Reply

Baroreflex Sensitivity and Renal Sympathetic Denervation

We appreciate the insightful comments of Drs. Ormezzano and Baguet on our paper (1). In our proof-of-concept study, we demonstrated for the first time that impaired spontaneous cardiac baroreflex sensitivity (BRS) might be a valuable tool for identification of patients with hypertension who might benefit from renal sympathetic denervation (RDN). It is correct that we assessed BRS in 2 ways, namely, by phase-rectified signal averaging (PRSA; BRS_{PRSA}) and by the sequence method (BRS_{SEQ}). It is also correct that the prognostic value of BRS_{PRSA} in predicting response to RDN was superior to that of BRS_{SEQ}. However, our study was neither powered nor intended to compare the predictive values of different BRS measures. According to our pre-specified hypothesis, we defined BRS_{PRSA} as the primary variable, which was therefore tested in multivariate models. Importantly, we did not show that RDN led to restoration of impaired BRS as mentioned by Drs. Ormezzano and Baguet. This interesting hypothesis will be tested in upcoming projects.

The assessment of BRS by PRSA is conceptually new and differs from previous approaches to BRS assessment in many aspects. PRSA is a comprehensive signal processing technology that is capable of extracting periodic patterns out of complex biological signals such as recordings of heart rate, blood pressure, and respiratory activity (2,3). An extension of the PRSA technology allows the analysis of coupled periodic patterns in simultaneously recorded biosignals, which is of obvious advantage in assessment of spontaneous BRS (4,5). We agree that the prognostic value of a BRS measure is of great importance. The prognostic value of BRS_{PRSA} has been prospectively validated in 941 surviving patients with acute myocardial infarction, for which it proved to be superior to that of BRS_{SEQ} and other techniques in prediction of 5-year all-cause mortality (6). We acknowledge the promising results of BRS_{SEQ} as a risk predictor in patients with hypertension in the EVABAR (Evaluation of the Prognostic Value of Baroreflex Sensitivity in Hypertensive Patients) study. Therefore, we would like to suggest that Drs. Ormezzano and Baguet conduct a blinded analysis of BRS_{PRSA} in patients of the EVABAR study.

Feature Tracking Cardiac Magnetic Resonance Imaging in the Assessment of Left Atrial Function

We read with great interest the review article by Hoit (1), in which most of the available articles about the role of left atrial (LA) function and size in different cardiovascular diseases have been reviewed. As mentioned, analyzing LA function has always been challenging, given the distance of the LA from the chest wall and its thin asymmetrical wall. The presence of pulmonary veins and left atrial appendage also makes it more challenging to evaluate LA function than left ventricular function. On the other hand, cardiac magnetic resonance imaging (CMRI) has been proposed as the gold standard method for the assessment of LA volume. However, as the author mentioned, inability to measure phasic volumes had been a major limitation of CMRI.

Feature tracking (or tissue tracking) CMRI is a new technique in the assessment of myocardial wall motion and measurement of heart chamber volumes. This is a novel post-processing...
technique that tracks the myocardial wall by using cine CMR images. With feature/tissue tracking CMRI, phasic LA volume, LA strain and strain rate, and LA velocity can be measured using cine images. In a recent study performed with 28 patients with atrial fibrillation, feature-tracking MRI was able to detect changes in LA strain, strain rate, and velocity following catheter ablation (2). Preliminary studies within the Multi-Ethnic Study of Atherosclerosis have shown the usefulness of tissue-tracking–derived LA strain and strain rate in patients with atrial fibrillation (3), heart failure (4), and myocardial infarction (5).

The results of studies of reproducibility and repeatability of feature-/tissue-tracking methods of MRI have been mixed (6,7). Moreover, studies of LA structure and function from feature-/tissue-tracking CMRI specifically have been lacking. Although further technical improvements and more studies are required before feature-/tissue-tracking MRI can be used routinely, it is, nevertheless, a valuable tool for detailed assessment of phasic LA structure and function.

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I appreciate the interest shown by Dr. Habibi and colleagues, and thank them for their recent contributions to the field of left atrial (LA) function, which as they imply, were neglected in my State-of-the Art review (2). Calibrating the completeness of these reviews can be problematic and requires balancing the novelty of a method with its demonstrated validity and clinical utility. Tissue-tracking cardiac magnetic resonance (FT-CMR) is a new and potentially useful technique for measuring strain from routine cine CMR images using feature-tracking algorithms that were initially designed for echocardiographic strain analysis. FT-CMR tracks motion of a tissue voxel using standard steady-state free precession sequences and is simpler, more practical and available, and less time consuming than other CMR-based strain techniques. However, as Dr. Habibi and colleagues state in their letter, reproducibility and repeatability data for FT-CMR ventricular strain measurements are conflicting (1). More recently, in a study of 145 healthy volunteers, global circumferential but not longitudinal strain showed reasonable agreement with tagged CMR, with acceptable interobserver reproducibility (2). In another study, there was considerable variability between FT-CMR and two-dimensional speckle tracking echo strains of the right ventricle (RV) and left ventricle (LV) in 20 patients with tetralogy of Fallot and 20 control patients (3). Importantly, reproducibility, variability, and validation data for atrial FT-CMR (longitudinal) strain are nonexistent.

Moreover, there are no peer-reviewed studies of FT-CMR atrial strain measurement. Indeed, the studies cited by Dr. Habibi and colleagues are abstracts that have not, to date, undergone a rigorous review process. Those studies concluded that addition of FT-CMR LA strain helps distinguish subjects with atrial fibrillation from controls; that FT-CMR peak systolic atrial strain, but not LA volumes or emptying fraction, was associated with heart failure after adjusting for NT-proBNP (N terminal pro brain natriuretic peptide), traditional heart failure risk factors, and LV mass; and that FT-CMR peak systolic LA strain and diastolic strain rate are associated with significant late gadolinium LV myocardial scars (1). The FT-CMR field is indisputably inchoate; acquisition technique, cine sequence, field strength, and temporal resolution are variables that are likely to affect the accuracy and precision of FT-CMR measurements of atrial strain using CMR. The need for further pre-clinical analysis in addition to clinical trials was trumpeted in a recent editorial (4).

Finally, the focus of my review was the role of LA function in prognosis. Although it is tempting to extrapolate from the experience of echocardiographic LA strain, there are no studies of FT-CMR LA strain that examine outcomes or that compare LA strain measured with that of FT-CMR to echocardiography.

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Please note: Dr. Hoit is a speaker for Philips Medical.

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