AEPC-YIA session

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[III-AEPCYIA-06]Transcatheter Correction of Sinus Venosus Defect : From Bench Testing to Clinical Success

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Introduction
Transcatheter correction of sinus venosus atrial septal defect (SVASD) has emerged as an alternative to open-heart surgery when the anatomic configuration is suitable. The three main challenges of the procedure consist in achieving complete shunt occlusion, maintaining APVR patency, and achieving stable stent implantation.
For at-risk cases concerning these matters of cocnern, we developed a step-by-step simulation program that included 3D modeling, virtual simulation, 3D printing, and hands-on simulation training (HOST) to assess procedure feasibility.
Methods
When we faced a complex SVASD, a 3D stereolithography (STL) model was electively segmented using cardiac CT DICOM; then, a virtual stent produced from a previous clinical procedure was merged with the SVASD STL to simulate the procedure and search for predictive keys of success or pitfails.
Then, a 3D printed-model of the SVASD (3D Heart Modeling, Caissargues, France) was created. Material was developed to produce similar echogenicity, radiotransparency, and distensibility to those of cardiovascular tissue.
To achieve bench-testing, the 3D-printed model was fixed in a container filled with radiotransparent and echogenic liquid and plugged to a pump-driven circuit to simulate the procedure in a catheterization laboratory, with close-to-reality conditions including transesophageal echocardiography (TEE), fluoroscopy, and angiography.
Results
In selected cases, the virtual simulation confirmed the high risk of PV obstruction or residual shunting but did not rule out feasibility of transcatheter correction.
HOST permitted to test PV obstruction risk by the inflation of differents balloon in the SVC. When compliant balloon inflation produced a bulge that obstructed a PV, it gave an important warning to test the PV with a non-compliant one. However, when PV stenosis/obstruction was observed when a non-compliant balloon was inflated at a similar diameter than the SVC diameter above the APVR, it made us choose to protect the concerned PV during the real procedure using a trans-septal puncture. When a long stent was deployed at the target site in the SVC, PV could be protected by inflating a balloon posteriorly in the PV towards the left atrium if necessary.
At the end of the benchtesting, dissection and cone-beam CT of the 3D model can confirm the final

result of the in-vitro procedure.

Conclusion

The SV defect percutaneous correction program benefits from multi-modality imaging and complex cases can be facilitated and guided by hands-on simulation training on a newly developed, perfused, 3D-printed model.