Forecasting Post-Operative Stroke Risk in Operative Management of Urgent and Emergent Type A Aortic Dissection

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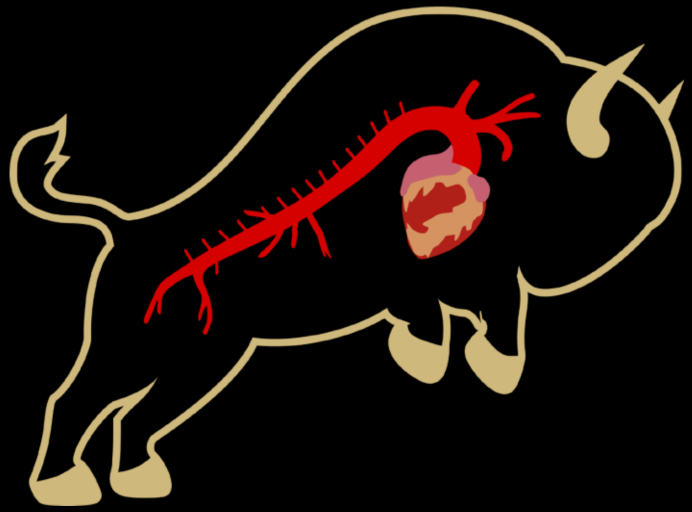
No disclosures



Introduction

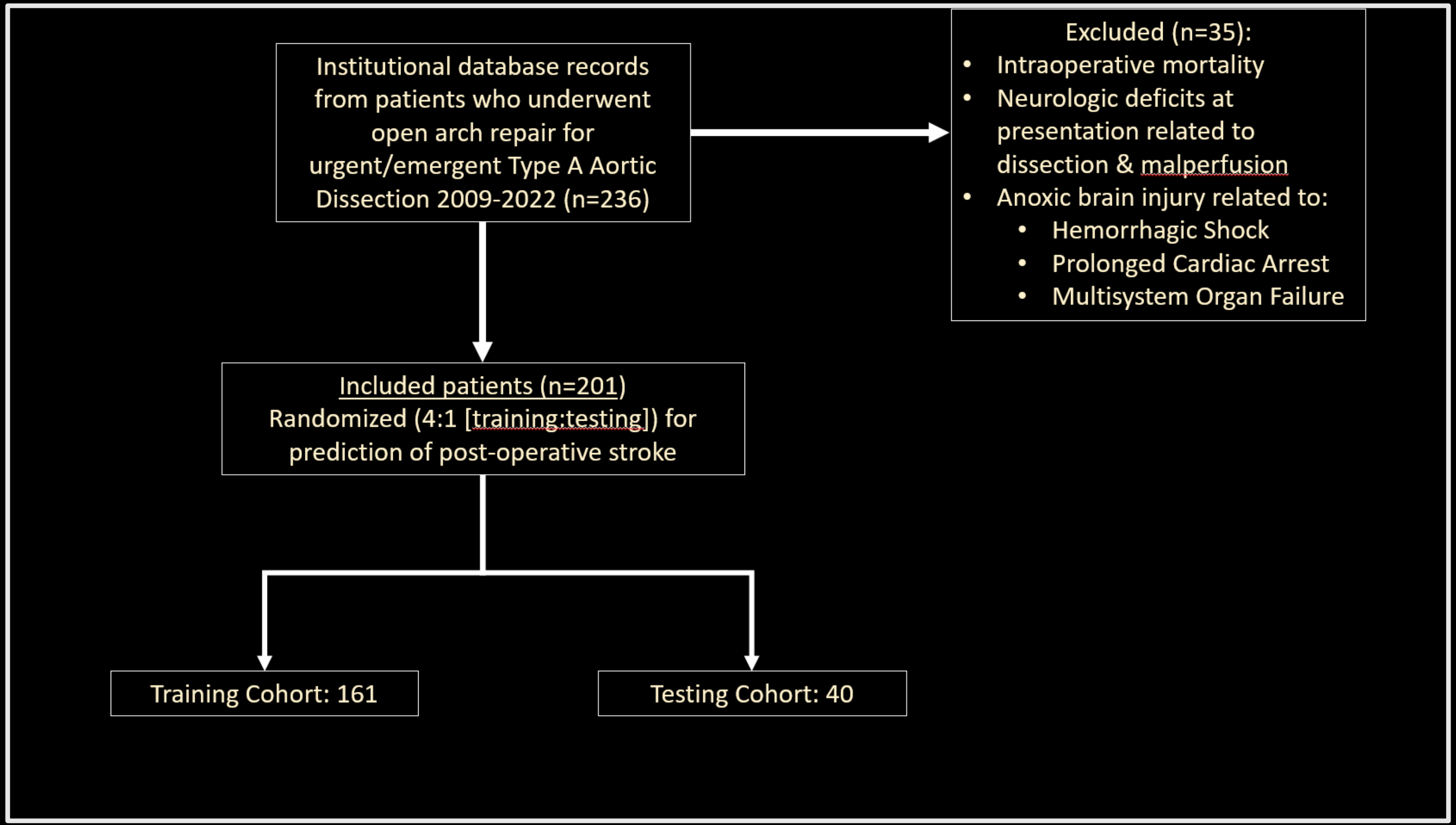
- Neuroprotective strategies during open aortic arch surgery have made advances, but there is still a significant risk of stroke
- Urgent and emergent type A dissection patients are at particular risk of stroke given patient acuity
- Determining risk factors that are predictive of stroke remains a topic of investigation
- Optimal cerebral protection strategy also remains a topic of investigation to mitigate stroke risk

Aim

- To utilize a machine-learning logistic regression model to assess pre-operative comorbidities and operative strategies and their impact on stroke risk for patients undergoing arch replacement for urgent and emergent type A aortic dissection

Methods

- Retrospective review of institutional prospectively-maintained aortic database from 2009-2022
- Identified patients who underwent urgent or emergent surgery for type A aortic dissection
- 201 patients were randomized at a 4:1 ratio into training and testing cohorts to develop logistic regression models to predict perioperative ICU stroke



Methods

- From index hospitalization, extracted 29 input parameters including demographic, pre-operative, and intra-operative variables
  - Social vulnerability index was calculated by patient address
- Evaluation metric assessment of model performance:
  - Accuracy
  - Area under receiver-operating characteristic curve (AUC-ROC)
  - Area under precision-recall curve (AUC-PR, mean average precision)
- Calculated odds ratio for impact on risk of stroke, created Forest Plot to illustrate effect sizes, confidence intervals derived from logistic regression model

Demographics	
Age	60 ± 14
Male	138 (68.7%)
SVI ≥ 75%	49 (24.4%)
Comorbidities	
No Comorbidities	4 (2.0%)
HTN	162 (80.6%)
Smoking	56 (27.9%)
Diabetes	15 (7.5%)
CAD	10 (5.0%)
Surgical History	
No Hx CT Surgery	141 (70.1%)
Hx Sternotomy	27 (13.4%)
Aortic Presentation	
Malperfusion	76 (37.8%)
No Malperfusion	125 (62.2%)
CKD Category	
Baseline GFR	79 ± 26
Normal	78 (38.8%)
Mild	69 (34.3%)
Moderate	44 (21.9%)
Severe	10 (5.0%)
Procedure Type	
Hemiarch	115 (57.2%)
Total Arch	83 (41.3%)
Elephant Trunk	95 (47.3%)
Adjunctive Procedure	
No Adjunctive Procedure	50 (24.9%)
Root	77 (38.3%)
Mechanical Circulatory Support	4 (2.0%)
CABG	9 (4.5%)
Circulatory Arrest Protection	
Shaggy Protocol	27 (13.4%)
HCA Only	4 (2.0%)
Non-Shaggy RCP	10 (5.0%)
Non-Shaggy ACP	151 (75.1%)
Non-Shaggy ACP + RCP	7 (3.5%)

Results

Demographics	
Age	60 ± 14
Male	138 (68.7%)
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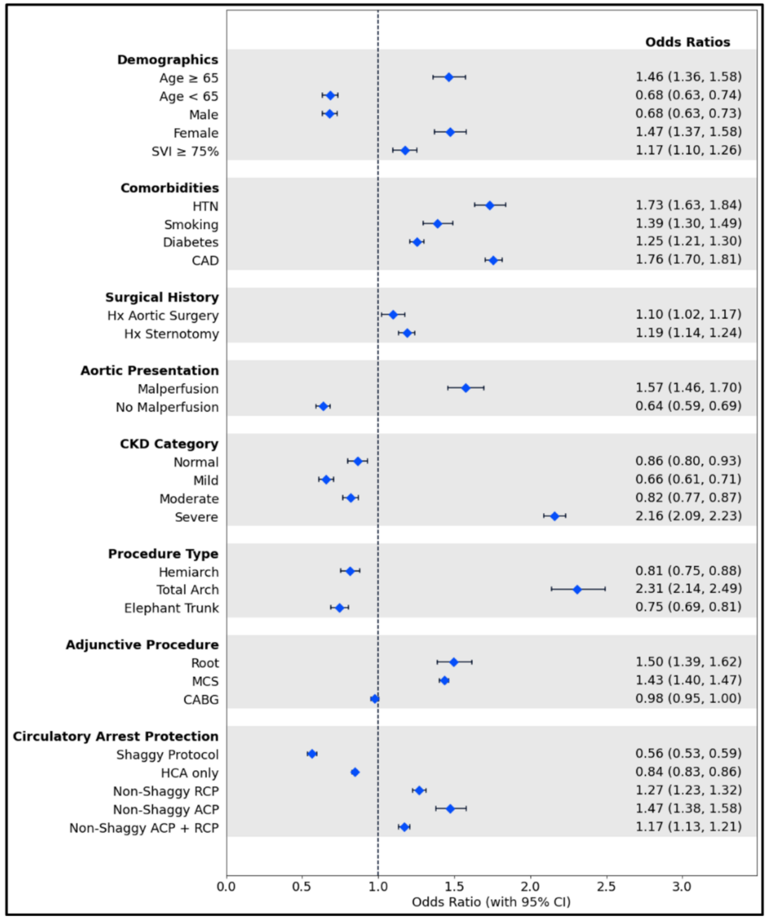

Figure: Patient Characteristics and Forest Plot illustrating the effect sizes and confidence intervals from the final logistic regression model. Each variable is represented by a point estimate and a horizontal line indicating the 95% confidence interval. Values are mean ± SD or n (%).

- Post-operative stroke occurred in 18.9% of patients (38/201)
- 71% cross-validation accuracy, 73% test accuracy
- AUC-ROC of 0.71, AUC-PR of 0.50
- Increased stroke risk:
  - Age ≥ 65
  - Female
  - High social vulnerability index (SVI ≥ 75%)
  - Dissection with malperfusion (cerebral excluded)
  - Severe CKD
  - Total Arch procedure
  - Adjunctive Root

Results: Circulatory Arrest Protection

Circulatory Arrest Protection	
Shaggy Protocol	27 (13.4%)
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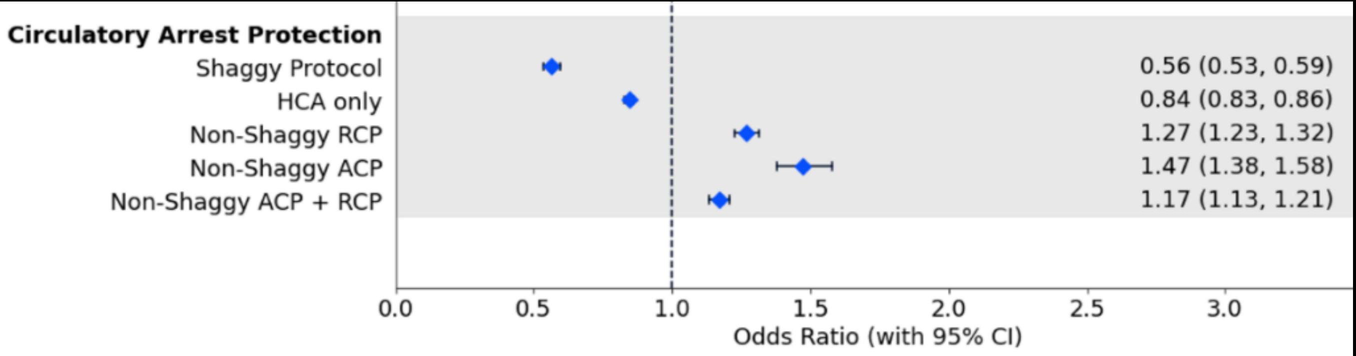

- Shaggy Aorta protocol
  - Patient cannulated centrally for CPB
  - Innominate artery is cannulated for SACP during cooling
  - Distal anastomosis completed under HCA with RCP only (if < 10 minutes) vs RCP for 3-10 minutes + SACP (if > 10 minutes)
  - RCP is used to allow flushing out of potentially embolic debris

Conclusions

- A machine-learning logistic regression model achieved excellent accuracy, quantified impact of specific patient characteristics in predicting stroke after operative management of acute type A aortic dissection
- Risk factors for stroke include advanced age, CKD, female gender, high social vulnerability, malperfusion, more extensive arch replacement, adjunctive root replacement
- Shaggy protocol demonstrated decreased stroke risk
- Limitations
  - Circulatory arrest protection strategy may be reflection of risk of stroke at time of procedure (e.g. RCP only may be selected in group at risk for embolization)
  - Historical bias; Shaggy protocol adopted in December 2018
  - Single center study, limited sample size

Questions???