

# WHAT ARE THE LIMITS OF VALVE SPARING AORTIC ROOT REPLACEMENT FOR AORTIC INSUFFICIENCY?

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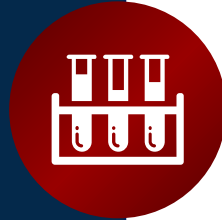
# MISSION

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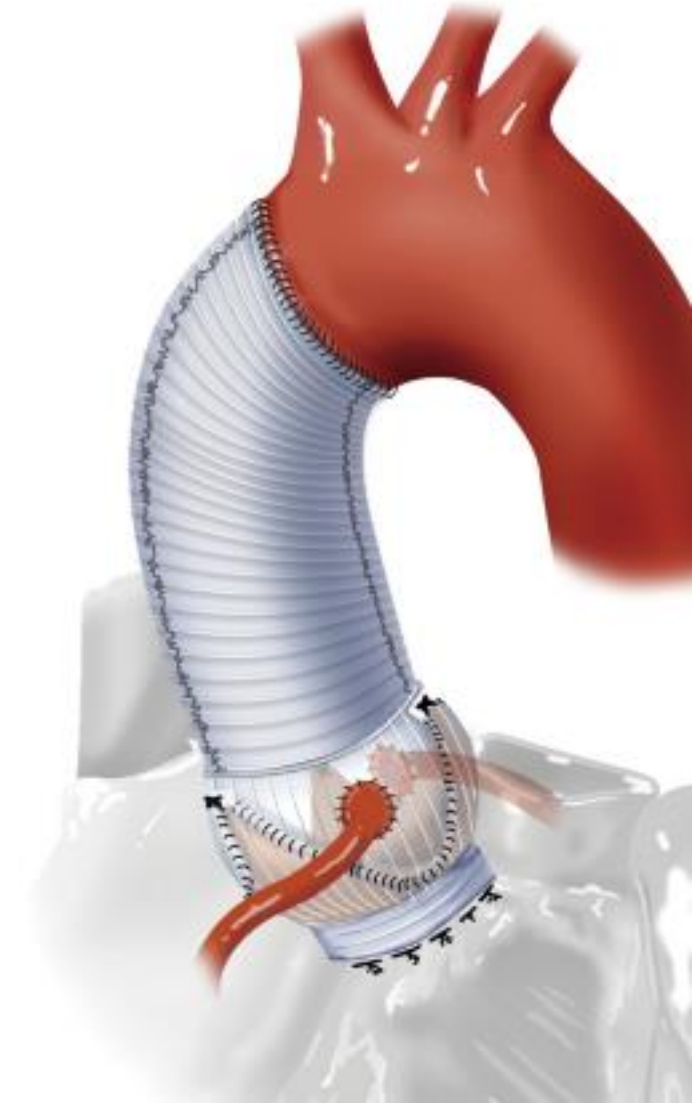
Educate future generations of clinical leaders in medicine, imaging, genetics, surgery nursing and science to innovate and care for Aortic patients.

# BACKGROUND

- Chronic aortic insufficiency (AI) leads to dilation of the left ventricle (LV) and LV hypertrophy from progressive volume and pressure overload, ultimately leading to heart failure
- The aim of surgery for patients with AI is to prevent further LV decompensation and restore LV function/size overtime
- Surgery is indicated for patients with severe AI and:
  - Symptoms of heart failure (1B recommendation)
  - EF <55% (1B recommendation)
  - LV internal diameter in end systole (LVIDs) > 50mm (2A recommendation)
  - LV internal diameter in end diastole (LVIDd) > 65mm (2B recommendation) <sup>1</sup>
- The timing of surgery for AI, particularly for younger patients, is controversial and recent data suggests that many patients who meet guideline criteria and undergo aortic valve replacement may not have LV normalization <sup>2,3</sup>

# BACKGROUND

- Valve sparing aortic root replacement is one surgical option for patients with AI<sup>4</sup>
- Tends to be reserved for younger patients with good ventricular function given longer cross clamp time and potential need for re-cross clamp compared to conventional aortic valve/root replacement
- The optimal timing of valve sparing aortic root replacement for severe AI is unknown
- **Objective of study: To determine which factors predict failed left ventricular remodeling after valve sparing aortic root replacement for severe aortic regurgitation**



# METHODS

- A prospectively maintained institutional database was queried to identify 486 patients that underwent elective valve sparing aortic root replacement between 2004 and 2022
- Patient's whose primary indication for surgery was severe AI were identified and compared to patients whose primary indication for surgery was aortic root aneurysm
- Operative and post-operative data, including echocardiographic variables at 1, 3, and 5 years, were extracted from the medical record system
- Echocardiographic variables of specific interest:
  - LVEF
  - LV internal diameter in end diastole
  - LV internal diameter in end systole
  - AI severity
- Risk factors for persistent abnormal left ventricular function and diameters on post-operative echocardiography were identified with odds ratios

# RESULTS

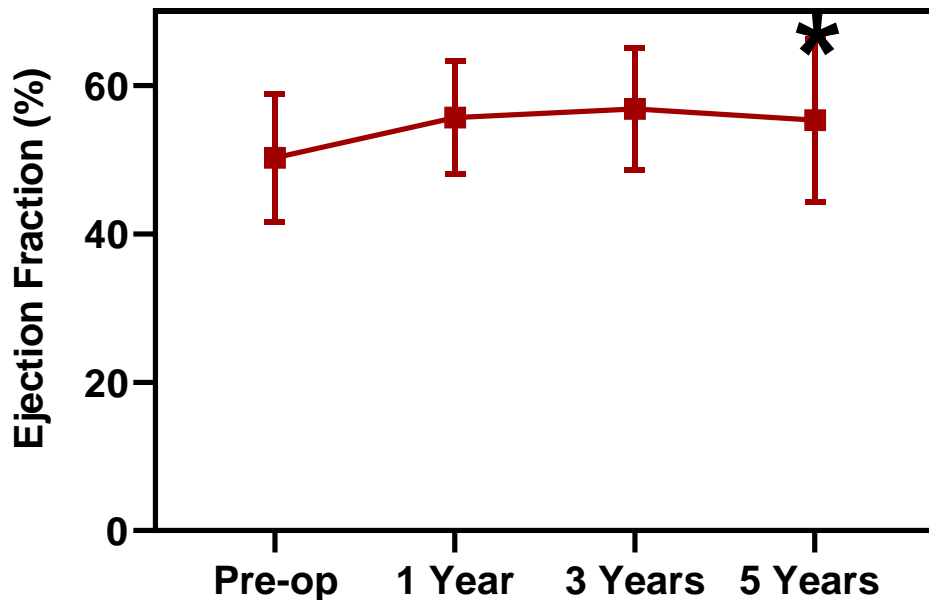
- There were 114 patients who underwent surgery for severe AI compared to 372 patients who did not have severe AI pre-operatively
- Patients with severe AI were more likely to have:
  - Lower pre-operative ejection fraction
  - Symptoms of heart failure
  - Larger LVIDd
  - Larger LVIDs

	Severe AI (n=114)	Non-severe AI (n=372)	P Value
Age (years)	46.9 ± 13.3	48.5 ± 14.1	0.28
Male Sex (n, %)	101 (89%)	300 (81%)	0.05
Bicuspid Aortic Valve (n, %)	52 (46%)	85 (23%)	<0.01
Class 2, 3 or 4 Heart Failure (n, %)	39 (34%)	69 (19%)	0.02
Pre-operative Ejection Fraction (%)	51 ± 9	58 ± 7	<0.01
Left ventricular end diastolic diameter (cm)	6.4 ± 0.8	5.3 ± 0.6	<0.01
Left ventricular end systolic diameter (cm)	4.1 ± 0.8	3.4 ± 0.6	<0.01
Cardiopulmonary bypass time (min)	265 ± 53	259 ± 49	0.28
Cross clamp time (min)	215 ± 39	214 ± 42	0.7
Length of stay (days)	6.7 ± 2.8	6.9 ± 3.8	0.65

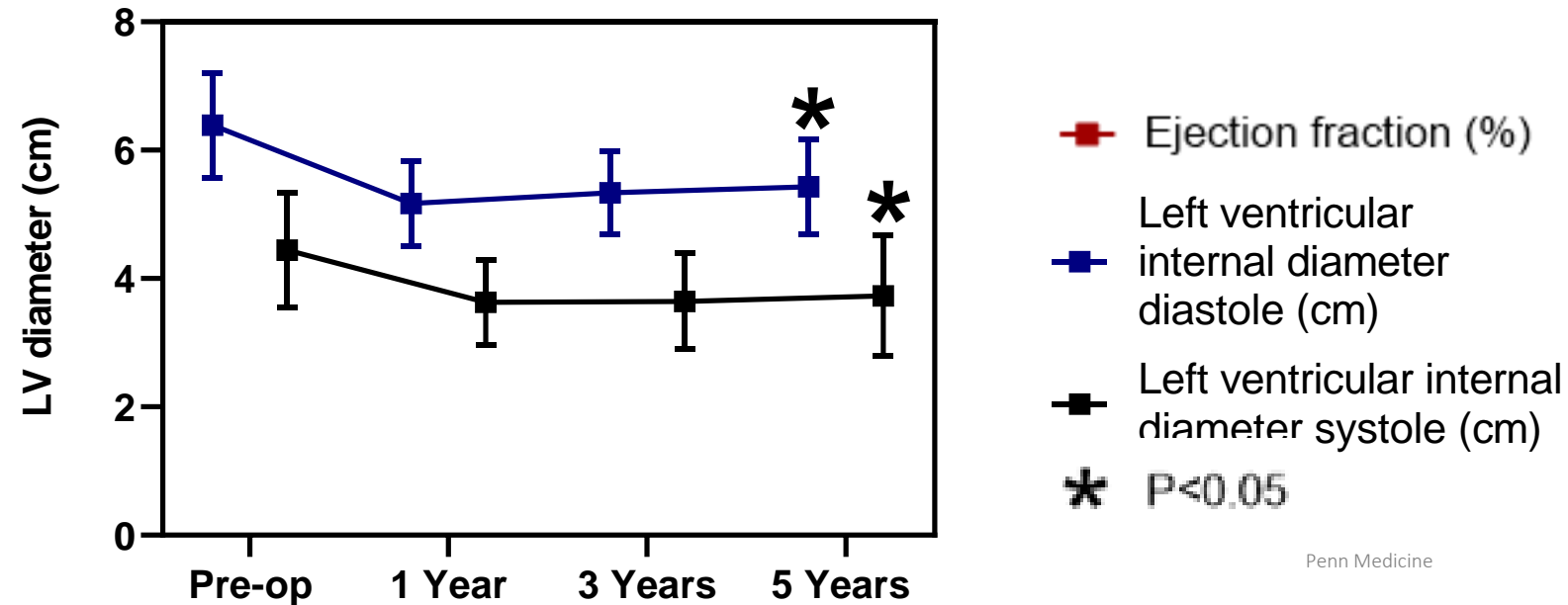
# RESULTS

- There were 101 patients with severe AI who underwent valve sparing aortic root replacement in whom long-term echocardiography was available
- When the entire cohort of patients with severe AI was analyzed, there was:
  - Significant improvement in left ventricular ejection fraction (Figure A)
  - Significant reduction in LVIDd (Figure B)
  - Significant reduction in LVIDs (Figure B)

**A.**



**B.**



# RESULTS

- There were 44 patients (44% of cohort) in whom LV function and diameters remained abnormal (EF < 55%, LVIDd > 6.5 cm, LVIDs > 5.0 cm)
- There were 57 patients in whom left ventricular function and size parameters returned to normal parameters (EF > 55%, LVIDd < 6.5 cm, LVIDs < 5.0 cm)

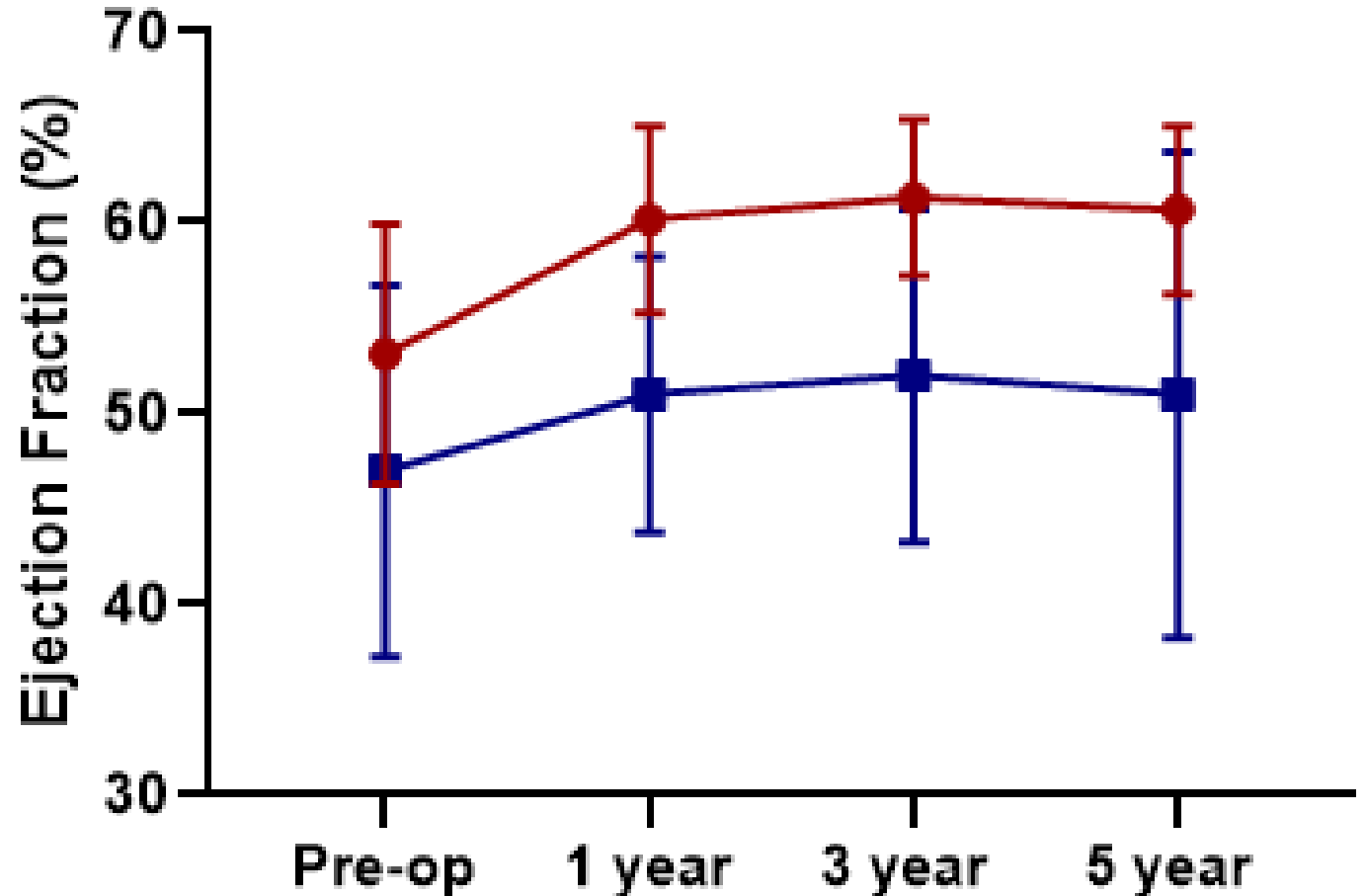


Figure shows the EF over time for patients in whom LV function and diameters remained abnormal (blue line) compared to those patients in whom LV size and function normalized after surgery (red line). EF < 55% pre-operatively was a significant risk factor for persistent LV dysfunction post-operatively



# RESULTS

- Risk factors identified for failed left ventricular remodeling included pre-operative:
  - Heart failure symptoms (OR 2.3, 95% CI 1.0-5.2,  $p=0.05$ )
  - Ejection fraction  $<55\%$  (OR 0.37, 95% CI 0.16-0.01,  $p=0.02$ )
  - LVIDd  $> 6$  cm (OR 5.5, 95% CI 2.0-15,  $p<0.01$ )
  - LVIDs  $> 4.5$  cm (OR 3.1, 95% CI 1.3-7.2,  $p=0.01$ )

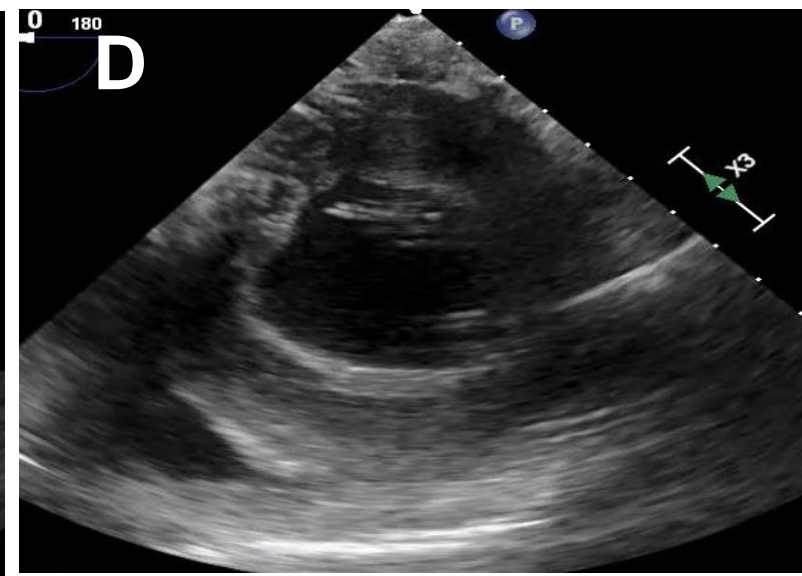
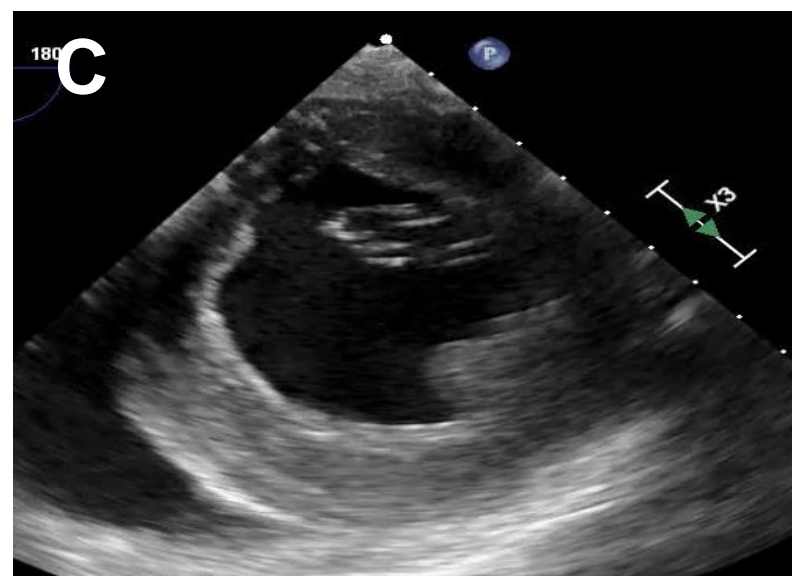
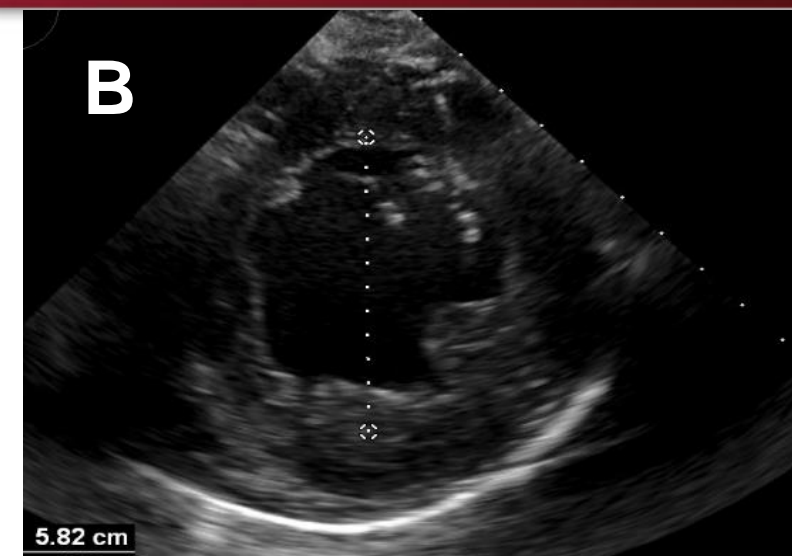
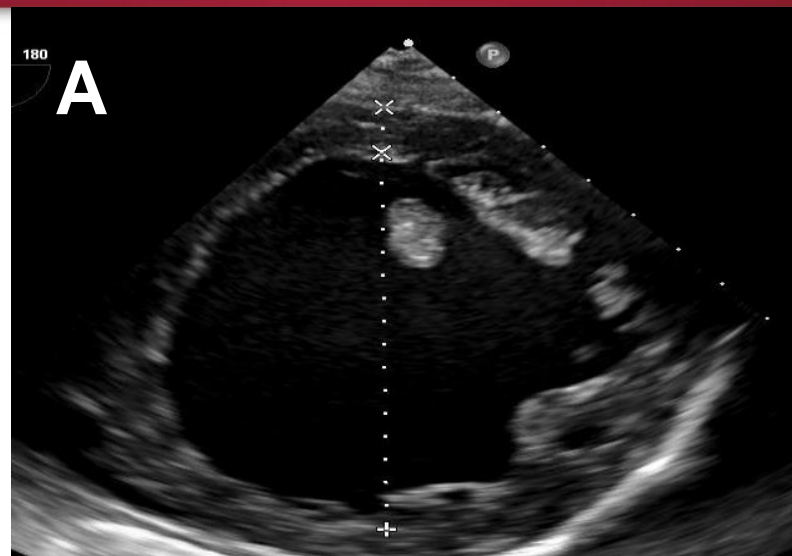


Figure shows a patient with severe AI and dilated LV in diastole (Figure A) and systole (Figure B). 3 years after valve sparing root replacement, LV diameter has improved but remains abnormal in diastole (Figure C) and systole (Figure D) despite intact valve repair

# CONCLUSIONS

- Valve sparing aortic root replacement leads to significant improvement in left ventricular function and diameters from baseline among most patients with severe aortic regurgitation
- There is a subset of patients in whom left ventricular function and diameters do not return to normal parameters after surgery
- Pre-operative heart failure, EF <55%, LVIDs > 6cm and LVIDs >4.5cm are risk factors for failed left ventricular remodeling and suggest valve sparing aortic root replacement should be considered earlier than guidelines suggest in this subset of patients
- Future work is needed with cardiac MRI and echocardiographic strain analysis to determine the optimal timing for valve sparing aortic root replacement in patients with severe AI

# REFERENCES

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