Unplanned Coronary Artery Bypass Graft in Aortic Root Replacement

Background

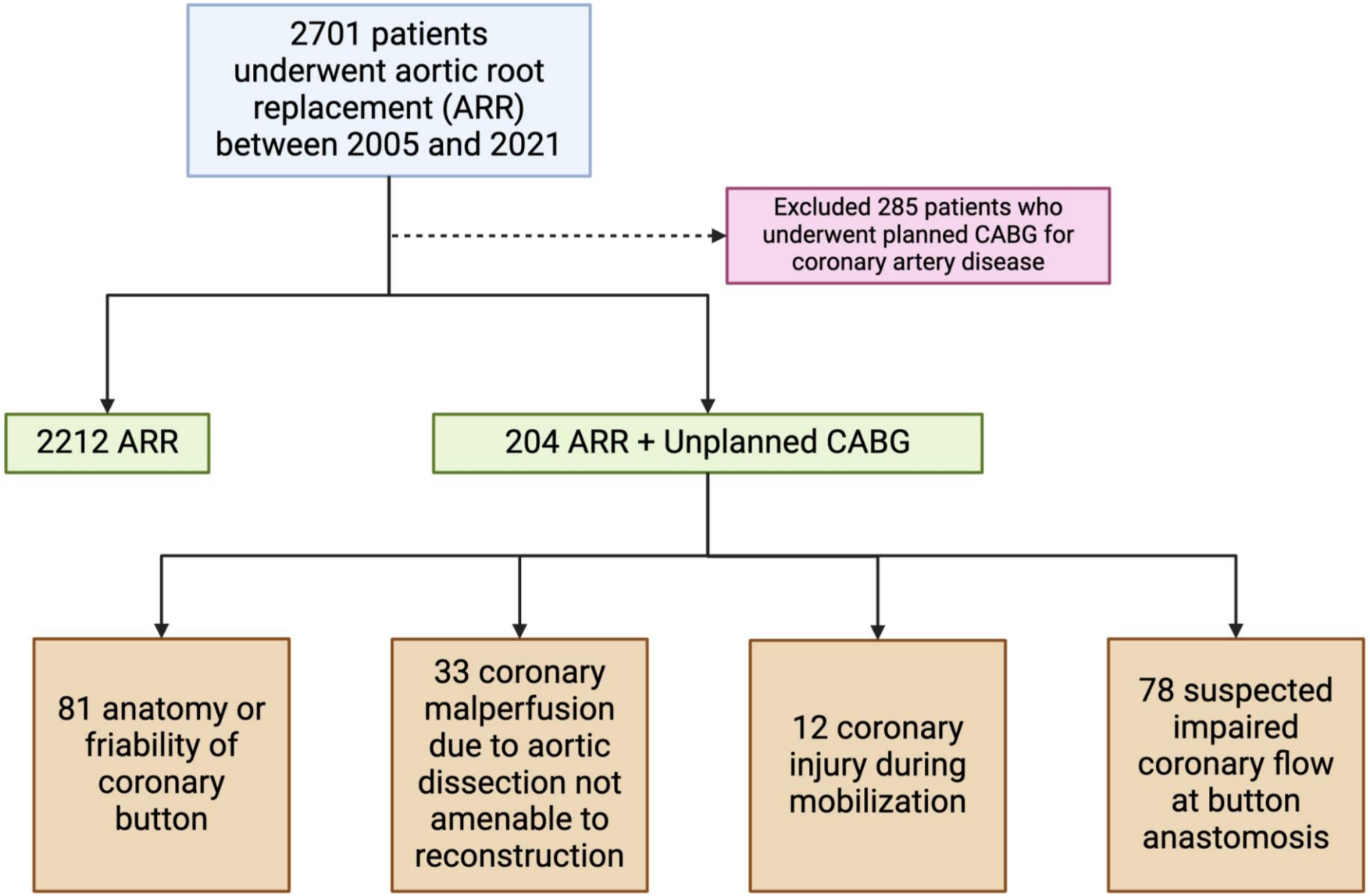
- Coronary artery bypass graft (CABG) may unexpectedly become necessary in aortic root replacement (ARR)[1]
- Reasons include[2]
  - Geometry of root
  - Tissue friability
  - Extent of dissection
  - Injury during mobilization
  - Myocardial ischemia or bleeding due to coronary button trouble

1. Byrne, Annals (2005)
2. Keeling, Annals (2018)

Hypothesis/Objectives

- We hypothesize unplanned CABG affects outcomes in ARR
- Objectives
  - To determine how unplanned CABG affects morbidity and mortality in ARR
  - To determine which factors are associated with undergoing unplanned CABG

Methods: Patients



Methods: Endpoints and Statistics

- Primary analysis: Propensity score matching (PSM) was performed to compare patients who underwent ARR or ARR + Unplanned CABG alongside landmark analysis to study long-term mortality
- Secondary analysis: Multivariable logistic regression was used to determine which variables were associated with need for unplanned CABG

Patient demographics

	ARR	ARR + Unplanned CABG	P-value
n	2,212	204	
Age (median [IQR])	55.00 [44.00, 65.00]	57.00 [44.75, 68.00]	0.05
Female sex(%)	419 (18.9)	55 (27.0)	0.008
BMI (median [IQR])	27.50 [24.50, 31.33]	27.70 [24.50, 32.00]	0.57
Status (%)			<0.001
Elective/Urgent	1340 (60.6) / 713 (32.2)	70 (34.3) / 82 (40.2)	
Emergent/Salvage	157 (7.1) / 2 (0.1)	50 (24.5) / 2 (1.0)	
CKD (%)	373 (16.9)	70 (34.3)	<0.001
DM (%)	244 (11.0)	33 (16.2)	0.04
HTN (%)	1572 (71.1)	167 (81.9)	0.001
Surgical indication (%)			<0.001
Aneurysm with or without aortic valve dysfunction	1954 (88.3)	144 (70.6)	
Dissection/Infection	172 (7.8) / 86 (3.9)	37 (18.1) / 23 (11.3)	
Dyslipidemia (%)	1113 (50.3)	114 (55.9)	0.15
CVD (%)	214 (9.7)	36 (17.6)	0.001
PVD (%)	133 (6.0)	25 (12.3)	0.001
Connective tissue disease (%)	106 (4.8)	6 (2.9)	0.30
Moderate/severe AI (%)	1261 (57.0)	119 (58.3)	0.77
Moderate/severe AS (%)	425 (19.2)	44 (21.6)	0.47
Reoperation (%)	638 (28.8)	111 (54.4)	<0.001
LVEF (median [IQR])	55.00 [53.00, 60.00]	55.00 [52.38, 60.00]	0.72

Procedural Characteristics

	ARR	ARR + Unplanned CABG	P-value
n	2,497	204	
Type of Root Replacement (%)			<0.001
Biologic Bentall	1388 (55.6)	142 (69.6)	
Mechanical Bentall	291 (11.7)	37 (18.1)	
Ross	38 (1.5)	1 (0.5)	
Homograft	22 (0.9)	2 (1.0)	
VSRR	758 (30.4)	22 (10.8)	
Concomitant aortic procedure (%)			0.03
Hemiarch	895 (40.5)	102 (50.0)	
Partial/Total arch	188 (8.5)	17 (8.3)	
Concomitant MV procedure (%)	126 (5.7)	16 (7.8)	0.28
Bypass time (median [IQR])	189 [146, 233]	272 [230, 335]	<0.001
Cross clamp time (median [IQR])	158 [117, 196]	205 [171, 251]	<0.001
Circulatory arrest (%)	1241 (49.7)	118 (57.8)	0.03

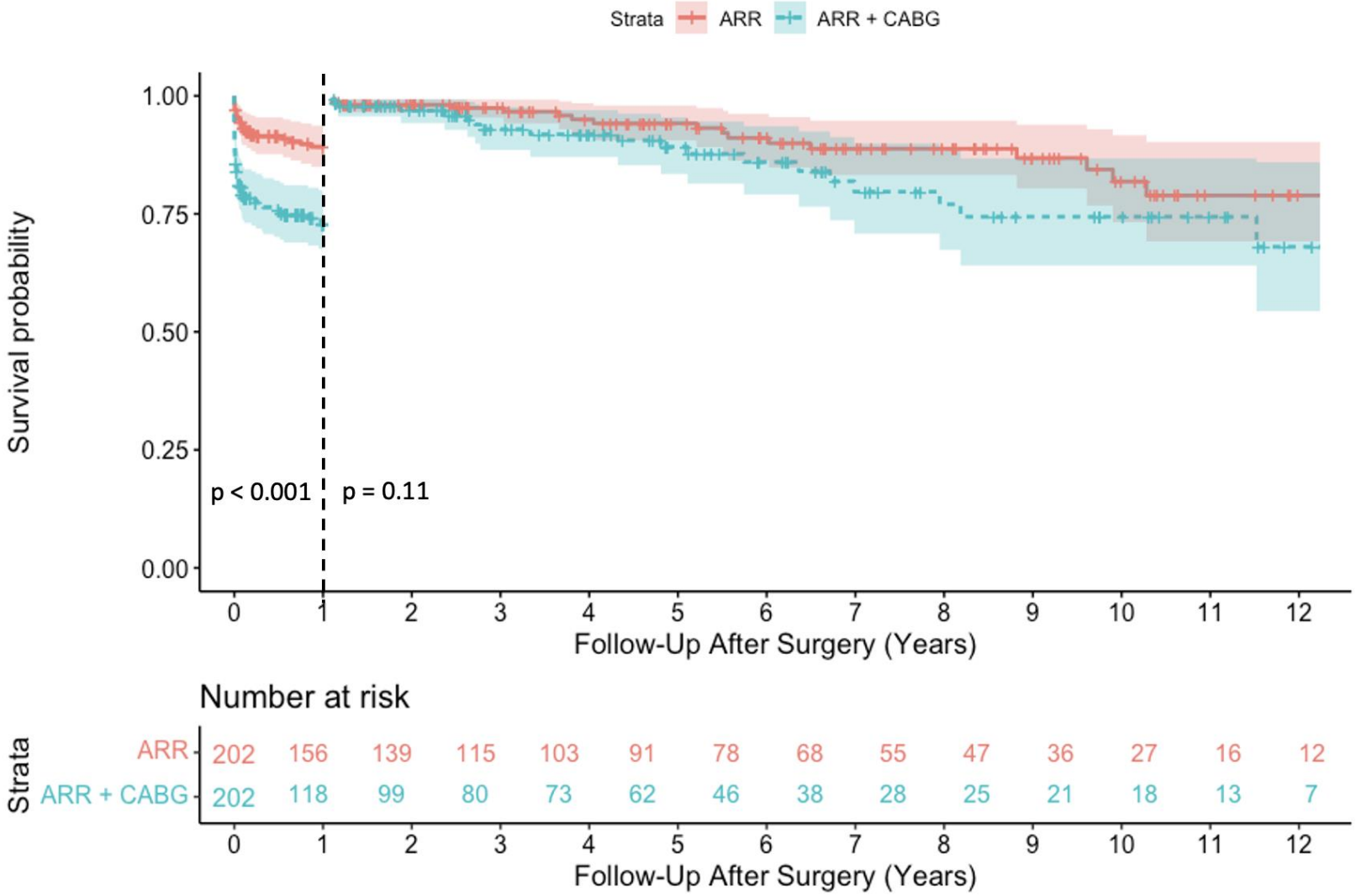
Results: PSM between patients who underwent ARR and ARR + Unplanned CABG

	ARR	ARR + Unplanned CABG	P-Value	SMD
n	202	202		
Age (mean (SD))	56.43 (14.36)	56.21 (14.92)	0.88	0.015
Female gender (%)	52 (25.7)	53 (26.2)	1.00	0.011
BMI (mean (SD))	27.63 (6.10)	28.77 (6.12)	0.06	0.187
CKD (%)	74 (36.6)	69 (34.2)	0.68	0.052
DM (%)	28 (13.9)	33 (16.3)	0.58	0.069
HTN (%)	163 (80.7)	165 (81.7)	0.90	0.025
Dissection (%)	32 (15.8)	36 (17.8)	0.69	0.053
Dyslipidemia (%)	111 (55.0)	113 (55.9)	0.92	0.020
CVD (%)	29 (14.4)	35 (17.3)	0.50	0.081
PVD (%)	23 (11.4)	24 (11.9)	1.00	0.015
Connective tissue disease (%)	9 (4.5)	6 (3.0)	0.60	0.079
Moderate/severe AI (%)	129 (63.9)	118 (58.4)	0.31	0.112
Moderate/severe AS (%)	48 (23.8)	43 (21.3)	0.63	0.059
Reoperation (%)	105 (52.0)	109 (54.0)	0.77	0.040

Results: PSM shows increased morbidity and mortality in patients undergoing ARR + CABG

	ARR	ARR + Unplanned CABG	P-Value
N	202	202	
In hospital mortality (%)	15 (7.4)	42 (20.8)	<0.001
Stroke (%)	11 (5.4)	17 (8.4)	0.33
Renal failure (%)	22 (10.9)	36 (17.8)	0.07
Postoperative dialysis (%)	17 (8.4)	23 (11.4)	0.41
Respiratory failure (%)	57 (28.2)	99 (49.0)	<0.001
Reoperation for bleeding (%)	21 (10.4)	31 (15.3)	0.18

Results: Landmark analysis shows mortality is increased in the first year even after accounting for perioperative mortality



Results: Variables associated with ARR+CABG

	OR + 95% CI	P-value
Age	1.00 [0.99-1.01]	0.77
Gender	1.44 [1.02-2.03]	0.04
CKD	1.77 [1.26-2.48]	<0.001
DM	1.13 [0.74-1.73]	0.57
HTN	1.49 [0.99-2.24]	0.05
CVD	1.20 [0.79-1.81]	0.39
PVD	1.45 [0.89-2.35]	0.13
Reoperation	2.26 [1.62-3.15]	<0.001
Type of root replacement compared to biologic Bentall		
Mechanical Bentall	1.07 [0.69-1.65]	0.77
Ross	0.33 [0.04-2.55]	0.29
Homograft	1.09 [0.58-2.07]	0.78
Valve sparing root replacement	0.41 [0.25-0.68]	<0.001
Surgical indication compared to aneurysm with or without valve dysfunction		
Dissection	2.61 [1.69-4.04]	<0.001
Endocarditis	1.87 [1.04-3.33]	0.03
Concomitant arch replacement	1.39 [1.01-1.91]	0.04

Multivariable logistic regression for undergoing ARR + Unplanned CABG

Limitations

- Limited sample size of each type of unplanned CABG
- Retrospective nature of study

Conclusions

- Unplanned CABG occurs in 1 out of 10 ARR
- Unplanned CABG leads to higher operative and 1-year mortality in ARR
- Female gender, CKD, reoperation, not undergoing VSRR, dissection, endocarditis, and concomitant arch replacement are associated with unplanned CABG