

Courtesy

HerzKlinik Hirslanden, Zurich, Switzerland
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Prof. Dr. Jürg Grünenfelder, Cardiac Surgeon
Dr. Patric Biaggi, Echocardiologist

Symptoms

2D echocardiography showed severe left ventricular and left atrial dilatation in four-chamber view. Two chamber view showed a low ejection fraction of 25-30%. 2D echo also showed moderate to severe mitral regurgitation due to the dilated left ventricular.

Patient history

81 year old female with dilated cardiomyopathy with an ejection fraction of 30% with progradient dyspnoea over the last few months and was classified NYHA III heart failure with standard drug regimen. Angiography showed no coronary stenosis.

System information

Allura Xper FD20 FlexMove with EchoNavigator and iE33 xMatrix with live 3D TEE

Findings

A 3D TEE guided trans-septal puncture of the septum is performed from the right femoral venous puncture. The Steerable Guide Catheter and Clip Delivery System (CDS) of the MitraClip® device were positioned in the left atrium for clip deployment using EchoNavigator; live integrated Echo X-ray image guidance.

Conclusion

The MitraClip® device was successfully deployed. Post operative echocardiography confirmed that the clip had been effectively placed to reduce the mitral regurgitation. Patient follow-up was done the same as after conventional MitraClip repair later.

Mitral Valve Regurgitation

EchoNavigator intuitively combines live x-ray and echo making the procedure more straightforward

Until recently, symptomatic mitral regurgitation could only be treated surgically. The introduction of new percutaneous devices such as MitraClip® represents an entirely new catheter-based alternative for repair of mitral regurgitation for high-risk patients with severely impaired left ventricular function and heart failure.

Catheter based Mitral repair procedures require excellent interventional skill and depend highly on echocardiographic imaging besides fluoroscopy X-ray.

During the procedure, (3D) transesophageal echo (TEE) imaging provides critical insights into soft tissue anatomy, whereas X-ray finds its strength in visualizing the percutaneous devices. Traditionally, these images are visualized separately and are operated by two different operators, so the interventionalist or surgeon can spend a considerable amount of time switching back and forth between fluoroscopy and echo images and mentally aligning them with each other. Clear communication and understanding is required between the operator and echocardiologist to ensure alignment on the next steps.

Background of institute

Prof. Dr. Roberto Corti, Interventional Cardiologist, Prof. Dr. Jürg Grünenfelder, Cardiac Surgeon, and Dr. Patric Biaggi, Echocardiologist.



HerzKlinik Hirslanden, Zurich, Switzerland

The Klinik Hirslanden is a modern private clinic in Zurich, which belongs to Hirslanden, the leading private clinic group in Switzerland. The modern infrastructure and the high standards of its medical staff and their colleagues are the foundation and the emphasis is on the well-being of their patients.

The Hospital offers a comprehensive range of treatments that will benefit all patients, where 3000 coronary angiography, and more than 300 structural heart interventions are performed annually.

PHILIPS

Solution

Philips EchoNavigator is developed to address some key challenges faced by interventionalist or surgeon by integrating X-ray and Echo intelligently and intuitively, providing in a single image a clear impression of the spatial relationship between the catheter and the soft tissue around it, as well as soft tissue markers on the live fluoroscopy image.

This gives the operator confidence for accurate device targeting during procedures. The interventionalist or surgeon is directly able to quickly interrogate the echo images from the tableside to assess their treatment or deployment strategy, without affecting the echo image view presented optimally by the echocardiologist.

At the same time, the echocardiologist is able to see the echo image in context with the X-ray image and make the necessary adjustments. This enhanced teamwork can lead to more accurate device maneuvering to help simplify the procedure, and make the procedure more straightforward.

Case: Patient is a 81 year old female with dilated cardiomyopathy with normal blood and pulmonary pressures and in sinus rhythm

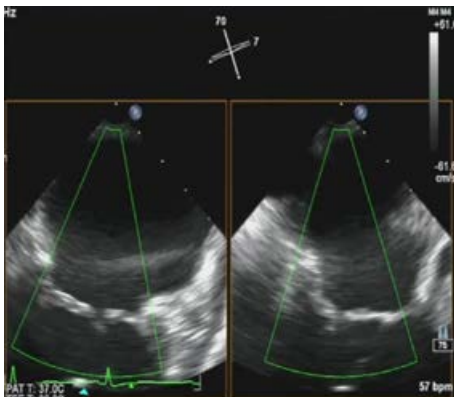


Figure 1: 2D Echo showing the valve leaflets (The mechanism of the regurgitation was tethering of both leaflets due to the dilated LV)

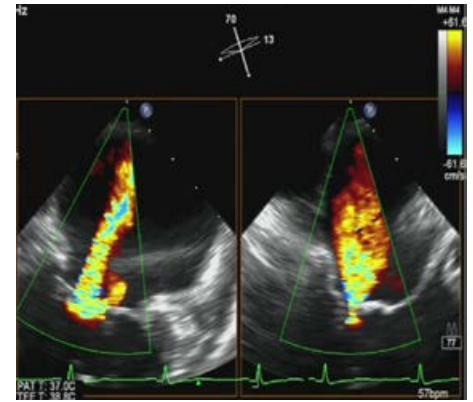
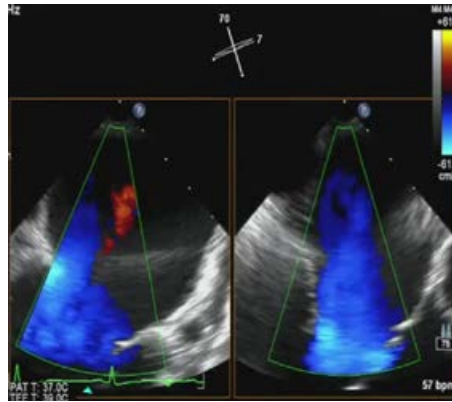


Figure 2a and 2b: 2D echo showing the chamber dilatation and MR jet

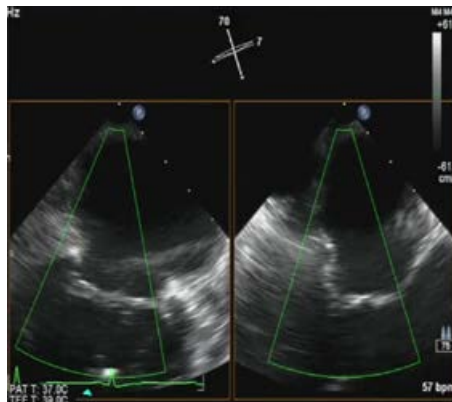


Figure 3: 2D echo showing the A2P2 segment and the gap



Figure 4: 3D echo confirming the gap visualized in 2D echo.

treated for heart failure with standard drug regimen. The patient was classified NYHA III and had an Ejection fraction 30% with progradient dyspnoea over the last few months. Angiography showed no coronary stenosis.

Echo Findings: 2D Echo done before the procedure showed severe left ventricular and left atrial dilatation in a four-chamber view. The two-chamber view showed a low ejection fraction of 25-30%. 2D echo also showed moderate to severe mitral regurgitation and showed that the mechanism of the regurgitation was tethering of both leaflets due to the dilated LV (Figure 1).

3D Echo confirmed the severity of mitral regurgitation. Median gradient across the mitral valve was measure at 1mmHg and a mitral valve area of 4.5 cm² was measured. 3D echo showed both leaflets of the mitral valve to be open and moving well with good visualization of the origin of the mitral regurgitation jet (Figure 2a and 2b) that was in the gap at the center of the A2P2 segments of the mitral valve (Figure 3 and 4). On the 3D echo, the best location for clipping was identified as the medial part of A2P2 segment. Coaptation length of 4 mm was confirmed to be good for clip placement. In addition, considerable tenting was also seen.

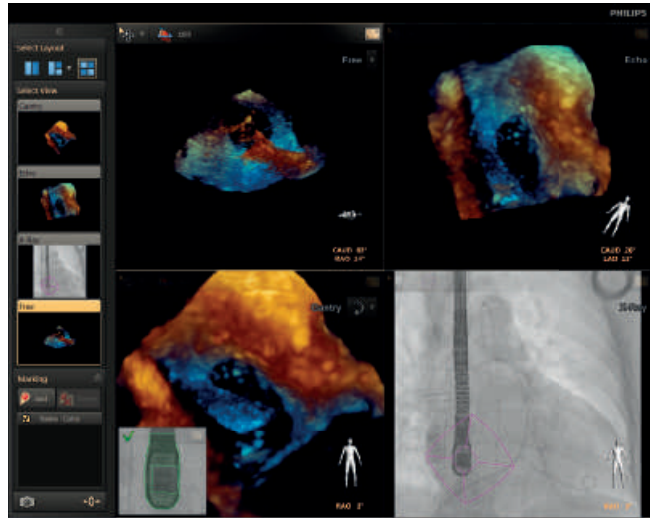
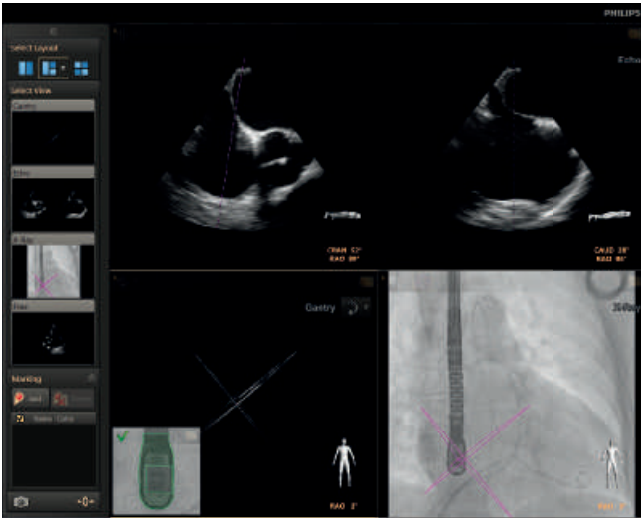


Figure 5a and 5b: Correct registration of the echo probe with EchoNavigator (green probe head in bottom left indicates that probe tracking is correct). Orientation of Echo slices or volume is indicated on the X-ray view in magenta.

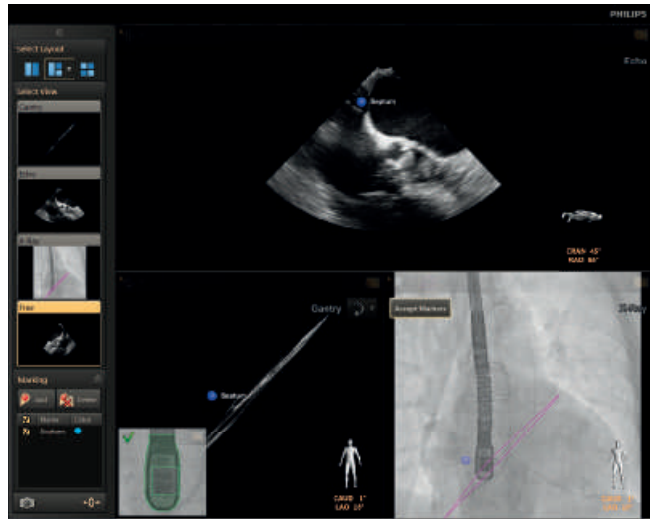
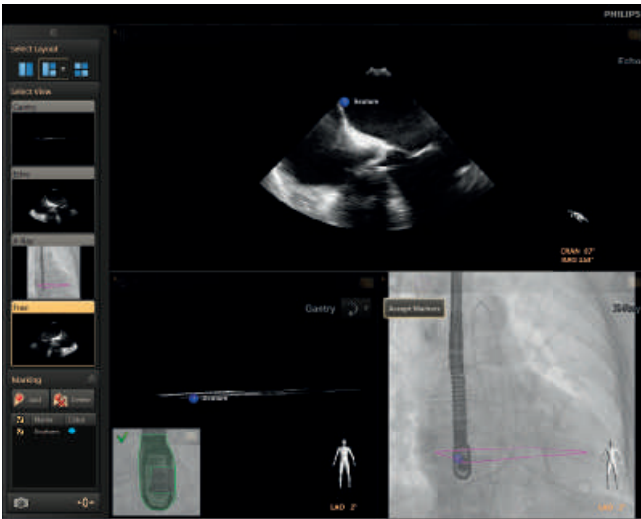


Figure 6a and 6b: Marking the septum in 2D x-plane (blue marker). The marker becomes visible in X-ray and remains in the correct location even if Echo probe or the X-ray system is moved to another location (6b).

Method and material used

X-ray system: Philips Allura Xper FD20

FlexMove with EchoNavigator

Echo system: Philips iE33 xMatrix with live 3D TEE.

Transseptal puncture

The right femoral vein and left femoral artery and vein are cannulated for access and hemodynamic assessment and monitoring. A TEE guided transseptal puncture of the septum is performed from the right femoral venous puncture.

The transseptal sheath was introduced and guided towards the superior vena cava. Then, two angulated views were taken, and registration was done with the EchoNavigator as indicated by the probe in the left bottom corner turning “green” (see Figure 5a). The x-ray c-arm was then moved to LAO view for visualization (see Figure 5b) while the echo image followed the c-arm orientation in real time automatically.

Next, a marker is placed using EchoNavigator to mark the septum in 2D

(Figure 6a and 6b) followed by visualization in 3D (Figure 7a and 7b). The puncture site selected for this case was 3-4 cm above the mitral annulus, and in a posterior, in order to be able to steer the delivery system to the mitral valve. The image was then rotated and the height and posteriority of the puncture spot as well as the characteristics of the septum were then visualized in the linked images, and the catheters guided to the marked target location. Advancing of needle and sheath along with the puncture was done by standard technique. The area of tenting was also visualized.

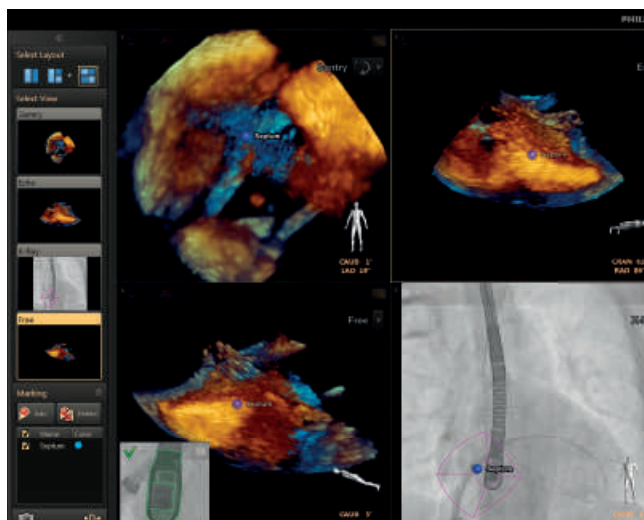
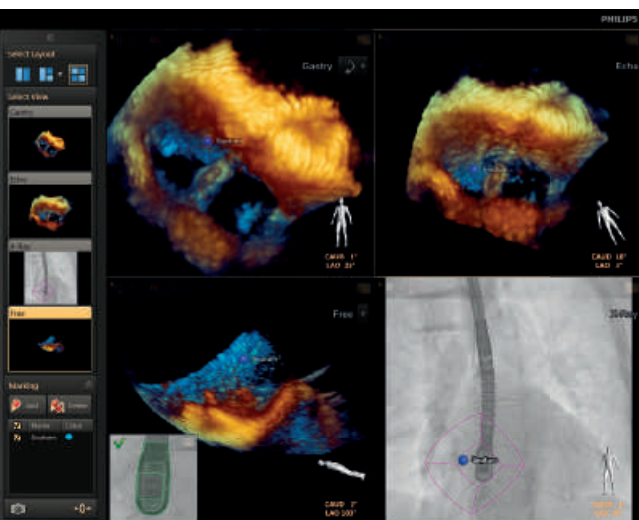


Figure 7a and 7b: Visualization of the septum marking in 3D (Blue marker).

Placement of Clip

The Steerable Guide Catheter and clip delivery system of the Mitraclip® device were positioned in the left atrium for clip deployment using echocardiographic and fluoroscopic guidance. Once the guide was in place, the mitral valve was re-visualized

using 3D echo. A marker was placed on the mitral valve using the EchoNavigator (Figure 8 and 9), and the clip was steered towards the marker (Figure 10 and 11). The clip arms were opened and the clip was positioned, deployed in the standard way.

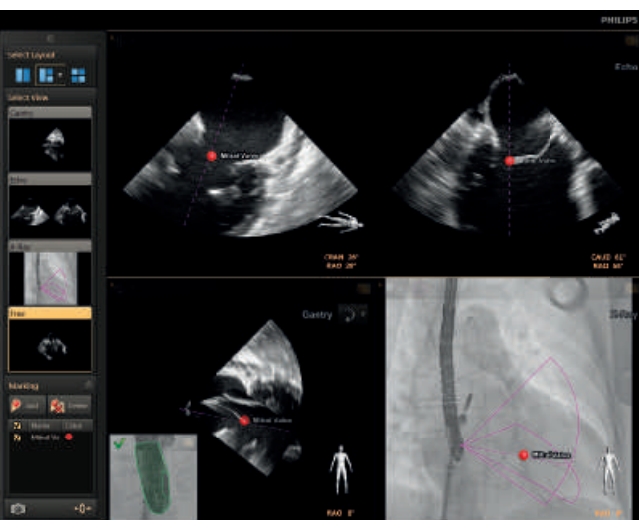


Figure 8: Placing a marker (red dot) on the mitral valve in 2D x-plane. Marker is shown in overlay on X-ray helping in catheter guidance to target position.

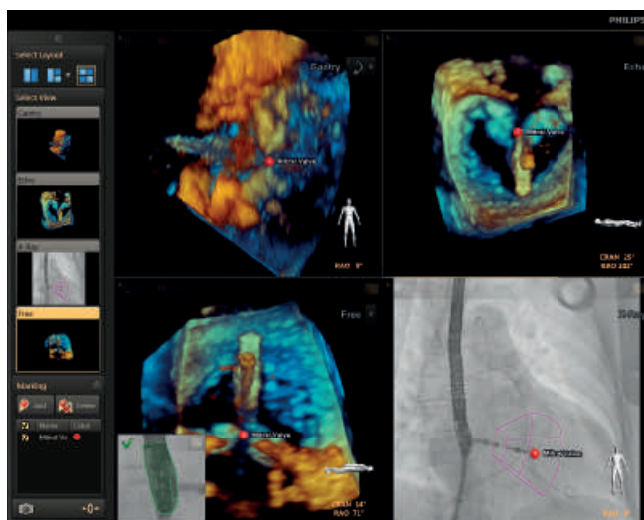


Figure 9: Visualization of the marker (red dot) in 3D echo multiple 3D views enabled visualization of depth of the marker and helped move the clip towards the valve.

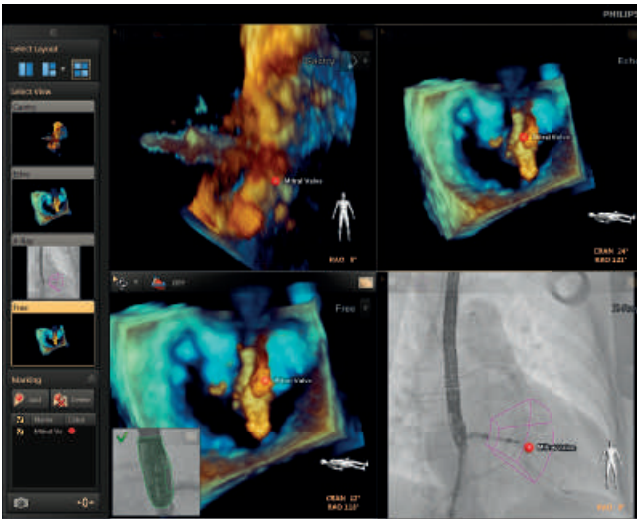


Figure 10: The clip was steered towards the marker and aligned perpendicular to the valve leaflets before entering the valve.

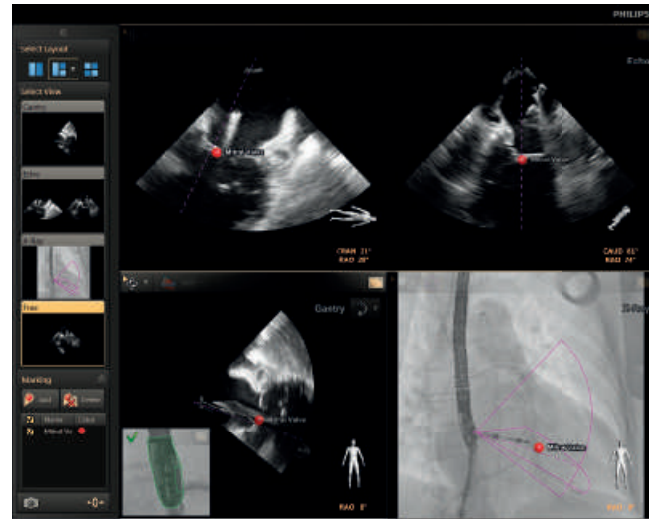


Figure 11: Visualization on the steering of the clip in 2D x-plane

Final results:

The delivery system and catheter were removed and groin access was closed with a cutaneous purse string. Post operative echo confirmed that the clip had been effectively placed to reduce the mitral regurgitation. Patient follow-up was done the same as after conventional MitraClip repair.



Prof. Dr. Jürg
Grünenfelder



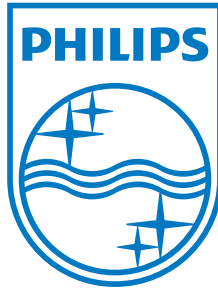
Prof. Dr.
Roberto Corti

"We have learned that ideally two live imaging technologies are needed to guide catheter-based repairs to the heart and a multidisciplinary team is needed to perform it, which adds to the complexity of such procedures. The development of a more sophisticated imaging technology such as EchoNavigator will definitely help to provide us with a better understanding of the complex structures of the heart and their repair."



Dr. Patric Biaggi

"EchoNavigator facilitates the MitraClip procedure in many ways. We take the greatest benefit from the fact that communication between the interventionalist and echocardiologist is easier. I can mark the locations of interatrial septal puncture and the optimal location for clip placement on the screen, and these markers are then automatically updated on the fused echo-angio images. With the use of EchoNavigator, catheter steering and a targeted clip placement becomes much easier."



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