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VFFR AND VCI VERSUS ANGIOGRPAHY FOR GUIDING PCI; A VIRTUAL STUDY

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Introduction

Using Fractional flow reserve (FFR) to guide percutaneous coronary intervention (PCI) improves outcomes and reduces costs. In the FAME study(1), FFR guidance reduced the total length of stent per patient from 51.9mm to 37.9mm. However, invasive FFR is currently used in <10% of all cases (2). Angiography-based virtual (v) FFR solutions permit less invasive physiological assessment and lend themselves to virtual coronary intervention (VCI). VCI has been shown to predict the response to PCI with a high degree of accuracy(3). In this study, we sought to determine the potential impact of vFFR and VCI on real world stenting.

Methods

Patients who had undergone PCI without FFR guidance were identified from the Sheffield archive. A 3D reconstruction of the diseased artery was generated from the angiogram and imported into the VIRTUheart^{TM} workflow. Baseline vFFR was calculated using computational fluid dynamics (CFD) analysis(4). If vFFR was <0.80, VCI was performed(3). Three PCI strategies were modelled. First, the actual PCI procedure was replicated. Second, the FFR_{max} was determined; the minimal amount of stenting to achieve the best possible FFR(5). Third, the optimal strategy was determined; the minimal amount of stenting to achieve a post VCI FFR > 0.90. This value was chosen as it has previously been demonstrated to be associated with improved clinical outcomes(6). For each strategy, the total number and length of stent per patient was determined and compared to the actual procedure.

Results

Forty-three patients and 56 vessels were studied. Mean vFFR pre-PCI was 0.74 (±0.16). Twenty-four (43%) vessels had a baseline FFR > 0.80. For the actual procedure, mean post-PCI vFFR was 0.90 (±0.09). The number of stents per patient was 1.40 (±0.62). Total stent length per patient was 29.35mm (±15.23mm). Mean FFR_{max} was 0.92 (± 0.07). FFR_{max} was on average 0.02 (±0.03) higher than the corresponding actual post-PCI FFR. When the virtual procedure was planned to achieve FFR_{max}, the number of stents per patient was 0.93 (±1.02) (p=0.003). Total stent length per patient was 21.60mm (±26.6mm) (p=0.04). When the virtual procedure was planned to achieve a post VCI FFR > 0.90, the number of stents per patient was 0.93±1.02 (p=0.002). Total stent length per patient was 19.9mm(±24.9mm) (p=0.01).

Conclusion

In our cohort, 43% of vessels had a vFFR > 0.80 suggesting PCI could have been avoided. Using vFFR and VCI to plan PCI led to a significant reduction in the total number and length of stents recommended per patient. Further work on a larger cohort is required to determine if these findings would translate to improved clinical outcomes.

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