# Assessment of Transcatheter heart valve Migration and Embolization Risk Following Valve-in-MAC

Samuel J. Hill, Alistair Young, Ronak Rajani, Adelaide De Vecchi
Kings College London
St Thomas Campus, London, SE17EH

**Aims**: Transcatheter heart valve Migration and Embolization (TVEM) is a rare, but catastrophic event where the prosthetic moves due to heamodynamic forces acting on the device. TVEM for Transcatheter Mitral Valve Replacement (TMVR) is largely undocumented, so this study is focussed on the replacement of the mitral valve for patients with Mitral Annular Calcification (MAC) known as Valve-in-MAC (ViMAC).

**Methods**: Three dimensional flow simulations are performed using the computational fluid dynamics (CFD) package STARCCM+. Results of the simulation are processed to collect the force of acting on the device and pressure gradients in the LVOT. Measurements are performed on CT data sets to assess the mitral valve size and shape, the extent and location of the calcification and the size of the Neo-LVOT after implantation. Three patients considered for ViMAC have been analysed, considered VIM-1, VIM-2 and VIM-3.

**Results**: Force acting on the device frame was found to be proportional to the level of obstruction with cases VIM-1 (pressure gradient (PG) of 19.5mmHG) and VIM-2 (PG of 2.5mmHG) having a maximum of 0.24N & 0.14N, and VIM-3 (PG of 80.6mmHg) in excess of 1.17N. Average force on the valve for VIM-1, VIM-2 and VIM-3 were 0.17N, 0.12N and 0.71N respectively. VIM-1 showed calcification fully surrounding the annulus aside from the lateral wall, VIM-2 calcification was mainly deposited on the apical wall, while VIM-3 had calcification on the septal and lateral walls.

**Conclusion**: This study has highlighted the need for consideration of the level of obstruction present when considering prosthetic stability in ViMAC. The method can identify areas of the device frame subject to high heamodynamic force and advise on the spatial location of calcified regions on the mitral annulus. When used in conjunction with the direction of action of the fluid forces, the method can help predict the device stability.

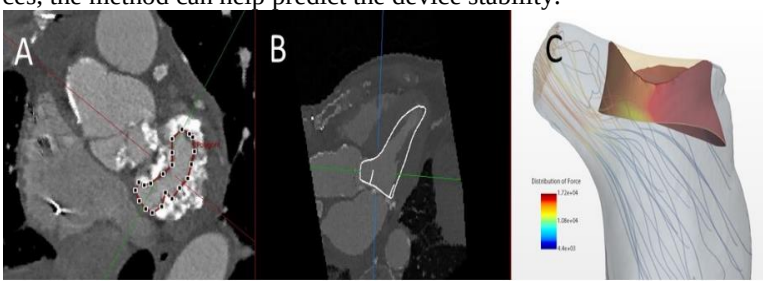


*Figure 1- (a) Segmentation and measurement of the mitral valve. (b) Overlay of simulation domain on CT scan. (c) Distribution of force acting on the device frame during peak ejection.*