

The Safety Strategy Combined 14 Fr and 16 Fr Perfusion Method with Atherosclerotic Cases for Minimally Invasive Cardiac Surgery

Tomohisa Takeichi (CE)¹ *, Akitoshi Yamada (MD)², Takanori Tanaka (CE)¹, Kunihiro Fujiwara (CE)¹, Hidekazu Nakazu (MD)², Ryo Toma (MD)², Kiyoto Mitsui (CE)¹, Takumi Sugita (CE)¹, Yoshihisa Morimoto (MD)²
Department of Clinical Engineering and ² Cardiovascular Surgery, Kitaharima Medical Center, Hyogo, Japan

Introduction

- The perfusion strategy for 3D endoscopic minimally invasive cardiac surgery (MICS) has not yet been fully established.
- We encountered a case of postoperative cerebral infarction while utilizing combined antegrade and retrograde perfusion in a patient with atherosclerosis.
- To address this, we conducted a mixing zone study and refined our combined antegrade and retrograde perfusion strategy (1).

Objective

- This study evaluates the efficacy of the modified approach.

Methods

A combination of antegrade (ascending aorta or axilla) and retrograde perfusion indicated cases

- An atheroma thickness > 4 mm or total circumferential calcification based on preoperative enhanced computed tomography (CT).
- Modified group is defined as the strategy after mixing zone study (Combination of 14Fr/14Fr or 16Fr)

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32 patients

Control group (n=8)

Modified group (n=24)

Primary outcomes

Cerebral infarction

Secondary outcomes

In ICU stay

Acute kidney injury

In hospital stay

Hospital mortality

	Control group(n=8)	Modified group(n=24)	P-value
Preoperative patient characteristics			
Age (years)	77.8 ± 4.0	75.9 ± 7.7	0.65
Female (%)	1(12.5)	9(37.5)	0.38
BSA (m²)	1.6 ± 0.13	1.6 ± 0.21	0.87
LVEF (%)	55.3 ± 9.8	58.2 ± 7.7	0.38
eGFR (mL/min/1.73 m²)	51.6 ± 22.3	50.7 ± 18.9	0.95
Cr (mg/dL)	1.2 ± 0.46	1.5 ± 1.4	0.85
History of cerebral infarction (%)	0	2(8.3)	0.55
Prior cardiac surgery (%)	1(12.5)	7(29.1)	0.64
EuroSCOREII	3.4 ± 1.9	6.3 ± 3.5	0.035

	Control group(n=8)	Modified group(n=24)	P-value
Perioperative patient outcomes			
Isolated AVR (%)	3(37.5)	3(12.5)	0.29
Isolated MV surgery(+Maze) (%)	5(62.5)	20(83.3)	0.33
Repair (%)	4(50.0)	7(29.1)	0.41
Replacement (%)	1(12.5)	13(54.1)	0.09
MV surgery+TAP (%)	1(12.5)	1(41.6)	1.0
Ascending Aorta+Femoral perfusion (%)	6(75.0)	7(41.1)	0.08
French size			
AscAo 14Fr+Femoral 14Fr (%)	0	3(12.5)	0.54
AscAo 14Fr+Femoral 16Fr (%)	3(37.5)	21(87.5)	0.01
AscAo 14Fr+Femoral 18Fr (%)	3(37.5)	0	0.01
AscAo 14Fr+Femoral 20Fr (%)	1(12.5)	0	0.25
subclavian Graft+Femoral 14Fr (%)	1(12.5)	0	0.25
Mean CI (L/min/m²)	2.1 ± 0.14	2.1 ± 0.11	0.48
CPB time (min)	239.4 ± 95.0	214.5 ± 65.9	0.07
Procedure time (min)	302.9 ± 89.6	306.3 ± 174.7	0.24
Postoperative outcomes			
Cerebral infarction (%)	0	0	1.0
Acute kidney injury (%)	1(12.5)	8(33.3)	0.39
Hospital mortality (%)	1(12.5)	0	0.25
Axilla dissection (%)	0	0	1.0
Ventilation time(h)	10.3 ± 16.8	10.4 ± 14.1	0.96
CK(IU/L)	1315.3 ± 958.1	1050.1 ± 690.4	0.16
IIn ICU stay(day)	1.5 ± 1.8	1.3 ± 0.94	0.92
In hospital stay(day)	12.1 ± 11.1	10.6 ± 8.1	0.26

Discussions

1. Regarding two choices of cannula size

Flow<4.0L/min: 14Fr/14Fr
Flow>4.0L/min: 14Fr/16Fr

2. The mixing zone combination of 14Fr/14Fr or 16Fr

Since the abdominal branch arteries are not taken into account, the actual mixing zone may be located below that predicted by the 3D vascular model (1).

The mixing zone of utilized 3D model

Conclusions

The modified perfusion strategy is a safety method to prevent cerebral infarction.

References

1. Tomohisa Takeichi, et al. Assistance from a mixing zone model to perform aortic femoral perfusion strategy with severe atherosclerotic and arteriogenic aortic disease for endoscopic minimally invasive redo mitral valve repair. J Extra Corpor Technol 2025, 57, 32–37.