Development of an in vitro platform for transesophageal echocardiographic and color Doppler hemodynamic assessments of left atrial appendage occlusion devices

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Introduction: Device-related thrombus (DRT) remains a significant complication after left atrial appendage occlusion (LAAO) and is associated with device position. Clinical prospective study of the influence of device position on DRT is cumbersome.

Purpose: To establish an in vitro bench test platform that allows visual, transesophageal echocardiographic and color Doppler hemodynamic assessments of left atrial appendage occlusion devices.

Methods: Based on a mock circulatory system, an in vitro platform was developed to create pathophysiological environment and left atrium wall motion under atrial fibrillation condition.

Results: LAAO devices could be visualized in the left atrium phantom model using transesophageal echocardiography and color Doppler measurement of local blood velocity at LAAO devices were proven to be capable. Deep implantations resulted in uncovered left upper pulmonary vein ridges. In comparison to ostium-fitted device positions, deep implantations were associated with reduced velocity of blood and the local velocity in the “cul-de-sac” remained lower than the critical threshold of 0.2 m/s.

Conclusions: An in vitro platform was developed that allows transesophageal echocardiographic and color Doppler hemodynamic assessments of left atrial appendage occlusion devices.