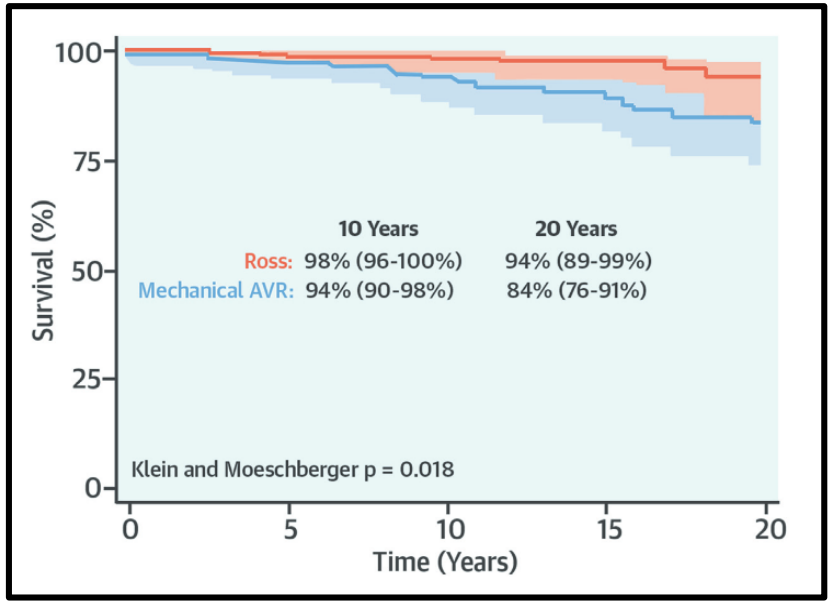
Left ventricle strain evaluation in patients undergoing the Ross procedure versus mechanical aortic valve replacement

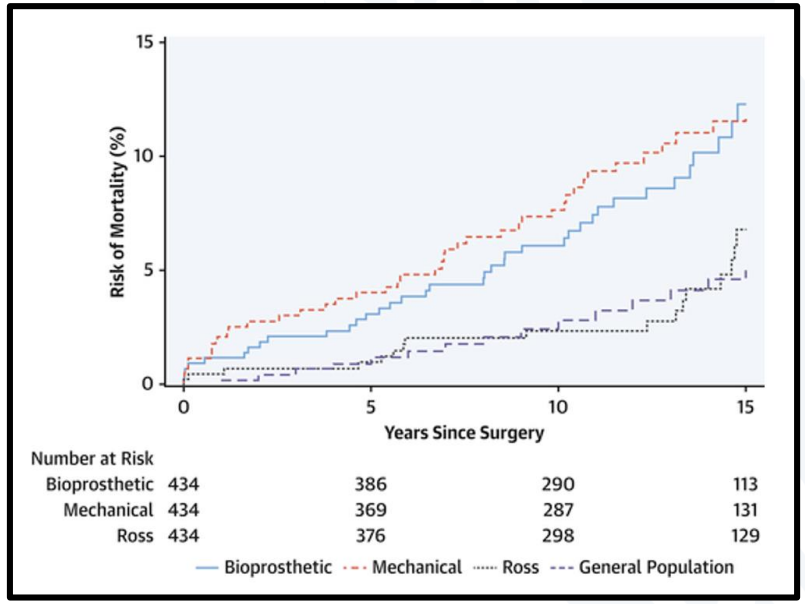
Background

Several studies have demonstrated better survival after aortic valve replacement (AVR) with a pulmonary autograft (Ross procedure) compared with a mechanical prosthesis.

Buratto et al. *JACC* 2018



El-Hamamsy et al. *JACC* 2022



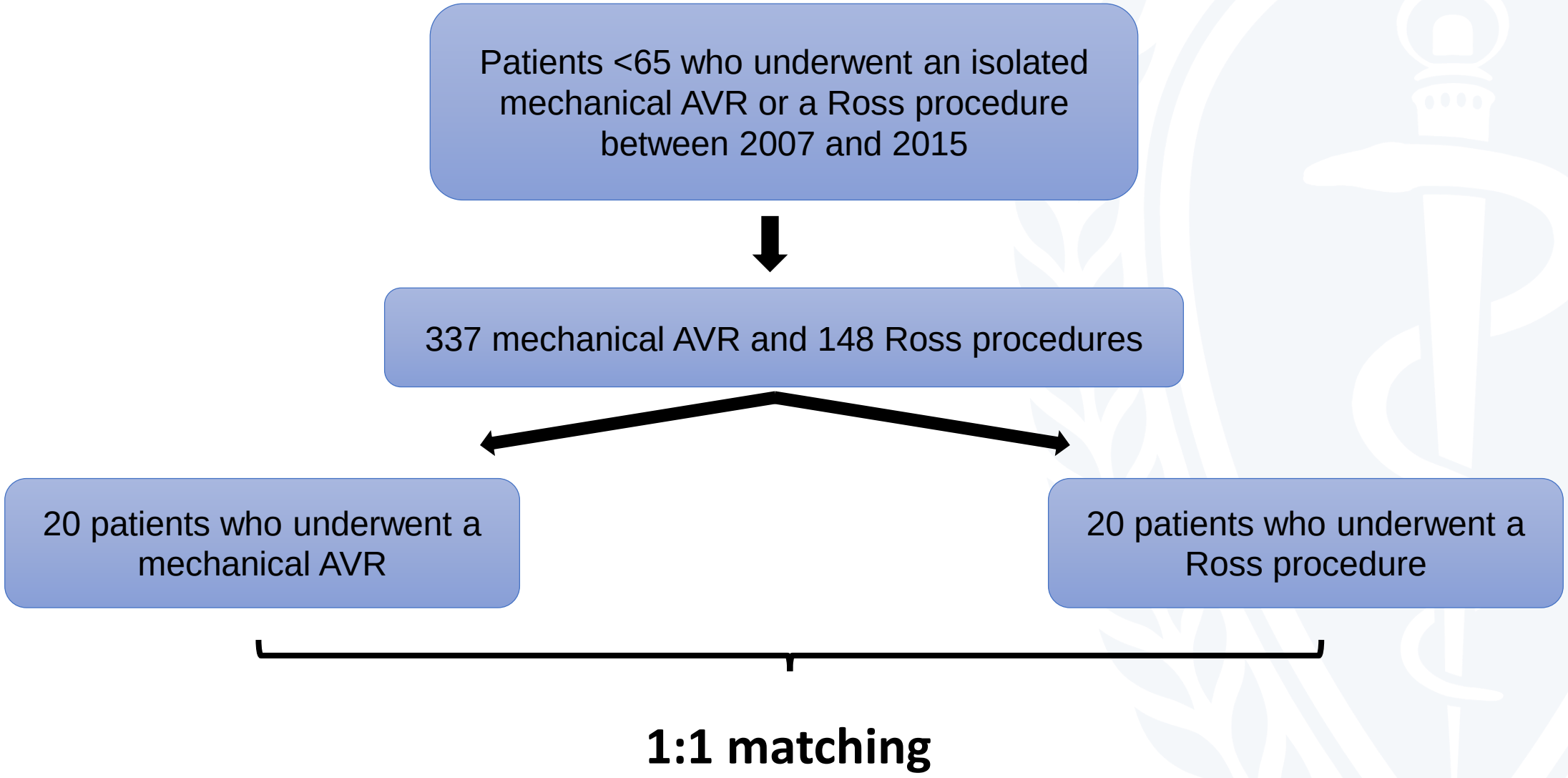
Background

The favorable hemodynamics associated with the pulmonary autograft may lead to better overall "left ventricular health".

Objective

To compare left ventricle (LV) strain during peak exercise in patients who underwent a Ross procedure versus a mechanical AVR

Methods


Patients <65 who underwent an isolated mechanical AVR or a Ross procedure between 2007 and 2015
337 mechanical AVR and 148 Ross procedures
20 patients who underwent a mechanical AVR
20 patients who underwent a Ross procedure
1:1 matching

Methods

All patients underwent cardiac magnetic resonance at rest and during pexercise to measure LV strain.

Patient characteristics

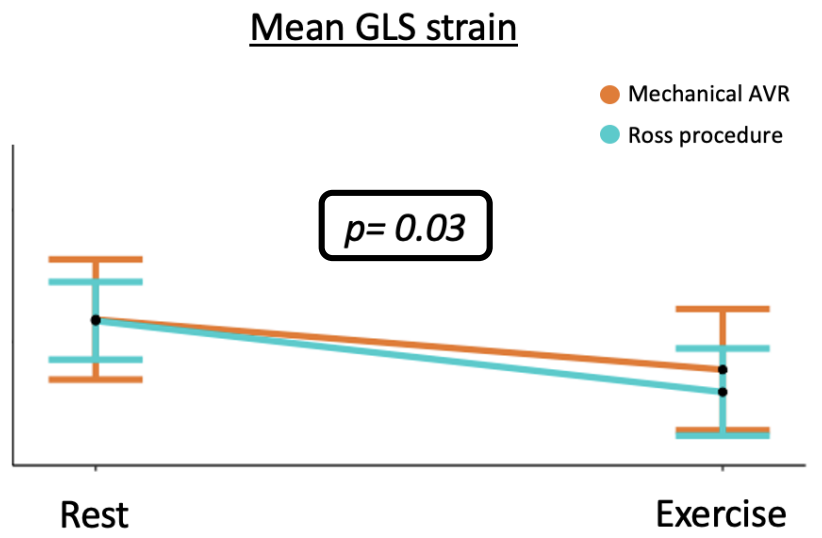
Characteristics	Ross procedure (n=20 patients)	Mechanical AVR (n=20 patients)	p value
Age	54±10	52±11	0.60
Sex (F)	3 (15%)	2 (10%)	0.99
BMI (kg/m^2)	28±5	29±3	0.20
BSA (m^2)	2.0±0.2	2.1±0.2	0.37
Hypertension	7 (35%)	9 (45%)	0.73
Dyslipidemia	7 (35%)	8 (40%)	0.69
Diabetes	2 (10%)	1 (5%)	0.99
Medication			
ACE inhibitors	3 (15%)	1 (5%)	0.29
ARB	4 (20%)	2 (10%)	0.38
Beta-blockers	6 (30%)	8 (40%)	0.44
CCB	3 (15%)	2 (10%)	0.63
Prosthesis size (mm)	NA	25±2	NA
Time since surgery (years)	4±2	4±2	0.50

Results

Baseline parameters	Ross procedure (n=20 patients)	Mechanical AVR (n=20 patients)	p value
Heart rate (bpm)	68±13	67±9	0.98
LVEF (%)	57±6	59±8	0.22
Indexed LVESV (mL/m^2)	35±11	34±11	0.38
Indexed LVEDV (mL/m^2)	80±22	81±14	0.43
Global longitudinal strain	-14±1	-14±2	0.75
Circumferential strain	-17±3	-17±3	0.98
Radial short-axis (SAX) strain	30±7	30±8	0.74
Radial long-axis (LAX) strain	23±4	23±6	0.66

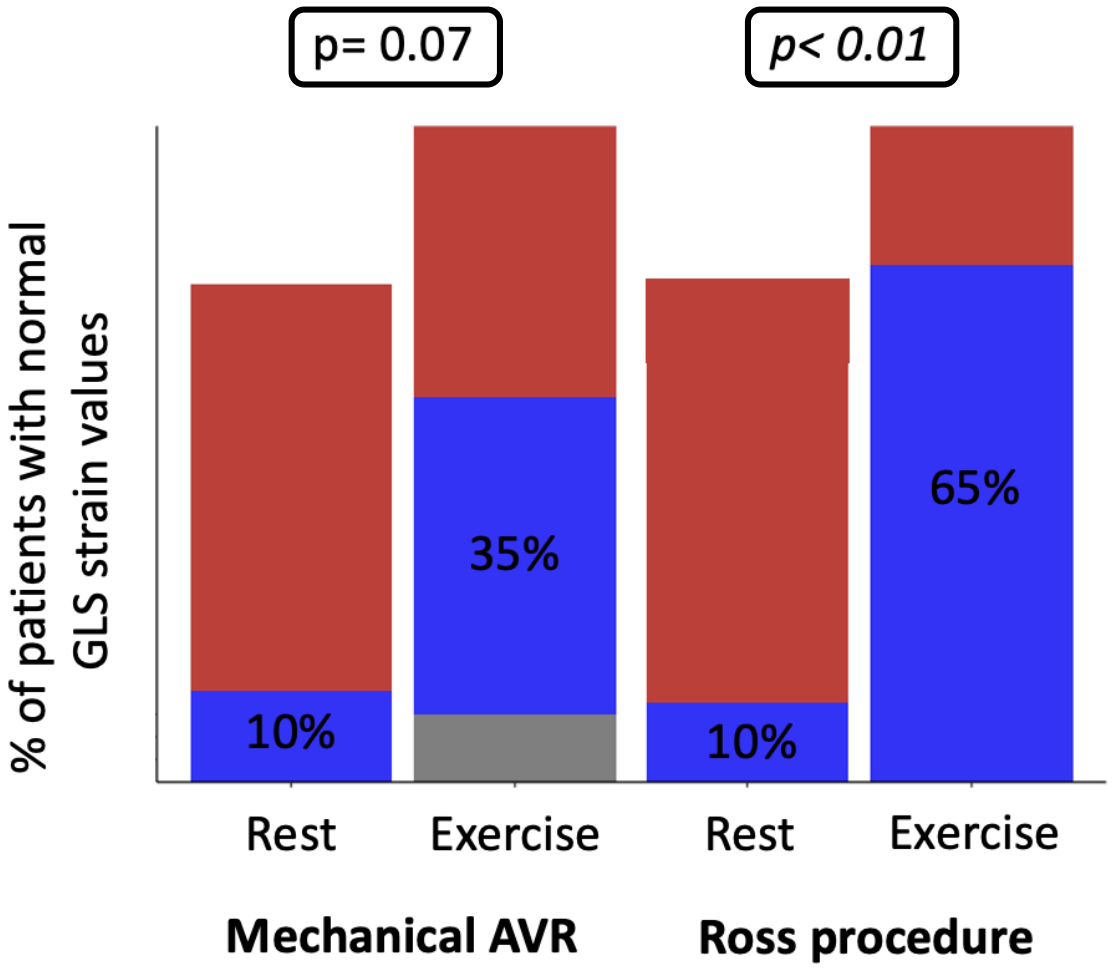
Results

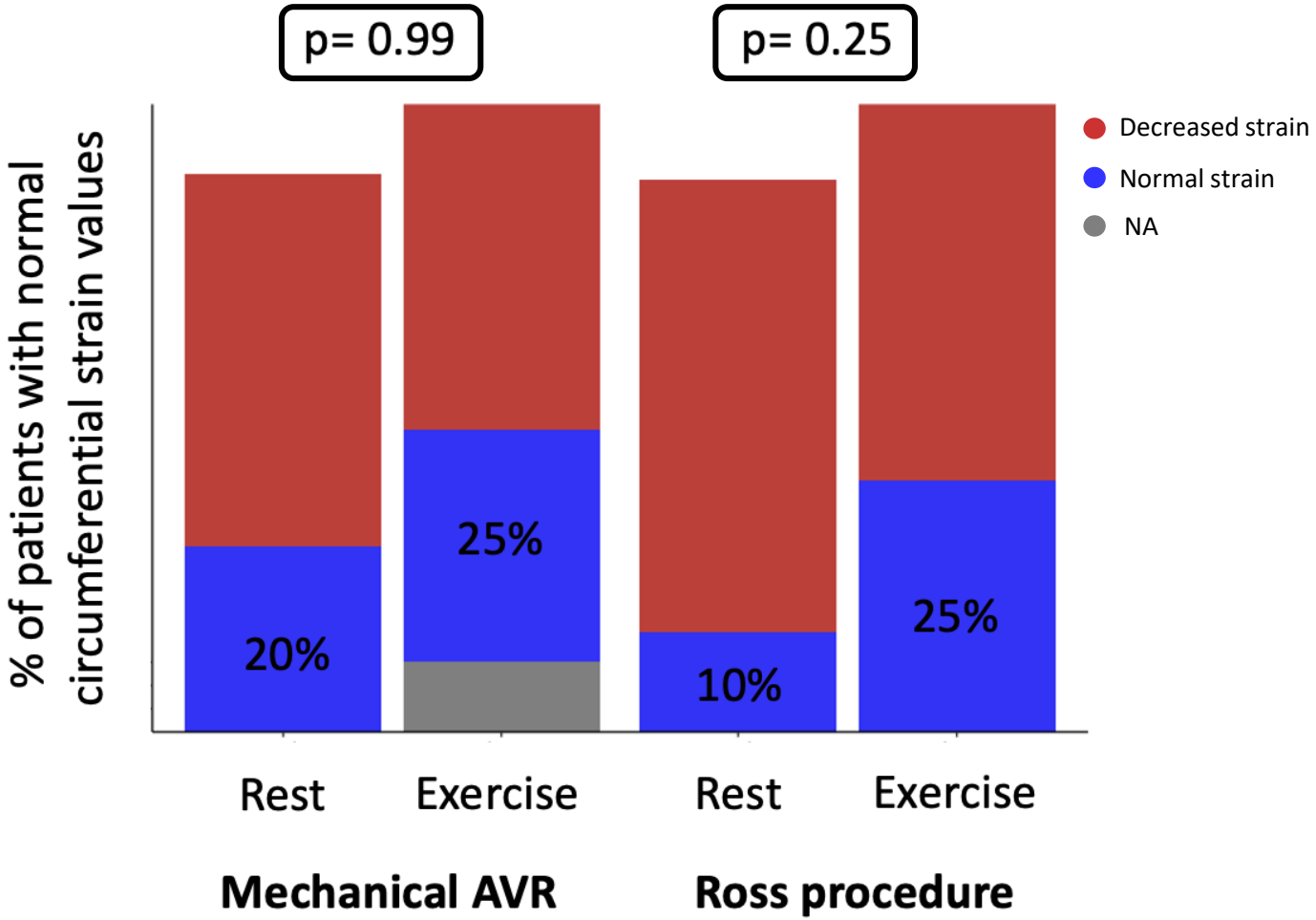
Strain during peak exercise	Ross procedure (n=20 patients)	Mechanical AVR (n=20 patients)	p value
Global longitudinal strain (GLS)	-17±2	-16±2	0.11
Circumferential strain	-18±2	-18±3	0.99
Radial short-axis (SAX) strain	34±7	33±10	0.67
Radial long-axis (LAX) strain	31±6	29±7	0.25



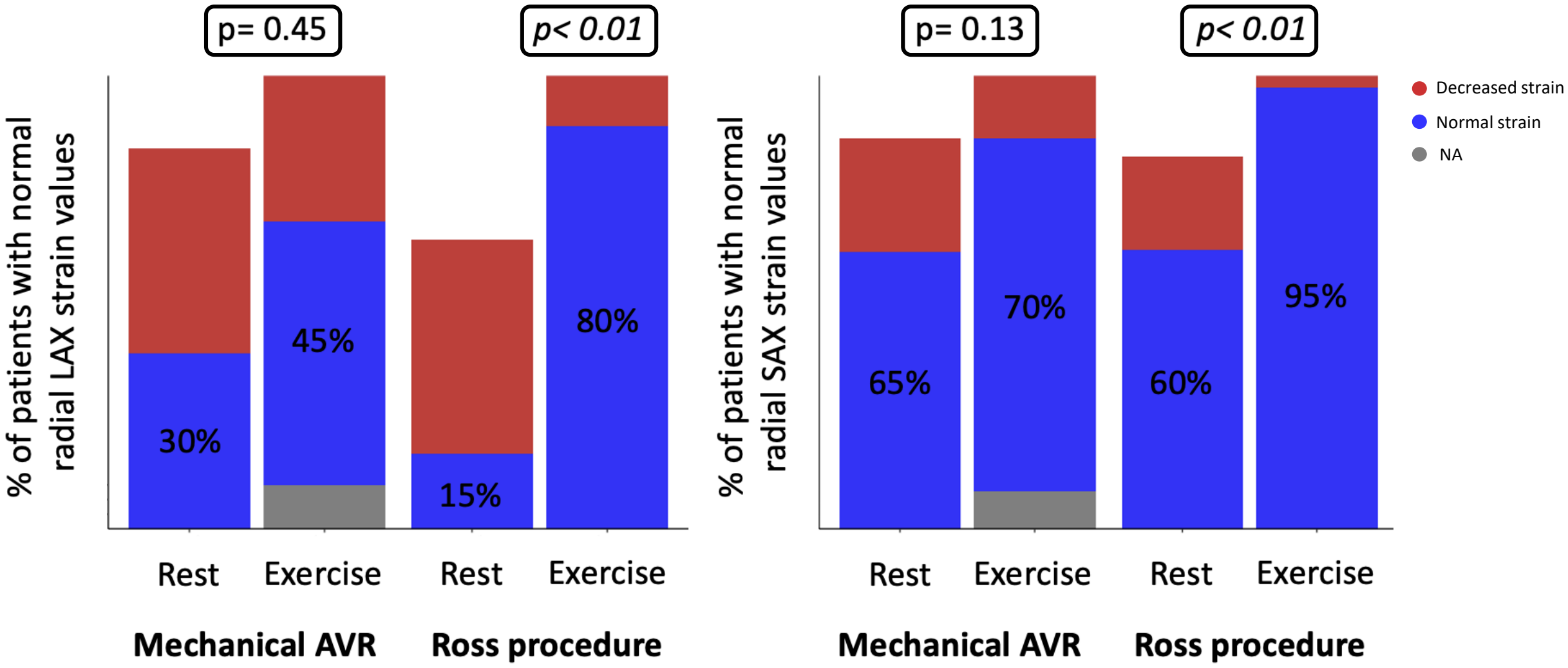
Compared with mechanical AVR, the Ross procedure resulted in greater GLS improvement during exercise

Results


p= 0.07
p< 0.01
% of patients with normal GLS strain values
10%
35%
10%
65%
Rest
Exercise
Rest
Exercise
Mechanical AVR
Ross procedure


p= 0.99
p= 0.25
% of patients with normal circumferential strain values
20%
25%
10%
25%
Rest
Exercise
Rest
Exercise
Mechanical AVR
Ross procedure
Decreased strain
Normal strain
NA

Results


p= 0.45
p< 0.01
p= 0.13
p< 0.01
% of patients with normal radial LAX strain values
% of patients with normal radial SAX strain values
30%
45%
15%
80%
65%
70%
60%
95%
Rest
Exercise
Rest
Exercise
Rest
Exercise
Rest
Exercise
Mechanical AVR
Ross procedure
Mechanical AVR
Ross procedure
Decreased strain
Normal strain
NA

Results

Compared with mechanical AVR, the Ross procedure results in a greater proportion of patients reaching normal global longitudinal, radial LAX and radial SAX strain values during peak exercise

Conclusions

- The Ross procedure results in **greater GLS improvements** during peak exercise when compared with mechanical AVR
- A larger proportion of patients have **normal strain values** during peak exercise after a Ross procedure.
- These findings provide a **physiological explanation** for the difference in long-term outcomes between these options.