

# Stress Echocardiography: Back to the Future

## *Ecocardiografía de estrés: Vuelta al futuro*

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In this issue of the *Journal*, Arbucci et al present their experience with triple imaging vasodilator stress echocardiography (SE) (1): regional wall motion abnormalities (RWMA, first generation); coronary flow velocity reserve (CFVR, second generation); and deformation strain imaging (third generation). The 3 parameters stratified in 30 years of experience can be obtained with extraordinary success rate, their results are often concordant and - what is more interesting - sometimes discordant, with unmatched wall motion, flow and strain responses. (1)

To be honest, there are limitations in this paper. There is no coronary angiographic information. Prognostic data are missing. Explanations of the unmatched responses remain foggy. Yet, the conveyed message is innovative, visionary, and powerful. This is not SE as it is described in evidence-based contemporary guidelines. It is SE as it will reshape in the near future: comprehensive (a one-stop shop for flow and function); quantitative (operator-independent); beautiful (with results easy to communicate at first sight).

Coronary flow velocity reserve during vasodilator SE, together with assessment of RWMA, was first proposed in the year 2000 by Lowenstein et al (3), and only 3 years later semi-simultaneously published in international journals by three independent groups from Europe (4), the Far East (5), and South America. (6) The usefulness of dual RWMA and CFVR imaging has been recently reaffirmed in a large scale, international, multi-center study, and is especially attractive for the possibility to catch two birds: obstructive epicardial coronary stenosis and coronary microvascular integrity, with one stone (a single stress). (7)

State-of-the-art SE diagnosis remains subjective to visual eyeballing, but it is now possible to corroborate the current naked eye evaluation with quantitative assessment of regional and global myocardial deformation indices. The rationale behind strain SE is its quantitative nature, the ability to differentiate tethering from surrounding segments, and the earlier onset

of RWMA during the ischemic cascade (potentially leading to higher diagnostic sensitivity). At present, strain SE cannot be used routinely in clinical practice due to its limited feasibility (around 80%), noisy data in high heart rate states (>100 bpm), lack of parameter and software standardization, and missing effectiveness studies. The obvious approach is to combine strain imaging with vasodilator stress, since heart rate increase is mild and image quality unchanged (1). Strain has the potential to provide quantitative support to SE but only with certain stresses and in certain (apical) segments. (1)

Medical images need to be not only smart (full of information) but also beautiful (easy to understand at first sight). In this aspect, SE has a weakness. When consistent with regional wall motion analysis by an expert observer, deformation imaging is perfectly suited for a report “dressed to kill”; -according to the Oxford dictionary “wearing glamorous clothes intended to create a striking impression”-. A polar map of strain shows a “red cherry pie” pattern in normal response, and a “blueberry slice” reaching apical segments in abnormal response. The color is based on quantitative deformation indices, and referring cardiologists are inclined to trust the quantitative “cherry and blueberry pie” abnormal pattern of an ischemic response fed with numbers. (1)

### **Back to the future**

SE is today well embedded in guidelines, and rapidly becoming the dominant technique for functional testing for three overriding extra-cardiologic reasons. First, for its relatively low cost in an era of health care money rationing. Second, for its radiation-free safety in the presence of increasing awareness (of doctors and patients) of long-term cancer effects of ionizing radiation. (7) Third, for its 100-fold lower environmental impact compared to other competing techniques. (8) The imaging community is increasingly aware that small risks of individual scans multiplied by millions

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of imaging examinations each year worldwide become unsustainable population risks, economic wastes, environmental burdens and societal costs. (9) Stress echocardiography is the paradigm of a “green imaging” technique, safe and sustainable for patients, operators and the environment. This burst of renewed interest for extra-cardiologic reasons also determined a cultural Renaissance of the SE technique, once monotonous with a single parameter (RWMA) applied to a single patient with a single technology, and now omnivorous, versatile, ideally fit for functional testing within and outside coronary artery disease. In the recent editorial comment to the Stress Echo 2020 study on CFVR (6), Sharon Mulvagh highlighted that *“the current shift toward SE parameters with both known and novel parameters is a new frontier. It will be interesting to observe the impact of SE 2020 in shifting practice. There has been a reluctance to “go with the flow” on this side of the Atlantic, but perhaps this will change with clear demonstration of feasibility and incremental value of a multiparametric SE approach, especially in women, who could benefit greatly from a noninvasive, nonionizing assessment of myocardial microvascular integrity”*. (10) In the words of Valentin Fuster, *“we could call this approach “Going back to the future” because the concept of CFVR (although not new) is coming back with fullest speed in Europe and USA. I can see a future by which the use of this protocol may provide a lot of information”*. (11) The paper by Arbucci, Lowenstein et al. tells us that the future is now.

#### Conflicts of interest

None declared.

(See authors’ conflicts of interest forms on the website/Supplementary material).

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