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Comparison of pressure wire versus microcatheter for fractional flow reserve measurements: limitations of microcatheter-based measurements

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We read with great interest the recent paper by Pouillot et al[1], assessing the clinical impact of the new fractional flow reserve (FFR) microcatheter (Navvus™ MicroCatheter; ACIST Medical Systems, Inc., Eden Prairie, MN, USA). Seventy-seven consecutive patients were recruited into a prospective registry and had FFR evaluated by microcatheter (FFRMC) and by pressure wire (FFR_W). The authors reported that the mean FFR_W (0.83±0.08) was significantly higher than the mean FFRMC (0.80±0.10) (p=0.012) and that the Bland-Altman analysis showed a bias of –0.03±0.05 for lower FFRMC values compared to FFR_W values. The Pearson's correlation coefficient (r) between FFR_W and FFRMC was 0.85 (p<0.0001). Hence, using a threshold of 0.80 for FFR, the indication for revascularisation would have differed when based on FFRMC versus FFR_W in 20/88 (23%) of the lesions. Furthermore, the FFR_W system crossed all lesions whereas the FFRMC system crossed only 88% of lesions.

These results are of great value, increasing our knowledge base in terms of understanding the impact of FFRMC measurements in a real-world population. In addition, three previous studies have demonstrated that FFRMC overestimates FFR: Menon et al[2] demonstrated in 52 lesions that the mean FFR_W (0.81±0.11) was higher than FFRMC (0.79±0.12); Wijntjens et al[3] demonstrated in 28 lesions that the mean FFR_W (0.86±0.06) was higher than FFRMC (0.82±0.07) (p<0.001); and Fearon et al[4] demonstrated in 169 lesions that the mean FFR_W (0.83±0.10) was higher than FFRMC (0.81±0.10) (p<0.001).

A major limitation of all these studies is that either the patient population included had low vessel calcification and tortuosity (complexity), or the angiographic vessel characteristics/complexity were not included. However, the current article reported a 12% failure in crossing the lesion with the FFRMC system, mainly due to tortuous and/or calcified arteries, but the level of angiographic vessel complexity for the whole population was not provided. Consequently, the performance of the FFRMC system in a real-world population, especially in patients with high vessel complexity, remains poorly defined. Hypothetically, in patients with high vessel complexity, the magnitude of overestimation by the FFRMC system will increase and the diagnostic accuracy

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deteriorate. To date, only Fearon et al[4] have reported the sensitivity (88%), specificity (78%), and diagnostic accuracy (81%) of the FFRMC using a cut-off value of FFR_W ≤0.80 as reference standard. Lastly, as the mean difference between FFRMC and FFR_W was 0.02-0.04 units, the performance of FFRMC for values between 0.75 and 0.85 ("diagnostic grey zone") needs to be evaluated. This is important as a significant proportion of FFR measurements are within this "diagnostic grey zone" and it is likely that the diagnostic accuracy of the FFRMC system deteriorates, due to overestimation, in the "diagnostic grey zone".

To resolve these limitations, the performance of FFRMC needs to be evaluated in a large prospective study that includes patients with moderate and high vessel complexity to establish the real-world diagnostic utility compared to FFR_W and whether different cut-off values should be considered for the FFRMC system, with particular attention to lesions that are in the "diagnostic grey zone". Otherwise, we may inadvertently revascularise patients with FFR measurements >0.80.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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