

Stable CAD - Invasive imaging and functional assessment

Constant resistance ratio: a new resting index validated by iFR using a pressure microcatheter

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Aims: Instantaneous wave-free ratio (iwFR) has been shown to be non-inferior to fractional flow reserve (FFR) for guiding revascularisation in randomised trials. Here, we propose a new resting index: constant resistance ratio (cRR), which can be reliably calculated from the pressure waveforms independent of ECG. We hypothesised that the diagnostic performance and numerical values of cRR are in high agreement with iwFR. To validate this, we performed a retrospective study using a pressure microcatheter (PMC) system, through which both cRR and iwFR were derived from the original waveforms.

Methods and results: The diastolic "wave-free" period, which is the foundation of iwFR, can be reliably identified by calculating the time derivative of Pd/Pa and finding the longest period when it equals zero. The mean Pd/Pa within such constant (and minimum) resistance periods is defined as cRR. Retrospective invasive coronary pressure measurements using a PMC system from 86 patients (87 vessels) at four medical centres were used to perform the validation study comparing the diagnostic and numerical agreement of cRR with iwFR. From quantitative coronary angiography, the mean reference vessel diameter was 3.1 ± 0.5 mm and mean diameter stenosis was $49 \pm 12\%$. All pressure tracings included in the study met the following criteria: (1) with >20 resting cardiac cycles recorded, (2) of clinically acceptable drift (≤ 0.03), and (3) without ventricularisation or damping. The primary endpoint was the Bland-Altman bias between cRR and iwFR. Secondary endpoints included the diagnostic agreement, correlation, and receiver operating characteristic (ROC) analysis. The mean cRR and iwFR values were 0.93 ± 0.05 and 0.93 ± 0.05 , respectively. The Bland-Altman analysis showed a minimal mean bias of -0.0001 between cRR and iwFR, with $[-0.012, 0.012]$ 95% limits of agreement. The Pearson correlation coefficient between the two indices was 0.994. Using 0.89 as the cutoff for both cRR and iwFR, the diagnostic accuracy of cRR was 97% [95% CI: 90%-99%], with an area under the ROC curve of 0.994.

Conclusions: This study shows that the proposed new resting index cRR is numerically equivalent to iwFR, and the two indices are also identical in terms of diagnostic agreement.