Last Word on Viewpoint: Pick your Poiseuille: normalizing the shear stimulus in studies of flow-mediated dilation

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TO THE EDITOR: We thank all contributors involved in providing commentary to the aforementioned Viewpoint. Discourse regarding the assessment and utility of flow-mediated dilation (FMD) and the underlying shear stimulus energize and inform future research and practice.

Several commentators (see Ref. 2) wrote to agree enthusiastically with the concept that trying to standardize the underlying computations for the shear stimulus is necessary if the shear stimulus is to be important as either a stand-alone measure of cardiovascular and metabolic risk or a normalization factor for FMD. To these writers, the check is in the mail.

Several other investigators noted that the suggestion to take into account Poiseuille’s Law when estimating shear rate is useful but flawed, given the numerous issues that remain unknowns in the calculation of the shear stimulus. These involve difficulties associated with the unknown influence of individual ultrasound systems, compliance and viscosity on shear rate calculations, application of Poiseuille’s Law to the in vivo human vasculature, and the size of the resistance vasculature that is made ischemic. Several authors suggested that until we define how best to calculate and measure the shear response to a period of ischemia in various populations, applying the calculations of Poiseuille’s Law may not yield substantial benefit above and beyond current practice. We agree that there are myriad other factors that affect both the shear stimulus as well as its relationship (or lack thereof) to the conduit response (1). However, we also argue that there is a critical need in this line of vascular research for more standardized measurements that can be compared between studies and laboratories to determine the clinical and scientific validity of shear rate estimations alone and in concert with conduit dilatory responsiveness. Uniformity in calculations involving existing common shear estimations is one way to achieve such comparisons. Multi-site investigations, cooperative data sharing, symposiums, and proof-of-concept studies are among other possibilities.

Finally, several authors suggested that the difficulty associated with striving for normalized FMD measurements (i.e., expense, practical issues, equipment limitations, complexity, repeated measures) mean that normalized FMD—with any estimate of the shear stimulus—is unlikely to develop into a routine clinical test. With this concept, we respectfully disagree. The ease and convenience of a measure should not determine its clinical validity, just as difficulty and complexity should not invalidate a useful measure. Rather, focusing our efforts on establishing the most accurate assessment of endothelial function will help investigators and clinicians alike improve on the prognostic ability and intervention-specific sensitivity often assumed inherent in the use of FMD. Subsequent techniques aimed at making FMD as cost and time effective as possible will then be feasible without eliminating scientific accuracy. To reference a sport-specific mantra appropriate for October, you can’t steal second if you haven’t gotten to first.

REFERENCES

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