# Impact of Social Vulnerability on Aortic Arch Surgery

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## Introduction

- Socioeconomic status (SES) is a known factor influencing morbidity and mortality
- CDC's social vulnerability index (SVI) quantifies neighborhood-level vulnerability
- Although high SVI has been associated with adverse outcomes in trauma, CABG, and AAA repair, its impact on aortic arch surgery remains unknown
- It is predicted that in total aortic arch (TAR) and hemiarch aortic arch (HAR) replacement, higher SVI will correlate with increased comorbidities, surgical acuity, and post-operative morbidity and mortality

## Methods

- The single center retrospective study examined adult patients undergoing HAR and TAR performed for aortic aneurysm and/or dissection between 2010 and 2022
- SVI was calculated by patients' residential ZIP code
- The cohort was stratified into three groups:
  - SVI < 0.33
  - SVI 0.33 – 0.66
  - SVI ≥ 0.66
- The primary endpoint was post-operative mortality, with control for confounding bias through multi-variable logistic regression

## Results

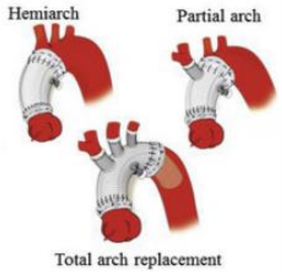


**Figure 1. Visual depiction of hemiarch vs partial arch vs total arch replacements**

| | SVI<0.33 (n=275) | SVI 0.33-0.66 (n=331) | SVI>=0.66 (n=147) | p-value |
|---|---|---|---|---|
| *Pre-Operative Characteristics* | | | | |
| Age, years | 62 [50, 70] | 60 [51, 69] | 60 [49, 68] | 0.43 |
| Race | | | | **<0.01*** |
| White | 233 (84.7) | 262 (79.2) | 86 (58.5) | |
| Hispanic | 15 (5.5) | 28 (8.5) | 22 (15.0) | |
| Black | 15 (5.5) | 29 (8.8) | 25 (17.0) | |
| Other | 12 (4.4) | 11 (3.3) | 13 (8.8) | |
| Missing | 0 | 1 (0.3) | 1 (0.7) | |
| Comorbidities | | | | |
| Dyslipidemia | 100 (36.4) | 93 (28.1) | 52 (35.4) | 0.07 |
| Hypertension | 185 (67.3) | 213 (64.4) | 112 (76.2) | **0.04*** |
| Smoking | 62 (22.5) | 84 (25.4) | 46 (31.3) | 0.15 |
| Diabetes | 19 (6.9) | 26 (7.9) | 20 (13.6) | **0.05*** |
| Renal disease | 25 (9.1) | 32 (9.7) | 18 (12.2) | 0.57 |
| Peripheral vascular disease | 7 (2.5) | 3 (0.9) | 10 (6.8) | **<0.01*** |
| Obesity | 90 (32.7) | 110 (33.2) | 56 (38.1) | 0.50 |
| Stroke | 24 (8.7) | 24 (7.3) | 9 (6.1) | 0.60 |
| Liver disease | 4 (1.5) | 8 (2.4) | 2 (1.4) | 0.60 |
| Pulmonary disease | 56 (20.4) | 76 (23.0) | 32 (21.8) | 0.74 |
| Coronary disease | 32 (11.6) | 44 (13.3) | 19 (12.9) | 0.82 |
| Etiology | | | | **0.04*** |
| Aneurysm | 190 (69.1) | 208 (62.8) | 86 (58.5) | |
| Dissection | 36 (13.1) | 71 (21.5) | 33 (22.4) | |
| Aneurysm and dissection | 49 (17.8) | 50 (15.1) | 26 (17.7) | |
| Missing | 0 | 2 (0.6) | 2 (1.4) | |
| *Operative Characteristics* | | | | |
| Status | | | | **0.02*** |
| Elective | 197 (71.6) | 198 (59.8) | 85 (57.8) | |
| Urgent | 30 (10.9) | 49 (14.8) | 22 (15.0) | |
| Emergent | 48 (17.5) | 84 (25.4) | 40 (27.2) | |
| Procedure | | | | **0.01*** |
| Total arch | 63 (22.9) | 82 (24.8) | 53 (36.1) | |
| Hemi arch | 212 (77.1) | 249 (75.2) | 94 (63.9) | |
| Adjunctive non-aortic procedures | 159 (57.8) | 212 (64.0) | 90 (61.2) | 0.29 |
| Bladder nadir temperature, C | 27.1 [25.6, 28.0] | 26.8 [25.0, 27.9] | 26.5 [24.0, 27.9] | **0.01*** |
| Cardiopulmonary bypass time, min | 146 [119, 202] | 154 [120, 212] | 166 [133, 215] | **0.02*** |
| Cross clamp time, min | 97 [71, 132] | 100 [74, 135] | 100 [72, 139] | 0.73 |
| Circulatory arrest time, min | 11 [7, 22] | 12 [8, 22] | 15 [10, 25] | **0.01*** |
| RBC transfused, units | 1 [0, 4] | 1 [0, 4] | 2 [0.00, 4] | 0.45 |
| FFP transfused, units | 3 [0, 6] | 4 [0, 6] | 4 [2, 6] | **0.03*** |
| Platelets transfused, units | 2 [0, 2] | 2 [0, 3] | 2 [1, 3] | **0.03*** |
| Cryoprecipitate transfused, units | 0 [0, 0] | 0 [0, 0] | 0 [0, 0] | 0.84 |
| *Post-Operative Outcomes* | | | | |
| Unplanned Reoperation Needed | | | | 0.56 |
| No | 246 (89.5) | 281 (84.9) | 126 (85.7) | |
| Yes | 27 (9.8) | 47 (14.2) | 20 (13.6) | |
| ICU complications | | | | |
| New renal replacement therapy | 11 (4.0) | 19 (5.7) | 9 (6.1) | 0.53 |
| Spinal cord injury | 3 (1.1) | 3 (0.9) | 1 (0.7) | 0.91 |
| Cerebrovascular injury | 20 (7.3) | 34 (10.3) | 21 (14.3) | 0.07 |
| Delirium | 27 (9.8) | 43 (13.0) | 17 (11.6) | 0.48 |
| Seizure | 8 (2.9) | 5 (1.5) | 5 (3.4) | 0.36 |
| Extended mechanical ventilation | 22 (8.0) | 36 (10.9) | 15 (10.2) | 0.48 |
| Infection | 16 (5.8) | 31 (9.4) | 22 (15.0) | **0.01*** |
| Mesenteric ischemia | 2 (0.7) | 2 (0.6) | 0 | 0.60 |
| Myocardial infarction | 2 (0.7) | 3 (0.9) | 0 | 0.52 |
| Postoperative transfusion, Y/N | | | | |
| None | 91 (33.1) | 92 (27.8) | 37 (25.2) | 0.18 |
| RBC | 76 (27.6) | 102 (30.8) | 49 (33.3) | 0.45 |
| Platelets | 55 (20.0) | 78 (23.6) | 35 (23.8) | 0.51 |
| FFP | 57 (20.7) | 75 (22.7) | 38 (25.9) | 0.49 |
| Length of stay, days | 7 [6, 11] | 8 [7, 13] | 9 [7, 13] | **<0.01*** |
| ICU length of stay, days | 3 [2, 5] | 3 [2, 6] | 4 [2, 6] | **0.05*** |
| Postoperative in-hospital mortality | 16 (5.8) | 29 (8.8) | 11 (7.5) | 0.39 |
| Discharge disposition | | | | 0.54 |
| Home | 213 (77.5) | 236 (71.3) | 106 (72.1) | |
| ACR | 12 (4.4) | 25 (7.6) | 7 (4.8) | |
| SNF | 17 (6.2) | 20 (6.0) | 13 (8.8) | |
| LTAC | 4 (1.5) | 7 (2.1) | 6 (4.1) | |
| OSH | 6 (2.2) | 6 (1.8) | 2 (1.4) | |
| Home with home health | 7 (2.5) | 8 (2.4) | 2 (1.4) | |
| In-hospital death | 16 (5.8) | 29 (8.8) | 11 (7.5) | |
| Post-discharge death (within one year) | | | | 0.28 |
| No | 226 (82.2) | 268 (81.0) | 123 (83.7) | |
| Yes | 13 (4.7) | 8 (2.4) | 7 (4.8) | |

**Table 1.** Summary of pre-operative, operative, and post-operative outcomes for patients undergoing HAR or TAR stratified by SVI (with higher SVI denoting increased social vulnerability). All reported values are median [interquartile range]. Performed tests are Kruskal-Wallis rank sum for continuous variables and Chi-square test for categorial variables. * p < 0.05

## Discussion

- For 753 patients, higher SVI correlated with more baseline comorbidities and minority status
- SVI was associated with dissection pathology (p=0.04) and urgent/emergent procedures (p=0.02)
- Higher SVI was associated with TAR (p=0.01) as reflected by lower nadir bladder temperatures (p=0.01), longer cardiopulmonary bypass (p=0.02), longer circulatory arrest times (p=0.01), and more coagulation product usage
- High SVI patients had longer length of stay, higher rates of infection (p=0.01), and a trend towards increased stroke risk
- SVI did not correlate with in-hospital or late mortality

## Conclusions

- In socially vulnerable communities, patients who require aortic arch surgery have more comorbidities, present urgently or emergently with dissection pathology, and require more extensive arch repair
- Post-procedure, they have a higher risk of infection and a trend toward more stroke risk, but not higher rates of other adverse outcomes or increased mortality during or after hospital stay