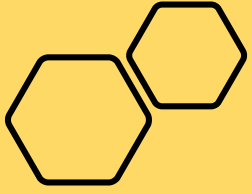




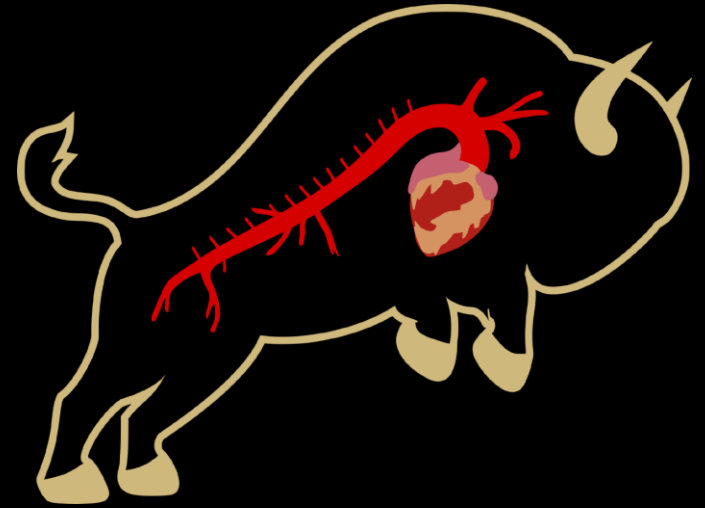
Cerebral Protection in Circulatory Arrest Patients: The “Shaggy Aorta” Protocol

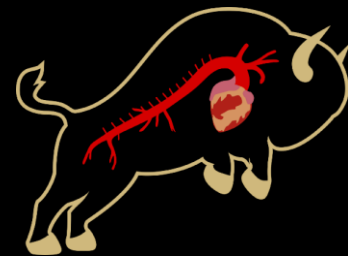
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No disclosures

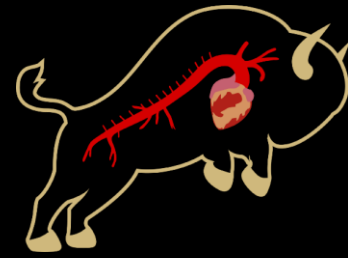




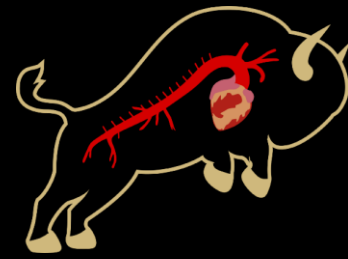
Introduction

- Stroke remains a significant risk in aortic arch surgery
- Both optimizing cerebral perfusion, and reducing risk of embolus is paramount in mitigating stroke risk
- Institutional protocols standardize cerebral protection strategies
- We discuss our “Shaggy Aorta” and institutional protocol for cerebral protection and discuss outcomes

Aim

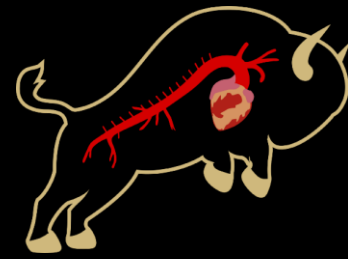


- Describe the Shaggy protocol & procedural set-up
- Describe outcomes of Shaggy protocol
- Compare outcomes of Shaggy protocol to non-Shaggy aortic procedures
- Develop a protocol for cerebral protection based on institutional experience



Methods

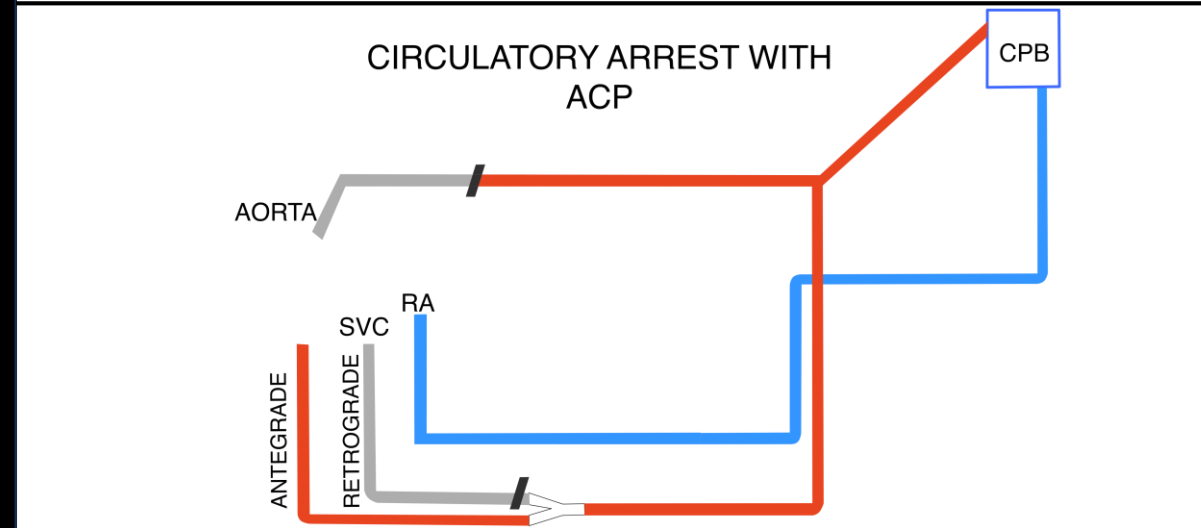
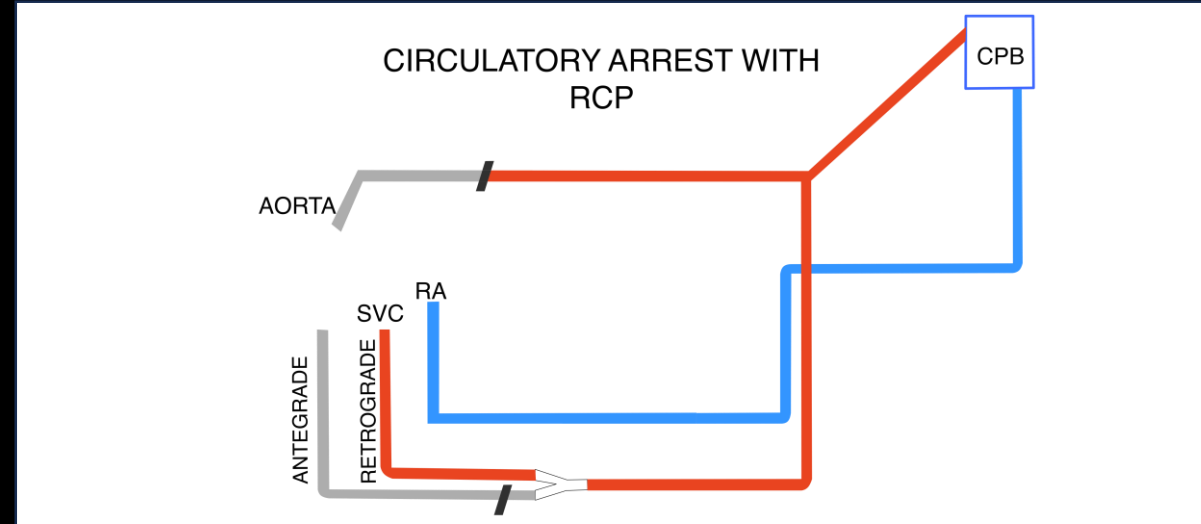
- A retrospective review of a single institution prospective database was used to review aortic arch patients who underwent cerebral protection via the “Shaggy Aorta” protocol (December 2018-May 2023)
- Shaggy Aorta protocol
 - Patient cannulated centrally for CPB
 - Head and neck arteries are debranched early, perfused directly with antegrade cerebral perfusion (ACP) through a trifurcated graft during cooling
 - During circulatory arrest with RCP, the grafts are opened to allow for drainage of retrograde blood, then they are de-aired and used directly for ACP (if needed)
 - Distal anastomosis completed under HCA with retrograde cerebral perfusion (RCP) only (if < 10 minutes) vs RCP for 3-10 minutes + ACP (if > 10 minutes)
 - Combines the potential benefit of retrograde cerebral perfusion for embolic washout with the metabolic benefits of ACP

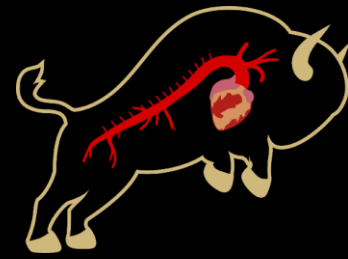


Methods: Shaggy Setup



- 1) ACP Cannula in graft
- 2) SVC/Retrograde Cannula
- 3) Aortic Cannula
- 4) Venous Return Cannula

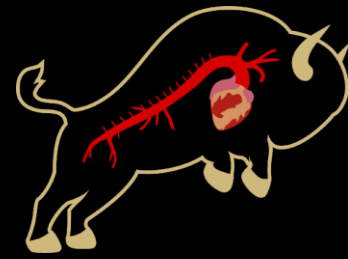




Results: Operative Characteristics

- In total, 229 patients identified
- Majority of patients underwent elective hemiarch surgery
- 107 (46.7%) required under 10 minutes of circulatory arrest (RCP only, mean time 6.2 mins)

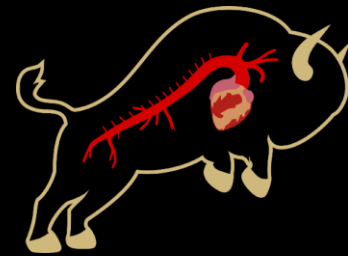
Operative Characteristics	N=229
Elective	185 (80.8%)
Hemiarch Replacement	158 (69.0%)
Zone2/Total Arch Replacement	71 (31.0%)
Adjunctive Aortic Valve or Root Procedure	155 (67.7%)
Intraoperative Statistics	
Nadir Bladder Temperature	27.4 ± 1.6
Cardiopulmonary Bypass Time (min)	147.1 ± 56.5
Aortic Cross-Clamp Time (min)	94.0 ± 41.5
Circulatory Arrest Time (min)	11.1 ± 8.5
Antegrade Cerebral Perfusion Time (min)	10.9 ± 8.8
Retrograde Cerebral Perfusion Time (min)	5.3 ± 2.5
Retrograde Cerebral Perfusion Only	107 (46.7%)
RCP Only Time (min)	6.2 ± 1.7
Intraoperative Transfusion	
Packed Red Blood Cells	1.4 ± 2.8
FFP	2.5 ± 4.1
Platelets	1.4 ± 1.6



Results: Postoperative Outcomes

- Stroke more common in total arch surgery
- Majority of stroke non-disabling
- All disabling stroke occurred in urgent/emergent procedures

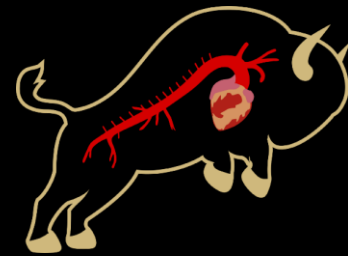
Variable	N (%)
New Renal Replacement Therapy	10 (4.4%)
Delirium	26 (11.4%)
Stroke	9 (3.9%)
Disabling Stroke	3 (1.3%)
Non-Disabling Stroke	6 (2.6%)
Elective Hemiarch Stroke (N=144)	2 (1.4%)
Elective Total Arch Stroke (N=41)	4 (9.8%)
Urgent/Emergent Hemiarch Stroke (N=14)	1 (7.1%)
Urgent/Emergent Total Arch Stroke (N=30)	2 (6.7%)
Infection	17 (7.4%)
Arrhythmia	56 (24.4%)
Prolonged Ventilation	21 (9.2%)
Mortality	9 (3.9%)



Results: Comparison to Non-Shaggy Protocol

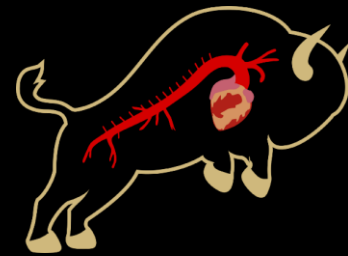
- Compared to non-Shaggy aortic arch surgeries starting December 2018
- Univariate analysis demonstrated reduced stroke and mortality in Shaggy protocol, but notable differences in procedural urgency and type of arch surgery

	Shaggy Protocol	Non-Shaggy Protocol	p-value
N	229	215	
Elective	188 (82.1%)	102 (47.4%)	<0.001
Urgent/Emergent	41 (17.9%)	113 (52.6%)	
Hemiarch	168 (73.4%)	137 (63.7%)	0.032
Total Arch	61 (26.6%)	78 (36.2%)	
Stroke	9 (3.9%)	31 (14.4%)	<0.001
Mortality	9 (3.9%)	21 (9.8%)	0.022



Results: Multivariate Comparison

- Multivariate logistic regression
 - Included variables: procedural urgency, arch replacement type, shaggy protocol
 - Stroke endpoint
 - Regression model ($p < 0.001$) as predictor for stroke
 - **Shaggy protocol remains independently significant (OR 0.3989, CI [0.167,0.8853], $p=0.0293$)**
 - Mortality endpoint:
 - Regression model ($p < 0.001$) as predictor for mortality
 - Shaggy protocol not independently significant ($p=0.284$)



Conclusions & Neuroprotection Protocol

Preoperative:

- Evaluate risk for Stroke
 - Circle of Willis Status
 - Other Anatomic Anomalies affecting Cerebral Protection
- Obtain cerebral oximetry and/or EEG when able

Intraoperative:

Surgeon:
-Start RCP: Washout embolus
-If duration of circulatory arrest >10 minutes, transition to ACP (consider prior to 10 if expected)

Anesthesiology/Perfusion:
-Optimize pressure delivery, DO₂
-Prevent anemia
-Monitor head saturation

Neuromonitoring Team:
-Monitor EEG Changes

Postoperative:

- Admission to CTICU
- Wean sedation as early as feasible to obtain neurologic exam
- Extubate as early as feasible
- Hourly neurologic checks
- Avoid anemia, hypoxemia
- Maintain MAP>65, if high risk consider higher MAP goal

Concern for Stroke

- Stroke alert: neurology consult, immediate imaging, evaluate for embolic debris
- If large vessel occlusion, discuss with neuro-interventional radiology
- Correct anemia (Hgb >8 g/dL)
- Correct hypoxemia (SpO₂>92%)

- The “Shaggy protocol” reduces risk for stroke in aortic arch surgery
 - When stroke does occur, typically non-disabling
- Developing an institutional protocol is vital for minimizing stroke risk

Questions???

