Total Circulatory Arrest Alone is Safe

in Hemiarch repair under Moderate Hypothermia

Chee-hoon Lee[1], MD., Joon Bum Kim[2], MD., PhD., Mi Hee Lim[1], MD., Min Ho Ju[1], MD., and Hyung Gon Je[1], MD., PhD.

[1]*Department of Cardiovascular and Thoracic Surgery, Research Institute for Convergence of Biomedical Science and Technology, Pusan National University Yangsan Hospital, Korea*

[2]*Stanford University, Department of Thoracic and Cardiovascular Surgery, Asan Medical Center, University of Ulsan, College of Medicine, Seoul, Korea*

Objective

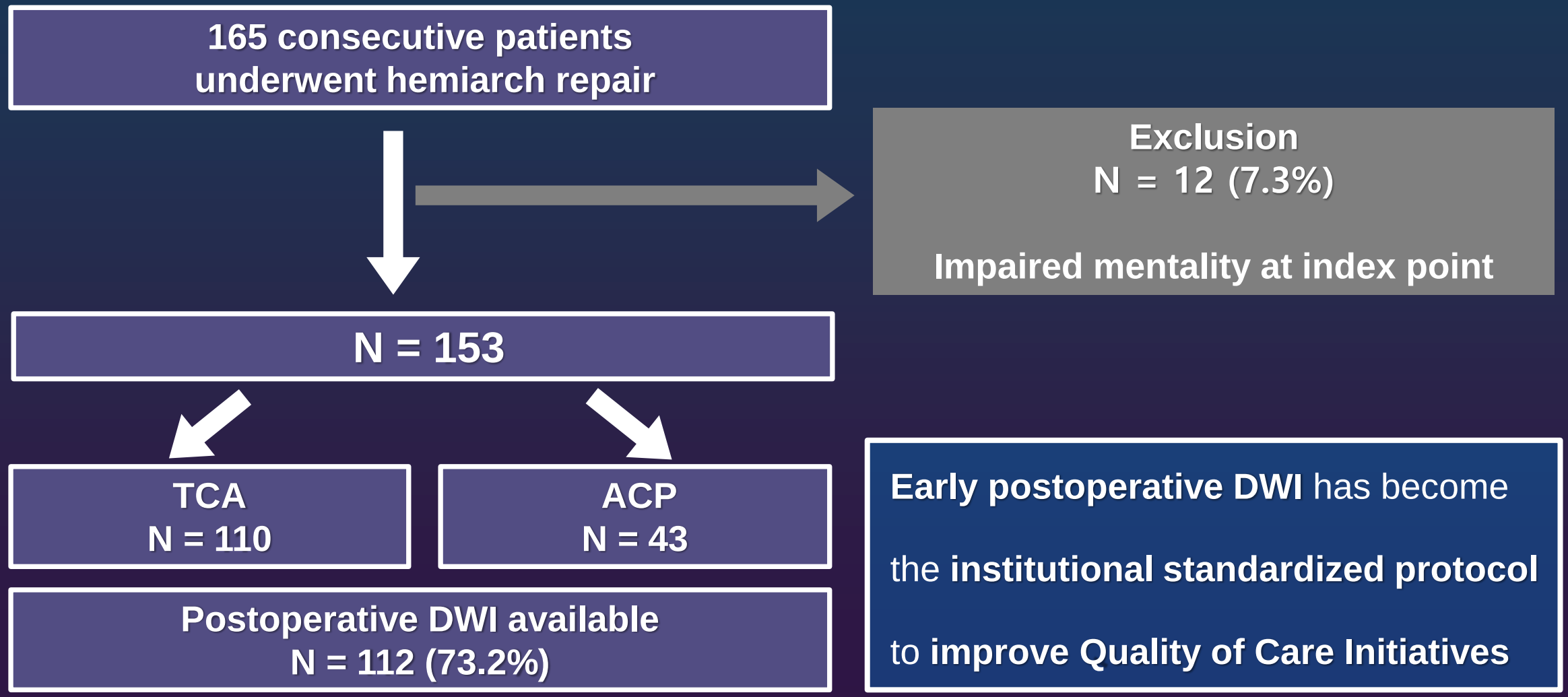
- ✓ Previous studies showed **equivalent safety** of **total circulatory arrest** (TCA) alone for **hemiarch repair** compared to **antegrade cerebral perfusion** (ACP).
  - ✓ For brief periods (< 30 mins)
  - ✓ Under moderate hypothermia (25-28°C)

- ✓ Nevertheless, **concerns** regarding potential **risk of neurologic injuries** are still **linger**

- ✓ We sought to **compare neurologic safety** in these setting: **TCA alone** vs. **ACP** using **postoperative** brain **diffusion-weighted MRI** (DWI)

Methods

- From Jan. 2019 through Aug. 2023



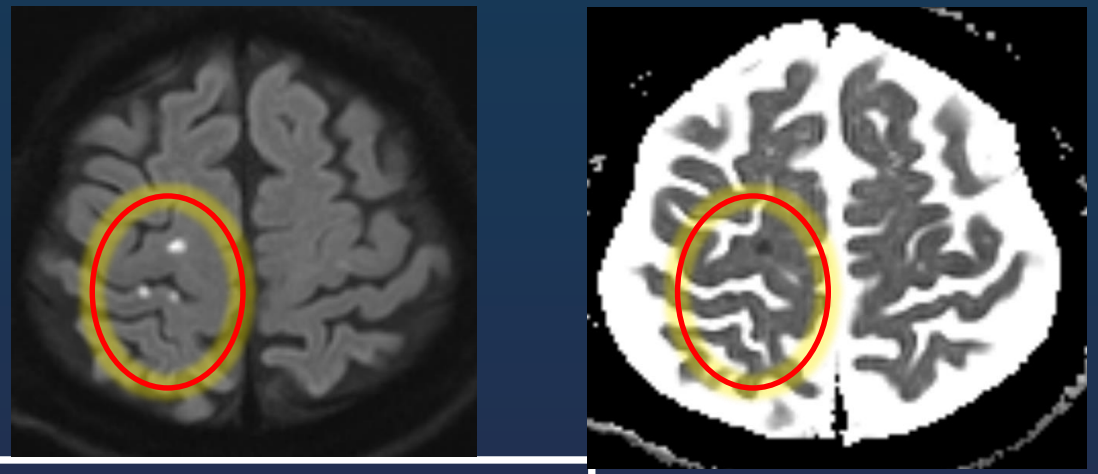
Early postoperative DWI has become the **institutional standardized protocol** to **improve Quality of Care Initiatives**

✓ Outcomes of interest

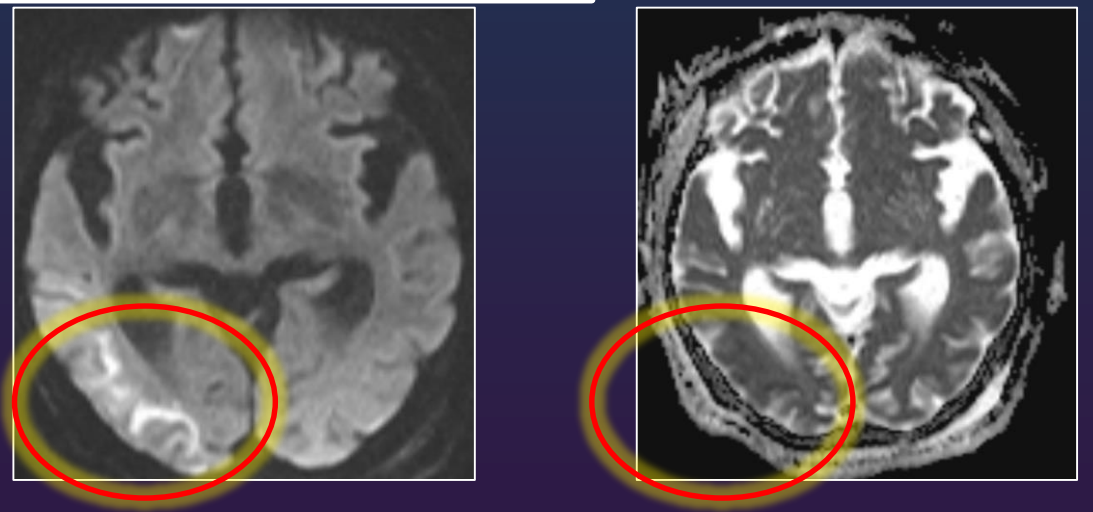
- ✓ Clinical outcomes
  - ✓ Mortality
  - ✓ Major adverse events
  - ✓ Overt neurologic injuries

- ✓ The incidence & number of acute brain lesions in postoperative DWI

Embolic infarctions



Watershed infarction



DWI ADC map

- ✓ Definition of acute infarction; High signal intensity in DWI and correlates with low signal intensity on the apparent diffusion coefficient (ADC) map

Results

Table 1. Baseline summary

Variables	TCA (N = 110)	ACP (N = 43)	*P*-value
Age (year), n (%)	66.6 ± 13.1	63.5 ± 13.3	0.200
Female gender, n (%)	59 (53.6)	15 (34.9)	0.057
Diabetes, n (%)	18 (16.4)	5 (11.6)	0.675
Hypertension, n (%)	72 (65.5)	28 (65.1)	0.331
Prior CVA, n (%)	13 (11.9)	6 (14.0)	0.925
CKD stage ≥ 3, n (%)	39 (35.5)	15 (34.9)	> 0.99
NYHA Functional class ≥ 3, n (%)	50 (45.5)	17 (39.5)	0.007
EuroSCORE II, mean ± SD	15.6 ± 20.4	8.8 ± 13.1	0.044
LV ejection fraction (%), mean ± SD	58.2 ± 9.6	56.1 ± 10.1	0.313
Acute aortic dissection, n (%)	46 (41.8)	23 (53.5)	0.261

Results

Table 2. Operative profiles summary

Variables	TCA (N = 110)	ACP (N = 43)	*P*-value
Operative procedures, n (%)			
Hemi-arch only	42 (38.2)	23 (53.5)	0.124
Root replacement or re-implantation	41 (37.3)	6 (14.0)	0.009
Aortic valve replacement	27 (24.5)	15 (34.9)	0.277
Minimally invasive access, n (%)	22 (20.0)	10 (23.3)	0.823
The lowest core temperature (℃), median [IQR]	25 [25, 25]	25 [25, 25]	0.332
TCA time (min), median [IQR]	18 [15, 21]	6 [4, 8]	< 0.001
ACP time (min), median [IQR]	0 [0, 0]	16 [13, 25]	< 0.001

Results

Table 3. Early clinical outcomes

Variables	TCA (N = 110)	ACP (N = 43)	*P*-value
Adverse outcomes, n (%)			
Re-exploration for bleeding	5 (4.5)	4 (9.3)	0.458
Need for ECMO	1 (0.9)	1 (2.3)	> 0.99
New onset dialysis	4 (3.6)	3 (7.0)	0.647
Mechanical Ventilation ≥ 24 hours	14 (12.7)	10 (23.3)	0.173
Early mortality	6 (5.5)	3 (7.0)	> 0.99
Without transfusion, n (%)	19 (17.3)	6 (14.0)	0.798
Bleeding amount for 12 hours (ml), median [IQR]	467 [319, 700]	470 [335, 722]	0.985
Intensive care unit stay (hour), median [IQR]	25 [22, 46]	25 [22, 46]	0.977
Length of stay (day), median [IQR]	7 [6, 8]	7 [6, 9]	0.279

Results

Table 3. Neurologic outcomes

Variables	TCA (N = 110)	ACP (N = 43)	*P*-value
Temporary neurologic deficit, n (%)	10 (9.1)	7 (16.3)	0.324
Permanent neurologic deficit, n(%)	2 (1.8)	1 (2.3)	> 0.99
Postoperative DWI available, n (%)	85 (77.3)	27 (61.8)	0.106
Incidence of acute watershed infarction, n (%)	2 (2.4)	2 (7.4)	0.524
Incidence of acute embolic infarction, n (%)	52 (61.2)	17 (63.0)	> 0.99
Number of embolic infarctions, median [IQR]	1 [0 – 3]	3 [0 – 6]	0.128

Results

- ✓ Inverse probability of treatment weighing (IPTW) adjustments for comparative neurologic outcomes

  - ✓ TCA vs. ACP

Variables	**Odds ratio**	**95% CI**	***P*-value**
Temporary neurologic deficit	0.98	0.90 – 1.08	0.73
Permanent neurologic deficit	0.98	0.93 – 1.03	0.44
Number of embolic infarctions	N/A	N/A	0.17

Conclusion

✓ For short period (<30 min), TCA alone with moderate hypothermia was not inferior to a strategy adding antegrade cerebral perfusion in open hemiarch repair with regard to the risk of neurologic injuries