

# Hybrid visualization modalities in structural heart diseases interventions // The 18th Dalian International Cardiovascular Congress (Dalian, China, Nov 28-Dec 5)

The topic, I want to discuss with you is about our cath lab eyes improvement.

[Dalian 2020 16th Cardiovascular congress](#) from [Igor Buzaev](#) on [Vimeo](#).

## The visualization.

The problem is that fluoroscopy visualization is limited because it makes only the shadows, that x-ray positive materials drops on the detector. But what if we need to see the soft tissues, flows for a prolonged time with no need the contrast. What if we need to see more than an X-ray picture at the moment?

To solve this problem usually, the doctor looks at the fluoroscopy screen and then changes his view to the echocardiography picture. But it is not very useful, because sometimes we need to see the relationships of our instruments, catheters, wires with soft tissues and flows. We see the instrument without soft tissues on fluoroscopy. We see the catheter as the small point or circle on echocardiography and

it hard to understand what part of the catheter we see at the moment.

This is crucial in such procedures as transseptal puncture, where echocardiography is good for septum surface and needle position, but fluoroscopy is necessary for needle manipulation and angle choice.

In mitral paravalvular leak, we need the fluoroscop to occluder deliver and deployment and echocardiography to see paravalvular flow and occluder position.

In atrioseptostomy with stent for pulmonary hypertension echocardiography shows us the septum and fluoroscopy in the middle of the stent to put inside.

To solve this problem engineers invented a hybrid visualization modality. The principle is that the transesophageal probe has x-ray positive direction markers and they can be detected on the fluoroscopy and the device can calculate the direction of the ultrasound beam. Then the plane of ultrasound picture projects to fluoroscopy in real-time to show ultrasonic picture over the fluoroscopy. Different modes can be combined 2D doppler flow or 3D reconstruction. Operators can change the opacity of the ultrasound image.

The application of this technology is useful in atrial septal defect complicated anatomy closure, left atrial appendage closure, paravalvular leaks, pulmonary vein isolation, TAVI and transseptal puncture and stenting

What if we do not see something during our intervention? The study of Otto (2011) shows that in complicated anatomy even routine atrial septal defect closure can result in complications even a death. That is why the visualization is important as one of the instruments to prevent some anatomical predictors of late complications... such are malposition, embolization erosion et cetera

We need to see a lot of factors to prevent them: the rims,

sizes, and relationships of the structures. This is the picture of sizing balloon hybrid visualization. And you see the transesophageal probe and on echocardiography over the fluoroscopy we see the right atrium and balloon.

This is a motion picture, the live view. And sometimes it is very useful to decrease the radiation dose of patient and your team.

This is the device opening moment and you can see that sometimes we can work without fluoroscopy getting the familiar fluoroscopy-like picture by echo.

In some hard cases like that where the septum is floppy and vertical one of the options is to send the patient to the surgery. But if you sure in visualization, you can try to close it safely.

In this our case the occluder is be opened with a funny angle perpendicular to the septum. And it the cardiologist has no enough experience he can do the push and pull test. He ensure that it is fixed well and detach system, but the position is wrong even it is fixed well.

This is the case, when another option that combines the preplanned CT scan over the fluoro is useful to save someone. It can be useful to see that something is wrong. It let the doctor stop and think that he need to better understand and check the anatomical relations of the device once again.

In this picture we see here that the occluder is not parallel to the septum.

Here you see balloon assistant repositioning of the occluder. When we use another femoral vein access. Put the sizing balloon near the occluder. And push occluder to be more vertical with inflated sizing balloon.

And you see the good position now of the occluder on two types of hybrid visualizations.

There are echocardiography with fluoro at the left part of the screen, 3D echocardiography at the middle part of the screen, and segmentated multislice CT scan over the fluoroscopy in realtime at the right part of the screen.

In this video, you see how a 3D segmented multislice CT scan rotates with a C-arch position change. It can be useful to choose the implantation plane.

But we can do atrial septal defect cases in 95% without any problems. Only 5% needs some additional visualization or non-standard approaches. Doing ASD cases with Echonavigator is more like training to use this technology in future, in more difficult and rare cases where the operator should avoid the training curve of visualization device.

Paravalvular leaks and atrioseptostomy stenting are the cases where real Echonavigator magic starts.

Do you see how 2D plane of echo and doppler is projected to the fluoroscopy screen?

This is our patient with large eighteen times ten mitral paravalvular leak with LIKS-twenty six mechanical mitral prosthesis implanted in 2010. There is a paravalvular leak at 6'o clock resulting the haemolitic anemia, dispnea, and pulmonary hypertension 76 mm hydrargirum.

We decided to have transapical approach to close this paravalvular leak. Surgeons opens the apex and we put the sheath to left ventricle over the purse string suture.

Then we tryed to pass the leak with the MPA catheter but we need to see the flow.

Look at this picture. You see the flow without any contrast. We can choose the C-arch position to better pass the leak. We can see the catheter. We can direct it to pass the leak with full control.

We can put the marker on the echocardiography picture and see

it on fluoroscopy. Like on this video. The fluoroscopy and echo works as one device.

Look how easy we can see the flow and pass the wire in the left atrium. I have seen the flow, repositioned the C-arch and easily passed the fistula. Before getting this visualization instrument, it can take hours to find that hole.

We choosed 18th Occlutech waist rectangle shaped paravalvular leaks dedicated device. We assembled it in 10F cordis sheeth and delivered with medtronic sentrant sheeth, because the original delivery system is bulky and too long for transapical deployment in this case.

This is the final result. The 18×10 mitral paravalvular leak closure without any residual leak. It is very fast and effective because the search of the leak is the most time-consuming stage made easier with hybrid visualization.

Another case is atrial septal defect stenting. The patient with idiopathic pulmonary hypertension. She have syncopes despite three component-specific therapy.

This is how we make the stent modification to limit the hole size and make the sand clock shape. We pass the suture under the one stent strata and make the ring with the node 6-7 mm in diameter.

You see here on the slide the relationships of stent on fluoroscopy and septum location with echocardiography.

Here is the positioning of the stent moment.

This is an implantation moment. You see the balloon with a stent in the atrium septum.

This is the final result of fluoroscopy. There is a perfect positioning of device. Before the hybrid modality the stent

deployment moment was like shooting with closed eyes. The risk of the embolization was real.

This is the echocardiography of the stent position in the septum. We have 6 months follow-up with clinical improvement, no syncope. Good position of the stent without migration.

So the hybrid visualization is useful, but not necessary in patent foramen ovale or atrial septal defect cases because it is easy to do with fluoro, easy to deploy in 95% of cases. But it is great to learn the method on easy cases. Also hybrid helps in complicated anatomy ASD as I have shown.

It is useful in TAVI, but the calcium helps to see the landing zone and for opening fluoroscopy and echocardiography separately is mostly enough, but....

Echonavigator is magic in mitral paravalvular leaks procedures.

Because echo magic is doppler flow and fluoro is needed to see the catheter, an occluder deliver and the deployment.

Echonavigator is magic in the atrioseptostomy with stent for pulmonary hypertension because echocardiography shows the septum and fluoroscopy in the middle of the stent.

My EchoNavigator impressions are that it is a unique technology, it disburdens the brain in mixing different images from different displays. It is useful when the Xray does not visualize the target. We need in easy cases like ASD closure for training before real need and in difficult cases. It is a little bit strange, but this device is very easy to use, just plug CVXi to angiographic station and play.

Thank you very much for your attention.