Strut thickness impact on thrombogenicity in BRS: In-vitro insights

Shengjie Lu, PhD; Jaryl Ng, BEng; Huiying Ang, PhD; Valeria Paradies, MD; Philip E. Wong, MD; Rasha Al-Lamee, MD; Kadem Al-Lamee, PhD; Nial Bullett, PhD; Naveed Ahmed, PhD; Michael Joner, MD, PhD; Nicolas Foin, MSc, PhD; Naveed Ahmed, PhD; Michael Joner, MD, PhD


Background and Objective

• Recent clinical studies with Bioabsorbable Vascular Scaffolds (BVS) have shown trends toward a higher rate of stent thrombosis with these devices when compared with latest metallic DES.
• Large strut thickness of current bioresorbable vascular scaffolds (BRS) has been suspected to have an impact on thrombogenicity.
• Large strut thickness has been reported to increase the amount of foreign material in the lumen and result in higher flow disturbance, flow separation and areas of recirculation, thereby possibly increasing the thrombogenic risk of the device.1
• Perturbed flow patterns around large, protruding struts have been associated with increased platelet adhesion, inflammatory responses, as well as reduced re-endothelialisation.2
• The aim of this study was to compare scaffold thrombogenicity of a thin-strut BRS (ArterioSorbTM) compared to a larger strut BVS and a standard metallic DES in an in-vitro model of perfused with blood.

Methods

• Scaffolds and stent with different strut thickness including the Absorb BVS (157µm), a thin-strut BRS (ArterioSorbTM, 95µm) and the everolimus-eluting Xience stent (81µm), (all 3.0mm in size, n=6 BVS, n=5 ArterioSorbTM, n=6 Xience) were expanded in 3mm in-vitro coronary artery perfusion models.
• The samples were perfused with porcine blood at a rate of 200ml/min for 4 minutes. Mean cross-sectional thrombus area was evaluated using OCT and immunofluorescence (IF) analysis and mean fluorescent (FL) intensity measured at confocal microscopy.

Results

• From the in vitro perfusion coronary model, thin-strut ArterioSorbTM BRS showed significantly smaller thrombus area in IF images as compared to the BVS (0.006 vs. 0.036 mm²/mm, p<0.01). (Figure 2 and 3)
• No difference was found between thin-strut BRS and Xience (0.006 vs. 0.007 mm²/mm, p=0.99).
• Similar trend can be observed in cross-sectional thrombus area in OCT images and mean FL intensity which indicates the overall activated platelets adhering on the stent surfaces. (Figure 4)

Summary

• Compared to larger strut BRS, the thin-strut BRS and metallic DES showed decreased acute platelet adherence and thrombus formation at both OCT and FL analysis.
• This in-vitro model suggests that clot formation on scaffolds may be modulated by strut profile.

References:


Disclosure: Dr Kadem Al-Lamee is the co-founder and CEO of Arterius.