol* 188 (2007): S39-S49.
7. Yoshiga, Yasuhiro, Akihiko Shimizu, Takeshi Ueyama and Makoto Ono, et al. "Successful cryoballoon pulmonary vein isolation in a patient with situs inversus and dextrocardia." *J Arrhythm* 32 (2016): 493-495.
8. Leftheriotis, Dionyssios, Ignatios Ikonomidis, Panayota Flevari and Alexandra Frogoudaki, et al. "Cryoballoon ablation under transesophageal echocardiographic guidance in dextrocardia." *Hellenic J Cardiol* 60 (2019): 61-63.
9. Yokoyama, Yasuhiro, Takeshi Aiba, Koji Miyamoto and Hideaki Kanzaki, et al. "Pulmonary vein isolation and pacemaker implantation in a patient with dextrocardia situs inversus." *Int Heart J* 62 (2021): 927-931.
10. Castriota, Fausto, Roberto Nerla, Angelo Squeri and Antonio Micari, et al. "Working in the mirror: Left atrial appendage closure in a patient with dextrocardia." *Cardiovasc Interv* 9 (2016): e117-e120.
11. Miyasaka, Yoko, Marion E. Barnes, Bernard J. Gersh and Stephen S. Cha, et al. "Time trends of ischemic stroke incidence and mortality in patients diagnosed with first atrial fibrillation in 1980 to 2000: Report of a community-based study." *Stroke* 36 (2005): 2362-2366.
12. Iskandar, Sandia, James Vacek, Madhav Lavu and Dhanunjaya Lakkireddy. "Left atrial appendage closure for stroke prevention: Devices, techniques and efficacy." *Cardiol Clin* 34 (2016): 329-351.
13. Lip, Gregory YH, Amitava Banerjee, Giuseppe Boriani and Chern en Chiang, et al. "Antithrombotic therapy for atrial fibrillation: Chest guideline and expert panel report." *Chest* 154 (2018): 1121-1201.
14. Yamada, Takumi, H. Thomas McElderry, Harish Doppalapudi and Michael Platonov, et al. "Focal atrial fibrillation in dextrocardia." *Ann Noninvasive Electrocardiol* 14 (2009): 301-304.
15. Zhao, Xin, Xin Su, De-Yong Long and Cai-Hua Sang, et al. "Catheter ablation of atrial fibrillation in situs inversus dextrocardia: Challenge, improved procedure, outcomes and literature review." *Pacing Clin Electrophysiol* 44 (2021): 293-305.
16. Kohli, Utkarsh and Sohail Hassan. "Dextrocardia and atrial fibrillation ablation: Relevance of anatomy." *J Interv Card Electrophysiol* 60 (2021): 155-157.

How to cite this article: Zhenyu, Cui, Han Suxia and Xiang Yan. "Streamlined One-stop Surgical Management for an Older Patient with Dextrocardia and Atrial Fibrillation: A Case Report." *J Clin Case Rep* 14 (2024): 1623