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Strain Analysis by Speckle Tracking Echocardiography Allows Discovery of Essential Similarities in Left Ventricular Function between Rats and Humans

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Rats are commonly used as experimental models of human heart diseases to investigate left ventricular (LV) function under controlled conditions, assuming that LV function of rats and humans are alike. LV of Rats and humans has the same anatomical structure of continuum helical fibers. The question is whether this similarity infers similarity in LV function, and whether LV of rats is a good model for studying human LV function. The aim of this study was to investigate the similarities and differences in LV function between rats and humans by comparing various measurements performed on healthy rats and humans. The analysis was applied to 110 sedated Sprague-Dawley rats and 120 humans that underwent standard echocardiography. In order to compare the LV twist, torsion-to-shortening ratio, LV rotation and circumferential strain measurements short axis scans were obtained. Longitudinal strain was compared between rats and humans from long axis scans. The measurements were assessed by utilizing a speckle tracking echocardiography approach. The results show that the longitudinal strain is equal in rats (-16.3±3.6%) and humans (-16.2±4.2%), while the circumferential strain is larger in humans ($P<0.01$). The LV twist was found to be equal in rats (8.7±4.4 deg) and humans (9.7±4.5 deg). However, for rats the rotation was larger at the apex ($P<0.01$) and lower at the base ($P<0.001$). The torsion-to-shortening ratio parameter was found to be equal in rats and humans (rats 0.43±0.21, humans 0.41±0.21). The similarity of the torsion-to-shortening ratio parameter between humans and rats indicates same transmural distribution of contractile myofibers in rats and humans. Moreover, the longitudinal strain and LV twist are equal in rats and humans, and thus no scaling is needed while comparing these parameters among rats and humans. These parameters are recommended to be measured, while evaluating LV function of a rat model of heart disease, in order to infer to human LV function.