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RESEARCH LETTER

Left Ventricular Thrombosis Following Apical Myocardial Infarction: Might Cardiac Magnetic Resonance Strain Analysis Tell Us Something?

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Left ventricular thrombosis (LVT) is a well-recognized complication of myocardial infarction (MI) with harmful consequences such as the risk of embolic complications; its incidence, estimated with cardiac magnetic resonance (CMR), is about 5%.[1] Several risk factors for LVT following MI have been identified, such as ST-segment–elevation MI, large infarct size, anterior/apical location, reduced left ventricular ejection fraction, and the presence of microvascular obstruction; on the contrary, relevant mitral regurgitation seems to lower this risk.[1] In the past years, speckle tracking echocardiography has emerged as a surrogate marker of left ventricular systolic function. Several authors have demonstrated the association between reduced echocardiography-quantified myocardial strain and LVT following MI (more evident for apical regional strain).[2] Recently, global longitudinal strain on feature-tracking CMR has emerged as an independent predictor of cardiovascular events following MI.[3] However, the relationship between abnormalities on feature-tracking CMR and LVT formation after MI is still unexplored.

We performed a retrospective analysis including all the patients with a previous diagnosis of antero-apical ST-segment–elevation MI who underwent CMR at our institute between August 2013 and October 2020. The study protocol was approved by the Ethics Committee on Human Research; because of the retrospective observational nature of the study, written consent was not required. Patients with ongoing anticoagulant therapy and those with severe mitral regurgitation were excluded. Data that support the study findings are available from the corresponding author upon reasonable request. After performing a propensity score matching (balancing age, sex, time from MI, left ventricular ejection fraction, and number of left ventricular segments with transmural late gadolinium enhancement), we tested differences in global and segmental strain on CMR between patients with and without LVT by applying a Mann-Whitney *U* test. Furthermore, difference in terms of apical to global radial strain percentual deviation, calculated as ([Global Radial Strain–Apical Radial Strain]/Global Radial Strain)×100, was tested. All CMRs were performed using 1.5 T scanner (Siemens Magnetom

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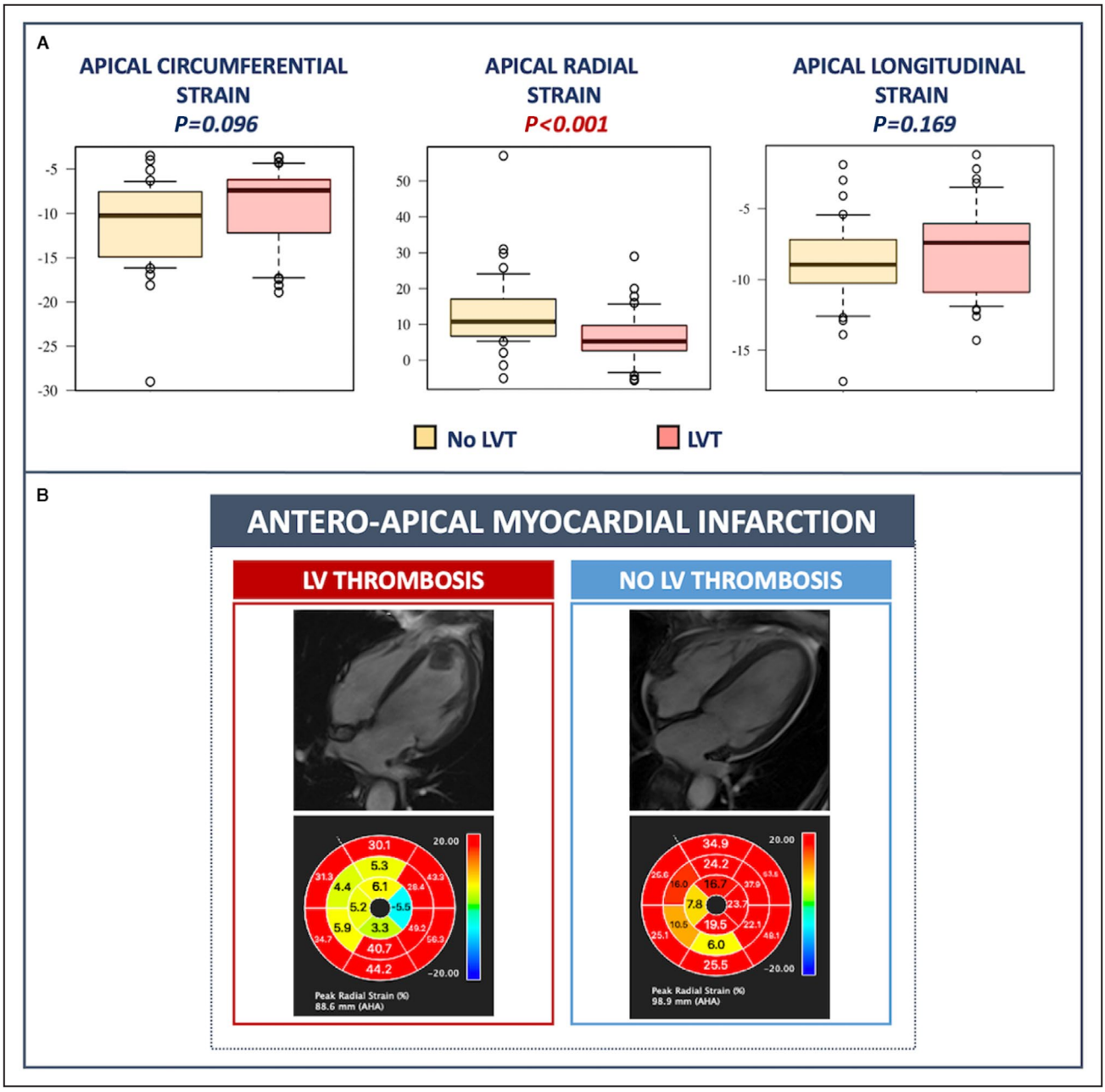

Figure. Correlation between apical strain analysis and left ventricular thrombosis.
(**A**) Association between apical strain on FT-CMR and LVT after antero-apical MI: apical radial strain significantly differs in the two groups. (**B**) Example of a pair of matched patients; cine 4-chamber CMR images and their respective radial strain are reported. CMR indicates cardiac magnetic resonance; FT-CMR, feature-tracking cardiac magnetic resonance; LV, left ventricle; LVT, left ventricular thrombosis; and MI, myocardial infarction.

Avanto 1.5 T); feature-tracking analysis was done with the software Circle CVI42 version 5.13.7. Interobserver variability was certified in 10 randomly selected patients.

Of 356 patients enrolled, 37 (10.4%) were diagnosed with LVT. After performing propensity score matching, we obtained a sample of 36 pairs (72 unique patients), with a mean age of 65 (SD ± 11) years; 59 (82%) of them were men. In both groups, the median left ventricular ejection fraction was 35% [interquartile range (IQR) 27–42]; the median number of segments with transmural late gadolinium enhancement was 7 [IQR 5–8]. The median time from MI was 15 days [IQR 7–32] in the LVT-positive and 19 [IQR 6–20] in the LVT-negative group. Despite the comparable extension of MI and late gadolinium enhancement between the 2 groups, a significant difference in apical radial strain was detected, with a median value of 10.75 [IQR 6.8–16.5] in patients without LVT compared with 5.25 [IQR

2.7–9.6] in patients with LVT (P<0.001; Figure). No significant differences were found in terms of global longitudinal, radial and circumferential strain (P=0.19, P=0.2, and P=0.49, respectively) and segmental circumferential and longitudinal strain. When considering the percentual deviation of apical radial strain to the global one, a significant difference was found, with a median deviation of 12% [IQR –20–48] in patients without LVT and of 51% [IQR 47–75] in the LVT-positive group (P<0.001). Applying a receiver operating characteristic curve analysis, an apical to global radial strain percentual deviation value of 26% was found to be the most accurate in terms of sensitivity and specificity (area under the curve, 0.74; 95% CI, 0.62–0.85).

In conclusion, among patients with transmural antero-apical MI, reduced apical radial strain on feature-tracking CMR is associated with the presence of LVT. Furthermore, among patients with LVT, a greater apical to global radial strain percentual deviation was found, suggesting the importance of apical radial strain reduction, especially when compared with surrounding myocardium, in thrombus formation. To the best of our knowledge, this is the first evidence suggesting the possible ability of feature-tracking CMR in identifying patients at risk for LVT formation after MI. Larger studies will be needed to validate our results and investigate their clinical implications.

ARTICLE INFORMATION

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