Early and long-term outcomes of conventional and valve-sparing aortic root replacement
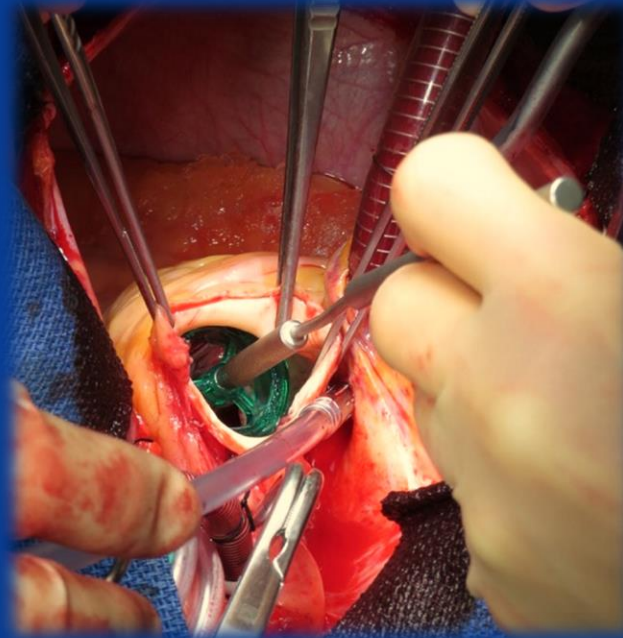
Krishna Mani, Robert Morgan, Mark Edsell, Maria Teresa Tome Esteban, Frank Schroeder, Marjan Jahangiri

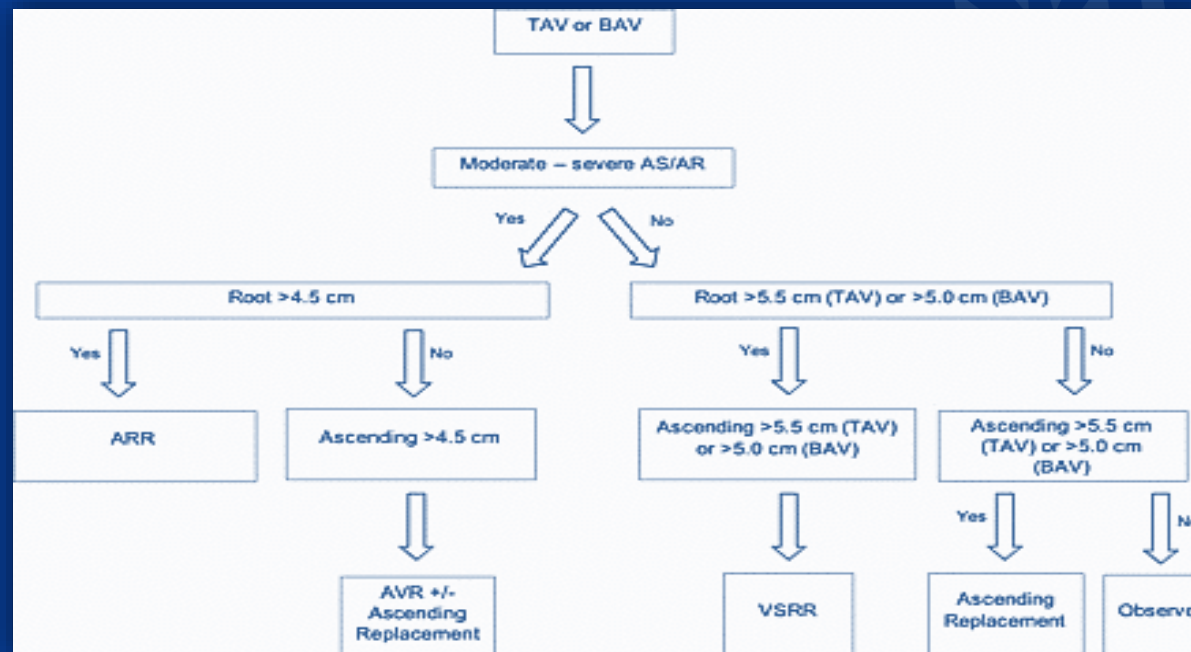St. George's Hospital, London, United Kingdom

St George's
University of London

Objective

- We aim to determine the early and long-term outcomes of conventional aortic root (ARR) and valve sparing root replacement (VSRR).

Methods

- **Prospective data of 641 consecutive patients undergoing elective and urgent aortic root surgery between 2006 and 2022 was collected.**

- **All patients underwent pre-operative echocardiogram and CT scanning and follow-up at 6 months, 1 year and then annually.**

- **Younger patients with syndromes underwent genetic analysis.**

- **Patients with aortic diameters of >4.5 cm were referred for surgery.**

AR, aortic regurgitation; ARR, aortic root replacement; AS, aortic stenosis; AVR, aortic valve replacement; BAV, bicuspid aortic valve; TAV, tricuspid aortic valve; VSRR, valve-sparing root replacement.

Methods

- **All valve sparing root replacements were performed using the remodeling technique.**

- **Primary outcomes were operative mortality and incidence of postoperative complications. Secondary outcomes were long-term survival and requirement for re-intervention.**

- **Median follow-up was 7.8 years (range, 0.5–14.5).**
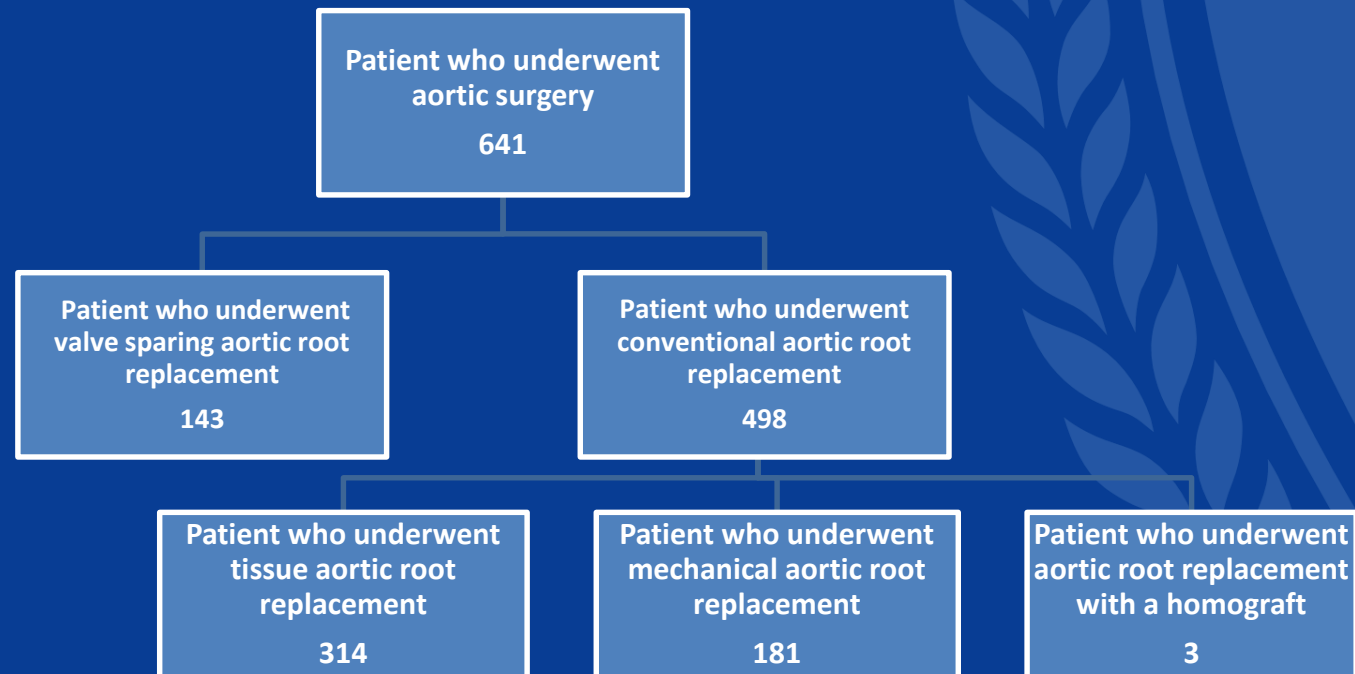
Results - Baseline Characteristics

	All Cases N=641(%)	ARR N=498 (%)	VSRR N=143 (%)
Baseline Characteristics			
Age, years	60 (18-84)	55 (18-84)	51 (18-68)
Male sex	507 (79)	384 (77)	101(71)
EuroScore 2	3.6 +/- 4.0	3.8 +/- 4.3	3 +/- 2
Smoking	220 (34)	184 (37)	36 (25)
Hypertension	311 (48)	294 (59)	17 (12)
Diabetes mellitus	54 (8)	48 (10)	6 (4)
Prior myocardial infarction	30 (5)	30 (6)	0
Prior stroke/transient ischemic attack	26 (4)	22 (4.4)	4 (3)
Creatinine >1.5mg/dl	56 (9)	50 (10)	7(3)
Connective tissue diseases	143 (22)	52 (10)	91 (63)

Data are reported as median (IQR:25%-75%) for continuous variables and number (%) for categorical variables

Results – Preoperative Imaging characteristics

	All Cases N=641(%)	ARR N=498 (%)	VSRR N=143 (%)
Left Ventricular function ejection fraction			
>50%	385 (60)	270 (54)	115 (80)
30-50%	188 (29)	162 (33)	26 (18)
<30%	68 (11)	66 (13)	2 (1)
Valve morphology			
Tricuspid	428 (67)	287 (58)	141 (99)
Bicuspid	213 (32)	211 (42)	2 (1)
Fusion patterns			
Left - right fusion	155	153	2
Left - none fusion	21	21	0
Right-none fusion	20	20	0
Other	17	17	0
Aortic Valve Pathology			
Stenosis	438 (68)	438 (88)	0
Regurgitation	125 (19)	59 (12)	66 (46)
Normal	78 (12)	0	78 (55)
Mixed disease	164 (25)	164 (32)	0
Preoperative Aortic parameters			
Aortic Annulus	25 (17-60)	25 (17-60)	25 (23-31)
Ascending Aorta	47 (23-92)	-	-
Aortic Arch	30 (16-49)	32 (16-40)	24 (21-36)
Descending Aorta	28 (13-80)	28 (13-80)	22 (18-42)

Data are reported as median (IQR:25%-75%) for continuous variables and number (%) for categorical variables
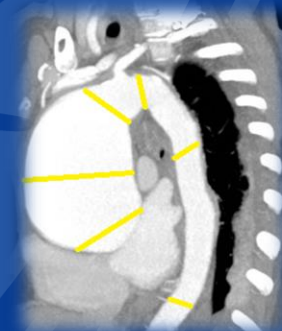
Results – Operative Details

	N=641 (%)
Classification of intervention	
Elective	520 (81)
Urgent	121 (19)
Redo procedure	18 (2.8)
Procedure type	
ARR only	498 (78)
Tissue valve	314 (63)
Mechanical	181 (36)
Homograft	3 (0.6)
ARR + concomitant procedure	84 (17)
ARR + coronary artery bypass graft surgery	43
ARR + radiofrequency ablation	15
ARR + mitral valve repair	10
ARR + mitral valve replacement	3
ARR + other	2
ARR + arch replacement	9
ARR + arch replacement + elephant trunk	1
ARR + PFO Closure	1
VSRR	143 (22)
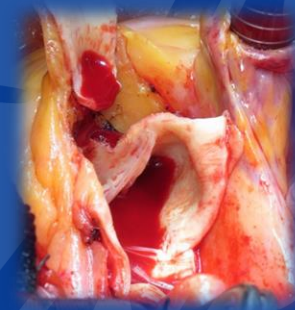
SD, Standard Deviation; ARR, Aortic Root Replacement; VSRR, Valve-Sparing Root Replacement; PFO, Patent foramen ovale. Data are reported as median (IQR:25%-75%) for continuous variables and number (%) for categorical variables.

Results – Operative Outcomes and Complications

	All Cases N=641(%)	ARR N=498 (%)	VSRR N=143 (%)
Operative details			
Cross-clamp time, min	88 (54-208)	71 (67-208)	115 (51-169)
Cardiopulmonary bypass time, min	107 (75-296)	82 (75-296)	137 (78-198)
Outcome			
Hospital mortality	11 (1.7)	10 (2)	1 (0.7)
Transient ischemic attack/stroke	7 (1.1)	7 (1.4)	0
Re-sternotomy for bleeding	13 (2)	12 (2.4)	1 (0.7)
Haemofiltration	14 (2.2)	14 (2.8)	0
Intensive care unit stay, days	1.7 (1-17)	1.5 (1-170)	1 (1-3)
Hospital stay, day	6.9 (4-48)	7 (4-48)	6 (5-7)

Data are reported as median (IQR:25%-75%) for continuous variables and number (%) for categorical variables.

Results – Complications During Follow-up In All Patients

	All Cases N=641	ARR N=498 (%)	VSRR N=143 (%)
Follow-up	7.8 years (0.5-14.5 years)		
Post op DC cardioversion within one year	9 (1.4)	6 (1.2)	3 (2.2)
Stroke	4 (0.7)	4 (0.1)	0
Pacemaker placement	6 (0.9)	3 (0.6)	3 (2.1)
Readmitted for drainage of pericardial effusion	1 (0.1)	1 (0.2)	0
Readmission for pleural effusions	5 (0.8)	3 (0.6)	2 (1.4)
Redo surgery for tissue valve failure	3 (0.5)	3 (0.6)	0
Redo surgery for homograft failure	2 (0.3)	2 (0.4)	0
Redo surgery for endocarditis	2 (0.3)	2 (0.4)	0
Redo surgery for arch and descending	2 (0.3)	2 (0.4)	0
aneurysm	2 (0.3)	0	2 (1.4)
Redo operation for AV regurgitation			

DC = Direct current; VSRR, Valve Sparing Root Replacement; AV, aortic valve
Data are reported as median (IQR:25%-75%) for continuous variables and number (%) for categorical variables.

Conclusions

- ARR and VSRR (using the Remodeling technique) can be performed with low mortality and morbidity as well as a low rate of re-intervention during long-term follow-up, if performed by an experienced team with a consistent perioperative approach.

- Patients who underwent VSRR, using the remodeling technique, demonstrated freedom from moderate to severe AR was 98% at a median follow- up of 7.8 years with one hospital mortality and no perioperative stroke.

- This series provides contemporary evidence of how to balance the risks of aortic aneurysms and the risk of rupture at diameters of 4.5 cm against the risks and benefits of surgery.