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POTENTIAL ROLE OF CORONARY PHYSIOLOGY IN TREATING 'BYSTANDER' DISEASE IN PATIENTS WITH ST-ELEVATION MYOCARDIAL INFARCTION

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Background: Many patients with ST-segment elevation myocardial infarction (STEMI) have non-culprit lesions (NCLs) in other coronary arteries, for which optimal management is uncertain. In the COMPLETE trial, percutaneous coronary intervention (PCI) of eligible NCLs (vessel diameter ≥2.5mm) improved hard clinical outcomes, compared with conservative treatment. However, 99.3% of NCLs were assessed by visualisation of the angiogram using a threshold of ≥70% stenosis, which is an inaccurate method for assessing haemodynamic significance. A pressure wire was used to assess physiological significance (FFR ≤0.80) in only 0.7% of NCLs that visually had 50-69% stenosis.

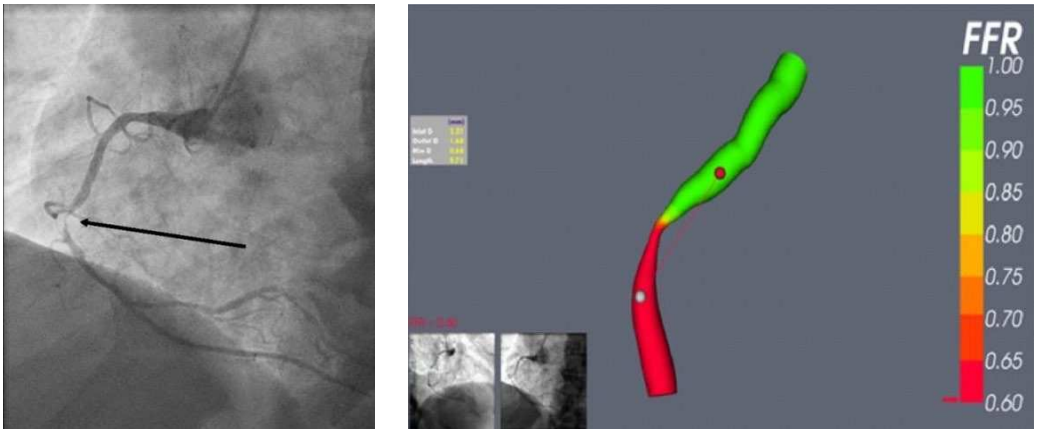

Figure 1: (Left) Angiogram of right coronary artery in a patient with STEMI affecting the left coronary artery. There is a proximal bystander lesion in the right coronary artery (arrow). (Right) Using VIRTUheart™ the bystander lesion is modelled, and then computational fluid dynamics are used to compute the 'virtual' FFR.

Hypothesis: In the 'real-world', the proportion of STEMI patients with NCL stenoses ≥50% that are of physiological significance, based upon fractional flow reserve (FFR) estimation, is low.

Methods: The angiograms of consecutive STEMI patients undergoing primary PCI were retrospectively reviewed by an interventional cardiologist to identify cases that either had NCL stenoses of 50-69% that would have been eligible for COMPLETE if FFR was ≤0.80 or fulfilled the COMPLETE eligibility criteria by visual assessment (stenosis ≥70%). The virtual FFRs of NCLs were computed using the VIRTUheart™ tool. The primary outcome was the proportion of all 'real world' STEMI patients with NCL stenoses ≥50%. Secondary outcomes were a) the proportion of patients with NCL stenoses of 50-69% who had vFFR ≤0.80 ('FFR-guided PCI' group; b) the proportion of NCL stenoses of >70% with a virtual FFR ≤0.80 ('PCI without FFR' group).

Results: Angiograms from 248 patients presenting with STEMI and undergoing primary PCI were reviewed. 70 cases (28%), were found with 86 NCLs that would have been potentially suitable for inclusion in COMPLETE (95% CI: 22.4% to 33.6%). Of these 70 cases, 59% of NCLs fell into the 'FFR-guidance' (50-69% stenosis) group and 41% into the 'PCI without FFR' (≥70% stenosis) group. Of the

70, 49 angiograms (70%) were technically suitable for modelling. A positive vFFR was found in 47% of NCLs (95% CI: 33.7% to 60.6%) (see Table 1).

Management group	Haemodynamic significance of NCLs		Total no. (%)
	vFFR ≤0.8 (%)	vFFR >0.8 (%)	
FFR-guidance for PCI	10 (32)	21 (68)	31 (63)
PCI without FFR	13 (72)	5 (28)	18 (37)
Total (%)	23 (47)	26 (53)	49 (100)

Table 1: Breakdown of haemodynamic significance (vFFR ≤0.8*) for NCLs successfully modelled using VIRTUheart™ in each management group, 'virtual' Fractional flow reserve= vFFR,*

Management group	Cohort no. (%)	
	COMPLETE	Sheffield
FFR-guidance for PCI	37 (0.7)	51 (59.3)
PCI without FFR	5151 (99.3)	35 (40.7)
Total	5188 (100)	86 (100)

Table 2: *Number of lesions suitable for pressure wire in COMPLETE and Sheffield populations*

Conclusion: In a 'real-world' STEMI population, 28% of patients could be considered for either FFR assessment (NCL stenosis 50-69%) or PCI without FFR according to the COMPLETE study criteria. However, of those, nearly 60% should undergo physiological assessment, according to COMPLETE eligibility criteria, even though very few were actually enrolled on this basis. Of the 60%, only 32% were physiologically significant; and, of all the NCLs, only 47% were physiologically significant. Further work is required to determine whether virtual FFR might provide a cost-effective means of identifying patients who will benefit from NCL revascularisation.