

Unilateral and bilateral cerebral perfusion during total arch replacement surgery: which is better?

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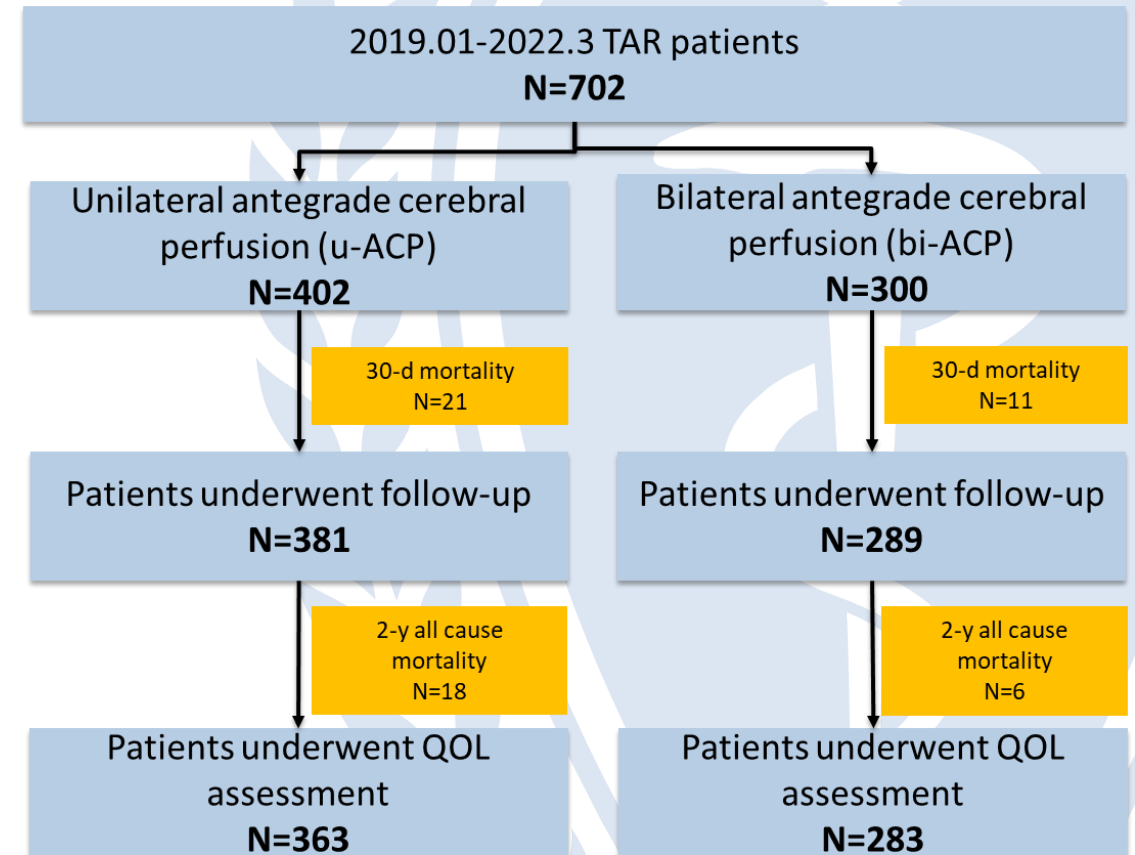
Objectives

- **The superiority of unilateral or bilateral cerebral perfusion remains a controversial topic**
- **To compare the impact of unilateral antegrade cerebral perfusion (u-ACP) and bilateral antegrade cerebral perfusion (b-ACP) on perioperative complications and short-term follow-up outcomes in Asian patients of total arch replacement surgery.**

Methods

- **Single-center retrospective cohort study**
- **702 patients separated into unilateral (n=402) and bilateral (n=300) antegrade cerebral perfusion groups**
- **Evaluate baseline characteristics between two groups and analyze perioperative and short-term postoperative complications**

Follow chart



Baseline characteristics

Preoperative characteristics	Total(n=702)	u-ACP(n=402)	b-ACP(n=300)	P value
Age(years),mean±SD	50.27±11.33	49.82±11.38	50.8±11.28	0.065
Males,n(%)	540 (76.9%)	316(78.6%)	224(74.7%)	0.22
Smoking,n(%)	243 (34.6)	138(34.3%)	105(35%)	0.853
Alcohol,n(%)	46 (6.6%)	29(7.2%)	17(5.7%)	0.419
Hypertension,n(%)	569 (81.1%)	319(79.4%)	250(83.3%)	0.183
Diabetes mellitus,n(%)	39 (5.6%)	24(6.0%)	15(5%)	0.579
COPD,n(%)	4 (0.6%)	4(1%)	0(0%)	0.14
CAD,n(%)	69(9.8%)	32(8%)	37(12.3%)	0.052
Ischemic stroke,n(%)	32 (4.6%)	16(4.0%)	16(5.3%)	0.395
Cerebral hemorrhage,n(%)	6 (0.9%)	3(0.7%)	3(1%)	0.704
Marfan syndrome,n(%)	22 (3.1%)	12(3%)	10(3.3%)	0.793
Pericardial effusion,n(%)	133 (19%)	73(18.2%)	60(20%)	0.82
Creatinine(μmol/L),median (IQR)	82.68(66.57,103)	87.3(68.42,106)	76.54(63.6,99.39)	0.001*
Ejection fraction(%),mean±SD	60.32±4.95	60.12±4.66	59.87±5.26	0.585
Hemoglobin (g/L),mean±SD	130.73±18.51	131.84±18.01	129.4±19.04	0.225
Platelets (*10 ⁹),mean±SD	192.88±75.19	186.15±70.02	200.98±80.41	0.183
Glucose(mmol/L),median (IQR)	6.85(5.88,7.93)	7.01(6.09,8.09)	6.68(5.76,7.68)	0.074
BUN(mmol/L),median (IQR)	6.68(5.36,8.53)	6.82(5.5,8.62)	6.57(5.29,8.43)	0.727
Albumin (g/L),mean±SD	38.44±4.55	38.87±4.66	37.92±4.37	0.055
Lactate(mmol/L),median (IQR)	1.5(1.1,2.14)	1.5 (1.1,2.06)	1.5(1.07,2.32)	0.608
Onset-Consultation Time(days),median (IQR)	10(5,18)	10(5,16)	10(5.20)	0.657

Perioperative characteristics

Perioperative characteristics	Total(n=702)	u-ACP(n=402)	b-ACP(n=300)	P value
CPB time (min),median (IQR)	189(156,232)	198(163,241)	181(151,214)	0.001*
Cross-clamp time(min),median (IQR)	118(97,149)	126(100,168)	113(93,140)	0.001*
Circulatory arrest time(min),median (IQR)	16(13,20)	18(14,22)	14(12,17)	0.001*
Nasopharyngeal temperature(C),median (IQR)	25(24,26.3)	25(23.6,25.5)	26(25,27.18)	0.000*
Rectal temperature(C),median (IQR)	27(25.9,28)	26.4(15,28)	28(27,28.88)	0.000*
Cooling time (min),median (IQR)	89(71,114)	92(72,120)	85.5(70,103.5)	0.015*
Rewarming time (min),median (IQR)	89(70,114)	91(75,120)	86(66.25,110.75)	0.008*
Operation duration(min),median (IQR)	395(330,468)	412(344,485)	370(315,445)	0.001*
Transfused RBC units(n),median (IQR)	0(0,2)	0(0,2)	0(0,1.75)	0.188
Transfused serum units(n),median (IQR)	4(0,6)	4(0,6)	2(0,6)	0.004*
Cerebral perfusion time(min), mean±SD	26.5±8.95	27.93±9.14	24.7±8.36	0.001*
Cerebral perfusion flow(mL/min),median (IQR)	10(8,12.5)	8(5,10)	13(10,15)	0.001*

Surgical strategies

Variable of surgical strategies	Total(n=702)	u-ACP(n=402)	b-ACP(n=300)	P value
Bentall operation,n(%)	166(23.6%)	97(24.1%)	69(23%)	0.377
Wheat operation,n(%)	13 (1.9%)	5(1.2%)	8(2.7%)	0.376
David operation,n(%)	30 (4.3%)	20(5.0%)	10(3.3%)	0.565
CABG operation,n(%)	165 (23.5%)	92(22.9%)	73(24.3%)	0.655
Intubation site				
Ascending aorta,n(%)	27 (3.8%)	18(4.5%)	9(3%)	0.314
Axillary artery,n(%)	361 (51.4%)	237(59.0%)	124(41.3%)	0.001*
Femoral artery,n(%)	423(60.3%)	203(50.5%)	220(73.3%)	0.001*
Artificial blood vessel branch,n(%)	11 (1.6%)	10(2.5%)	1(0.3%)	0.029*

Early outcomes

Postoperative outcomes	Total(n=702)	u-ACP(n=402)	b-ACP(n=300)	P value
Mechanical ventilation time(h),median (IQR)	18(12,43)	19(13,55)	18(11,37)	0.174
ICU time(h),median (IQR)	91(62,144)	90(63,159.88)	91.94(62,139.54)	0.91
Reintubate, n(%)	12 (1.7%)	6(1.5%)	6(2%)	0.608
Readmission to ICU, n(%)	34 (4.8%)	22(5.5%)	12(4%)	0.369
Second thoracotomy, n(%)	21 (3%)	14(3.5%)	7(2.3%)	0.377
TND, n(%)				
Neurological symptoms, n(%)	78 (11.1%)	54(13.4%)	24(8%)	0.023*
PND, n(%)	45(6.8%)	28(7.0%)	17(5.7%)	0.487
Postoperative ischemic stroke, n(%)	19 (2.7%)	14(3.5%)	5(1.7%)	0.142
Postoperative cerebral hemorrhage, n(%)	3 (0.4%)	1(0.2%)	2(0.7%)	0.579
Paraplegia, n(%)	17 (2.4%)	10(2.5%)	7(2.3%)	0.895
Hemiplegia, n(%)	6 (0.9%)	5(1.2%)	1(0.3%)	0.246
Paresis, n(%)	7 (1%)	3(0.7%)	4(1.3%)	0.468
IABP, n(%)	8 (1.1%)	4(1.0%)	4(1.3%)	0.729
ECMO, n(%)	10 (1.4%)	5(1.2%)	5(1.7%)	0.751
Tracheotomy, n(%)	6 (0.9%)	2(0.4%)	4(1.3%)	0.41
Renal insufficiency, n(%)	169 (24.1%)	100(25%)	69(23%)	0.565
Hemodialysis, n(%)	50 (7.1%)	32(8.0%)	18(6%)	0.318
Liver insufficiency, n(%)	265 (37.7%)	164(40.8)	101(33.7%)	0.054
30-d mortality, n(%)	32 (4.4%)	21(5.2%)	11(3.7%)	0.228

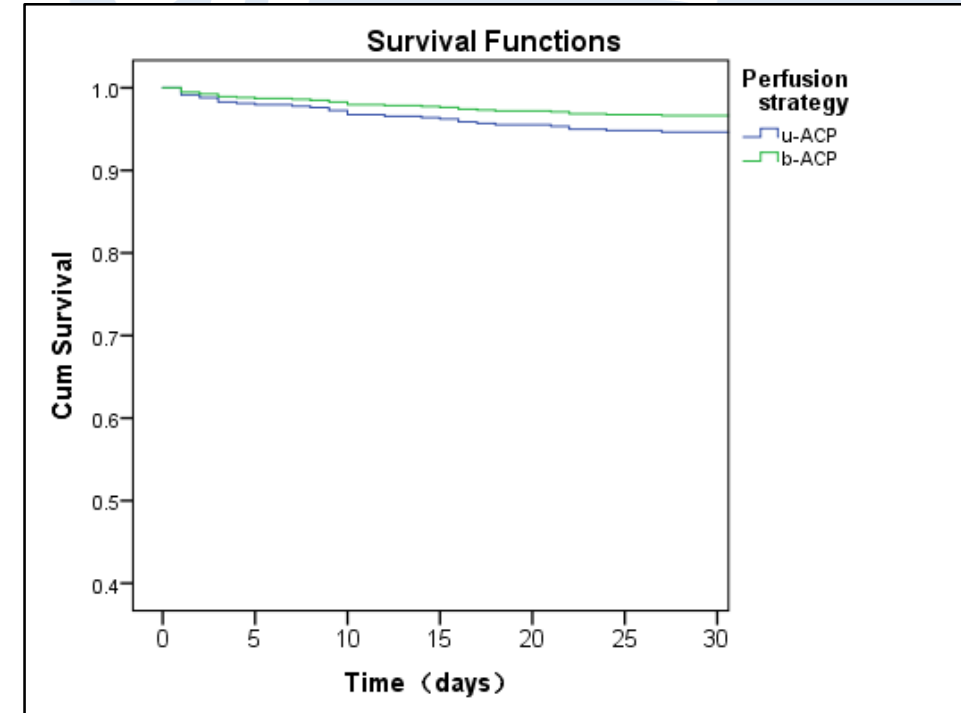
Follow up

Two-year follow-up after surgery	Total(n=670)	u-ACP(n=381)	b-ACP(n=289)	P value
All-cause mortality, n(%)	24(3.6%)	18(4.7%)	6(2.1%)	0.067
Quality of Life				0.006*
Low , n(%)	18(2.7%)	13(3.4%)	5(1.7%)	0.223
Medium , n(%)	144(21.5%)	66(17.3%)	78(27.0%)	0.004*
High, n(%)	484(72.2%)	284(74.5%)	200(69.2%)	0.023*
Dizziness, n(%)	45 (6.7%)	26(6.8%)	19(6.5%)	0.952

Univariate Logistic analysis

Variable	Hazard ratio (log10)	95%CI	P-value
Rewarming time	●	1.004(1.001-1.007)	0.002
Cooling time	●	1.006(1.001-1.012)	0.003
Circulatory arrest time	●	1.005(1.001-1.009)	0.025
CPB time	●	1.004(1.002-1.006)	0.001
Operation duration	●	1.003(1.002-1.005)	0.001
Cerebral perfusion flow	●	0.906(0.844-0.974)	0.007
BUN	●	1.083(1.011-1.161)	0.024
Creatinine	●	1.009(1.003-1.014)	0.002
Cerebral perfusion strategy	●	0.560(0.338-0.930)	0.025

Cox regression analysis 30-day mortality



Multifactor Logistic regression analysis of TND

Variables	β	Wald χ^2	P value	OR	95% CI
Cerebral perfusion strategy	-0.541	4.008	0.045	0.582	(0.343,0.989)
BUN	0.084	5.337	0.021	1.088	(1.013,1.168)
CPB time	0.004	9.628	0.002	1.004	(1.013,1.006)
Constant	-2.861	26.491	0	0.057	