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Simulating a novel angioplasty technique on a 3D printed model

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Research Abstract Title

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IRB Number: N/S (case report)

Describe role of Submitting/Presenting Trainee in this project (limit 150 words):
Co-author and presenter of oral presentation

Background, Objectives/Goal, Methods/Design, Results, Conclusions limited to 500 words

Background:
We present a case of extrinsic bronchial compression by a left pulmonary artery (LPA) stent. A 6-year-old with hypoplastic left heart syndrome status post Fontan palliation presented with pulmonary symptoms, including exercise intolerance and systemic desaturation. He underwent LPA stenting for proximal LPA stenosis with improvement in systemic oxygen saturation but continued respiratory symptoms. He underwent a rigid bronchoscopy, which revealed, airway compression was, and cardiac catheterization was planned to modify the contour of the LPA stent in order to alleviate bronchial compression. 3D modeling was used to simulate and guide the treatment plan prior to the intervention.

Methods/Design:
A 3D cardiac model was rendered of our patient, demonstrating external obstruction of the left bronchus by the previously stented LPA. After discussion with the pulmonary team, interventional cardiology, and the advanced imaging team, the decision was made to proceed with a potential catheter intervention to relieve the obstruction. A double balloon technique was used to make the proximal portion of the stent oval in the superoinferior dimension and narrower in the anteroposterior dimension, thus removing pressure from the left bronchus. The technique was simulated using a 3D printed model on the bench top, and the model showed visual improvement in the compression of the left bronchus.

Results:
The patient underwent double balloon angioplasty of the left pulmonary artery. This was done under guidance of a rigid bronchoscope to evaluate the left bronchial compression throughout the procedure. At the conclusion of the procedure, there was subjective improvement in the diameter of the bronchus.

Conclusions:
3D-printed cardiac models can be used for procedural planning. In this case, a 3D-model helped to demonstrate usefulness of a theoretical interventional treatment strategy and also helped to guide the angioplasty technique.