INTRODUCTION

Transcatheter Aortic Valve Implantation (TAVI) is an alternative treatment to conventional surgical aortic valve replacement for patients with aortic stenosis. Patients with severe aortic stenosis suffer also from diastolic dysfunction and impaired coronary flow (perfusion). The coronary perfusion depends on the pressure gradient between the myocardial tissue during diastole and the coronary origin located at the aortic root (sinuses of Valsalva), and thus subjected to changes in diastolic flow field near the closing valve’s leaflets. Coronary perfusion can be influenced by the valve size and design as well as diastolic time.

OBJECTIVE

In this study, we examine the impact of replacement valve on the coronary perfusion and on the pressure changes in the aortic root, compared with aortic stenosis and an intact valve.

Experimental Setup

- Physiological flow conditions (Mock circulation)
- Flow visualization in a transparent flexible model
- Hemodynamic Pump
- Time-Dependent Controlled Coronary resistance (synchronized with the pump)

Cases Studied:

- The examination considered healthy, stenosed and TAVI valves.
- Pressure, flow rates and flow patterns at different CO, Heart Rate and coronary resistance are investigated.

Methods

- Simultaneous Pressure measurements at three locations
- Flow rate measurements
- Flow visualization in transparent Models

Visualization

- PIV

Results

Pressure Gradient Measurements for the three cases (Phase Averaged)

Coronary Flow Measurements for different flow conditions

Conclusions:

- Coronary flow increases with aortic stenosis
- Aortic valve replacement leads to normalization of coronary flow
- Coronary flow increases with HR and CO
- The results agree with clinical evidence and with the numerical model regarding the effect of valve stenosis and TAVI on coronary flow

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