American Journal of Clinical Cardiology

Clinical Image

CT-Derived 3D Printing for Evaluating the Feasibilty of Percutaneous Closure for a Large Atrial Septal Defect

José Suárez de Lezo, Javier Suárez de Lezo, José Segura and Jordi Broncano*

Department of Cardiology (Grupo Corpal) and Radiology (Ressalta), Hospital Cruz Roja de Córdoba, Spain

Clinical Image

Percutaneous closure of Atrial Septal Defect (ASD) may be a difficult procedure in certain complex conditions [1,2]. Large defects in adult patients with pulmonary hypertension need careful anatomic studies before making decisions for treatment, because small rims may result in device embolization. We present the case of a female patient, 43 years old, who came to our hospital for having progressive shortness of breath. The study revealed a large ostium secundum ASD with significant left to right shunt and pulmonary hypertension. Transesofageal echocardiography showed small posterior and inferior rims. We performed a retrospective-ECG gated cardiac CT study and asked for 3D printing of the whole atria [3]. Figure 1 shows the right and left atrial views of the septum. Figure 2 shows the right view together with a classical scheme of atrial remnants. Posterior and inferior rims were considered small but we thought in mind that it could adjust adequately to the device. To prove this, we performed on the 3D printing a virtual closure with a 24 mm Amplatz device (Figure 3). Once in place, we performed manual maneuvers of pulling and pushing to test the stability of the device which resulted firmly attached. After this test we decided to try percutaneous closure in the patient. Under mild anesthesia we performed cardiac catheterization with transesophagical echo monitoring in given moments. Two venous and one arterial femoral access allowed simultaneous pressure recordings (Figure 4). The QP/QS was 2,3 and the pulmonary artery pressure was 60/40 mmHg. Figure 5 shows sequential angiograms during the procedure. We implanted a 24 mm Amplatz device. Before deployment, under echo and radiological monitoring, we performed pull and push maneuvers (Figure 6) that confirmed an adequate stability of the device. Finally, the device was deployed and remained stable. Figure 7 shows the echographic final result. After closure, the systemic pressure increased slightly and the pulmonary pressure did not initially decreased. The patient did well and was discharged 48 hours later. She improved markedly her functional class and one year later the peak pulmonary pressure estimated by Doppler signal was 35 mmHg, a significant late decrease as previously observed in this type of patients [4].

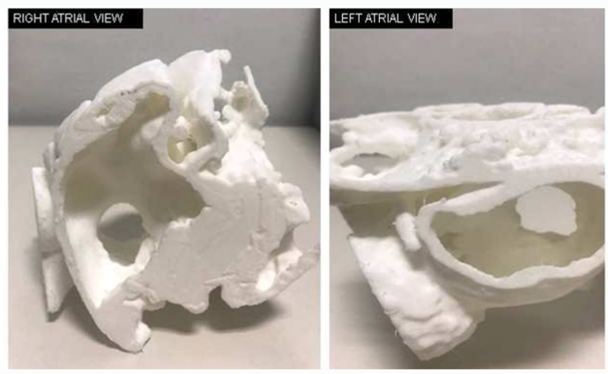

Figure 1: 3D printing of both atria. Right and left views.

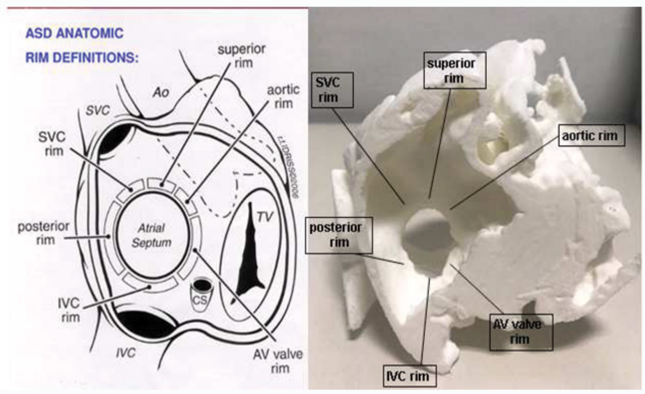

Figure 2: Anatomic details of the septum.

Citation: de Lezo JS, de Lezo JS, Segura J, Broncano J. CT-Derived 3D Printing for Evaluating the Feasibilty of Percutaneous Closure for a Large Atrial Septal Defect. Am J Clin Cardiol. 2021;2(1):1008.

Publisher Name: Medtext Publications LLC

Manuscript compiled: Apr 05th, 2021

***Corresponding author:** José Suárez de Lezo, Department of Cardiology (Grupo Corpal) and Radiology (Ressalta), Servicio de Cardiología, Hospital Cruz Roja, Avenida de la Victoria s/n, 14004-Córdoba, Spain, E-mail: jsuarezdelezo@infonegocio.com

Comment

Arguments in decision making selection for treatment need to be based on solid evidences. For large ASD closure in adult patients with pulmonary hypertension, the study of septal anatomy is crucial. Small remnants of the atrial septum may recommend surgical treatment as a first choice. However, conventional image techniques not always are as precise as needed for a firm decision. This patient is a good example of how cardiac CT-derived 3D printing may help in decision making. The 3D printing allowed us to touch the rims, select the size of a possible Percutaneous device and test, with a virtual closure, how would be after deployment the stability of the device and the degree of accommodation and attachment to the septum. Following this experiment, we became convinced that percutaneous closure was our first choice for treatment. During the procedure, all maneuvers performed before deployment confirmed the good stability of the implanted device.

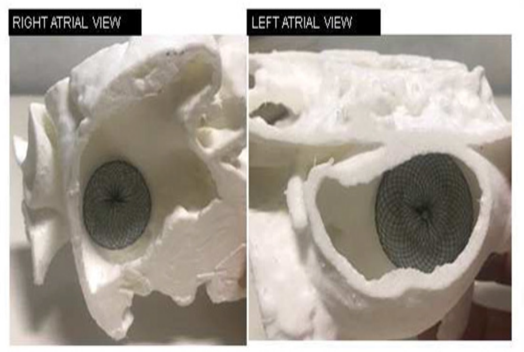

Figure 3: *In vitro* device occlusion. Right and left views.

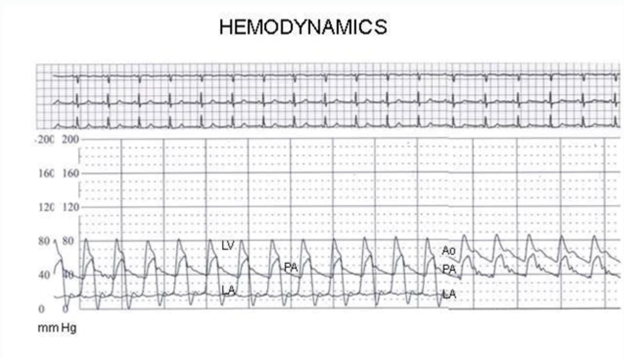

Figure 4: Simultaneous pressure recordings of the left ventricle, left atrium and pulmonary artery pressures before treatment. As can be seen, diastolic pulmonary pressure was much higher than the mean left atrial pressure.

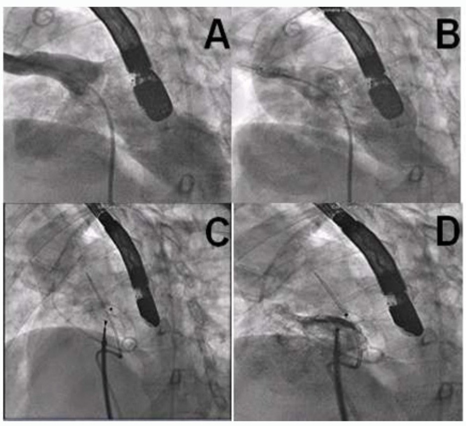

Figure 5: Sequential angiograms during the procedure. A: right superior pulmonary vein angiography in 4 chambers view at the initial phase, where a left to right jet delineates the defect in the septum, B: The whole right atrium is well contrast opacified, C: We implanted a 24 mm Amplatz device, D: Once in place, and before deployment, we performed a small right contrast injection through the canula to evaluate position

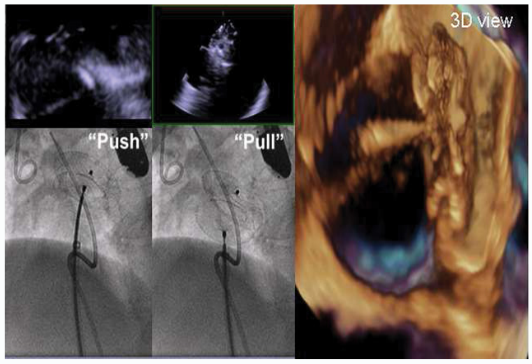

Figure 6: Radiologic and echographic images while maneuvers with the device by pushing and pulling, before deployment.

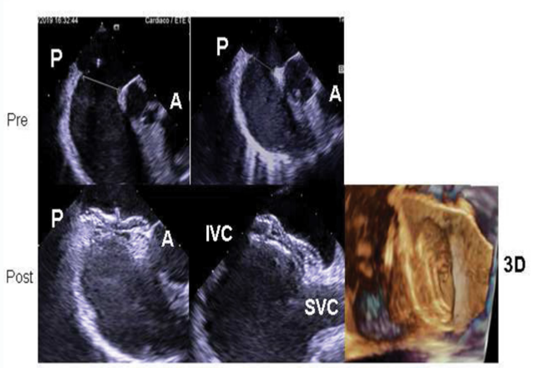

Figure 7: Trans esophageal echographic images before and after treatment. A: Anterior; P: Posterior; IVC: Inferior Vena Cava; SVC: Superior Vena Cava

References

1. Suárez de Lezo J, Medina A, Pan M, Romero M, Segura J, Pavlovic DJ, et al. Transcatheter occlusion of complex atrial septal defects. Catheter Cardiovasc Interv. 2000;51:33-41.

2. Rodriguez M, Suárez de Lezo J, Pan M, Romero M, Segura J, Pavlovic DJ, et al. Percutaneous closure of large atrial septal defects. Rev Esp Cardiol. 2002;144:877-80.

3. Thakkar AN, Chinnadurai P, Breinholt JP, Huie Lin C. Transcatheter closure of a sinus venosus atrial septal defect using 3D printing and image fusion guidance. Catheter Cardiovasc Interv. 2018;192:353-57.

4. Suárez de Lezo J, Medina A, Romero M, Pan M, Segura J, Caballero E, et al. Effectiveness of percutaneous device occlusion for atrial septal defect in adult patients with pulmonary hypertension. Am Heart J. 2002;144:877-80.