Assessing Cardiovascular Surgical Outcomes in Hemiarch, Total Arch, & Zone 2 Aortic Replacements: A Single-Center Experience

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Research Aim: To investigate the effect of zone 2 repair on postoperative outcomes.

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BACKGROUND

Traditionally, aortic arch reconstructions typically involved either distal repairs by hemiarch anastomosis or a more aggressive approach including the more distal aortic arch. However, Zone 2 arch replacement, advocated by a number of surgeons, offers numerous potential advantages (Appoo et al.).

Assessment of the three treatment groups would provide key insights for determining best practice in aortic arch repair.

DEFINITIONS

Landing Zone Classifications
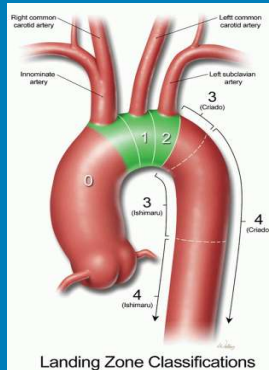
Zanotti et al.

- **Hemiarch** = distal anastomosis in zone 0 without aortic cross clamp
- **Zone 2** = distal anastomosis in zone 2 (between LCA and LSA).
- **Total** = distal anastomosis in zone 3 (beyond LSA)

TABLES

Table 1: Patient's Profile and Intraoperative Report

	Hemiarch	Total	Zone 2	Hemiarch V Total	Hemiarch V Zone 2	Total V Zone 2
	466	275	43	———	p-values	———
Baseline characteristics						
Male, n (%)	342 (73.4)	191 (69.5)	27 (62.8)	0.249	0.492	0.925
Age, years	63±14	63±14	62±13	0.949	0.534	0.554
Preoperative complications, n (%)						
Hyperlipidemia	230 (49.4)	142 (51.6)	16 (50.0)	0.549	0.879	0.889
Diabetes	55 (11.8)	39 (14.2)	5 (15.6)	0.353	0.421	0.924
Smoking History						
Former	108 (23.2)	105 (38.2)	9 (28.1)	0.867	0.001*	0.014
Current	49 (10.5)	30 (10.9)	4 (12.5)	0.212	0.173	0.118
COPD	33 (7.1)	36 (13.1)	2 (6.3)	0.004*	0.775	0.165
Chronic CHF						
Chronic	21 (4.5)	26 (9.5)	1 (3.1)	0.008	0.746	0.202
Acute	23 (4.9)	10 (3.6)	2 (6.3)	0.408	0.386	0.01
CAD	120 (25.8)	57 (20.7)	6 (18.8)	0.134	0.368	0.735
CKD (eGFR < 60)	93 (20.0)	67 (24.4)	4 (12.5)	0.102	0.283	0.106
Bicuspid Valve	146 (31.3)	29 (10.5)	5 (15.6)	<0.001*	0.039	0.478
HTN	329 (70.6)	212 (77.1)	17 (53.1)	0.055	0.052	0.001
Afib	44 (9.4)	26 (9.5)	2 (6.3)	0.992	0.551	0.488
Pre-op Ejection Fraction (EF<55)	183 (39.3)	91 (33.1)	10 (31.3)	<0.001*	0.015	0.433
Diagnosis, n (%)						
Aortic Dissection	92 (19.7)	97 (35.3)	11 (34.4)	<0.001*	0.015	0.987
Aortic Aneurysm	321 (68.9)	163 (59.3)	20 (62.5)	0.005	0.226	0.738
Infective Endocarditis	6 (1.3)	4 (1.5)	0 (0.0)	0.856	0.521	0.471
Aortic Value-Related	33 (7.1)	4 (1.5)	1 (3.1)	<0.001*	0.388	0.73
Rupture	1 (0.2)	0 (0.0)	0 (0.0)	0.441	0.775	-
Intraoperative, minutes						
Aortic Cross Clamp Time	94±40	116 [76-135]	113±54	<0.001*	0.019	0.905
Minimum Temperature	28 [25-28]	18 [18-25]	21±5	<0.001*	<0.001*	<0.001*
CPB	137 [107-167]	173±57	182±62	<0.001*	0.004*	0.847

Table 2: Short Term Follow-Up

	Unweighted						Inverse Probability Weighting					
	Hemiarch	Total	Zone 2	Hemiarch V Total	Hemiarch V Zone 2	Total V Zone 2	Hemiarch/Total	Hemiarch/Zone 2	Total/Zone 2	Hemiarch V Total	Hemiarch V Zone 2	Total V Zone 2
	466	275	32	p-value			Potential Outcome Means			p-value		
Length of Stay, days (median [IQR])	9 [6-15]	13 [7-20]	11 [6-16]	<0.001*	0.414	0.401	13.6/13.2	13.2/13.9	15.3/14.8	0.874	0.790	0.307
In-hospital Complications, n (%)												
Any Events	129 (27.7)	89 (32.4)	12 (37.5)	<0.001*	0.378	0.576	33.1/41.6	30.2/43.4	41.0/42.9	0.078	0.378	0.833
Mortality	23 (4.9)	15 (5.5)	1 (3.1)	0.309	0.085	0.060	14.5/15.7	14.0/9.4	15.6/11.9	0.726	0.602	0.730
Stroke	35 (7.5)	16 (5.8)	3 (9.4)	0.633	0.552	0.959	7.1/10.1	6.8/7.0	9.5/5.0	0.294	0.967	0.181
Reoperation for Bleeding	37 (7.9)	22 (8.0)	0 (0.0)	0.848	0.099	0.059	8.3/8.6	7.8/0.0	1.0/-	0.907	<0.001*	-
ARF	58 (12.4)	33 (12.0)	3 (9.4)	0.737	0.721	0.441	12.5/13.0	11.5/3.8	14.7/8.8	0.877	0.003	0.376
Mediastinitis	4 (0.9)	2 (0.7)	0 (0.0)	0.886	0.566	0.557	9.9/9.2	1.0/-	1.0/-	0.933	-	-
Respiratory Failure	64 (13.7)	53 (19.3)	11 (34.4)	0.026	<0.001*	0.217	12.1/22.9	11.3/34.0	25.7/14.8	0.003*	0.098	0.667

Table 1-2: Continuous variables were reported with mean+/-SD when normally distributed. Otherwise, they were described with medians and interquartile ranges. Categorical variables were displayed with numbers and percentages of the total. Continuous variables were compared with Student t-test when normally distributed and with Mann-Whitney U test for non-normal distribution. Categorical variables were compared using the Pearson's chi-squared test. Potential outcome means were shown as percentages for categorical variables and numerical values for continuous. Pairwise comparisons among hemiarch, total and zone 2 groups were performed with Bonferroni correction (significance level = 0.05/3=0.0167).

METHODS

- Single-center retrospective study (New York Presbyterian/Columbia University Aortic Center)

- Treatment groups included patients, 18 years or older, who underwent hemiarch, zone 2, and total arch repairs with concomitant ascending aorta replacements for all indications between July 2005 through December 2019

- All statistical analyses were performed with R version 9.4 and Stata/SE 16. Inverse Probability Weighting (IPW) adjusted for potential confounding bias.

Main Finding
Although further studies with a more expansive zone 2 cohort should be considered, our preliminary research suggests zone 2 aortic replacements serves as an viable treatment option.

DISCUSSION

Measured outcomes after application of IPW for each pairwise comparison indicates no significant difference in our primary endpoint -- the inability to achieve in-hospital "uneventful recovery", a combined metric consisting of in-hospital mortality, stroke, reoperation for bleeding, respiratory failure, acute renal failure (ARF), and deep sternal wound infection.

Similarly, analysis of secondary endpoints revealed comparable levels of stroke, mortality, and length of postoperative hospitalization in all three treatment groups.

REFERENCES

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