CARDIOVASCULAR FLASHLIGHT

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Geometrically correct three-dimensional optical coherence tomography: first self-expanding bifurcation stent evaluation

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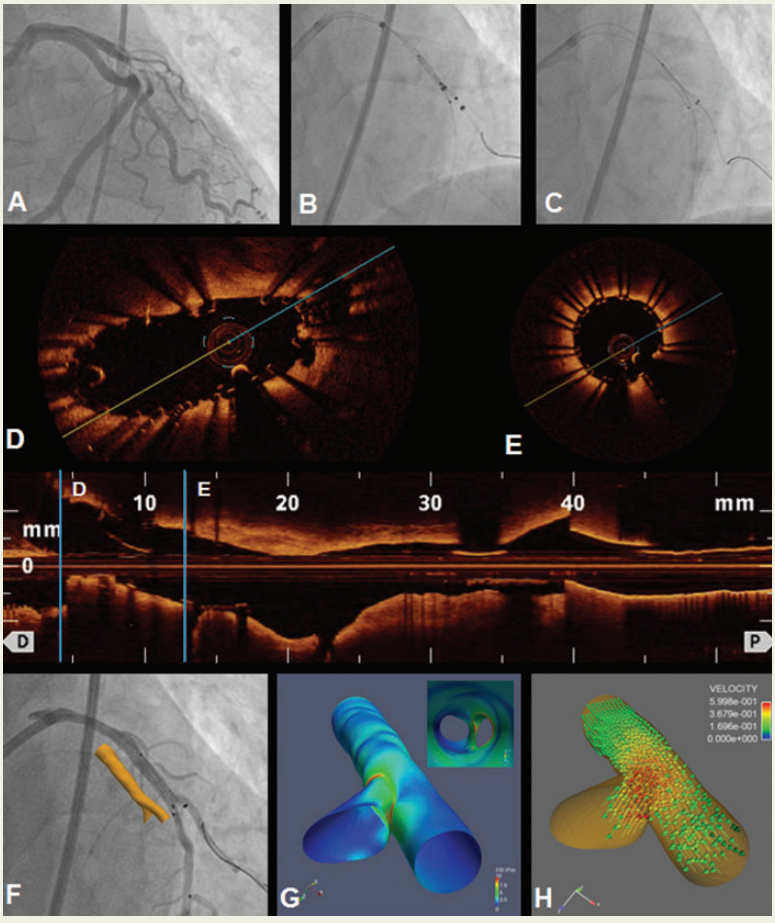
A 78-year-old female was referred to the Andreas Gruentzig Catheterization Laboratories suffering from angina pain CCS II. Coronary angiography demonstrated a bifurcation lesion in the middle left anterior descending and the first diagonal branch (*Panel A*). Based on these findings, percutaneous coronary intervention (PCI) was performed with implantation of a self-expanding biolimus A9^{TM}-eluting dedicated bifurcation stent with an abluminal biodegradable coating (AXXESS, Biosensors International, *Panel B*). After the stent implantation (*Panel C*), optical coherence tomography (OCT) was carried out to evaluate the final result (*Panels D* and *E*). The three-dimensional (3D) configuration of the artery was reconstructed *post hoc* from the angiographic lumen outline in two projections. The cross-sectional lumen borders were traced in the OCT images. These luminal contours were aligned in the previously reconstructed 3D arterial backbone and appropriately rotated. Then, the luminal boundaries were connected in non-uniform rational basis spline surfaces forming the 3D arterial model (*Panel F*). The arterial geometry downstream of the bifurcation was visualized by linearly connecting the respective luminal borders as traced in the OCT images where both branches were visible. Endothelial shear stress (*Panel G*) and blood velocity (*Panel H*, see Supplementary material online, *Video S1*) were calculated with the use of computational fluid dynamics.



Endothelial shear stress was high in the carina and low in the lateral walls of the bifurcation. In line with this, flow velocity was higher in the central flow divider region and lower at the lateral aspects of the bifurcation. We present for the first time a geometrically correct 3D reconstruction of a bifurcation stent by integrating OCT and biplane coronary angiography. This novel methodology provides a detailed anatomical and functional assessment of a stented bifurcation lesion, enables a precise evaluation of endothelial shear stress and local blood flow, and may be used as a complementary tool to improve outcomes after PCI.

Supplementary material is available at *European Heart Journal* online.