Supplementary material

Pu C, Hu X, Ye Y, et al. Evaluation of myocardial deformation pattern of left ventricular noncompaction by cardiac magnetic resonance tissue tracking. Kardiol Pol. 2020; 78: 71-74. doi:10.33963/KP.15133

Echocardiography

Each patient underwent a transthoracic echocardiographic examination using an IE 33 or EPIQ 7C ultrasound equipment (Philips, Boston, America). The ratio of non-compacted to compacted myocardium (NC/C) was measured manually in the short-axis or long-axis images at the end of systole, and the segment was defined as non-compacted myocardium if NC/C > 2.0.

CMR image acquisitions

All patients were examined on 1.5T magnetic resonance scanner (GE Signa HD excite, America) using 8-channel phased-array cardiac coil. Short-axis cine imaging covering the entire left ventricular (LV) and long-axis cine imaging were performed using an electrocardiogram-gated and balanced steady state free precession (bSSFP) sequence with the following parameters: slice thickness = 8mm, slice gap = 2mm, field of view (FOV) = 360mm, repetition time (TR) = 3.5ms, echo time (TE) = 1.5ms, flip angle = 45° and 20 phases per cardiac cycle. Late gadolinium enhancement (LGE) imaging was acquired 8-10 minutes after the injection of 0.2 mmol/kg of Gadolinium diethylenetriamine pentaacetate (Gd-DTPA, Bei Lu, Beijing, China) using a T1-weighted inversion recovery sequence with the following parameters: slice thickness = 8mm, slice gap = 2mm, field of view (FOV) = 360mm, TR = 6.5ms, TE = 3.5ms, flip angle

= 20°.

CMR image analysis

All the cine and LGE imaging were transferred to the CVI[42] software (Circle Cardiovascular Imaging Inc., Calgary, Alberta, Canada) for offline analysis. Endo- and epicardial contours in the cine images were manually traced in the short 3D module to obtain LV end-diastolic volume index (EDVi), end-systolic volume index (ESVi), stroke volume index (SVi) and ejection fraction (EF). By importing short-axis, two-chamber, three-chamber and four-chamber images in the tissue tracking module, endo- and epicardial contours of end diastole were manually delineated before being automatically propagated to all the other phases. All myocardial strain parameters were subsequently obtained including LV global radial, circumferential, and longitudinal strain (GRS/GCS/GLS) and regional strain (base, mid-cavity and apex) and segmental strain (Supplementary material, *Figure S1*). The ratio of NC/C was measured manually in the short-axis or long-axis images at the end of diastole except apical segment, and the segment was defined as non-compacted myocardium if NC/C > 2.3. The distribution of LGE in the LV myocardium was recorded too. LGE was deemed present only if myocardial enhancement was confirmed on both short-axis and matching long-axis areas using a signal intensity threshold > 5 SD above a remote reference region.

Supplementary Table S1. Morphological parameters of LVNC

	LVNC + EF ≥ 50% (n = 10)	**LVNC + EF < 50% (n = 13)**	***P* value**
Number of NC, n (%)	28 (18)	52 (25)	0.08
NC/C	3.5 (1.0)	4.2 (0.9)	0.15
LGE, n (%)	0 (0)	6 (46)	0.01

Continuous variables were expressed by mean (SD) with Student *t*-test, and categorical variables were expressed as frequency (percentage) with chi-square test.

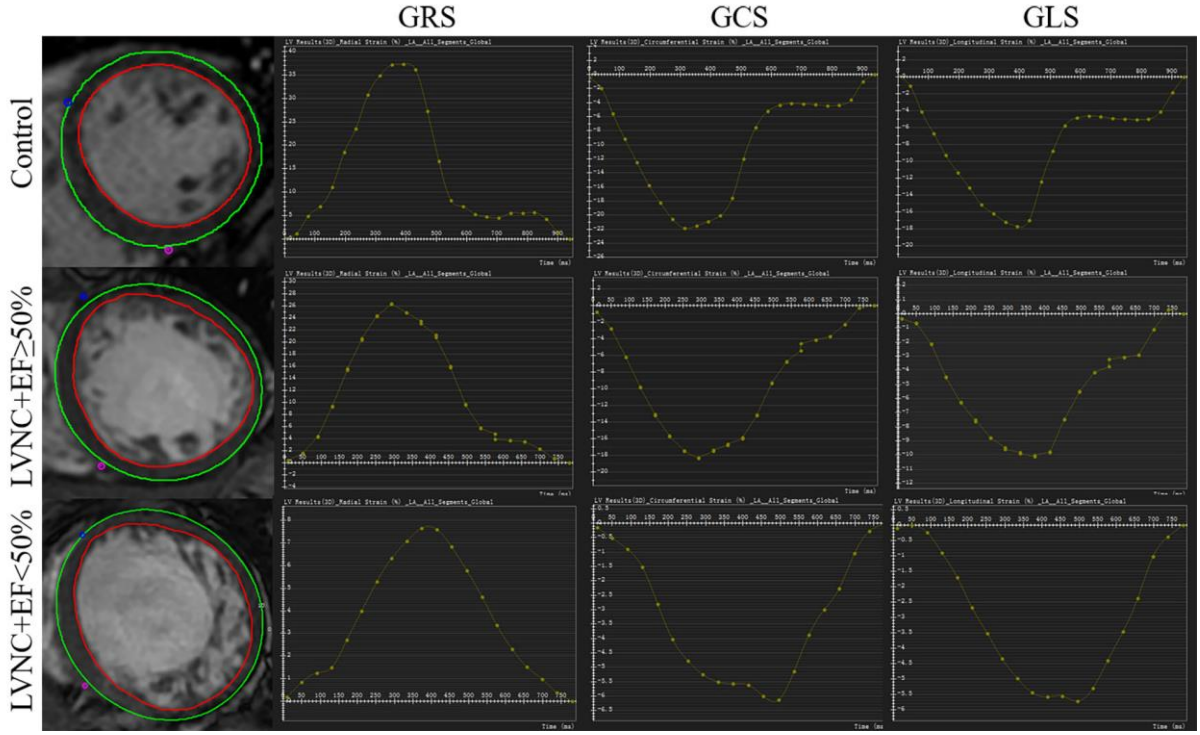
Abbreviations: C, compacted; EF, ejection fraction; LGE, late gadolinium enhancement; LVNC, left ventricular non-compaction; NC, non-compacted

Supplementary Table S2. Intra- and inter-observer reproducibility for strain mearsurements

	Intra-observer	**Inter-observer**
	ICC (95% CI)	**ICC (95% CI)**
GRS, %	0.960 (0.903, 0.984)	0.915 (0.708, 0.970)
GCS, %	0.991 (0.978, 0.997)	0.959 (0.901, 0.984)
GLS, %	0.940 (0.856, 0.976)	0.923 (0.817, 0.969)
Basal RS, %	0.921 (0.816, 0.968)	0.924 (0.818, 0.969)
Basal CS, %	0.971 (0.929, 0.988)	0.949 (0.877, 0.980)
Basal LS, %	0.789 (0.546, 0.910)	0.653 (0.308, 0.847)
Mid-RS, %	0.892 (0.751, 0.955)	0.891 (0.692, 0.959)

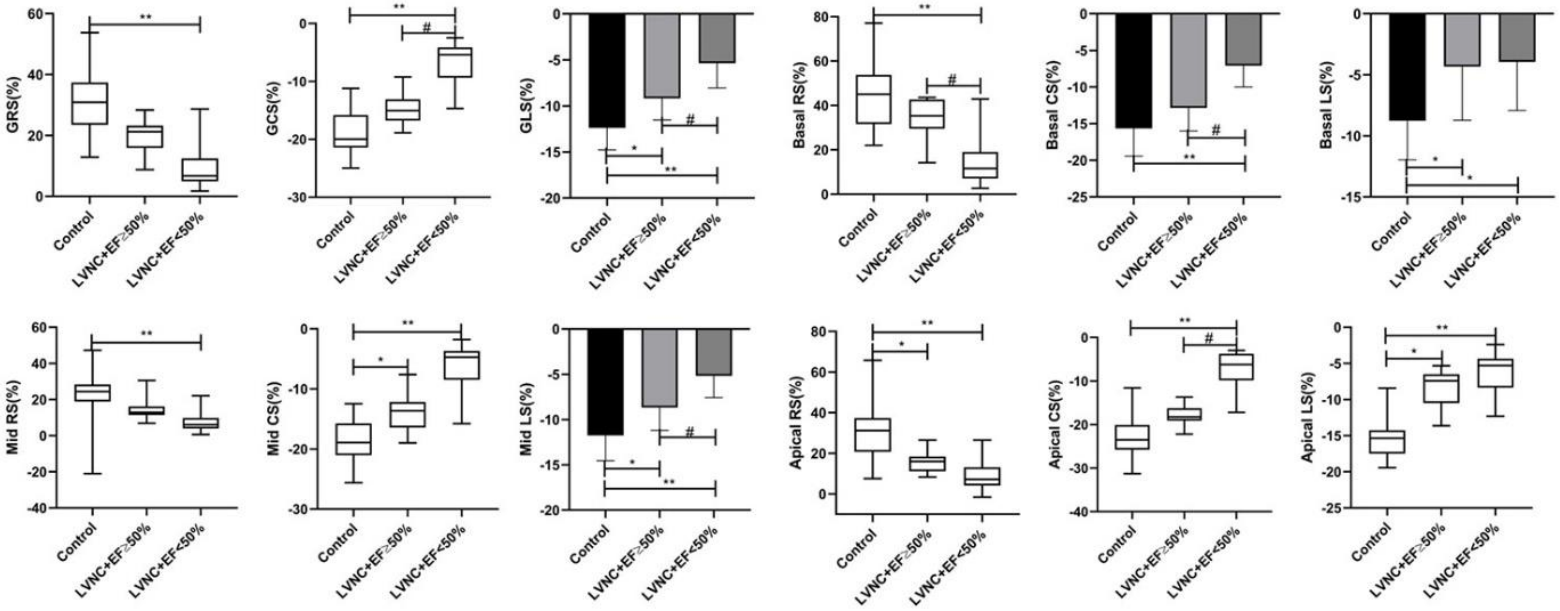
Mid-CS, %	0.990 (0.974, 0.996)	0.963 (0.909, 0.985)
Mid-LS, %	0.738 (0.457, 0.887)	0.655 (0.313, 0.847)
Apical RS, %	0.913 (0.793, 0.965)	0.631 (0.286, 0.834)
Apical CS, %	0.986 (0.966, 0.995)	0.929 (0.831, 0.971)
Apical LS, %	0.983 (0.959, 0.993)	0.933 (0.839, 0.973)

Abbreviations: G(CS), global (circumferential strain); G(LS), global (longitudinal strain); G(RS), global (radial strain); ICC, intraclass correlation coefficient



Supplementary Figure S1. The sample of GRS, GCS and GLS curves of healthy subject, patient with LVNC + EF ≥ 50% and patient with LVNC + EF < 50%. The first vertical column indicates the contours of epicardium and endocardium on LV short axis. The rest is strain curves. The abscissa indicates a certain phase of a cardiac cycle. The ordinate indicates the value of myocardial strain. The global strain is the average of peak segmental strain of the entire LV

expect for the apical segment (17th segment), which refers to the degree of myocardial deformation relative to its original length. In the three groups, GRS is 37.2%, 24.0%, 7.7%, GCS is -21.8%, -18.1%, -6.2%, GLS is -17.9%, -10.3%, -5.7%, respectively.



Supplementary Figure S2**.** Box plots (nonnormally distributed variables) and histograms (normally distributed variables) of Myocardial strain parameters in LVNC patients and control group. $*$ $P < 0.05$ ($**$ $P < 0.001$) vs control group, # $P < 0.05$ vs LVNC + EF ≥ 50% group.