The hemodynamic effects of paravalvular leakage using fluid structure interaction; transcatheter aortic valve implantation patient

ABSTRACT

In this study, the fluid structure interaction (FSI) method was utilized to investigate the hemodynamic effects between normal aorta and aorta with Transcatheter Aortic Valve Implantation (TAVI) of paravalvular leakage (PVL). A 3D model of patient specific aorta with annulus diameter of 27.3 mm was developed using MIMICS software. In this research, a similar TAVI valve model by referring to SXT 26 Edwards SAPIENT valve was drawn using CATIA software with valve opening of 100%. The two way of fluid structure interaction analysis has been performed using ANSYS 14.5 software (ANSYS Inc. Canonsburg, PA, USA). The results revealed that the undersized TAVI valve lead to PVL. It was noticed that the PVL happened at the gap in-between the TAVI valve and annulus diameter which is not completely round in shape. This phenomenon produced recirculation flow at the right side of ascending aorta after the flow passing through the valve. It has been proven that the PVL caused a huge impact on the losses of the mass flow rate and also recirculation of blood flow which may lead to blood thrombosis. Furthermore, the data shows that PVL causes higher aortic wall deformation instead of normal aortic condition and may lead to migration of the valve. Consequently, PVL may cause other serious problems such as stroke, arrhythmias and coronary ischemia, which required reoperation.

Keyword: Paravalvular leakage; TAVI; Fluid structure interaction; Edward Sapien