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

Matthew Knight, Vignesh Rammohan, Arfrah Preston, Gareth Williams, Abdulaziz Al Baraikan, Mina Ghobrial, Rebecca Gosling, Paul Morris, Patricia Lawford, Rodney Hose, Robert F. Storey, Julian Gunn

Dept of Infection, Immunity and Cardiovascular Disease, University of Sheffield, Sheffield, UK.  
Sheffield Teaching Hospital NHS Foundation Trust, Sheffield, UK  
Insigneo Institute for in silico Medicine, Sheffield, UK.

**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  $\geq 2.5$ mm) improved hard clinical outcomes, compared with conservative treatment. However, 99.3% of NCLs were assessed by visualisation of the angiogram using a threshold of  $\geq 70\%$  stenosis, which is an inaccurate method for assessing haemodynamic significance. A pressure wire was used to assess physiological significance ( $\text{FFR} \leq 0.80$ ) in only 0.7% of NCLs that visually had 50-69% stenosis.

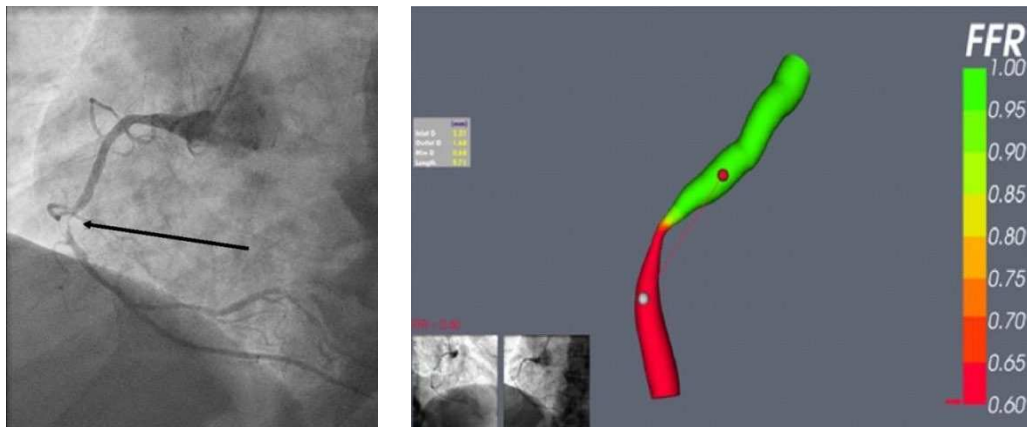


Figure 1: (Left) Angiogram of right coronary artery in a patient with STEMI affecting the left coronary artery. There is a proximal bystander lesion in the right coronary artery (arrow). (Right) Using VIRTUheart™ the bystander lesion is modelled, and then computational fluid dynamics are used to compute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

**Hypothesis:** In the 'real-world', the proportion of STEMI patients with NCL stenoses  $\geq 50\%$  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  $\leq 0.80$  or fulfilled the COMPLETE eligibility criteria by visual assessment (stenosis  $\geq 70\%$ ). 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  $\geq 50\%$ . Secondary outcomes were a) the proportion of patients with NCL stenoses of 50-69% who had  $\text{vFFR} \leq 0.80$  ('FFR-guided PCI' group; b) the proportion of NCL stenoses of  $>70\%$  with a virtual FFR  $\leq 0.80$  ('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' ( $\geq 70\%$  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 $\leq$ 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  $\leq$ 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.