Hemodynamic performance of different stent strategies for coronary bifurcations. Evaluation with a mathematical model.

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**Purpose**

Best percutaneous treatment strategy for lesions in coronary bifurcations is an ongoing subject of debate. There is limited data that analyses the effect of the different bifurcation strategies on coronary flow.

Our aim is to evaluate the influence of different bifurcation stenting strategies on hemodynamic parameters, both in the main vessel (MV) and side branch (SB).

**Methods**

A computerized mathematical model based on finite volume analysis, was used to evaluate hemodynamic patterns in the following cases: bifurcation with no stenting, simple stenting in main vessel (SS), simple stent in main vessel and "kissing balloon" through the side branch (KB) and "Coulotte Technique" (CT). For each case a 45º and 90 º bifurcation configuration was evaluated (Fig.1).

Three parameters were measured in MV and SB: volumetric flow and pressure decrease, low shear stress area (<20% (<0.1 Pa) of the value proximal to bifurcation) and vorticity (index of turbulence). Low shear stress has been related to plaque formation and restenosis.

**Results**

Overall 90º bifurcations, regardless of the technique, had a worse haemodynamic behaviour (greater decrease in pressure and SB flow and more turbulence) compared to 45º (Fig 2 ). CT technique preserves the best the flow in the SB but only in the 45º configuration, with no advantage over KB in 90º (Table 1).

SS is the technique that provides worst haemodynamic performance (Table 1). This behaviour may be explained by differences in turbulence (Vorticity- Fig. 3), however the area exposed to low shear stress was the greatest with the CT technique at 45º (Fig. 4).

**Conclusions**

In our mathematical model, bifurcation angle has a great influence in the haemodynamic behaviour of different stenting techniques. SS technique has the worst results in terms of haemodynamics due to a higher degree of turbulence. However CT creates the largest low shear stress area mainly, in 90º bifurcations.