Clinical Outcomes of Atrial Fibrillation in Aortic Aneurysm Patients: Insights from the National Inpatient Sample

Analysis for RCOP NIS Cardio13

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## Preamble:

* **Reference Papers:**
  + [Kumi et al. 2024](https://doi.org/10.1136/bmjopen-2023-077839)
* **Study Objective**: Examine the impact of atrial fibrillation on in-hospital mortality and length of stay among inpatient admissions with a principal diagnosis of aortic aneurysm (AA).
* **Data Source**: Cross-sectional analysis of the National Inpatient Sample (NIS) from 2018 to 2020.
* **Patient Selection**: Included all inpatient admissions with a principal diagnosis of AA.
* **Aortic Aneurysm + Atrial Fibrillation Categories**:
  + Aortic Aneurysm with Atrial Fibrillation
  + Aortic Aneurysm without Atrial Fibrillation
* **Primary Outcomes**:
  + In-hospital all-cause mortality
  + Total hospital length of stay (days)
  + Total charge, inflation adjusted to 2020 ($)
* **Statistical Analysis**: Multiple logistic and linear regression to determine the independent association of atrial fibrillation with in-hospital mortality and length of stay, respectively, adjusted for:
  + Demographics: Age, sex, race, residential income, insurance, hospital region, hospital bedsize, hospital location, and teaching status.
  + Medical History: Hypertension, cerebrovascular disease, heart failure, diabetes mellitus, chronic kidney disease, chronic obstructive pulmonary disease, and HIV/AIDS.
  + Comorbidities: Charlson comorbidity index.
* **Software:** All analyses were performed using R Version 4.4.1 (R Foundation for Statistical Computing, Vienna, Austria)

## Baseline Table:

| **Characteristic** | **Overall**, N = 200,2501 | **Aortic Aneurysm without Atrial Fibrillation**, N = 161,2201 | **Aortic Aneurysm with Atrial Fibrillation**, N = 39,0301 | **p-value**2 |
| --- | --- | --- | --- | --- |
| Age, y | 70 (12) | 69 (12) | 73 (11) | <0.001 |
| Sex |  |  |  | 0.2 |
| Female | 59,240 (30%) | 47,475 (29%) | 11,765 (30%) |  |
| Male | 141,010 (70%) | 113,745 (71%) | 27,265 (70%) |  |
| Race |  |  |  | <0.001 |
| White | 150,495 (77%) | 119,555 (76%) | 30,940 (82%) |  |
| Asian or Pacific Islander | 5,250 (2.7%) | 4,145 (2.6%) | 1,105 (2.9%) |  |
| Black | 22,075 (11%) | 19,185 (12%) | 2,890 (7.6%) |  |
| Hispanic | 10,695 (5.5%) | 8,865 (5.7%) | 1,830 (4.8%) |  |
| Native American | 740 (0.4%) | 620 (0.4%) | 120 (0.3%) |  |
| Other | 5,130 (2.6%) | 4,155 (2.7%) | 975 (2.6%) |  |
| Charlson comorbidity index | 2.63 (1.70) | 2.54 (1.66) | 2.98 (1.80) | <0.001 |
| Residential income |  |  |  | <0.001 |
| $1 - $51,999 | 54,180 (28%) | 45,185 (29%) | 8,995 (23%) |  |
| $52,000 - $65,999 | 53,525 (27%) | 43,500 (27%) | 10,025 (26%) |  |
| $66,000 - $87,999 | 48,415 (25%) | 38,300 (24%) | 10,115 (26%) |  |
| $88,000 or more | 40,700 (21%) | 31,440 (20%) | 9,260 (24%) |  |
| Expected primary payer |  |  |  | <0.001 |
| Private | 47,895 (24%) | 40,020 (25%) | 7,875 (20%) |  |
| Medicaid | 13,350 (6.7%) | 11,680 (7.3%) | 1,670 (4.3%) |  |
| Medicare | 133,140 (67%) | 104,660 (65%) | 28,480 (73%) |  |
| Other | 5,610 (2.8%) | 4,630 (2.9%) | 980 (2.5%) |  |
| Hospital region |  |  |  | <0.001 |
| Midwest | 49,140 (25%) | 39,265 (24%) | 9,875 (25%) |  |
| Northeast | 35,830 (18%) | 28,735 (18%) | 7,095 (18%) |  |
| South | 77,960 (39%) | 63,855 (40%) | 14,105 (36%) |  |
| West | 37,320 (19%) | 29,365 (18%) | 7,955 (20%) |  |
| Hospital bedsize |  |  |  | <0.001 |
| Large | 131,165 (66%) | 104,555 (65%) | 26,610 (68%) |  |
| Medium | 46,390 (23%) | 37,925 (24%) | 8,465 (22%) |  |
| Small | 22,695 (11%) | 18,740 (12%) | 3,955 (10%) |  |
| Hospital location and teaching status |  |  |  | <0.001 |
| Rural | 6,100 (3.0%) | 5,170 (3.2%) | 930 (2.4%) |  |
| Urban, non-teaching | 22,565 (11%) | 18,685 (12%) | 3,880 (9.9%) |  |
| Urban, teaching | 171,585 (86%) | 137,365 (85%) | 34,220 (88%) |  |
| Hypertension | 166,000 (83%) | 132,060 (82%) | 33,940 (87%) | <0.001 |
| Cerebrovascular disease | 17,455 (8.7%) | 13,190 (8.2%) | 4,265 (11%) | <0.001 |
| Heart failure | 36,420 (18%) | 23,845 (15%) | 12,575 (32%) | <0.001 |
| Diabetes mellitus | 35,950 (18%) | 28,625 (18%) | 7,325 (19%) | 0.042 |
| Chronic kidney disease | 41,105 (21%) | 31,270 (19%) | 9,835 (25%) | <0.001 |
| Chronic obstructive pulmonary disease | 60,135 (30%) | 47,770 (30%) | 12,365 (32%) | <0.001 |
| HIV/AIDS | 1,420 (0.7%) | 1,135 (0.7%) | 285 (0.7%) | 0.8 |
| 1Mean (SD); n (%) | | | | |
| 2Wilcoxon rank-sum test for complex survey samples; chi-squared test with Rao & Scott's second-order correction | | | | |

## Outcomes Table:

| **Characteristic** | **Overall**, N = 200,2501 | **Aortic Aneurysm without Atrial Fibrillation**, N = 161,2201 | **Aortic Aneurysm with Atrial Fibrillation**, N = 39,0301 | **p-value**2 |
| --- | --- | --- | --- | --- |
| Died during hospitalization | 12,550 (6.3%) | 9,660 (6.0%) | 2,890 (7.4%) | <0.001 |
| Length of stay (days) | 3.0 (1.0, 7.0) | 3.0 (1.0, 6.0) | 6.0 (2.0, 10.0) | <0.001 |
| Inflation-adjusted total charge ($) | 138,826 (81,133, 236,247) | 132,582 (78,755, 221,753) | 174,159 (96,684, 303,059) | <0.001 |
| 1n (%); Median (IQR) | | | | |
| 2chi-squared test with Rao & Scott's second-order correction; Wilcoxon rank-sum test for complex survey samples | | | | |

## Multivariable Logistic Regression:

### All-Cause Mortality:

| **Characteristic** | **OR**1 | **95% CI**1 | **p-value** |
| --- | --- | --- | --- |
| Atrial fibrillation categories |  |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 1.09 | 0.98, 1.21 | 0.11 |
| Age, y | 1.03 | 1.02, 1.03 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 0.57 | 0.52, 0.62 | <0.001 |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 1.23 | 0.97, 1.57 | 0.084 |
| Black | 1.15 | 1.00, 1.33 | 0.052 |
| Hispanic | 1.08 | 0.90, 1.30 | 0.4 |
| Native American | 0.88 | 0.41, 1.90 | 0.7 |
| Other | 1.25 | 0.96, 1.63 | 0.10 |
| Charlson comorbidity index | 1.25 | 1.19, 1.32 | <0.001 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.96 | 0.85, 1.08 | 0.5 |
| $66,000 - $87,999 | 0.96 | 0.85, 1.08 | 0.5 |
| $88,000 or more | 0.83 | 0.73, 0.96 | 0.009 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.05 | 0.85, 1.29 | 0.6 |
| Medicare | 0.71 | 0.63, 0.80 | <0.001 |
| Other | 0.91 | 0.69, 1.22 | 0.5 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 1.15 | 1.00, 1.33 | 0.050 |
| South | 1.03 | 0.91, 1.17 | 0.6 |
| West | 1.15 | 1.00, 1.33 | 0.052 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 1.01 | 0.90, 1.12 | 0.9 |
| Small | 1.05 | 0.91, 1.20 | 0.5 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 0.88 | 0.68, 1.13 | 0.3 |
| Urban, teaching | 0.87 | 0.69, 1.09 | 0.2 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.49 | 0.44, 0.54 | <0.001 |
| Cerebrovascular disease |  |  |  |
| No | — | — |  |
| Yes | 1.80 | 1.57, 2.06 | <0.001 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 1.30 | 1.15, 1.47 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.56 | 0.48, 0.64 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | 0.72 | 0.62, 0.84 | <0.001 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | 0.60 | 0.53, 0.67 | <0.001 |
| HIV/AIDS |  |  |  |
| No | — | — |  |
| Yes | 0.36 | 0.21, 0.61 | <0.001 |
| 1OR = Odds Ratio, CI = Confidence Interval | | | |

## Multivariable Linear Regression:

### Length of Stay:

| **Characteristic** | **Beta** | **95% CI**1 | **p-value** |
| --- | --- | --- | --- |
| Atrial fibrillation categories |  |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 2.5 | 2.3, 2.7 | <0.001 |
| Age, y | -0.09 | -0.10, -0.09 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | -0.92 | -1.1, -0.74 | <0.001 |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 1.1 | 0.60, 1.7 | <0.001 |
| Black | 1.7 | 1.4, 2.0 | <0.001 |
| Hispanic | 1.3 | 0.88, 1.7 | <0.001 |
| Native American | -0.20 | -1.1, 0.74 | 0.7 |
| Other | 0.95 | 0.46, 1.4 | <0.001 |
| Charlson comorbidity index | 0.94 | 0.79, 1.1 | <0.001 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | -0.06 | -0.28, 0.16 | 0.6 |
| $66,000 - $87,999 | 0.00 | -0.24, 0.25 | >0.9 |
| $88,000 or more | 0.09 | -0.17, 0.35 | 0.5 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.8 | 1.3, 2.3 | <0.001 |
| Medicare | -0.18 | -0.41, 0.05 | 0.13 |
| Other | 0.48 | -0.09, 1.1 | 0.10 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.85 | 0.49, 1.2 | <0.001 |
| South | 0.62 | 0.35, 0.90 | <0.001 |
| West | 0.47 | 0.19, 0.75 | <0.001 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | -1.4 | -1.6, -1.1 | <0.001 |
| Small | -1.6 | -1.9, -1.4 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 0.71 | 0.32, 1.1 | <0.001 |
| Urban, teaching | 2.2 | 1.8, 2.6 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | -1.0 | -1.3, -0.73 | <0.001 |
| Cerebrovascular disease |  |  |  |
| No | — | — |  |
| Yes | 3.4 | 3.0, 3.9 | <0.001 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 1.2 | 0.85, 1.5 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | -1.7 | -2.0, -1.4 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | -0.50 | -0.89, -0.11 | 0.011 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | -1.1 | -1.4, -0.91 | <0.001 |
| HIV/AIDS |  |  |  |
| No | — | — |  |
| Yes | -5.2 | -6.4, -4.0 | <0.001 |
| 1CI = Confidence Interval | | | |

### Inflation Adjusted Total Charge:

| **Characteristic** | **Beta** | **95% CI**1 | **p-value** |
| --- | --- | --- | --- |
| Atrial fibrillation categories |  |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 47,941 | 40,621, 55,261 | <0.001 |
| Age, y | -2,783 | -3,131, -2,435 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 6,361 | 1,199, 11,522 | 0.016 |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 26,644 | 2,981, 50,307 | 0.027 |
| Black | 23,852 | 14,251, 33,452 | <0.001 |
| Hispanic | 40,239 | 24,788, 55,690 | <0.001 |
| Native American | -14,332 | -43,291, 14,626 | 0.3 |
| Other | 45,354 | 23,988, 66,720 | <0.001 |
| Charlson comorbidity index | 16,310 | 12,197, 20,422 | <0.001 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 6,209 | -507, 12,925 | 0.070 |
| $66,000 - $87,999 | 6,262 | -1,641, 14,165 | 0.12 |
| $88,000 or more | 19,413 | 9,054, 29,772 | <0.001 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 14,948 | -652, 30,547 | 0.060 |
| Medicare | 327 | -7,732, 8,387 | >0.9 |
| Other | 16,937 | -4,483, 38,356 | 0.12 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 34,073 | 18,832, 49,314 | <0.001 |
| South | 33,133 | 25,613, 40,653 | <0.001 |
| West | 107,084 | 82,039, 132,129 | <0.001 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | -32,361 | -42,797, -21,925 | <0.001 |
| Small | -38,304 | -49,943, -26,666 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 48,425 | 37,048, 59,803 | <0.001 |
| Urban, teaching | 75,489 | 66,329, 84,648 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | -38,978 | -48,329, -29,626 | <0.001 |
| Cerebrovascular disease |  |  |  |
| No | — | — |  |
| Yes | 99,018 | 82,127, 115,909 | <0.001 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 40,971 | 26,631, 55,312 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | -28,123 | -36,201, -20,046 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | -7,887 | -21,650, 5,876 | 0.3 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | -24,755 | -31,262, -18,247 | <0.001 |
| HIV/AIDS |  |  |  |
| No | — | — |  |
| Yes | -118,687 | -154,398, -82,977 | <0.001 |
| 1CI = Confidence Interval | | | |