Aortic stiffness in type-1 diabetes mellitus; beware of hypertension

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Over the past years considerable progress has been made in the field of cardiovascular magnetic resonance (CMR), providing accurate evaluation of left ventricular mass, volumes and function [1–9]. CMR has shown unique abilities in characterizing myocardial tissue composition. In particular, high-resolution contrast-enhanced CMR has been used to visualize myocardial fibrosis with a high accuracy [10–16]. For instance, in patients with acute myocardial infarction, the injured myocardium shows increased CMR contrast compared to normal myocardium when imaged by delayed gadolinium enhancement. The transmural extent of delayed gadolinium enhancement predicts functional outcome after interventional procedures performed in patients with acute myocardial infarction and chronic ischemic heart disease [16–21]. Not only in the setting of an acute myocardial infarction, but also in patients with various manifestations of cardiomyopathy, evidence of delayed gadolinium enhancement may have important clinical and prognostic implications [22–30]. Magnetic resonance angiography (MRA) has been introduced as a method that can provide visualization of all three major coronary arteries, coronary bypasses and the aorta within a single three-dimensional acquisition [31–40]. CMR has become the first choice imaging modality in complex congenital heart disease and imaging great vessels [41–46]. In particular, CMR has proven to be of indispensable value in identifying aortic stiffness in Marfan patients using pulse wave velocity measurements [47, 48]. In these patients pulse wave velocity is the propagation speed of the pressure or flow wave front traveling along the aorta. For instance, it has been shown that aortic stiffness in Marfan syndrome, together with mean blood pressure, is reduced by beta-blocker therapy, and CMR is well suited to detect these changes by measuring aortic distensibility and pulse wave velocity.

In the present issue of the *International Journal of Cardiovascular Imaging*, Brandts et al. [49] investigated in type-1 diabetes mellitus patients the role of hypertension and of diabetes mellitus itself on aortic stiffness by using CMR. The hypothesis of the study was that hypertension has a predominant effect on aortic stiffness in type-1 diabetes mellitus patients. In addition, it was established to what extent type-1 diabetes mellitus itself independently adds to aortic stiffness. Subjects were divided into 4 groups: 32 healthy volunteers, 20 diabetes mellitus patients, 31 hypertensive patients, and 28 patients with both diabetes mellitus and hypertension. Aortic stiffness was measured by means of pulse wave velocity using...
velocity-encoded CMR (Medis, Leiden). Mean aortic pulse wave velocity was 5.7 ± 1.2 m/s in healthy volunteers, 5.9 ± 1.2 m/s in diabetes mellitus patients without hypertension, 7.3 ± 1.2 m/s in hypertensive patients, and 7.3 ± 1.3 m/s in patients with both diabetes mellitus and hypertension. Compared to healthy control subjects, aortic pulse wave velocity was significantly higher in patients with hypertension and in patients with both diabetes mellitus and hypertension. However, aortic pulse wave velocity was not increased in patients having diabetes mellitus alone. The authors concluded that hypertension has a predominant contributive effect on aortic stiffness in diabetes mellitus patients whereas the direct diabetic effect on aortic stiffness was insignificant.

The main finding of the study was that the independent effect of type-1 diabetes mellitus on aortic pulse wave velocity was minor; aortic pulse wave velocity was not significantly different between healthy volunteers and type-1 diabetes mellitus patients. Secondly, the independent effect of hypertension on aortic pulse wave velocity was most important; aortic pulse wave velocity was significantly higher in hypertensive patients than in healthy volunteers. In addition, the combination of type-1 diabetes mellitus and hypertension resulted in increased aortic stiffness, and was significantly higher than in patients having type-1 diabetes mellitus alone. Interestingly, the authors showed that aortic stiffness in type-1 diabetes patients mainly depends on having additional hypertension, and not on diabetes alone. Therefore, identification of hypertension in patients with type-1 diabetes is of importance for risk stratification and can be used for guiding therapy in order to improve cardiovascular outcome.

Investigating the hypertensive contribution on aortic stiffness in patients with type-1 diabetes mellitus is utmost relevant for cardiovascular risk assessment as type-1 diabetes mellitus is often associated with hypertension. The current study is unique in the sense that it used CMR-assessed pulse wave velocity measurements. More recent studies from the same group showed that stiffness of the aorta was independently associated with systolic left ventricular function [50]. In addition, aortic stiffness independently predicted white matter brain atrophy in patients with type-1 diabetes mellitus [51].

In summary, the study by Brandts et al. [49], using CMR-determined pulse wave velocity measurements, convincingly demonstrates that hypertension has a predominant contributive effect on aortic stiffness in diabetes mellitus type-1 patients, whereas the direct diabetic effect on aortic stiffness was very small. Since aortic stiffness and diabetes mellitus are highly associated with adverse cardiovascular events, identifying hypertension in diabetes mellitus type-1 patients seems utmost relevant for further risk stratification.

Conflict of interest None.

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