

**Supplementary Table 1. Characteristics in The Subgroups**

Parameter	Moderate/Severe (n=27)	Mild (n=26)	p value
Age, years old	74 [65 - 80]	65 [53 - 72]	0.041
Male, n (%)	18 (66.7)	19 ( 73.1)	0.766
Body mass index (kg/m <sup>2</sup> )	21.6 [19.8 - 23.9]	23.3 [21.9 - 28.0]	0.067
Systolic blood pressure, mmHg	106 [97 - 125]	114 [105 - 120]	0.142
Diastolic blood pressure, mmHg	69 [60 - 74]	69 [65 - 77]	0.35
Heart rate, /min	70 [66 - 79]	68 [56 - 72]	0.06
<b>Past medical history</b>			
Ischemic cardiomyopathy, n (%)	12 (44.4)	12 ( 46.2)	1
COPD, n (%)	11 (40.7)	7 ( 26.9)	0.387
Diabetes, n (%)	17 (63.0)	14 ( 53.8)	0.583
<b>Heart Failure Severity</b>			
NYHA class $\geq$ III, n (%)	11 (40.7)	7 ( 26.9)	0.387
B-type natriuretic peptide, pg/ml	406 [254 - 535]	206 [143 - 351]	0.003
MAGGIC score	32 [28 - 35]	26 [19 - 31]	0.003
<b>Echocardiography</b>			
IVSD, mm	10 [8 - 11]	10 [9 - 11]	0.726
LV diastolic diameter, mm	63 [57 - 67]	56 [47 - 64]	0.021
LV systolic diameter, mm	56 [45 - 61]	44 [37 - 57]	0.029
Left atrial diameter, mm	47 [44 - 51]	40 [37 - 46]	0.006
LV ejection fraction, %	19 [15 - 32]	30 [19 - 43]	0.094
Mitral E velocity, cm/s	88 [69 - 110]	75 [59 - 97]	0.111
Tissue Doppler e', cm/s	3.9 [3.3 - 5.6]	5.1 [4.4 - 5.9]	0.046
E / e'	20.0 [14.3 - 32.2]	13.3 [11.5 - 18.9]	0.011
Right atrial pressure, mmHg	8 [8 - 8]	3 [3 - 8]	0.017
Systolic PAP, mmHg	36 [29 - 40]	31 [29 - 37]	0.19
GLS, % (absolute value)	6.9 [5.3 - 10.2]	11.4 [8.9 - 15.6]	0.004
MR volume, ml	25 [21 - 33]	14 [10 - 19]	<0.001
Mitral EROA, cm <sup>2</sup>	0.16 [0.13 - 0.23]	0.10 [0.07 - 0.11]	<0.001
MR / LA area ratio	0.27 [0.23 - 0.34]	0.12 [0.09 - 0.19]	<0.001
Mitral valve tenting height, mm	9.0 [8.0 - 11.7]	9.6 [7.6 - 10.7]	0.551
MR grade, n (%)			<0.001
mild	0 ( 0.0)	26 (100.0)	
moderate	19 (70.4)	0 ( 0.0)	
moderate-severe	7 (25.9)	0 ( 0.0)	
severe	1 ( 3.7)	0 ( 0.0)	

COPD, chronic obstructive pulmonary disease; NYHA, New York Heart Association; MAGGIC, Meta-Analysis Global Group In Chronic heart failure; LV, left ventricular; PAP, pulmonary artery pressure; GLS, global longitudinal strain; MR, mitral regurgitation; EROA, effective regurgitant orifice

**Supplementary Table 2. Change by Each Exercise in The Significant MR Group**

Parameter	Ergometer-ESE	Handgrip-ESE	p value (ergometer- vs. handgrip-ESE)
Δ Heart rate, /min	34 [21 - 47] **	10 [6 - 15] **	<0.001
Δ Systolic blood pressure, mmHg	29 [16 - 43] **	26 [7 - 39] **	0.06
Δ LV ejection fraction, %	6 [3 - 8] **	2 [1 - 4] **	<0.001
Δ Stroke volume, ml	10 [6 - 22] **	-1 [-8 - 3]	<0.001
Δ E / e'	1.5 [-1.2 - 5.3]	2.1 [-1.0 - 3.4]	0.46
Δ Right atrial pressure, mmHg	0 [0 - 6] *	0 [0 - 0]	0.006
Δ Systolic PAP, mmHg	24 [17 - 34] **	13 [10 - 19] **	0.001
Δ GLS, % (absolute value)	1.1 [0.7 - 2.2] **	0.0 [-1.1 - 0.8]	<0.001
Δ MR volume, ml	10 [4 - 16] **	14 [9 - 16] **	0.08
Δ LA / MR area	0.09 [0.02 - 0.12] *	0.07 [0.03 - 0.12] **	0.39
Δ MR grade	1 [0 - 1] *	1 [1 - 2] **	<0.001

Abbreviations are the same as in the table 1. \* p < 0.05 vs. baseline; \*\* p < 0.001 vs. baseline. Paired t-tests were used for comparison except for MR grade which was compared using Wilcoxon signed rank test.

**Supplementary Table 3. Cox Proportional Hazard Models for Adverse Events in The Significant MR Group**

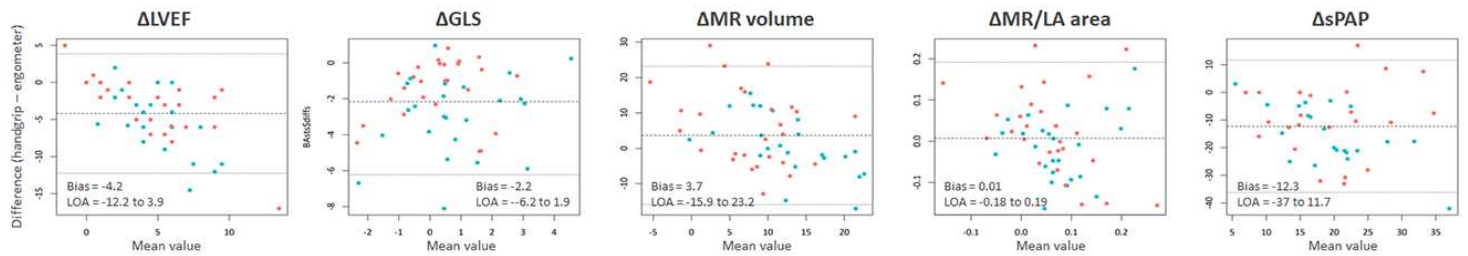
Exercise type	Parameter	Univariable	
		HR [95% CI]	p value
Ergometer-ESE	High Δ LVEF	0.58 [0.22 - 1.51]	0.26
	<b>High Δ GLS</b>	<b>0.32 [0.11 - 0.94]</b>	<b>0.037</b>
	High Δ MR volume	0.76 [0.30 - 1.94]	0.57
	High Δ sPAP	0.59 [0.21 - 1.67]	0.32
Handgrip-ESE	High Δ LVEF	1.21 [0.47 - 3.12]	0.70
	High Δ GLS	0.89 [0.35 - 2.27]	0.81
	High Δ MR volume	0.79 [0.31 - 2.00]	0.62
	High Δ sPAP	1.20 [0.44 - 3.32]	0.72

Abbreviations are the same as in previous tables

## Supplementary Figures

**Supplementary Figure 1. Bland Altman Plots**

Plots show that there is no significant systemic errors between the handgrip and ergometer

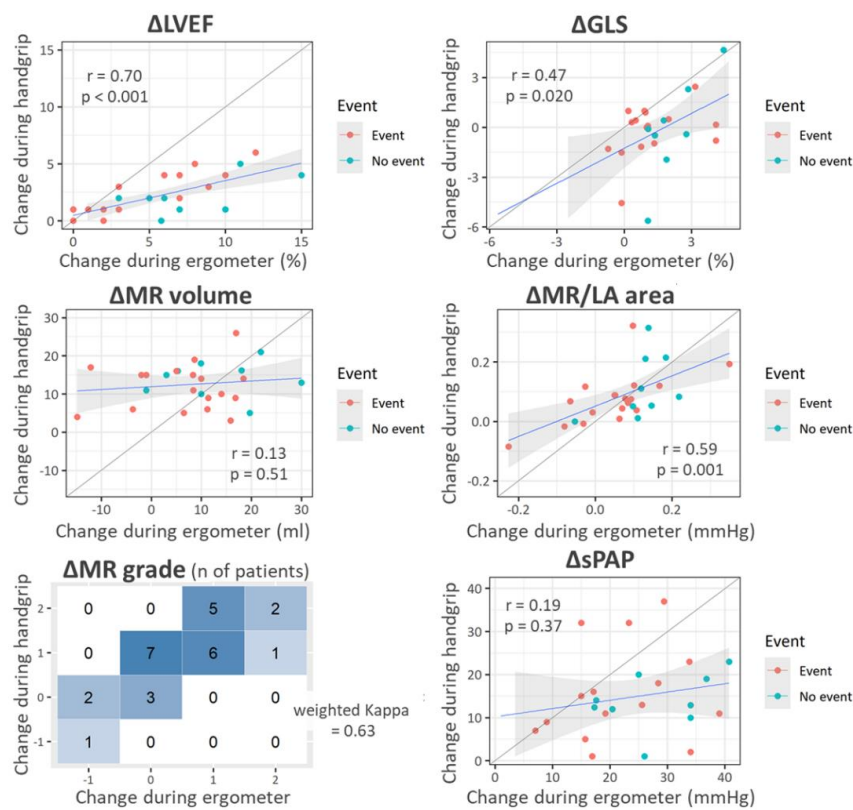


ESE.

## Supplementary Figure 2. Correlation between the changes during handgrip- and ergometer-ESE in the subgroup

Similar to the entire cohort, changes in echocardiographic parameters were weak to moderate ( $r = 0.13$  to  $0.59$ ), except for LVEF ( $r = 0.70$ ) in the subgroup with patients with moderate or greater MR.

ESE, exercise stress echocardiography; GLS, global longitudinal strain; LA, left atrium; LVEF, left ventricular ejection fraction; MR, mitral regurgitation; PAP, systolic pulmonary artery pressure



### Supplementary Figure 3. Association of the changes during exercise with clinical outcomes in the subgroup

The prognostic results in the subgroup was the same as in the entire cohort; only the change in GLS during ergometer exercise was prognostic.

ESE, exercise stress echocardiography; GLS, global longitudinal strain; LVEF, left ventricular ejection fraction; MR, mitral regurgitation; PAP, systolic pulmonary artery pressure

