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## Maximum acceleration and acceleration time as markers to assess severity of peripheral artery disease

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We were pleased to read the paper from de Willems et al entitled “Diagnostic accuracy of the maximal systolic acceleration to detect peripheral arterial disease.”<sup>1</sup> The superiority of maximal systolic acceleration (ACCmax) and acceleration time (AT) in terms of diagnostic accuracy in peripheral arterial disease has long been recognized and has been brought back into the spotlight in recent years.

We have no doubt about the high diagnostic value of ACCmax in lower extremity artery disease (LEAD),<sup>2,3</sup> just as AT also shows high diagnostic performance in either diagnosing critical limb ischemia or excluding significant LEAD.<sup>4, 5, 6, 7</sup> However, a high degree of accuracy in measurement techniques is required, especially when investigating the ACCmax.<sup>8</sup> From a physics point of view, the acceleration is the first derivative of the time-velocity curve and so, acceleration is only really maximal for a tiny instant, because it is the definition of a derivative. Furthermore, the time lapse during which acceleration is truly maximal tends to decrease as the arterial duplex waveform dampens, making it increasingly difficult for nonvascular specialists to measure accurately. In this regard, the intraobserver and interobserver reproducibility of ACCmax and AT between inexperienced and experienced vascular ultrasound operators should be thoroughly addressed before any world-wide bed-side use as diagnostic tools.

In their Methods section, Willems et al explained the importance of accurately adjusting the speed scale before recording the Doppler waveform (“covering at least three-quarters of the window”), but the statement “the time scale contained a maximum of 3 to 4 heartbeats” about the scrolling speed is insufficient, because it obviously depends on the heart rate, especially because this setting is important before any acceleration measurement. We think that accuracy about the scrolling speed (in mm/s) should always be stated:  $\geq 100$  mm/s and preferably, 150 to 200 mm/s.

With regard to the results, we believe that it would have been preferable to publish a single cut-off value based, for example, on the highest or lowest value of ACCmax measured on either the fibular, anterior or posterior tibial arteries as the measurement ATmax previously described (highest AT value between the dorsalis pedis artery and the lateral plantar artery). This metric would facilitate the diagnostic use of ACCmax and avoid the need to remember multiple cut-off values.

In this context, presence of critical limb ischemia (CLI) can often be a challenge. An analysis of ACCmax performance to detect CLI would have been of great value. All the more so because, from an analysis of Figure 3, there seems to be a significant overlap of ACCmax values between the stages claudication and CLI, which does not seem to be the case for AT.

In conclusion, we would like to warmly congratulate the authors on this study. We have no doubt that both ACCmax and AT are both valuable (and perhaps the only) Doppler waveform measurements to assess the overall severity of LEAD (velocity scale and scrolling speed). For now, the acceleration measurement of the steepest systolic slope remains a rough estimate when measured on a time-velocity curve, but this problem could easily be overcome if ultrasound scanner manufacturers could find a way to also provide an acceleration-time curve, because this is only its first derivative.

#### **Disclosures**

None.

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