Does the pre-procedural pathophysiological pattern impact post-procedural hemodynamic outcomes and vessel prognosis in multivessel coronary artery disease?

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Aim: The pathophysiological pattern of coronary artery disease (CAD) pre-procedure may affect the physiological response to percutaneous coronary intervention (PCI). The aim of this study was to evaluate whether the pathophysiological pattern of CAD, derived from virtual pullbacks of angiography-based fractional flow reserve, impacted the immediate hemodynamic outcome post-PCI.

Methods and results: Among 503 consecutive patients with chronic coronary syndrome and non-ST elevated acute coronary syndrome treated at least 1 vessel in the Multivessel TALENT trial, 826 quantitative flow ratio (QFR) analysable vessels were enrolled. Pre-procedural pathophysiological patterns in CAD were characterized by the physiological distribution and local severity of coronary atherosclerosis using QFR-derived indexes acquired from pre-PCI angiograms. The physiological distribution of CAD was defined as "predominant diffuse" or "focal" according to a QFR pullback pressure gradient (PPG) index <0.78 and ≥0.78, respectively. Physiological local severity was assessed using QFR gradient per 1 mm (dQFR/ds), with a value ≥0.025/mm defining the presence of a "major gradient". The optimal post-PCI QFR value was defined as QFR ≥0.91.

Among the 826 vessels, 673 vessels were analysed (excluding vessels which have total occlusions, ostial lesions, and paired QFR not analysable). Mean pre-PCI PPG index was 0.70 with a nadir in the distribution curve. As per the definition, "focal" lesions were 30% of the total analysed vessels and 88% had a "major gradient". The majority of the vessels belong to predominantly diffuse disease with a major gradient (62.7%, Figure 1).

Compared to predominantly focal disease with a major gradient, predominantly diffuse disease had a higher risk of a post-PCI QFR <0.91 (OR 1.78, 95%CI 1.23-2.58). The scatterplot between pre-procedural PPGI and post-procedural QFR showed positive correlation (Piaison’s R=0.163, p<0.001, Figure 2). The correlation suggested that the vessels with focal lesions more frequently achieved optimal post-PCI QFR values compared to that with diffuse lesions. In multivariable analysis, low QFR PPG index (diffuse disease) was an independent factor for predicting a post-PCI QFR <0.91 (per 0.1 decreases of QFR PPG index, OR:10.3, 95% CI 1.7-63.3, p=0.012). The estimated 2-year VOCE, the powered secondary endpoint of this study, estimated by the post-QFR is 5.9% in treated vessels with predominant diffuse lesion, while 4.9% in that with predominant focal lesion based on the previous substudy of SYNTAX II trial.[1]

Conclusions: A physiological pattern of diffuse CAD pre-procedure was an independent factor in predicting an unfavourable immediate hemodynamic outcome post-PCI. Pre-procedural PPG index can be the predictor of not only post-PCI physiological value but also vessel base prognosis.
pre-PCI pathophysiological pattern

Predominantly diffuse
With no major gradient
80.8% optimal post-QFR

Predominantly focal
With no major gradient
85.7% optimal post-QFR

Predominantly diffuse
With major gradient
73.2% optimal post-QFR

Post-PCI QFR ≥ 0.91
Post-PCI QFR < 0.91
Relation between pre-PCI PPGI and post-PCI QFR (Piason’s R=0.163)