Fluoroscopic Notching of Left Atrial Disc – A Sign of Prolapse

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Abstract: Transesophageal echocardiography has been used throughout the procedure of transcatheter closure of atrial septal defect due to high resolution images as well as superior operator comfort in assessing device position. However, the centers, lacking the facility of intra-procedural transesophageal echocardiography, carry out the procedure using transthoracic echocardiography which may have higher chances of device malposition. In this case-series, we describe fluoroscopic features of device position or malposition which would prove beneficial to the centers in assessing device position in the transcatheter closure of atrial septal defect performed using transthoracic echocardiography.

Keywords: Transesophageal echocardiography, transthoracic echocardiography, fluoroscopy, atrial septal defect.

LEARNING OBJECTIVES

The flouroscopic assessment of device, appropriate left anterior oblique cranial and right anterior oblique caudal view, helps in recognizing left atrial disc prolapse. It has added value in assessing device position especially when closure is done in transthoracic echocardiographic guidance.

INTRODUCTION

Atrial septal defect (ASD) accounts for approximately 8-10% cases of all congenital cardiac anomalies and the commonest ASD is ostium secundum (OS) ASD [1]. Percutaneous closure of ASD has been performed since 1975 [2]. However, earlier devices were difficult to deploy, required large-bore delivery sheaths and prone to serious complications but now percutaneous closure of simple OS ASD has become technically less challenging and thereby it has become an alternative to surgical closure in majority of cases [3, 4].

As we know transesophageal echocardiography (TEE) gives high resolution images and superior operator comfort in assessing device position as compared to transthoracic echocardiography (TTE). In addition, while performing the procedure, the device position at atrioventricular rim, posterior rim and aortic rim can be assessed easily with TTE but device position at superior vena cava (SVC) rim and inferior vena cava (IVC) rim is difficult to assess. So, TEE is used throughout the procedure of transcatheter ASD closure in majority of the catheterization laboratory.

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However, the catheterization laboratories which are not having TEE carry out the procedure of percutaneous closure of ASD with the help of TTE. So, there are more chances of device malposition if only TTE is used. In this case-series, we are reporting fluoroscopic features of three cases of device position among 46 cases (done in TTE guidance only). In one of these cases (third case), we used these fluoroscopic signs to identify device malposition and corrected it by repositioning.

CASE-SERIES

a. Case Presentation

In this case-series, we are presenting cases of three female patients who were diagnosed with OS ASD. In case-1, a 22 year old female was diagnosed with ASD when evaluated for palpitations. An electrocardiogram (ECG) showed incomplete right bundle branch block (RBBB) and chest X-ray revealed mild cardiomegaly with pulmonary plethora. TTE demonstrated dilated right atrium (RA), right ventricle (RV) and pulmonary artery (PA) and an OS ASD. Colour Doppler imaging showed OS ASD and left-to-right shunt. Pre-operative assessment of ASD with TEE also revealed single OS ASD (maximum diameter of 20 mm) and deficient aortic rim. In case-2, a 25 year old female was diagnosed with OS ASD during cardiac evaluation for ejection systolic murmur during pregnancy. The patient was symptomatic with class-II shortness of breath and easy fatigability. An ECG showed RBBB and chest radiograph also demonstrated cardiomegaly with prominent main PA and plethoric lung fields. The diagnosis of OS ASD with dilated RA, RV and PA due to left-to-right shunt was confirmed by TTE. The OS ASD was large having maximum diameter of 27 mm with deficient aortic rim and interatrial septal length was

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52 mm as measured by TEE. In case-3, a 28 year old female was diagnosed to have single large OS ASD with significant left-to-right shunt upon evaluation for palpitations and easy fatigability. TEE showed suitability of transcatheter closure of large OS ASD (diameter of 26 mm) having deficient aortic and atrial rims.

b. Treatment

In all the three cases, we decided to close ASD with device deployment. The procedure was performed under conscious sedation and heparinization (with 100 U/kg). In case-1, a 24 mm CERA^{TM} ASD occluder (Lifetech Scientific, Shenzhen, China) was deployed from left upper pulmonary vein. By using TTE, the device was released. In case-2, the ASD closure was achieved with the help of 32 mm CERA^{TM} ASD occluder (Life tech Scientific, Shenzhen, China). We deployed the device from right upper pulmonary vein with American foot-ball technique after failed attempts from left upper pulmonary vein. In both the cases, once the device was deployed, we recorded right anterior oblique (RAO) caudal and left anterior oblique (LAO) cranial views. We followed up the patients after 48 hour for the confirmation of the device position by using TEE. We observed device malposition with slight left atrial (LA) disc prolapse. We also reviewed cine films and noticed notching of LA disc in LAO cranial and RAO caudal views (Figures **1** and **2**).

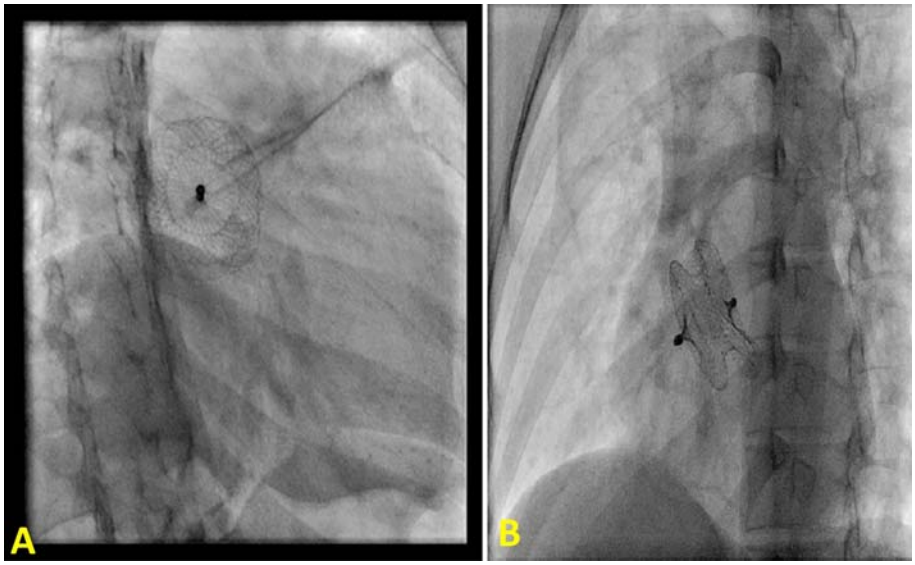

Figure 1: Notching of left atrial disc evidenced by (**A**) loss of circle in circle appearance in right anterior oblique caudal view and (**B**) irregular left atrial disc margin in left anterior oblique cranial view in case 1.

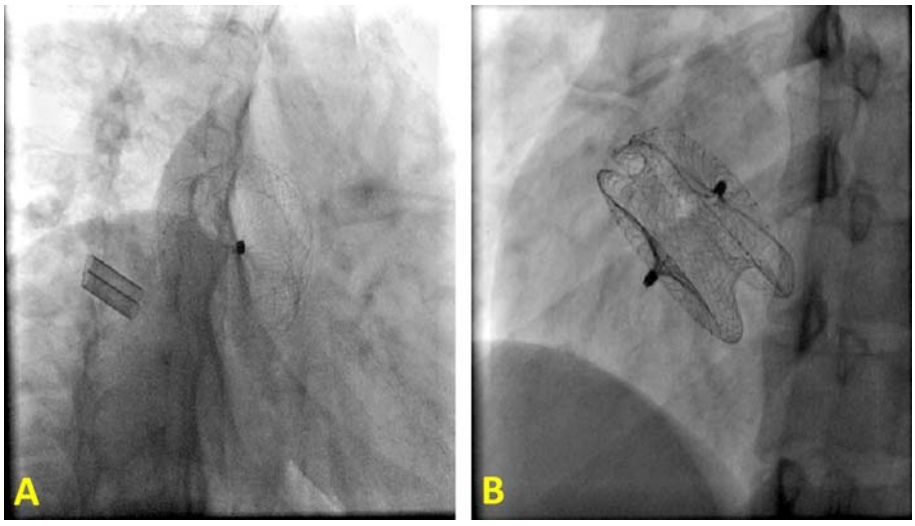

Figure 2: Notching of left atrial disc evidenced by (**A**) loss of circle in circle appearance in right anterior oblique caudal view and (**B**) irregular left atrial disc margin in left anterior oblique cranial view in case 2.

In case-3, we attempted ASD closure using a 28 mm, Cocoon^{TM} Septal Occluder (Medintek Medical products, Cankaya / Ankara) from right pulmonary vein. However, we noticed prolapse of LA disc by TTE and notching of LA disc in RAO caudal and LAO cranial views (Figure **3**). After repeated failed attempts we decided to deploy the same device with balloon-assisted technique. A 16 mm tyshak balloon was introduced through a contralateral femoral vein access and was drawn across the OS ASD. The balloon was inflated. The deployment of the device was initiated and balloon deflated and removed. The flouroscopic assessment revealed no notching of LA disc and TTE also confirm device position (Figure **4**). TEE done after 48 hours confirmed proper positioning of device.

c. Outcome and Follow-Up

We followed up the patients for 1 year. There was no complication in all three cases except small residual shunt (< grade 2 in case-1 and grade 1 in case-2).

DISCUSSION

Intra-operative TEE is the best tool for the assessment of device position and gives excellent operator comfort. TTE gives good images in assessing

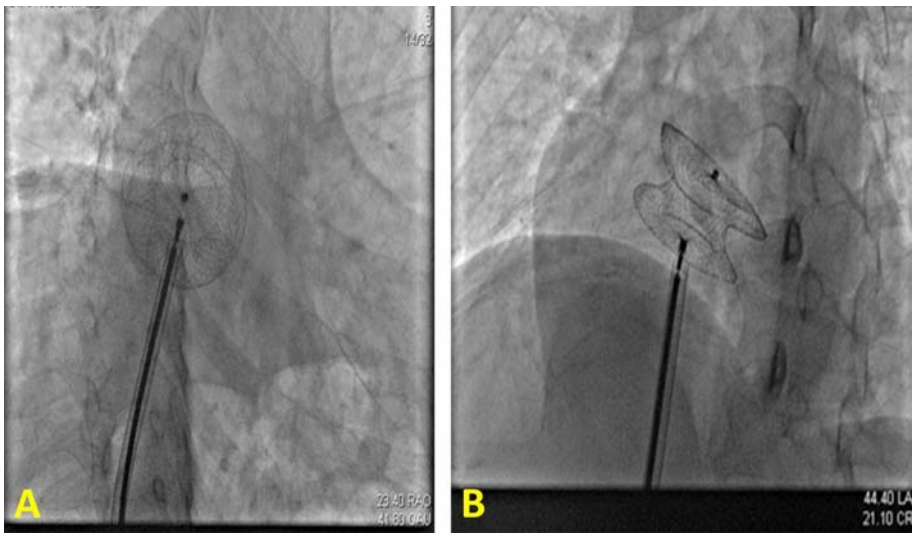

Figure 3: Notching of left atrial disc in (**A**) Right anterior oblique caudal and (**B**) Left anterior oblique cranial views after device deployment from Left upper pulmonary vein in case 3.

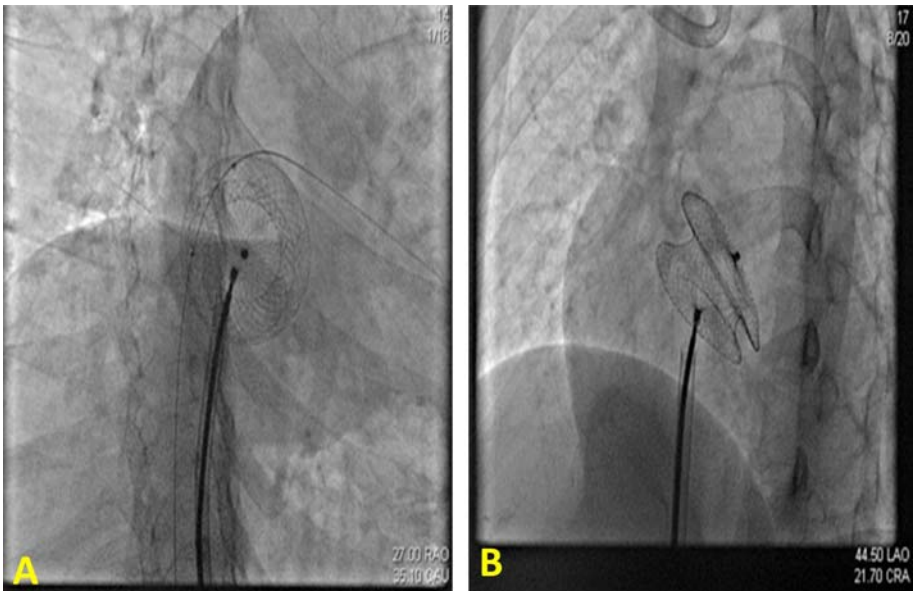

Figure 4: No notching of left atrial disc (circle in circle) in (**A**) Right anterior oblique caudal and (**B**) left anterior oblique cranial views after device deployment with balloon support in same patient (case 3).

device position in AV rim, posterior, atrial rims but the assessment of device position in IVC rim and SVC rim is difficult except in small children where good subcostal sagittal view can be obtained. However, the centers lacking TEE in catheterization laboratory are using TTE for ASD closures. In these cases, we describe fluoroscopic features which would help in identifying device malposition or disc prolapse, especially when the transcatheter closure had been performed under the guidance of TTE only. To our knowledge fluoroscopy has not been used in assessing device position or at least in identifying device malposition or partial disc prolapse.

An angulation of RAO caudal view is one in which RA disc screw and LA disc hub overlap on each other and thus the device appears as circle in circle appearance with overlapping screw & LA hub as nucleus (Figure **5A**). An angulation of LAO cranial view is one in which waist and junction of waist with discs is profiled clearly before and after release of the device (Figure **6A**). Any notching on LA disc is abnormal suggesting prolapsed of a disc (Figures **5B** and **6B**). Among both the views, RAO caudal is best view to appreciate the difference from normal device appearance.

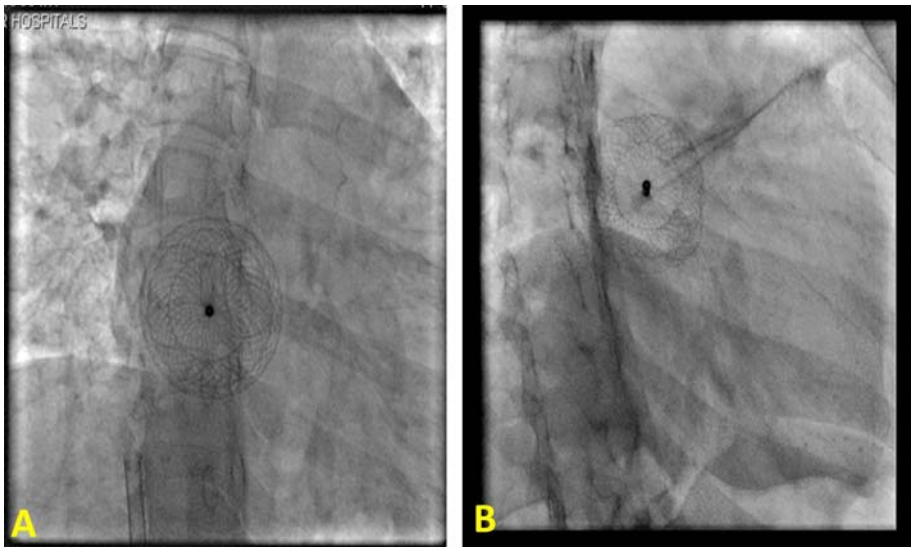

Figure 5: Right anterior oblique caudal view (**A**) normal circle in circle appearance suggested appropriate position of the device (**B**) Notching or incomplete outer circle suggesting left atrial disc prolapse.

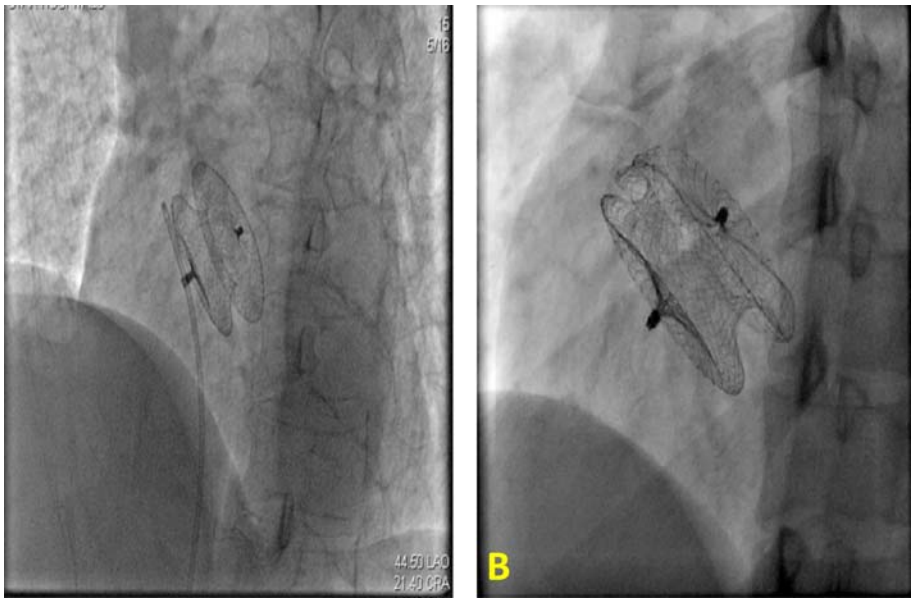

Figure 6: Left anterior oblique cranial view (**A**) waist and junction of waist with discs is profiled clearly (**B**) Notching of left atrial disc.

We recorded RAO caudal and LAO cranial views before and after device release in all three cases. In first two cases, we observed retrospectively notching of LA disc in LAO cranial and RAO caudal views in patients with documented LA disc prolapse after 48 hour by TEE. The notching (in these two cases) was observed at aortic rim position (with TEE) which is the common site for a disc prolapse. In third case, we used these signs to identify LA disc prolapse by fluoroscopy (Figure **3**) and we used balloon assisted deployment technique for device deployment to prevent device prolapse. Before release of the device, notching was seen in superior aspect as complete outer circle (LA disc margin) and incomplete inner circle (RA disc margin) due to downward pull by device cable. The use of fluoroscopy along with balloon assisted deployment showed normal LA disc without notching (Figure **4**).

So, the centers lacking TEE facility in catheterization laboratory can use these fluoroscopy signs along with TTE to identify device malposition or disc prolapse.

CONCLUSION

Fluoroscopy adds on to TTE assessment to identify and correct LA disc prolapse. So, these fluoroscopy signs along with TTE may prove beneficial to identify device malposition or disc prolapse for the centers lacking intra-procedural TEE facility in catheterization laboratory.

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