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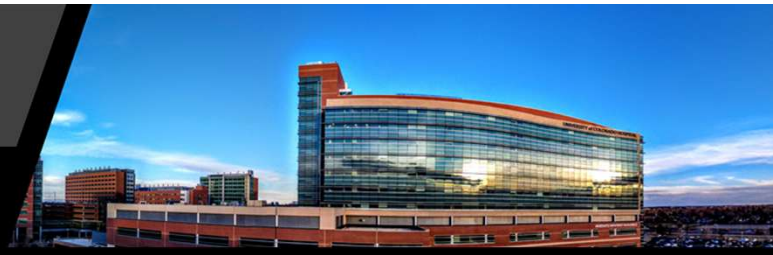

Hemiarch Efficiency: Retrograde Cerebral Perfusion

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Thoracic Aortic Program
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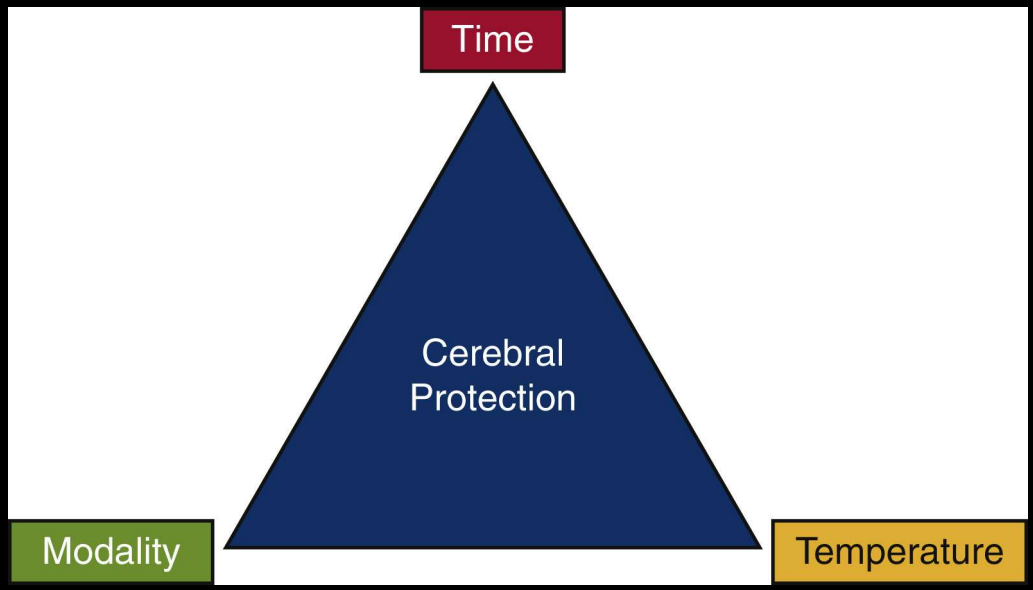
Disclosures

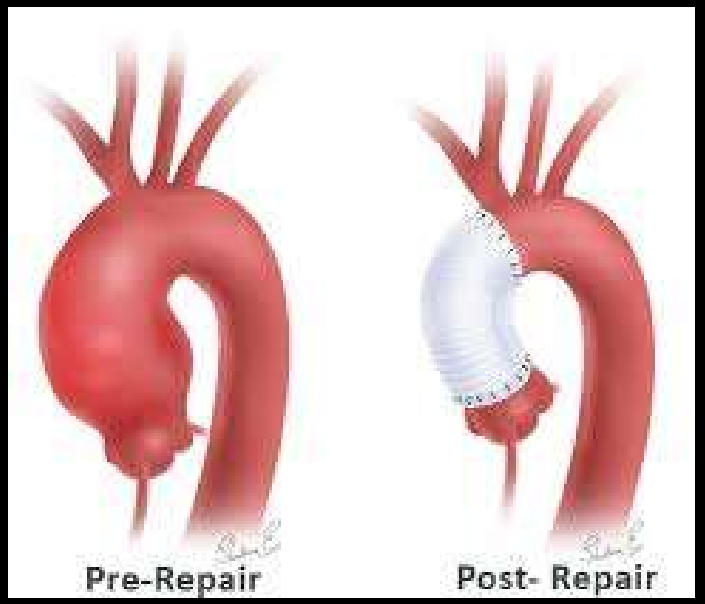
- No pay for direction of Cerebral perfusion
- Love operating, but love being done more
- Standing and waiting for things to happen does not go well for me



Ascending Aortic Surgery: Conduct

- Everything revolves around the Hemiarch portion
- Do what you can until target temp
  - -> do distal, then

Race: Finish the operation vs Finish Rewarming

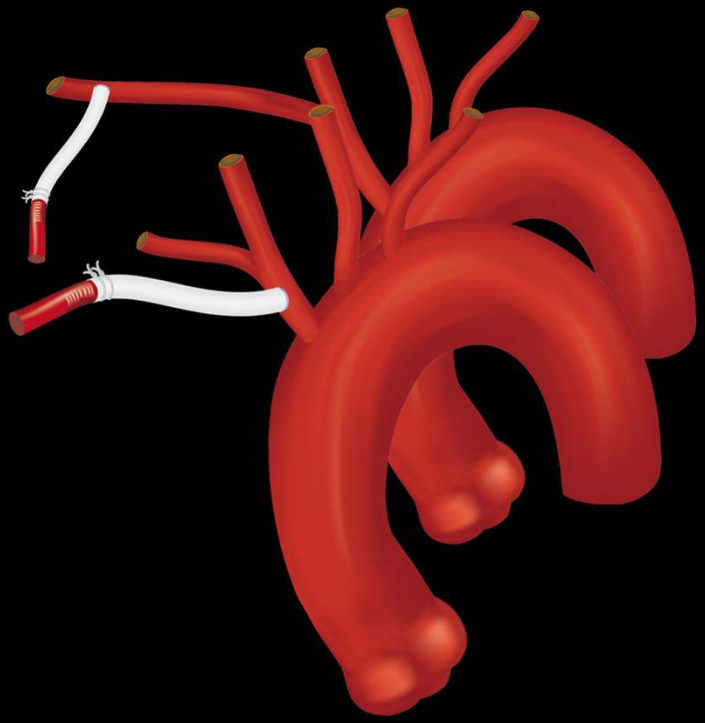


Ultimate Goal in Ascending Operations

- Remove all Abnormal Tissue
- Protect the Brain
- Optimize Time on Bypass
  - Too long, increases comorbidity
- Essentially, cool enough to protect brain and be warm enough to come off when done with procedure

Personal Progression

- 2009 EEG Silence Axillary SACP (20C)
  - Long Cases to begin,
- 2014 Innominate Graft, 2017 28C
  - Sewing on a graft takes time
  - Began central and Innominate
    - But delayed valve portion
- RCP written benefits were growing
  - But I could not go back to 20C



Antegrade versus retrograde cerebral perfusion for hemiarch replacement with deep hypothermic circulatory arrest: Does it matter? A propensity-matched analysis

Asvin M. Ganapathi, MD, Jennifer M. Hanna, MD, MBA, Matthew A. Schechter, MD, Brian R. Englum, MD, Anthony W. Castleberry, MD, MMCi, Jeffrey G. Gaca, MD, and G. Chad Hughes, MD

Axillary Cannulation
Selective Antegrade
Still 22C and EEG silence
All comers

TABLE 4. Thirty-day/in-hospital outcomes

Variable	Overall (n = 440)	RCP (n = 80)	Before matching ACP (n = 360)	Before matching *P* value	After matching ACP (n = 80)	After matching *P* value
Operative time (min)	345.2 ± 76.5	308.3 ± 72.7	353.4 ± 74.9	<.01	338.3 ± 80.3	.01
Any neurologic complication*	45 (10.3)	6 (7.5)	39 (10.8)	.36	9 (11.3)	.42
30-d/In-hospital mortality	15 (3.4)	2 (2.5)	13 (3.6)	.61	3 (3.8)	.65
30-d/In-hospital major composite morbidity	75 (17.0)	12 (15.0)	52 (17.5)	.59	8 (10.0)	.34
Any reoperation	19 (4.3)	2 (2.5)	17 (4.7)	.35	2 (2.5)	.99
Reoperation for bleeding	11 (2.5)	1 (1.3)	10 (2.8)	.39	2 (2.5)	.56
Intraoperative factor VIIa use	105 (23.9)	10 (12.5)	95 (26.4)	<.01	14 (17.5)	.38
Postoperative factor VIIa use	15 (3.4)	5 (6.3)	10 (2.8)	.15	3 (3.8)	.47
Prolonged (>24 h) ventilation	47 (10.7)	6 (7.5)	41 (11.4)	.29	7 (8.8)	.77
Acute renal failure†	35 (8.0)	8 (10.0)	27 (7.5)	.47	4 (5.0)	.23
New onset dialysis	9 (2.0)	2 (2.5)	7 (1.9)	.76	3 (3.8)	.65
TND	36 (8.2)	6 (7.5)	30 (8.3)	.24	5 (6.3)	.75
Clinical stroke	13 (3.0)	1 (1.3)	12 (3.3)	.27	2 (2.5)	.56
TIA	3 (0.7)	0 (0.0)	3 (0.8)	.27	3 (3.8)	.08
30-d Readmission	48 (10.9)	7 (8.8)	41 (11.4)	.48	13 (16.3)	.15
Discharge to other than home	28 (6.4)	3 (3.8)	25 (6.9)	.26	2 (2.5)	.65
Postoperative LOS (d)	7.7 ± 7.2	6.9 ± 5.5	7.9 ± 7.5	.15	7.6 ± 9.8	.58

Data presented as mean ± standard deviation or n (%). *RCP*, Retrograde cerebral perfusion; *ACP*, antegrade cerebral perfusion; *TND*, transient neurologic dysfunction; *TIA*, transient ischemic attack; *LOS*, length of stay. *Postoperative transient or permanent mental status change, TIA, or clinical stroke. †Maximum creatinine 2 times the baseline creatinine and >2.0 g/dL.

Deep Hypothermia With Retrograde Cerebral Perfusion Versus Moderate Hypothermia With Antegrade Cerebral Perfusion for Arch Surgery

Bradley G. Leshnower, MD, Srikant Rangaraju, MD, Jason W. Allen, MD, PhD, Anthony Y. Stringer, PhD, Thomas G. Gleason, MD, and Edward P. Chen, MD

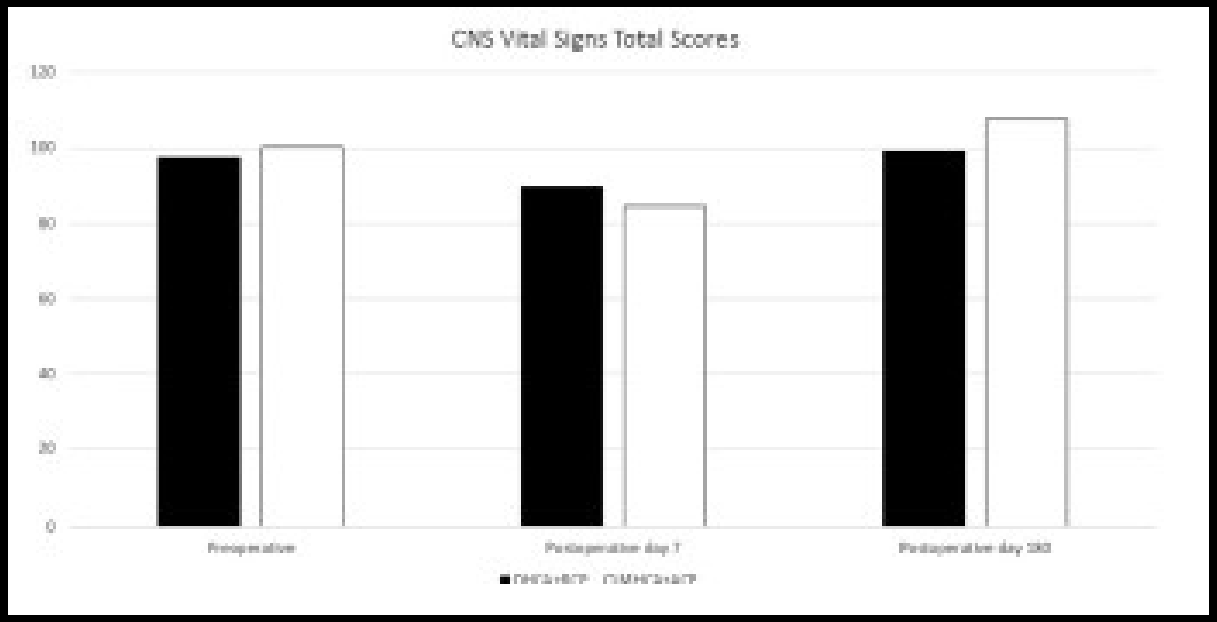
- Pilot Study
- RCP 20C vs ACP 20C Nasophryngeal

Procedures

Table 2. Intraoperative Data Comparing Patients Undergoing Hemiarch Replacement Using Deep Hypothermic Circulatory Arrest With Retrograde Cerebral Perfusion or Moderate Hypothermic Circulatory Arrest With Antegrade Cerebral Perfusion

Variable[a]	DHCA+RCP (n = 11)	MHCA+ACP (n = 9)	*p* Value
Aneurysm size, cm	5.4 ± 0.7	5.1 ± 0.3	0.26
Root replacement	5 (45)	5 (56)	1
Hemiarch	11 (100)	9 (100)	1
CABG	0	1 (11)	0.45
Aortic valve replacement	7 (64)	6 (67)	1
CPB, minutes	199 ± 58	173 ± 49	0.32
Cross-clamp, minutes	158 ± 42	154 ± 46	0.87
HCA, minutes	21 ± 4	19 ± 3	0.26
Temperature at HCA, °	19.9 ± 0.1	26.3 ± 1.8	<0.0001[b]
Total operative time, minutes	354 ± 71	322 ± 77	0.14
Intraoperative transfusion	8 (73)	7 (78)	1

Neurocognitive Outcomes Equal



Simple retrograde cerebral perfusion is as good as complex antegrade cerebral perfusion for hemiarch replacement

Akiko Tanaka, Anthony L. Estrera

- Retrograde became cultish
- People that believed in RCP really believed
- Relatively straight forward with Arterial connected to the SVC above the Azygous

There are no data that proves superiority of RCP or ACP during hemiarch repair. However, the safety of RCP has been proven in multiple studies up to 50 minutes of circulatory arrest time, which should be a long enough for a simple hemiarch replacement. When RCP is appropriately applied, a transient high opening pressure followed by maintenance perfusion pressure below 25 mmHg, it has proven to be as good as or better than ACP for hemiarch repair to augment cerebral protection during hemiarch replacement. This is due to its simplicity and better exposure of surgical field—with potentially lower risk of embolic events. Thus, we prefer RCP as the adjunct to profound hypothermic circulatory arrest for a hemiarch replacement.

RCP Consensus

- Relatively simple
- Cools, Washes out
  - Question effective delivery of oxygen and glucose
- Great for short periods
- Usually used with DHCA 18-24C

- Conduct of operation
  - Central Cannulation with beginning on proximal work
  - Then RCP for HCA
  - Strive to be done at rewarming

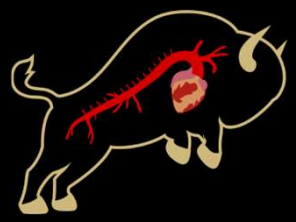
- Limit CPB and Op Time

And are our RCP parameters real?

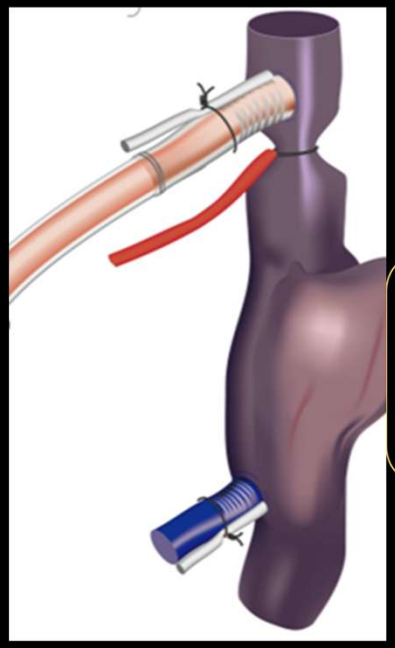
- Deep Hypothermia
- Flows <10ml/kg
- Pressure <25mm Hg
- Washout and Cooling
- Oxygen and Glucose not delivered to the tissue

- Not required for ACP
- Low Flows low pressure really washing out?
- Upper body return blood looks black, has to be removing oxygen and glucose

Initial experiences RCP high pressure, flow



- 79 RCP vs 248 ACP elective hemiarches at 28C
  - RCP 30-50mm Hg vs SACP 40-60mmHG
- No differences in outcomes
- ICU stay < days



Higher Than Traditional Parameters RCP
- Moderate hypothermia
- Pressure of 40 mmHg
- Oxygen Extraction 93.3%
- Similar neurological outcomes to ACP

SACP vs RCP at 28C

	Before Matching			After Matching		
	SACP (n = 248)	RCP (n = 79)	P-Value	SACP (n=60)	RCP (n=60)	P-value
Age (years)	62 (50 - 70)	60 (47 - 70)	0.80	62 (49 - 9)	59 (46 - 69)	0.55
Sex (Female)	61 (24.6%)	19 (24.0%)	0.99	16 (26.7%)	17 (28.3%)	0.99
Re-do Sternotomy	63 (25.4%)	20 (30.4%)	0.99	23 (21.7%)	19 (32.7%)	0.30
BMI (kg/m^2)	27.7 (24.9 - 31.9)	26.8 (23.9 - 31.2)	0.55	62 (48 - 69)	59 (46 - 69)	0.42
CPB (min)	138 (115 - 175)	125 (109 - 159)	0.03	121 (102 - 145)	124 (109 - 170)	0.35
XC (min)	95 (71 - 125)	97 (79 - 124)	0.54	90 (64 - 111))	97 (79 - 115)	0.12
Nadir Bladder Temp	27.6 (26.3 - 28.0)	28.0 (26.7 - 28.1)	0.02	27.5 (26-28.0)	28.0 (27.1 - 28.2)	0.07
Circ Arrest (min)	10 (7 - 12)	6 (5 - 8)	< 0.001	7 (5 - 9)	6 (5 - 8)	0.34
Hospital LOS (days)	7 (6 – 9)	7 (6 - 8)	0.84	7 (6 – 9)	7 (6 - 8)	0.90
ICU LOS (days)	3 (2 - 4)	2 (1 - 3)	0.03	2 (1 -3)	2 (1 - 3)	0.61
Stroke	6 (2.4%)	4 (5.0%)	0.26	2 (3.3%)	2 (3.3%)	0.99
Delirium	17 (6.8%)	4 (5.0%)	0.79	2 (3.3%)	4 (6.6%)	0.68

RCP at 28C is safe with short HCA

- Don’t know the limits (good so far at 10-20”)
- When predictable timing, it works well
- Facilitates Conduct of Operation
  - With Valve or composite root, usually ready to repefuse and come off
  - With David, usually warm 10”-20” before reperfusion

Questions?