Let’s twist

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In the 16th century, Leonardo DaVinci already described the rotational motion of the left ventricle (LV).1,2 and in 1669, Richard Lower observed that myocardial contraction could be compared with ‘the wringing of a linen cloth to squeeze out the water’.3 Three centuries later, the use of radiopaque markers in cineradiographic studies made it possible to measure this wringing motion in the human heart, as was shown by Ian McDonald and Neil Ingels.4,5 The mechanistic basis for this wringing motion or twist lies in the complex spiral architecture of the LV as revealed by the anatomical studies of Streeter et al.6 and Greenbaum et al.7 The LV consists of obliquely oriented muscle fiber(s) that vary from a small-radius, right-handed helix at the sub-endocardium to a larger-radius, left-handed helix at the subepicardium. The functional result of this three-dimensional helical structure is a cyclic systolic twisting and diastolic untwisting of the LV apex relative to the base. LV twist plays a pivotal role in the mechanical efficiency of the heart, as was shown by Ian McDonald and Neil Ingels.4,5

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short-axis image, so that the originally defined speckles move out of the plane. Furthermore, the imaged epicardium is sometimes too bright, causing signal saturation, which precludes discrimination of the subtleties of image contrast that allows speckle tracking to work. Also, the size of a tracking point is in reality larger as the one that is displayed. Therefore, placement of a tracking point in the epicardium can potentially result in stationary artefacts by tracking of non-moving speckles outside the heart. Motion of the mitral valve leaflets in the area of tracking points placed on the endocardium will potentially interfere with proper speckle tracking as well. Finally, and probably most importantly, in a significant number of patients, true apical rotation will be underestimated to a variable extent because of inability to visualize the true LV apex. The short-axis recordings and analyses should be done meticulously. Currently, the anatomical landmarks are to loosely defined and in particular attention should be made to record the correct cross-section at the LV apical level.14 This may partially explain the differences between measured LV twist in normal middle-aged human subjects in the literature (ranging from 8° to 20°).15,16 Despite proposed distance normalization algorithms, only 3D speckle tracking echocardiography can definitely solve this important limitation.

Chubby Checker’s song ‘The Twist’ changed dancing forever by separating the dancers and is one of only two songs to re-enter the Hot 100 list and return to the number 1 position. After an era of LV rotation research with magnetic resonance imaging, echocardiography may bring cardiac twisting back into the spotlight again and provide new insights into cardiac (patho)physiology.

References