What is the best cannulation strategy for acute type A aortic dissection

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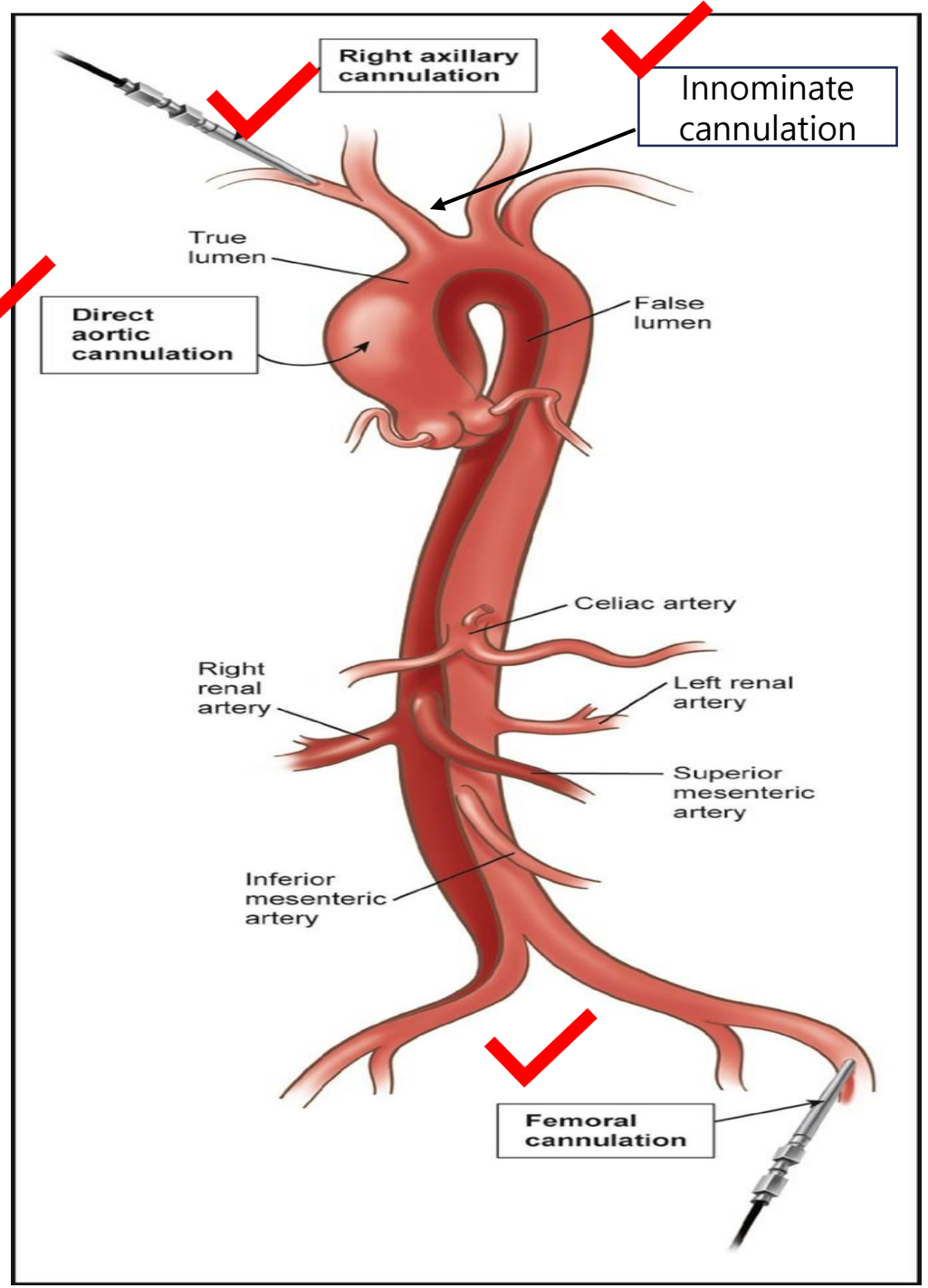
The Purpose and Principal of initial cannulation for acute type A dissection

- Quick to establish to CPB , (less than 30min ? 1h ?)
- Hypothermia for circulatory arrest
- Perfusion - malperfusion (brain, coronary, visceral , limb)
  - maintain vital sign
  - resolve the persistence of preop malperfusion
  - avoid new malperfusion that occurs after the initiation of CPB
- Avoid exacerbation of aortic dissection
- Technically easy and safe procedure

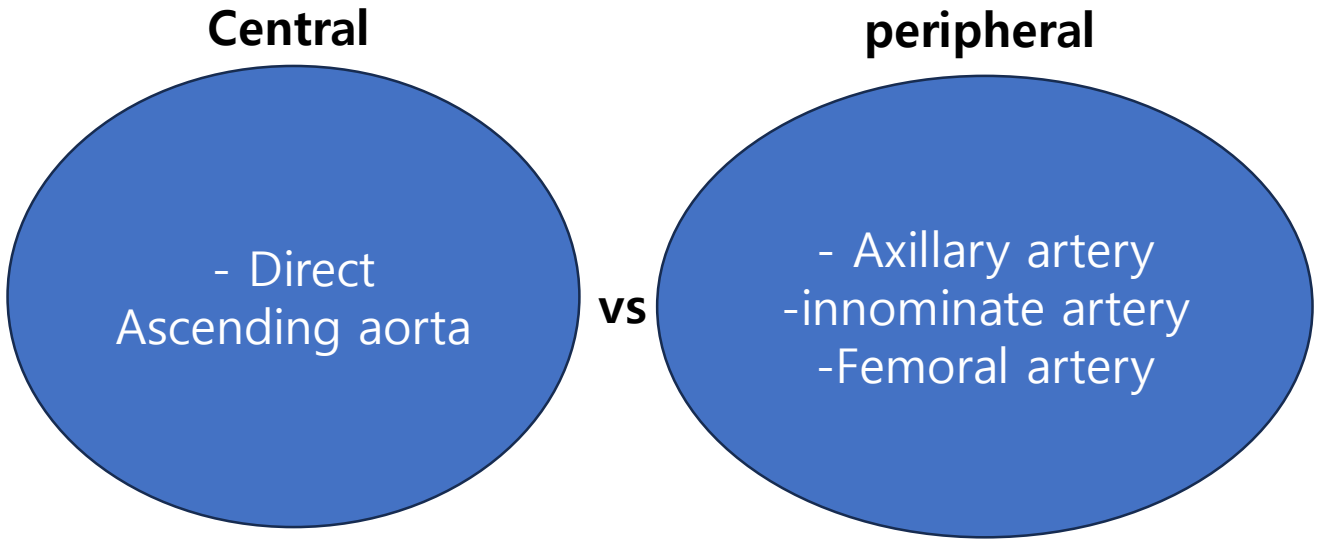
Various cannulation site introduction

- Femoral artery 1960~
- Axillary 1990~
- Innominate artery 1995~
- Ascending aorta 2000~

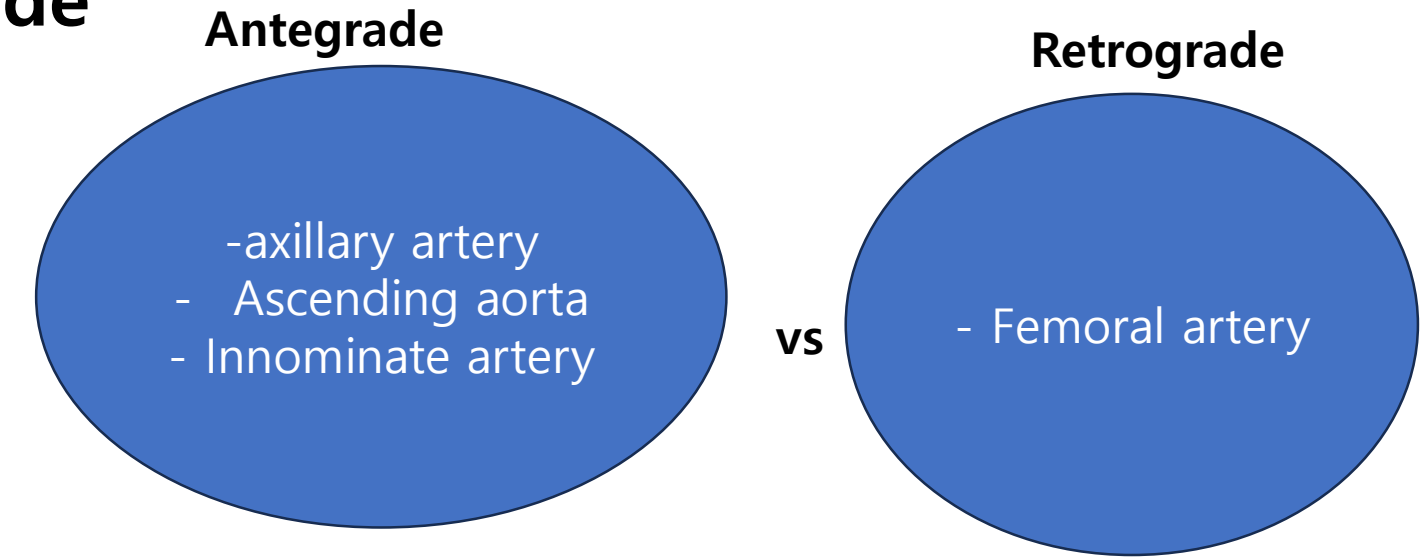


Types of cannulation

- **Central vs peripheral**



- **Antegrade vs Retrograde**



Advantage and disadvantage of various cannulations

- **Femoral cannulation**
- **Right Axillary cannulation**
- **Innominate artery cannulation**
- **Central cannulation (direct ascending)**

Acute aortic dissection of ascending aorta

1st successful acute aortic dissection repair

Morris et al JAMA
1962
32 years old
Aortic insufficiency
Complete recovery

Conclusion

In ruptures of the distal tendon of the biceps brachii, surgical repair by reattaching the tendon at the radial tuberosity appears to be indicated to provide maximum arm function. Though some patients can compensate for, or adjust to, the resulting weakness, repair is indicated to achieve the most satisfactory result possible.

535 Vine St, Scranton, Pa.

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Correction of Acute Dissecting Aneurysm of Aorta with Valvular Insufficiency

George C. Morris, Jr., MD, Walter S. Henly, MD, and Michael E. DeBakey, MD, Houston

DISSECTING ANEURYSM is a serious condition proving fatal in more than 75% of cases. The more common subacute or chronic types beginning in the descending thoracic aorta have been managed satisfactorily by resection and graft replacement for nearly a decade.[1] Recent reports have described elective repair for the more extensive type of dissecting aneurysm beginning just above the aortic valve in a few fortunate patients surviving weeks or months after the onset of the dissecting process.[1-6] The purpose of this report is to describe complete correction of this condition in its acute form and to illustrate the problem and its successful emergency treatment by a case report.

The process begins with a transverse tear, often circumferential, in the intimal and medial layers of the aorta just above the aortic valve (Fig 1). Through this tear the force of blood dissects the aortic wall, creating a false lumen. The process often extends along the entire length of the aorta and out along its great branches. Proximal progression of the dissection may dislocate the aortic valve leaflets, creating aortic insufficiency. The false lumen encroaches on the coronary arteries, often narrowing both and creating coronary arterial insufficiency. Death from this more lethal and rapidly fatal type of dissecting aneurysm often occurs within hours or several days following one of the complications, such as rupture of the dissecting process into the pericardium, myocardial ischemia, or the acute effects of aortic valvular insufficiency.

From the Cora and Webb Mading Department of Surgery, Baylor University College of Medicine.

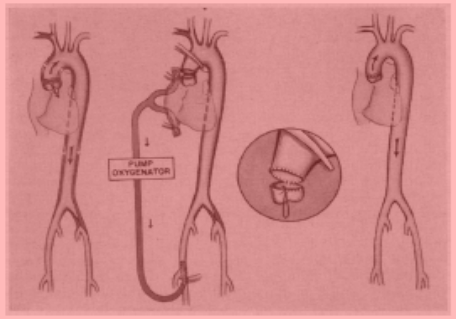
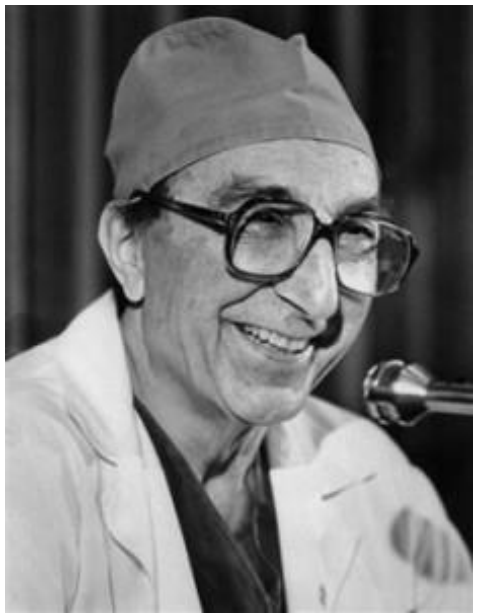


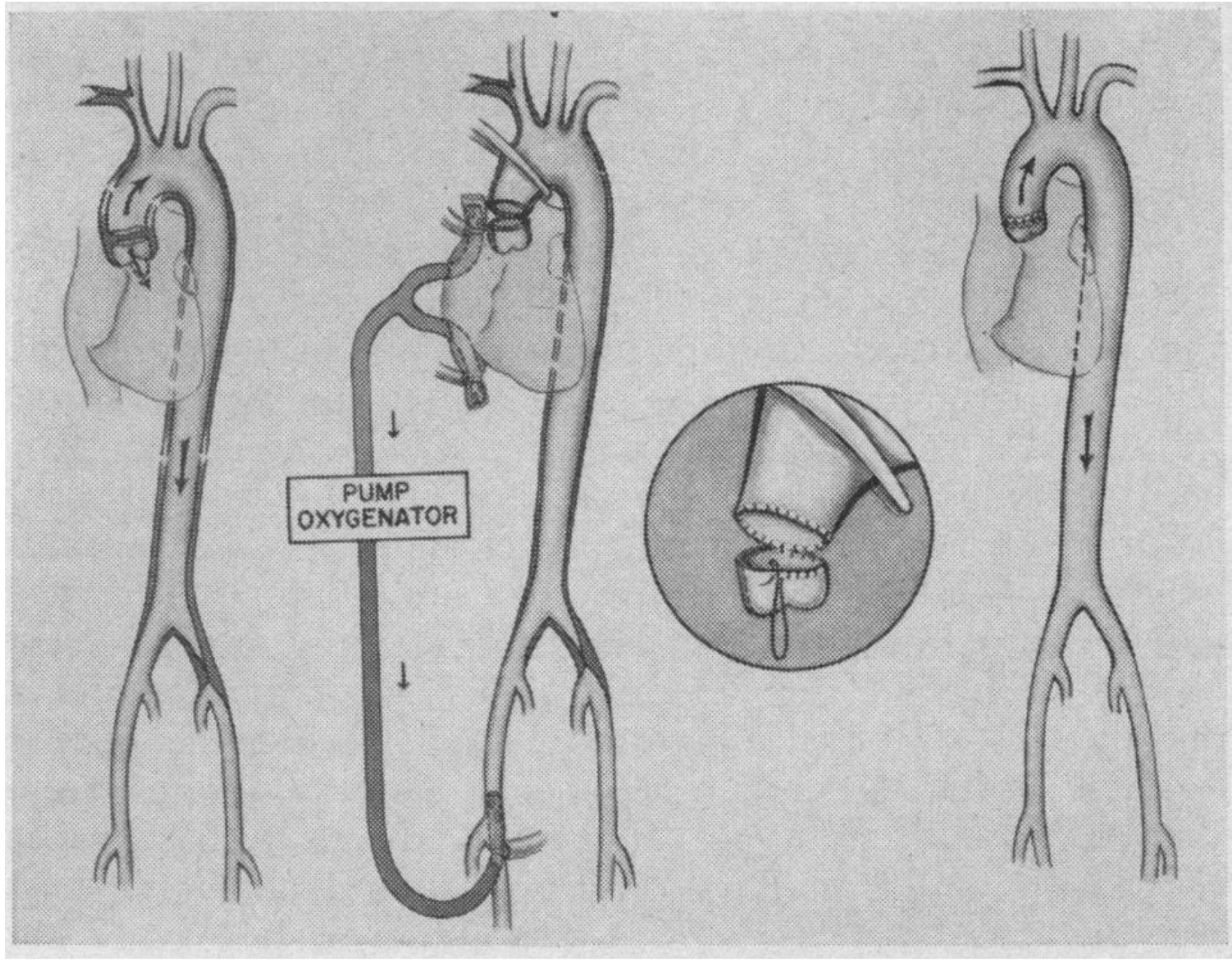
Fig 1.—Operative design for surgical repair and restoration of normal hemodynamics.

Operative design for surgical repair and restoration of normal hemodynamics is straightforward and effective (Fig 1). Using cardiopulmonary bypass with an aortic clamp proximal to the innominate artery, the ascending thoracic aorta is transected just above the aortic valve. At this level, the characteristic circumferential intimal tear giving rise to the dissecting process is exposed for direct repair. The double lumen can be visualized, as well as the disrupted and incompetent aortic valve. Obliteration of the false lumen proximally by continuous suture through all layers of the aorta restores the aortic valve leaflets to a normal position re-establishing competency of the valve. Similarly, the false lumen is obliterated distally by continuous suture. End-to-end anastomosis of the divided aorta completes the essential features of the operation. The cleavage in the aortic wall which was formerly a false lumen is subsequently allowed to heal by refusion of the aortic wall layers. An illustrative case demonstrates the effectiveness of this form of emergency surgical management in a patient with classical manifestations of this most grave and formidable type of acute dissecting aneurysm.

Report of a Case

A 32-yr-old physician had been in excellent health until Aug 15, 1962. While reading, he was suddenly seized by excruciating anterior and posterior chest pain. He was able




PUMP
OXYGENATOR

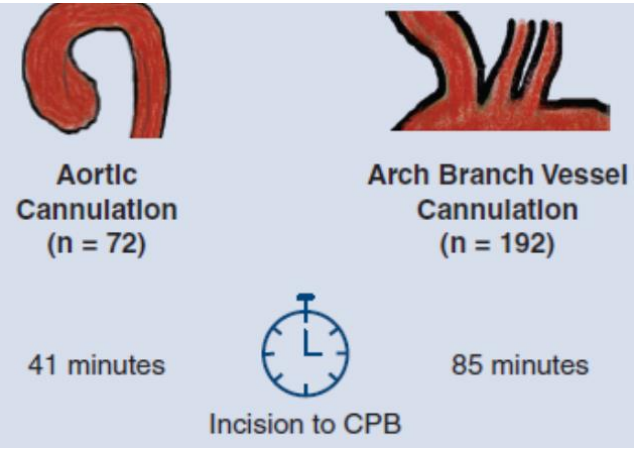
Femoral cannulation

- **Quick to establish CPB**
- **Easy to access even with closed chest**
- Less likely to be dissected

- More malperfusion due to retrograde aortic flow
- Need Additional cerebral perfusion after TCA
- Retrograde emboli -> stroke
- Inguinal wound problem

Right Axillary cannulation

- Antegrade flow
- **Can be used for antegrade cerebral perfusion rout**



- More Time consuming (30min? or 1hr?)
- Technically demanding in some cases
- Injury of brachial nerve or axillary artery stenosis

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Innominate artery cannulation

- Quick to establish CPB
- Can be used for antegrade cerebral perfusion rout
- **No additional wound**

- Frequent innominate artery dissection
- Atherosclerotic wall -> stroke
- Vessel injury leads to fetal complication (stroke)

Central cannulation (direct ascending)

- **Quick to establish CPB**
- Antegrade flow
- Need Additional cerebral perfusion after TCA

- Possible false lumen perfusion
- Possible aortic rupture

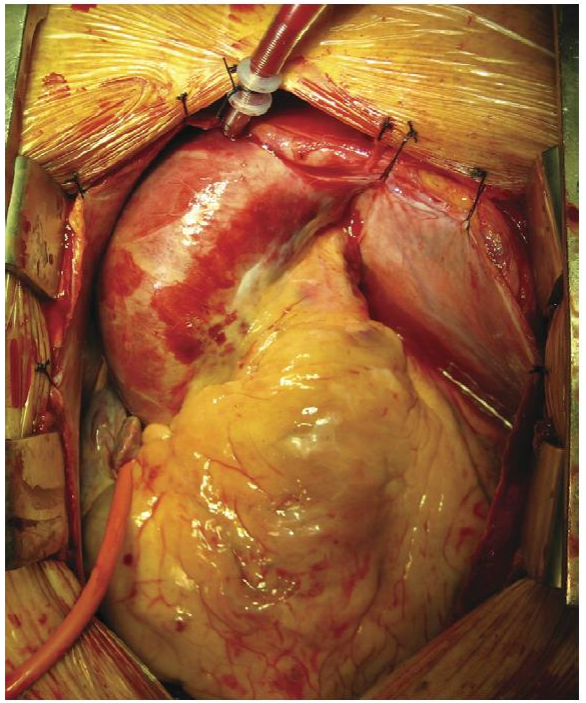

Fig 5. Intraoperative photograph of the patient shown in Figure 4, with a Level 3 dissection once cannulation was achieved.

Table 1 The advantages and disadvantages of each cannulation strategy

	Advantage	Disadvantage
Femoral artery cannulation	Quick to establish CPB	Possible more malperfusion due to retrograde aortic flow
	Easy to access even with closed chest	Possible atherosclerotic emboli
	Less likely to be dissected	
The right axillary artery cannulation	Antegrade flow	More time-consuming
	Can be used for antegrade cerebral perfusion rout	Technically demanding in some cases
		Possible injury to the brachial nerves
Central aortic cannulation	Antegrade flow	Possible false lumen perfusion
	Quick to establish CPB	Possible aortic rupture
Transapical cannulation	Antegrade flow	Technically unfamiliar to many surgeons
	Quick to establish CPB	Dangerous in patients with aortic stenosis
	Less likely to cause aortic rupture	

Comparative studies on cannulation strategies in surgery for acute type A dissection ?

There have been no prospective randomized controlled studies on this subject

large retrospective study and meta-analysis

- Femoral artery cannulation vs. axillary artery cannulation
- Central aortic cannulation vs. femoral artery cannulation
- Central aortic cannulation vs. axillary artery cannulation

Femoral artery cannulation vs. axillary artery cannulation

Femoral artery cannulation vs. axillary artery cannulation

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- IRAD data . 2024 ATS

Which cannulation (axillary cannulation or femoral cannulation) is better for acute type A aortic dissection repair? A meta-analysis of nine clinical studies

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Summary

There is a trend towards using the axillary artery cannulation (AXC) site for cardiopulmonary bypass surgery in patients requiring acute type A aortic dissection (AAD) repair. However, AXC has not been established as a routine procedure, because there is controversy about its clinical advantage when compared with femoral artery cannulation (FAC). This meta-analysis assesses major short-term outcomes in patients undergoing acute AAD repair with AXC or FAC using non-randomized retrospective studies dating from 1992 to 2011 comparing AXC and FAC for major outcomes. Outcomes of interest were short-term mortality, neurological dysfunction and malperfusion. The fixed-effects model was used. Sensitivity and heterogeneity were analysed. Analysis of nine non-randomized studies comprising 715 patients [AXC, 359 (50.2%) and FAC, 356 (49.8%)] showed a significantly lower incidence of short-term mortality in the AXC group [odds ratio, 0.25, 95% confidence interval (CI) (0.15, 0.42), $\chi^2 = 7.23$, $P < 0.01$]. The pattern of incidence of neurological dysfunction among the AXC group [odds ratio, 0.46, 95% CI (0.29, 0.72), $\chi^2 = 9.01$, $P < 0.01$] was similar. The incidence of malperfusion did not differ [odds ratio, 0.84, 95% CI (0.37, 1.90), $\chi^2 = 2.25$, $P = 0.67$]. Because no study was a randomized trial, our results are more uncertain than indicated by the 95% CI. Nevertheless, AXC seems to give better short-term mortality and neurological dysfunction rates than FAC.

Keywords: Type A aortic dissection • Axillary artery • Subclavian artery • Femoral artery • Cardiopulmonary bypass • Cannulation

Table 3: Intraoperative characteristics of eligible studies

Author (year)	Surgical procedure	CPB time (min)		ACC time (min)		TCA time (min)		Cerebral perfusion time (min)	
		AXC	FAC	AXC	FAC	AXC	FAC	AXC	FAC
Battaloglu (2008)	1-6	177 ± 60.8		81.03 ± 33.2		29.8 ± 14.4		31.1 ± 16.4	
Etz (2008)	1, 2, 4, 5	ND	ND	ND	ND	ND	ND	ND	ND
Lee (2012)	1-5	188.6 ± 52.2	168.7 ± 48.4	98.4 ± 32.5	85.4 ± 30.9	38.2 ± 21.0	23.9 ± 3.2	30.9 ± 14.8	32.8 ± 17.8
Sadi (2012)	1, 3-5	ND	ND	ND	ND	ND	ND	ND	ND
Moizumi (2005)	1-6	272 ± 122	267 ± 121	158 ± 69	164 ± 72	55 (21-153)		75 ± 53	65 ± 46
Nouraei (2007)	1, 3-5	201 ± 90 (90-464)		121 ± 51 (8-235)		20 ± 21 (0-99)		ND	ND
Orihashi (2013)	1, 3, 4	ND	ND	ND	ND	ND	ND	ND	ND
Pasic (2003)	1, 3-5	243 (69-665)	175 (81-259)	99 (44-170)	87 (47-110)	29 (15-43)	24 (11-66)	ND	ND
Reuthebuch (2004)	1, 3-6	155.6 ± 58.7	175.8 ± 64.3	88.15 ± 34.1	82.03 ± 36.7	ND	ND	23.5 ± 8.5	23.4 ± 10.2

CPB: cardiopulmonary bypass; ACC: aortic cross-clamp; TCA: total circulatory arrest; ND: not determined. Surgical procedure: 1, ascending aortic replacement; 2, hemi-arch replacement; 3, total arch replacement; 4, root replacement; 5, aortic valve replacement; 6, other procedures (CABG, descending aortic replacement, elephant trunk procedures and mitral valve replacement).

Table 4: Postoperative outcomes and complications of eligible studies

Author (year)	No. of patients			Short-term mortality		Neurological dysfunction		Malperfusion		Renal failure		Bleeding	
	AXC	FAC	Total	AXC	FAC	AXC	FAC	AXC	FAC	AXC	FAC	AXC	FAC
Battaloglu (2008)	35	6	41	5	0	1	0	5	0	ND	ND	ND	ND
Etz (2008)	31	31	62	2	6	1	1	ND	ND	ND	ND	ND	ND
Lee (2012)	58	53	111	3	5	19	17	1	0	2	2	5	2
Sadi (2012)	12	83	95	0	14	2	20	ND	ND	ND	ND	ND	ND
Moizumi (2005)	69	37	106	5	11	1	1	1	0	ND	ND	1	3
Nouraei (2007)	20	29	49	2	13	2	13	ND	ND	2	5	ND	ND
Orihashi (2013)	52	7	59	1	3	ND	ND	5	0	ND	ND	ND	ND
Pasic (2003)	20	50	70	1	11	1	4	2	8	ND	ND	ND	ND
Reuthebuch (2004)	62	60	122	5	14	17	36	3	6	7	14	10	19

ND: not determined; AXC: axillary artery cannulation; FAC: femoral artery cannulation.

The impact of arterial cannulation strategy on operative outcomes in aortic surgery: Evidence from a comprehensive meta-analysis of comparative studies on 4476 patients

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Objectives: There is a growing perception that peripheral cannulation through the femoral artery, by reversing the flow in the thoracoabdominal aorta, may increase the risk of retrograde brain embolization in aortic surgery. Central cannulation sites, including the right axillary artery, have been reported to improve operative outcomes by allowing antegrade blood flow. However, peripheral cannulation still rem
consensus for the routine use of central cannulation approaches has not been rea

Methods: A meta-analysis of comparative studies reporting operative outcom
versus peripheral cannulation was performed. Pooled weighted incidence rates f
obtained using an inverse variance model.

Results: A total of 4476 patients were included in the final analysis. Central c
patients, and peripheral cannulation was used in 1679 patients. Central cannulation showed a protective effect on in-hospital mortality (risk ratio, 0.59; 95% confidence interval, 0.48-0.7; $P < .001$) and permanent neurologic deficit (risk ratio, 0.71; 95% confidence interval, 0.55-0.90; $P = .005$) when compared with peripheral cannulation. A trend toward an increased benefit in terms of reduced in-hospital mortality was observed when only the right axillary artery was used as the central cannulation approach (risk ratio, 0.35; 95% confidence interval, 0.22-0.55; $P < .001$; $I^2 = 0\%$).

Conclusions: Central cannulation was superior to peripheral cannulation in reducing in-hospital mortality and the incidence of permanent neurologic deficit. This superiority was particularly evident when the axillary artery was used for central cannulation. (J Thorac Cardiovasc Surg 2014;148:2936-43)

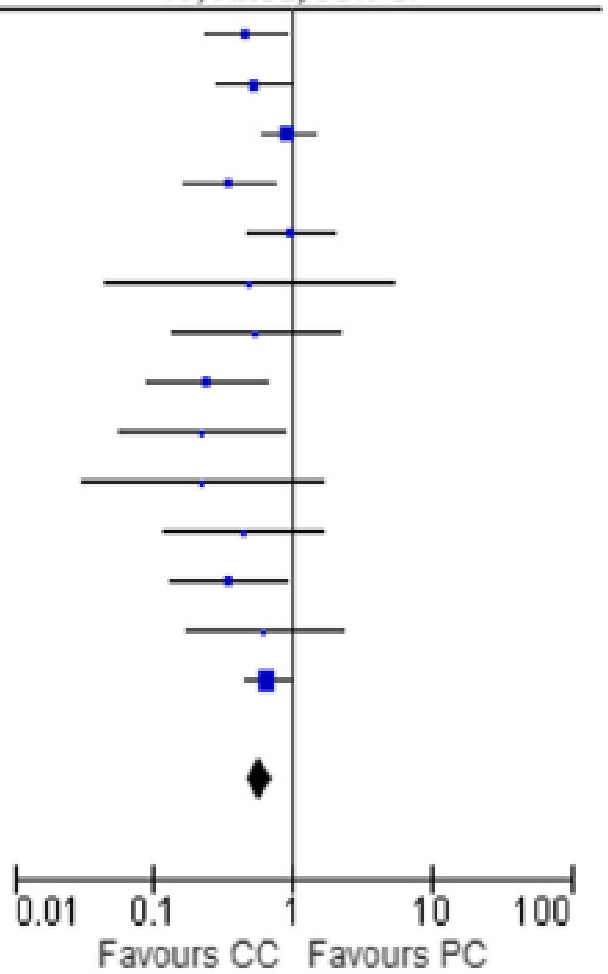
Central (N=2797) vs peripheral(1679)
(Central including axillary)

OUTCOME: in-hospital mortality

Study or Subgroup	CC Events	CC Total	PC Events	PC Total	Weight	Risk Ratio IV, Fixed, 95% CI
Di Eusanio 2013	11	200	28	237	8.7%	0.47 [0.24, 0.91]
Etz 2008	21	608	17	261	10.1%	0.53 [0.28, 0.99]
Etz 2013	62	311	19	89	18.8%	0.93 [0.59, 1.47]
Haldenwang 2012	15	107	6	15	6.5%	0.35 [0.16, 0.76]
Kamiya 2009	10	82	19	153	7.6%	0.98 [0.48, 2.01]
Lakew 2005	1	166	2	161	0.7%	0.48 [0.04, 5.30]
Lee 2012	3	58	5	53	2.1%	0.55 [0.14, 2.18]
Moizumi 2005	5	69	11	37	4.1%	0.24 [0.09, 0.65]
Nouraei 2007	2	20	13	29	2.1%	0.22 [0.06, 0.88]
Pasic 2003	1	20	11	50	1.0%	0.23 [0.03, 1.65]
Polat 2012	3	84	7	88	2.3%	0.45 [0.12, 1.68]
Reuthebuch 2004	5	62	14	60	4.3%	0.35 [0.13, 0.90]
Strauch 2005	3	49	7	71	2.3%	0.62 [0.17, 2.28]
Svensson 2004	70	961	42	375	29.6%	0.65 [0.45, 0.94]
Total (95% CI)		**2797**		**1679**	**100.0%**	**0.59 [0.48, 0.71]**
Total events	212		201			

Heterogeneity: $Chi^2 = 15.76$, $df = 13$ ($P = 0.26$); $I^2 = 18\%$

Test for overall effect: $Z = 5.30$ ($P < 0.00001$)

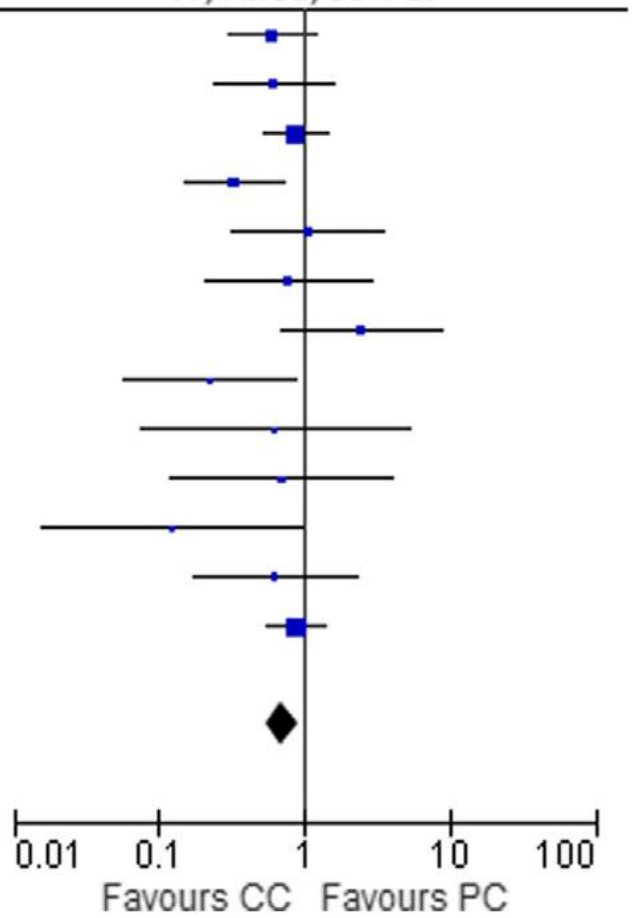


OUTCOME: Permanent neurologic deficit

Study or Subgroup	CC Events	CC Total	PC Events	PC Total	Weight	Risk Ratio IV, Fixed, 95% CI
Di Eusanio 2013	11	200	22	237	11.9%	0.59 [0.29, 1.19]
Etz 2008	10	608	7	261	6.4%	0.61 [0.24, 1.59]
Etz 2013	48	311	16	89	22.0%	0.86 [0.51, 1.44]
Haldenwang 2012	14	107	6	15	9.4%	0.33 [0.15, 0.72]
Kamiya 2009	4	82	7	153	4.1%	1.07 [0.32, 3.54]
Lakew 2005	4	166	5	161	3.5%	0.78 [0.21, 2.84]
Lee 2012	8	58	3	53	3.6%	2.44 [0.68, 8.71]
Nouraei 2007	2	20	13	29	3.1%	0.22 [0.06, 0.88]
Pasic 2003	1	20	4	50	1.3%	0.63 [0.07, 5.25]
Polat 2012	2	84	3	88	1.9%	0.70 [0.12, 4.08]
Reuthebuch 2004	1	62	8	60	1.4%	0.12 [0.02, 0.94]
Strauch 2005	3	49	7	71	3.4%	0.62 [0.17, 2.28]
Svensson 2004	56	961	25	375	28.0%	0.87 [0.55, 1.38]
Total (95% CI)		**2728**		**1642**	**100.0%**	**0.71 [0.55, 0.90]**
Total events	164		126			

Heterogeneity: $Chi^2 = 15.08$, $df = 12$ ($P = 0.24$); $I^2 = 20\%$

Test for overall effect: $Z = 2.83$ ($P = 0.005$)



Conclusions: Central cannulation was superior to peripheral cannulation in reducing in-hospital mortality and the incidence of permanent neurologic deficit. This superiority was particularly evident when the axillary artery was used for central cannulation

Femoral artery cannulation increases the risk of postoperative stroke in patients with acute DeBakey I aortic dissection

Xiaomeng Wang, MD,[a] Nan Liu, MD, PhD,[a] Hong Wang, MD, PhD,[a] Yongmin Liu, MD,[b] Lizhong Sun, MD,[b] Junming Zhu, MD,[b] and Xiaotong Hou, MD, PhD[a]

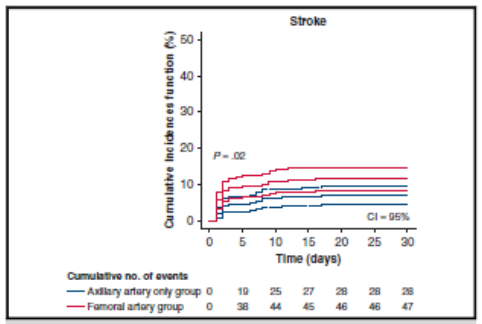
ABSTRACT

Background: The selection of different arterial cannulation site influences the incidence of postoperative stroke in patients with DeBakey I acute aortic dissection. The study aimed to explore the optimal arterial cannulation for these patients.

Methods: From January 2009 to 2019, a total of 1514 patients with DeBakey I acute aortic dissection underwent frozen elephant trunk and total arch replacement at a tertiary center. They were divided into 2 groups: the axillary artery only cannulation group (n = 1075) and the femoral artery cannulation group (n = 439). After balancing the differences of baseline condition by propensity score matching, the prognosis was compared.

Results: The incidence of stroke and acute brain infarction in the femoral artery cannulation group was higher than in the axillary artery only cannulation group (stroke, 11.7% vs 7.0%, $P = .03$; acute brain infarction, 6.0% vs 2.7%, $P < .01$). The femoral artery cannulation group was further divided into 2 groups: femoral artery only cannulation group (n = 106) and axillary combined with femoral artery cannulation group (n = 333). The comparison was performed between the axillary combined with femoral artery cannulation group and the axillary artery only cannulation group. After propensity score matching, the incidence of stroke and acute brain infarction in the axillary combined with femoral artery cannulation group was higher than in the axillary artery only cannulation group (stroke, 13.5% vs 7.2%, $P < .01$; acute brain infarction, 6.9% vs 2.5%, $P < .01$).

Conclusions: Axillary artery only cannulation is recommended as the optimal arterial cannulation strategy for most patients with DeBakey I acute aortic dissection. For those patients who are not suitable for axillary artery only cannulation, axillary combined with femoral artery cannulation is not recommended. (J Thorac Cardiovasc Surg 2023;166:1023-31)



The comparison of cumulative incidence functions of postoperative stroke between the AAOC and FAC groups adjusted for competing risk analysis. The cumulative incidence function in different artery cannulation groups.

CENTRAL MESSAGE

AAOC should be recommended as the optimal cannulation strategy for most patients with acute DeBakey type I aortic dissection, rather than combined FAC.

PERSPECTIVE

Our findings provide insight into the relationship between the arterial cannulation strategy and the risk of postoperative stroke for patients with acute DeBakey type I aortic dissection, especially in the selection and use of combined FAC. This

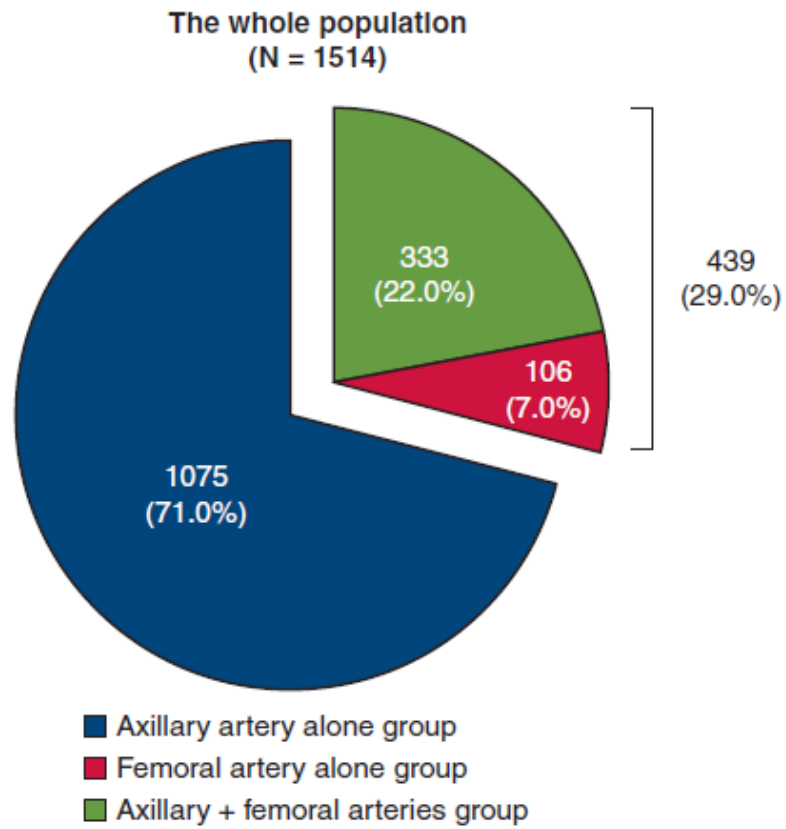


TABLE 2. Early outcomes of matched patients in different cannulation site groups

Name	Femoral artery N = 401	Axillary artery only N = 401	*P* value	SMD (%)	Axillary + femoral arteries N = 319	Axillary artery only N = 319	*P* value	SMD (%)
In-hospital death	53 (13.2)	36 (9.0)	.06	13.5	46 (14.4)	34 (10.7)	<.01	11.4
30-d death	50 (12.5)	36 (9.0)	.12	11.3	44 (13.8)	34 (10.7)	<.01	9.6
Stroke	47 (11.7)	28 (7.0)	.03	16.3	43 (13.5)	23 (7.2)	<.01	20.7
Acute brain infarction	24 (6.0)	11 (2.7)	<.01	15.9	22 (6.9)	8 (2.5)	<.01	20.8
Paraplegia	26 (6.5)	15 (3.7)	.10	12.5	21 (6.6)	16 (5.0)	.50	6.7
CRRT	63 (15.7)	65 (16.2)	.92	1.4	53 (16.6)	45 (14.1)	.41	7.0
Infection	73 (18.2)	52 (13.0)	.04	14.5	62 (19.4)	42 (13.2)	.04	17.0
Atrial fibrillation	64 (16.0)	55 (13.7)	.44	6.3	53 (16.6)	39 (12.2)	.14	12.5
Cardiac arrest	10 (2.5)	9 (2.2)	1.00	1.6	11 (3.4)	6 (1.9)	.33	9.7
LCOS	23 (5.7)	14 (3.5)	.16	10.7	23 (7.2)	10 (3.1)	.03	18.5
Tracheotomy	18 (4.5)	10 (2.5)	.17	10.9	16 (5.0)	9 (2.8)	.23	11.3
Reexploration for bleeding	38 (9.5)	35 (8.7)	.81	2.6	29 (9.1)	35 (11.0)	.50	6.3
Mechanical ventilation time (h)	32 (15-86)	22 (14-70)	.03	17.1	31 (14-91)	22 (13-63)	<.01	23.3
Intensive care unit stay time (d)	3 (2-6)	2 (1-5)	.32	11.0	3 (2-6)	2 (1-5)	.04	17.5

Data presented as median (interquartile) range for continuous variables and n (%) for categorical variables. *SMD,* Standard mean difference; *CRRT,* continuous renal replacement therapy; *LCOS,* low cardiac output syndrome.

Axillary vs Femoral Arterial Cannulation in Acute Type A Dissection: International Multicenter Data

Malak Elbatarny, MD,[1] Santi Trimarchi, MD,[2] Amit Korach, MD,[3] Marco Di Eusanio, MD,[4] Davide Pacini, MD,[5] Raffi Bekeredjian, MD,[6] Truls Myrmel, MD,[7] Joseph E. Bavaria, MD,[8] Nimesh D. Desai, MD,[8] Ibrahim Sultan, MD,[9] Derek R. Brinster, MD,[10] Chih-Wen Pai, PhD,[11] Kim A. Eagle, MD,[11] Himanshu J. Patel, MD,[12] and Mark D. Peterson, MD[1,13,14]; for the IR Investigators

ABSTRACT

BACKGROUND Cannulation strategy in acute type A dissection (ATAD) varies widely without known gold standar This study compared ATAD outcomes of axillary vs femoral artery cannulation in a large cohort from the Internatio Registry of Acute Aortic Dissection (IRAD).

METHODS The study retrospectively reviewed 2145 patients from the IRAD Interventional Cohort (1996-2021) w underwent ATAD repair with axillary or femoral cannulation (axillary group: n = 1106 [52%]; femoral group: n = 1([48%]). End points included the following: early mortality; neurologic, respiratory, and renal complications; malperfusi and tamponade. All outcomes are presented as axillary with respect to femoral.

RESULTS The proportion of patients younger than 70 years in both groups was similar (n = 1577 [74%]), as were bicus aortic valve, Marfan syndrome, and previous dissection. Patients with femoral cannulation had slightly more aortic ins ficiency (408 [55%] vs 429 [60%]; $P = .058$) and coronary involvement (48 [8%] vs 70 [13%]; $P = .022$). Patients with axill cannulation underwent more total aortic arch (156 [15%] vs 106 [11%]; $P = .02$) and valve-sparing root replacements ([22%] vs 112 [12%]; $P < .001$). More patients with femoral cannulation underwent commissural resuspension (269 [30.9 vs 324 [35.3%]; $P = .05$). Valve replacement rates were not different. The mean duration of cardiopulmonary bypass was longer in the femoral group (190 [149-237] minutes vs 196 [159-247] minutes; $P = .037$). In-hospital mortality was similar between the axillary (n = 165 [15%]) and femoral (n = 149 [14%]) groups ($P = .7$). Furthermore, there were no differences in stroke, visceral ischemia, tamponade, respiratory insufficiency, coma, or spinal cord ischemia.

CONCLUSIONS Axillary cannulation is associated with a more stable ATAD presentation, but it is a more extensive intervention compared with femoral cannulation. Both procedures have equivalent early mortality, stroke, tamponade, and malperfusion outcomes after statistical adjustment.

(Ann Thorac Surg 2024;117:1128-35)

1996-2021
N=2145

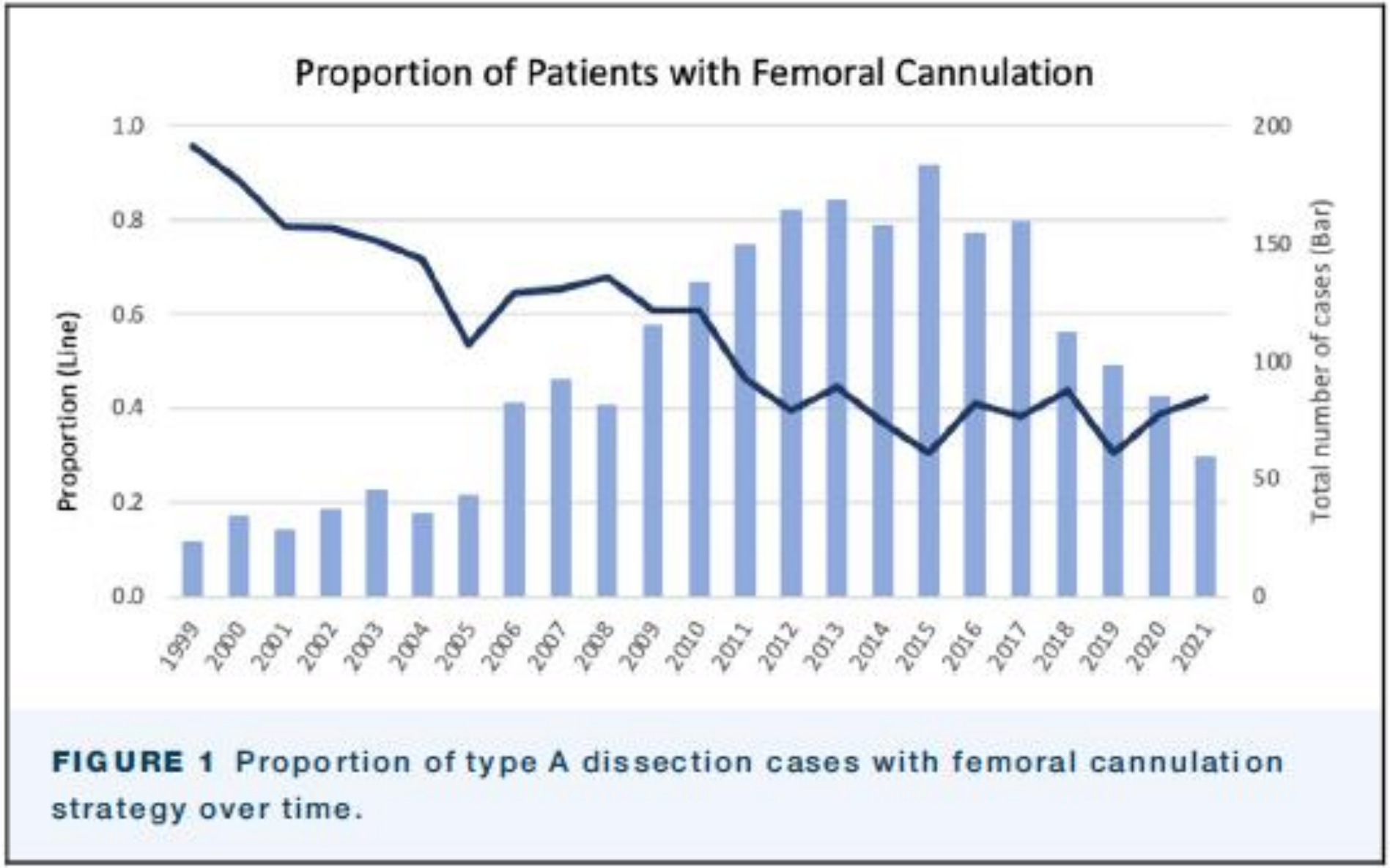


FIGURE 1 Proportion of type A dissection cases with femoral cannulation strategy over time.

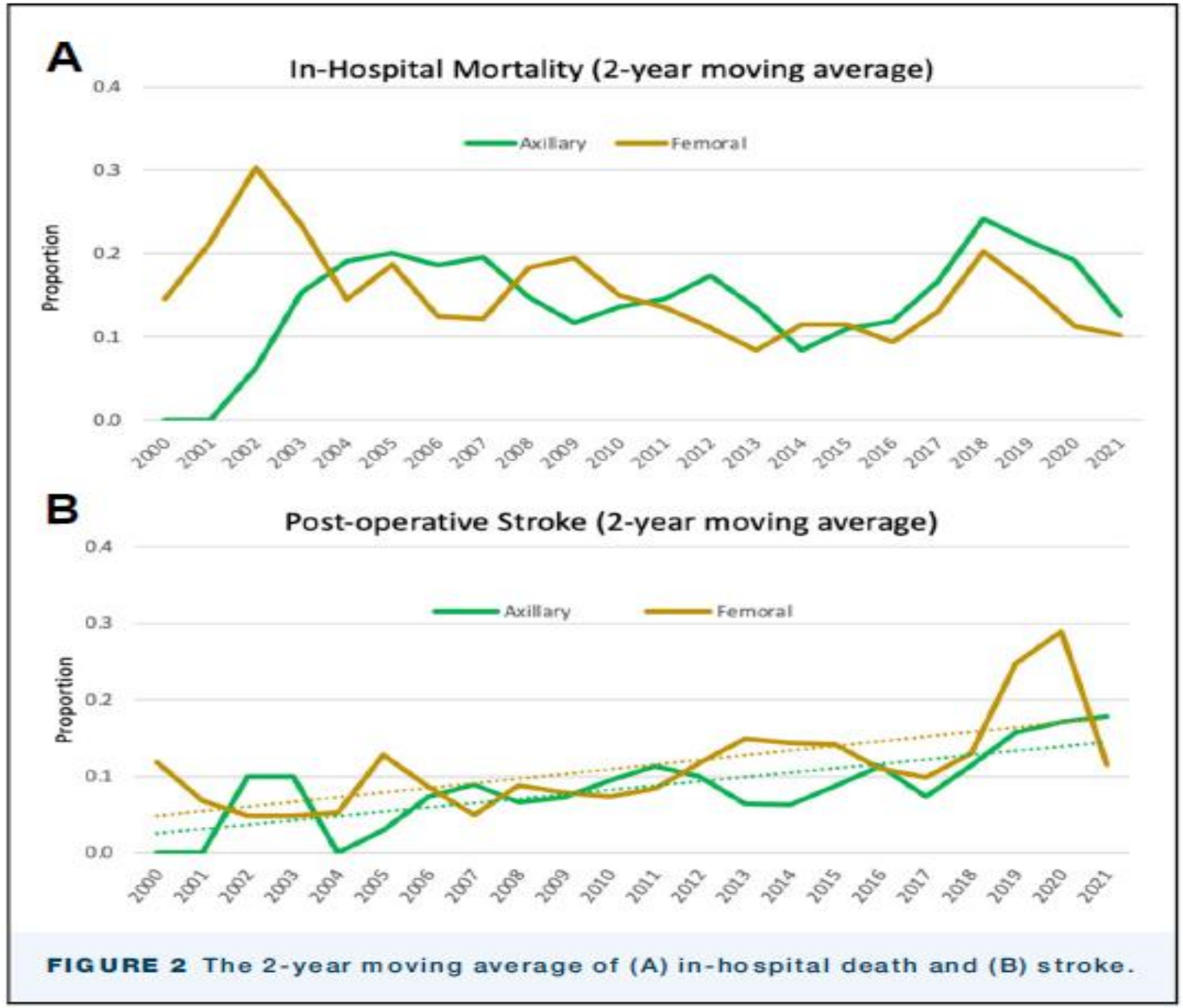


FIGURE 2 The 2-year moving average of (A) in-hospital death and (B) stroke.

TABLE 2 Perioperative Outcomes of Overall Cohort Compared by Cannulation Strategy

	Axillary		Femoral		
Perioperative Outcomes	N = 1155	51%	N = 1115	49%	*P* Value
Mortality	174	15	161	14	.72
Stroke	96	10	107	11	.37
Postoperative transient neurologic deficit	46	4.9	50	5.6	.53
Coma	31	3	35	4	.62
Spinal cord injury	17	2	20	2	.62
Mesenteric ischemia	37	4	24	2	.15
Acute renal failure	223	22	242	24	.17
Cardiac tamponade	78	8	77	8	1
Limb ischemia	56	6	39	4	.11
Respiratory insufficiency	219	28	156	27	.81
Length of hospital stay, d, median and IQR	11	7-19	12	8-19	.65

Values are n, %, or median and IQR. IQR, interquartile range (quartile 1 to quartile 3).

TABLE 3 Multivariable Regression for Mortality and Stroke[a]

Variable	OR (Mortality)	95% CI	*P* Value	OR (Stroke)	95%CI	*P* Value
Axillary vs femoral	1.23	0.82-1.85	.33	1.03	0.60-1.78	.92
Male	0.78	0.53-1.14	.20	1.03	0.61-1.74	.91
Age	1.04	1.03-1.06	<.0001	1.00	0.98-1.02	.75
Era[b]						
2 vs 1	1.03	0.54-1.96	.93	0.76	0.25-2.31	.63
3 vs 1	0.76	0.42-1.40	.38	1.35	0.53-3.45	.53
4 vs 1	0.41	0.20-0.84	.015	1.15	0.43-3.05	.78
5 vs 1	0.94	0.53-1.66	.84	1.89	0.76-4.66	.17
Hypertension	0.98	0.63-1.52	.93	0.91	0.53-1.56	.74
Stroke history	1.86	0.68-5.08	.22	4.40	1.16-16.67	.029
Marfan	0.61	0.14-2.66	.51	1.37	0.39-4.76	.62
Bicuspid aortic valve	0.53	0.15-1.81	.31	0.97	0.30-3.08	.95
Shock	2.03	1.07-3.84	.029	0.78	0.27-2.26	.65
Malperfusion						
Neurologic	0.57	0.23-1.43	.23	1.49	0.47-4.70	.50
Coronary	1.74	1.12-2.71	.014	0.74	0.37-1.48	.39
Visceral	2.02	0.82-4.97	.12	1.10	0.23-5.35	.90
Limb	2.65	1.65-4.27	<.0001	1.15	0.60-2.21	.67
Any arch intervention	0.92	0.61-1.38	.68	1.93	1.04-3.58	.038
Any root intervention	1.13	0.77-1.66	.52	1.16	0.70-1.91	.56
Cerebral perfusion						
Ante vs retrograde	1.96	1.08-3.58	.028	0.83	0.41-1.65	.59
None vs retrograde	3.21	1.55-6.62	.002	1.27	0.52-3.12	.60
Total bypass time	1.01	1.01-1.01	<.0001	1.00	1.00-1.01	.20

[a]Multivariable generalized linear model with random intercept for death and stroke; [b]Eras 1 to 5 are defined as follows: 1996-2007, 2008-2010, 2011-2013, 2014-2016, and 2017-2021. OR, odds ratio.

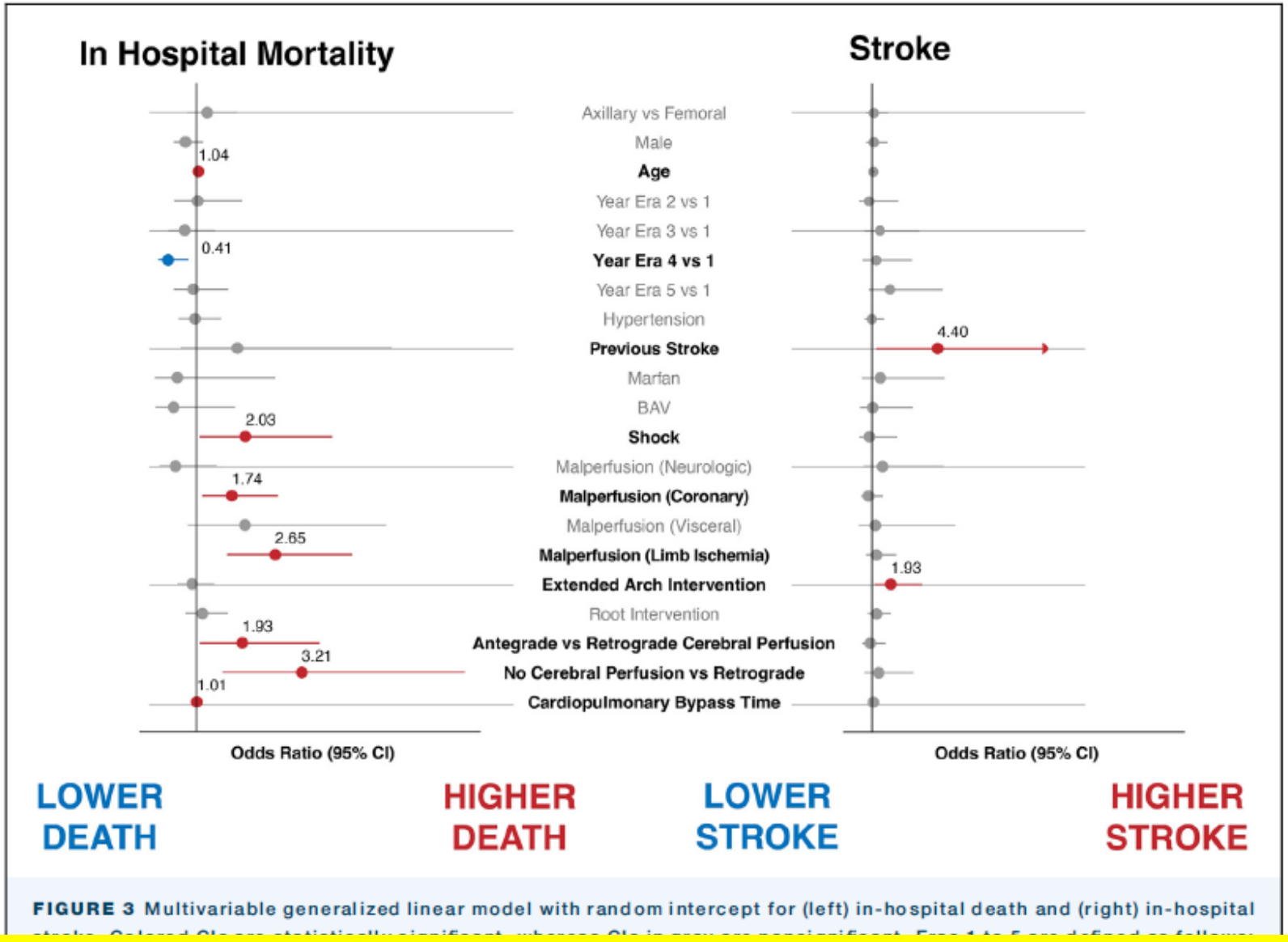


FIGURE 3 Multivariable generalized linear model with random intercept for (left) in-hospital death and (right) in-hospital

CONCLUSIONS: Axillary cannulation is associated with a more stable ATAD presentation, but it is a more extensive intervention compared with femoral cannulation. Both procedures have equivalent early mortality, stroke, tamponade, and malperfusion outcomes after statistical adjustment.

Central aortic cannulation vs. femoral artery cannulation

- Frederick et al. Ascending Aortic Cannulation in Acute Type A Dissection Repair. Ann Thorac Surg 2013;95:1808–11

- Kamiya t al. Comparison of ascending aorta versus femoral artery cannulation for acute aortic dissection type A. Circulation. 2009;120:S282–6.

- No meta-analysis

Ascending Aortic Cannulation in Acute Type A Dissection Repair

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Femoral and axillary cannulation for arterial inflow in acute type A aortic dissection are the most commonly used cannulation strategies in current practice. More recently, our group and others have successfully used a central cannulation technique with excellent results. Although this approach has been described, specific technical details have not been clearly defined. In addition, the ideal anatomic characteristics of different types of aortic dissections amenable to central cannulation have not been delineated. The purpose of this brief communication is to describe the technical and procedural details specific to cannulation of the dissected ascending aorta and to propose a classification scheme of ascending aortic dissection anatomy based on difficulty of central cannulation.

(Ann Thorac Surg 2013;95:1808–11)

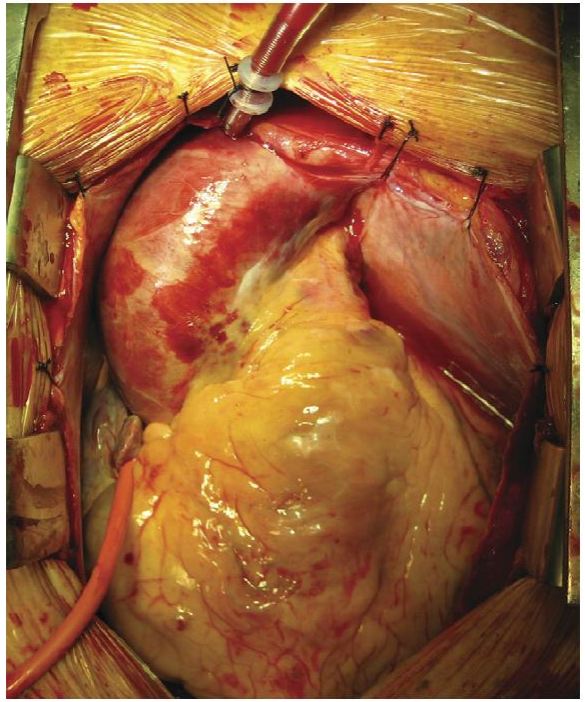

Table 1. Comparison of Clinical Outcomes in Aortic versus Peripheral Cannulation

Outcome	Aortic Cannulation (n = 88)	Peripheral Cannulation (n = 92)	OR (95% CI)	*P*
Stroke	10 (11)	19 (21)	0.49 (0.22–1.13)	0.13
Prolonged ventilation	50 (57)	47 (51)	1.26 (0.70–2.27)	0.53
Renal failure	15 (17)	15 (16)	1.05 (0.48–2.31)	1.00
In-hospital mortality	7 (8)	12 (13)	0.58 (0.22–1.54)	0.39

CI = confidence interval; OR = odds ratio; *P* = two-tailed *P* value resulting from Fisher's exact test.

Data are presented as n (%)

Comparison of Ascending Aorta Versus Femoral Artery Cannulation for Acute Aortic Dissection Type A

Hiroyuki Kamiya, MD; Klaus Kallenbach, MD, PhD; Dominique Halmer; Merve Özsöz; Kathrin Ilg, MD; Artur Lichtenberg, MD, PhD; Matthias Karck, MD, PhD

Background—The site of cannulation for repair of ascending aortic dissection remains controversial. We present our experience with ascending aortic cannulation for acute aortic dissection type A.

Methods and Results—From January 1988 to September 2007, we operated on 242 patients for acute aortic dissection type A. Medical records of 235 patients who received ascending aortic cannulation or femoral cannulation were retrospectively reviewed. Long-term follow-up was complete in 97% of patients. Cannulation was accomplished in 82 patients through the ascending aorta and in 153 patients through the femoral artery. Preoperative patient characteristics were almost comparable between groups. Similarly, there were no differences in preoperative patient characteristics and intraoperative parameters including operation time, bypass time, cross-clamp time, hypothermic circulatory arrest time, and percentage of total arch replacement. The 30-day mortality rate was 14% in the aortic group and 23% in the femoral group ($P=0.07$), and incidence of stroke was 4.9% in the aortic group and 4.5% in the femoral group ($P=0.86$). During follow-up (mean, 5.5 years), survival at 5 years and 10 years was 65% and 41% in the aortic group and 64% and 46% in the femoral group, respectively ($P=0.97$).

Conclusions—The cannulation site should be chosen according to the patient's pathology and status, and the present study suggests that ascending cannulation in patients with acute aortic dissection type A can be a safe alternative, offering acceptable early and long-term outcomes. (***Circulation*. 2009;120[suppl 1]:S282–S286.**)

Key Words: acute aortic dissection ■ aorta ■ extracorporeal circulation ■ CPB ■ cannulation site ■ surgery

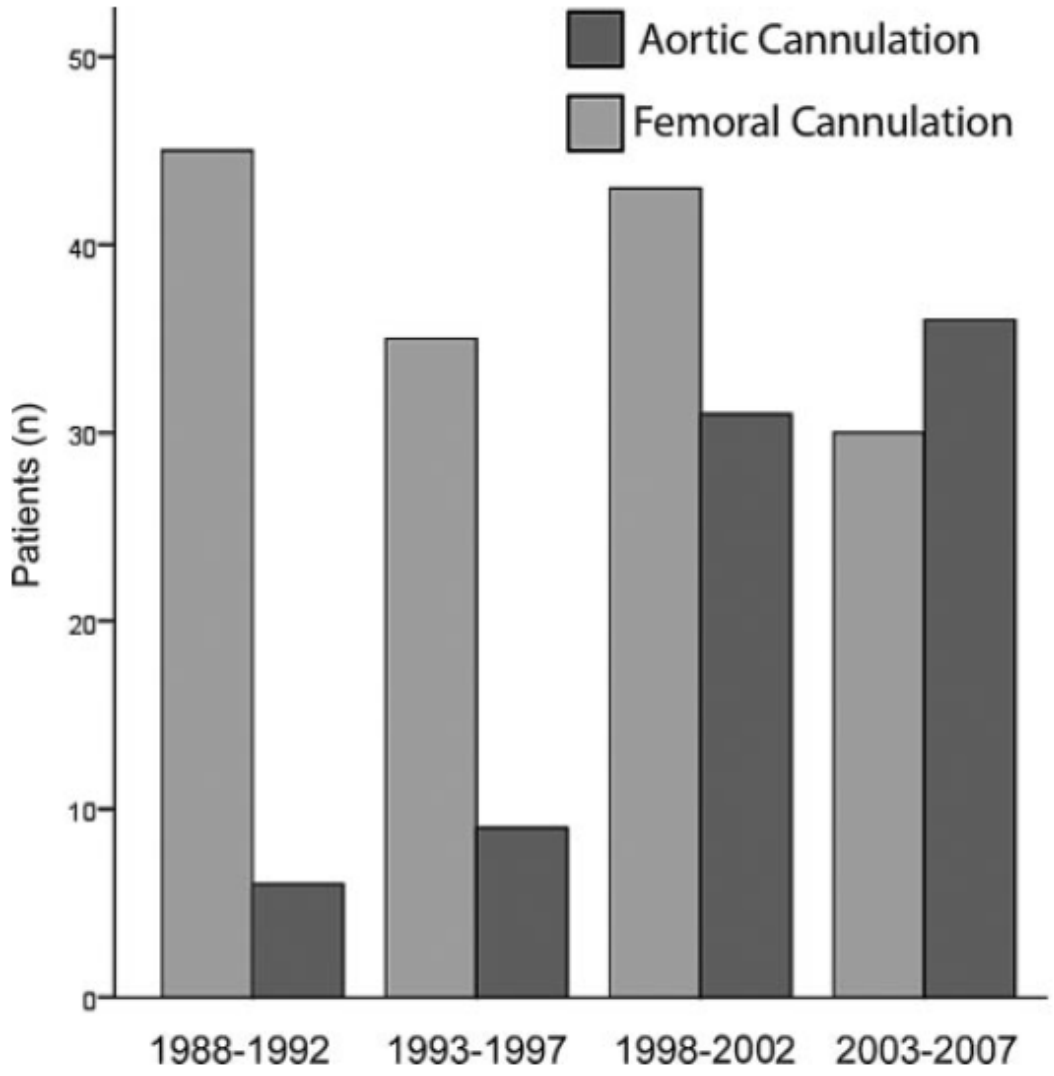

Figure 1. Distribution of cannulation sites.

Table 3. Early Mortality and Morbidities

	Aortic Cannulation (n=82)	Femoral Cannulation (n=153)	OR (95% CI)	*P*
In-hospital mortality	10 (12)	19 (12)	0.98 (0.43–2.21)	0.96
30-Day mortality*	11 (14)	35 (23)	0.51 (0.24–1.06)	0.07
Intraoperative death	6 (5)	11 (7)	1.02 (0.36–2.86)	0.97
Stroke	4 (5)	7 (5)	1.09 (0.31–3.86)	0.89
Temporary neurological dysfunction	13 (17)	31 (22)	0.76 (0.37–1.56)	0.45
Renal failure	10 (13)	18 (13)	1.08 (0.47–2.50)	0.85
Respiratory failure	12 (16)	13 (9)	1.85 (0.80–4.26)	0.15

Table 4. 30-Day Mortality in Each Period

	Aortic Cannulation	Femoral Cannulation	OR (95% CI)	*P*
1988–1992	1/6 (17)	11/44 (25)	0.60 (0.06–5.70)	0.65
1993–1997	0/9 (0)	7/35 (20)	0.80 (0.68–0.94)	0.17
1998–2002	5/30 (17)	11/42 (26)	0.56 (0.17–1.84)	0.25
2003–2007	5/36 (14)	6/27 (22)	0.56 (0.15–2.10)	0.30

Data are presented as n/N (%). OR indicates odds ratio.

Central aortic cannulation vs. axillary artery cannulation

- Reece TB et al. Central cannulation is safe in acute aortic dissection repair. J Thorac Cardiovasc Surg. 2007;133:428–34.

- Sabashnikov et al. Axillar or aortic cannulation for aortic repair in patients with stanford a dissection? Ann Thorac Surg 2016;102(3):787–94.

- Rosinski et al. Cannulation strategies in acute type A dissection repair: a systematic axillary artery approach. J Thorac Cardiovasc Surg. 2019;158:647-659.e5.

- Norton et al. Aortic and arch branchvessel cannulation in acute type A aortic dissection repair. JTCVS Techniques 2022;12:1-11

Central cannulation is safe in acute aortic dissection repair

T. Brett Reece, MD, Curtis G. Tribble, MD, Robert L. Smith, MD, R. Ramesh Singh, MD, Brendon M
Benjamin B. Peeler, MD, John A. Kern, MD, and Irving L. Kron, MD

Objective: The site of cannulation for the repair of asce remains controversial. It is not clear whether cannulation o safe or even preferred. We hypothesized that cannulatior could be done safely with acceptable complication and high-risk population.

Methods: The charts of repairs of acute ascending aortic di 1996 to 2005 were reviewed. Cannulation was accomplish dissected aorta (central) and in 46 patients through cannu axillary artery (peripheral). All were converted to sidearm for reperfusion. Groups were compared on the basis of con mortality, complications, hospital stays and final dispositic

Results: The groups were comparable on the basis of age a bidities. Similarly, there were no differences in bypass tir hypothermic circulatory arrest time between groups. Hosp operative complications, including stroke, were similar b peripheral group experienced more cardiac events (periphe $P < .05$) and higher mortality than the central group (peri 4.2%; $P < .05$).

Conclusions: Direct cannulation of the dissected aorta was safe compared with peripheral cannulation in these patients. Inasmuch as these data demonstrate that cannulation of the dissected ascending aorta is safe, this technique can be used to tailor the cannulation approach to specific anatomic and patient characteristics that might optimize postoperative outcomes in this disease entity.

TABLE 4. Complications and disposition

Complication/disposition	Central cannulation	Peripheral cannulation	*P* value
Infection	21% (5/24)	20% (9/46)	.8
Pulmonary	21% (5/24)	28% (13/46)	.9
Renal	12.5% (3/24)	17% (8/46)	.6
Stroke/TIA	21% (5/24)	28% (13/46)	
Arrhythmia	8% (1/24)	15% (7/46)	.4
MI	0% (0/24)	15% (7/46)	<.01*
Any cardiac	12.5% (3/24)	30% (14/46)	.07
Other (ileus)	4% (1/24)	9% (4/46)	.4
Any	33% (8/24)	51% (24/46)	.11
Hospital mortality	4% (1/24)	20% (9/46)	.15
30-Day mortality	0% (0/24)	17% (8/46)	.04*
Rehab/SNF placement	26% (6/23)	30% (11/37)	.8

Reece et al. JTCVS 2007

Cannulation strategies in acute type A dissection repair: A systematic axillary artery approach

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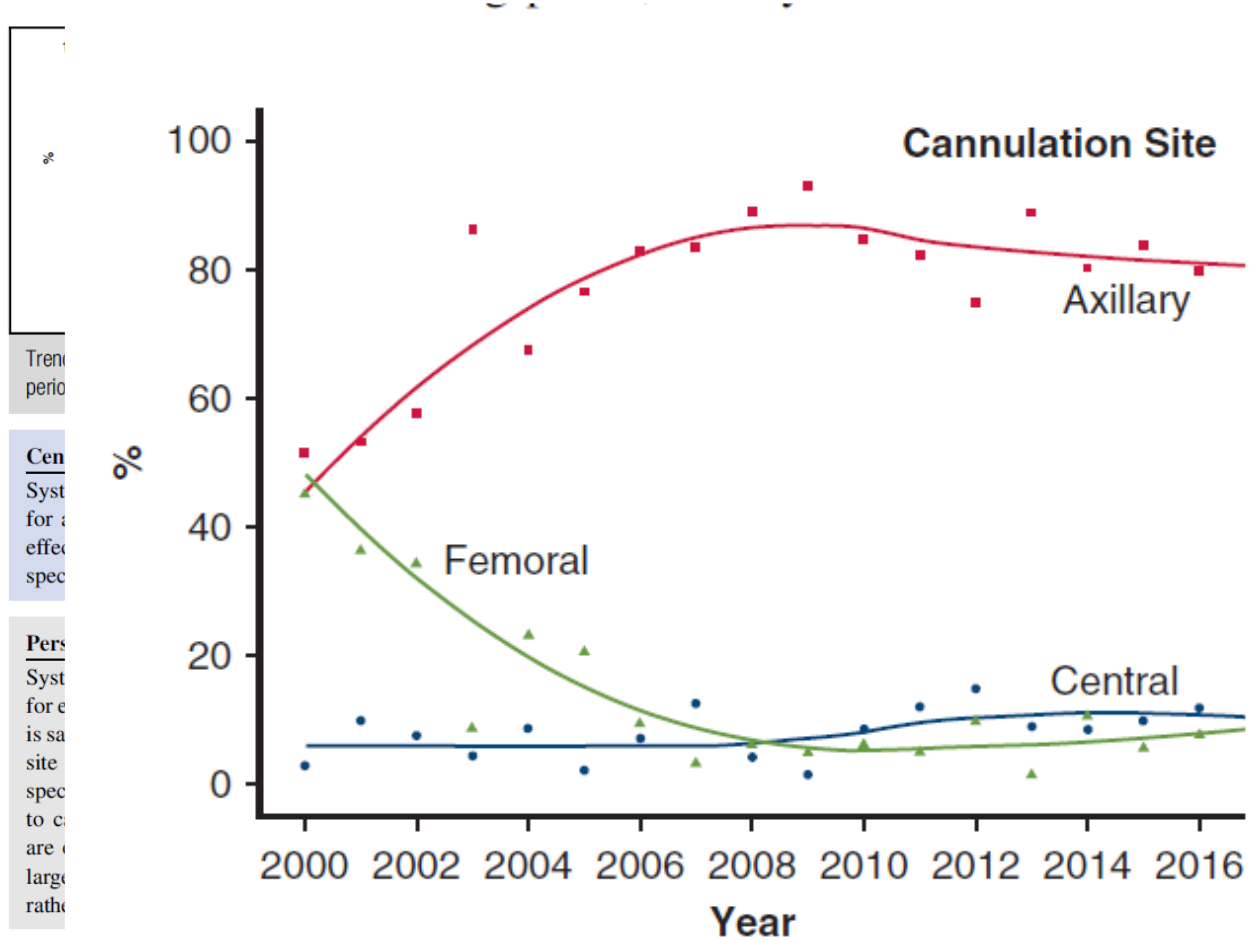
ABSTRACT

Objectives: Consensus regarding initial cannulation site for acute type A dissection repair is lacking. Objectives were to review our experience with systematic initial axillary artery cannulation, characterize patients on the basis of cannulation site, and assess outcomes.

Methods: From January 2000 to January 2017, 775 patients underwent emergency acute type A dissection repair. Initial axillary cannulation was performed in 617 (80%), femoral in 93 (12%), and central in 65 (8.4%). In-hospital mortality and stroke risk factors were identified using logistic regression.

Results: Reasons for selecting initial central or femoral instead of axillary cannulation included unsuitable axillary anatomy (n = 67; 42%), surgeon preference (n = 38; 24%), hemodynamic instability (n = 34; 22%), and preexisting cannulation (n = 19; 12%). Cannulation site was shifted or added intraoperatively in 82 (11%), with initial cannulation site being axillary (n = 23 of 617; 3.7%), central (6 of 65; 9.2%), or femoral (n = 53 of 93; 57%), for surgeon preference (n = 60; 73%), high flow resistance (n = 13; 16%), increased aortic false lumen flow (n = 6; 7.3%), and other (n = 3; 3.7%). In-hospital mortality was 8.6% (n = 67; lowest for axillary, 7.3% [*P* = .02]) and stroke 8.3% (n = 64). Hemodynamic instability (odds ratio [OR], 7.6; 95% confidence interval [CI], 4.2-14), limb ischemia (OR, 3.7; 95% CI, 1.5-9.3), stroke (OR, 5.5; 95% CI, 2.2-14), and aortic regurgitation (OR, 2.2; 95% CI, 1.2-4.2) at presentation were risk factors for mortality and central cannulation site (OR, 2.3; 95% CI, 1.05-5.1) and aortic stenosis (OR, 2.4; 95% CI, 1.2-4.6) for stroke.

Conclusions: Systematic initial axillary cannulation for acute type A dissection repair is safe and effective and can be tailored to patients' specific needs. With this strategy, comparable outcomes are observed among cannulation sites and are largely determined according to patient presentation rather than cannulation site. (J Thorac Cardiovasc Surg 2019;158:647-59)



See Commentaries on pages 660, 662, and 664.

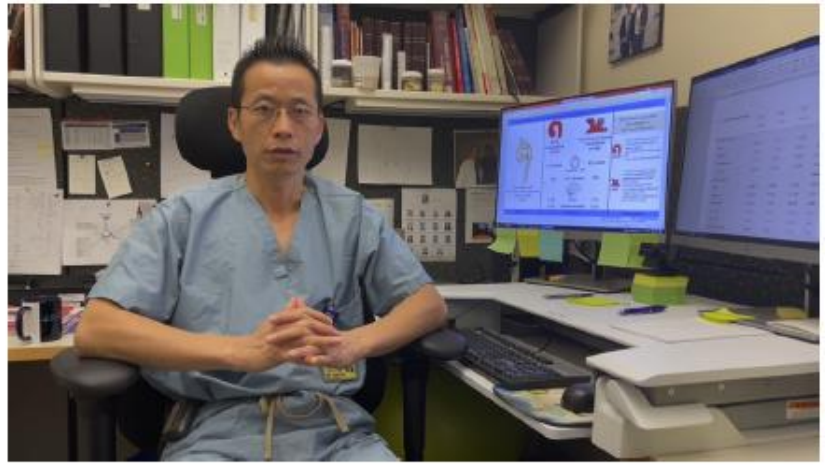
TABLE 4. In-hospital outcomes

Outcome	All (n = 775)		Initial cannulation site						*P* value
			Axillary (n = 617)		Central (n = 65)		Femoral (n = 93)		
	n*	Value	n*	Value	n*	Value	n*	Value	
Hospital death	775	67 (8.6)	617	45 (7.3)	65	7 (11)	93	15 (16)	.02
Stroke	775	64 (8.3)	617	47 (7.6)	65	9 (14)	93	8 (8.6)	.2
Disabling stroke	775	41 (5.3)	617	28 (4.5)	65	7 (11)	93	6 (6.5)	.09
Renal failure requiring dialysis	760	73 (9.6)	604	53 (8.8)	63	8 (13)	93	12 (13)	.3
Spinal cord infarction	775	5 (0.65)	617	5 (0.81)	65	0 (0)	93	0 (0)	.5
Respiratory failure requiring tracheostomy	775	104 (13)	617	77 (12)	65	10 (15)	93	17 (18)	.3
Bowel ischemia	775	15 (1.9)	617	11 (1.8)	65	2 (3.1)	93	2 (2.2)	.8
Reoperation for bleeding	775	69 (8.9)	617	52 (8.4)	65	6 (9.2)	93	11 (12)	.6
ICU length of stay, h†	775	40/95/364	617	39/94/356	65	42/90/444	93	39/125/397	.7
Postoperative length of stay, d†	775	6.1/10/24	617	6.1/10/23	65	6.7/11/27	93	5.7/10/27	.4

Data are presented as No. (%) except where otherwise noted. *ICU*, Intensive care unit. *Patients with data available. †15th/50th/85th percentiles.

Aortic and arch branch vessel cannulation in acute type A aortic dissection repair

Elizabeth L. Norton, MS,[a] Karen M. Kim, MD,[b] Shinichi Fukuhara, MD,[b] Aroma Naeem, BA,[b] Xiaoting Wu, PhD,[b] Himanshu J. Patel, MD,[b] G. Michael Deeb, MD,[b] and Bo Yang, MD, PhD[b]



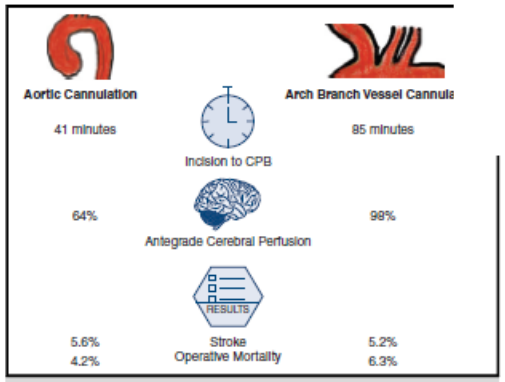
ABSTRACT

Objective: To evaluate central aortic cannulation and arch branch vessel (ABV) cannulation in acute type A aortic dissection repair.

Methods: From 2015 to April 2020, 298 patients underwent open repair of an acute type A aortic dissection. Patients undergoing femoral cannulation for cardiopulmonary bypass (n = 34) were excluded. Patients were then divided based on initial cannulation for cardiopulmonary bypass into central aortic cannulation (n = 72) and ABV cannulation (n = 192) groups. ABV sites included cannulation of the axillary, innominate, right/left common carotid, and intrathoracic right subclavian arteries.

Results: The aortic cannulation group was younger (59 vs 62 years; $P = .02$), more likely to be men (76% vs 60%; $P = .02$), and had more peripheral vascular disease (60% vs 37%; $P = .0009$). ABV dissection was similar between central and ABV cannulation groups (53% vs 60%; $P = .51$). The aortic cannulation group underwent less aggressive arch replacement, had shorter cardiopulmonary bypass times (200 vs 222 minutes; $P = .01$), less utilization of antegrade cerebral perfusion (93% vs 98%; $P = .04$), and received less blood transfusion (0 vs 1 U; $P = .001$). Postoperative outcomes were similar between aortic and ABV cannulation groups, including stroke (5.6% vs 5.2%; $P = 1.0$) and operative mortality (4.2% vs 6.3%; $P = .77$). In addition, postoperative strokes were similar in location (right-brain, left-brain, or bilateral), etiology (embolic vs hemorrhagic), and presence of permanent deficits. Aortic cannulation was not a risk factor for postoperative stroke (odds ratio, 0.94; $P = .91$) or operative mortality (odds ratio, 0.70; $P = .64$). Short-term survival was similar between central and ABV cannulation groups.

Conclusions: Both aortic and ABV cannulation were safe and effective cannulation strategies in acute type A aortic dissection repair. (JTCVS Techniques 2022;12:1-11)



Aortic and arch branch vessel cannulation had similar short-term outcomes.

CENTRAL MESSAGE

Aortic cannulation provides quicker institution of cardiopulmonary bypass with similar outcomes when compared with arch branch vessel cannulation; both cannulation strategies are safe and effective.

PERSPECTIVE

Both central aortic cannulation and arch branch vessel cannulation in acute type A aortic dissec-

Central Aortic vs Arch Branch Vessel Cannulation in Acute Type A Aortic Dissection Repair

Methods

Open Repair of an
Acute Type A Aortic Dissection
1/2015 – 4/2020
(n = 298)

Results

Aortic Cannulation (n = 72)

Arch Branch Vessel Cannulation (n = 192)

Aortic Cannulation (n = 72)		Arch Branch Vessel Cannulation (n = 192)
41 minutes	Incision to CPB	85 minutes
64%	ACP Utilization	98%
5.6%	Stroke	5.2%
4.2%	Operative Mortality	6.3%

Implications

Both Aortic and ABV Cannulation = Safe and Effective

Aortic

+ Quick establishment of CPB
+ No additional skin incision
– Risk of rupture
– Extra cannulation for ACP during HCA
– Can't resolve static cerebral MP

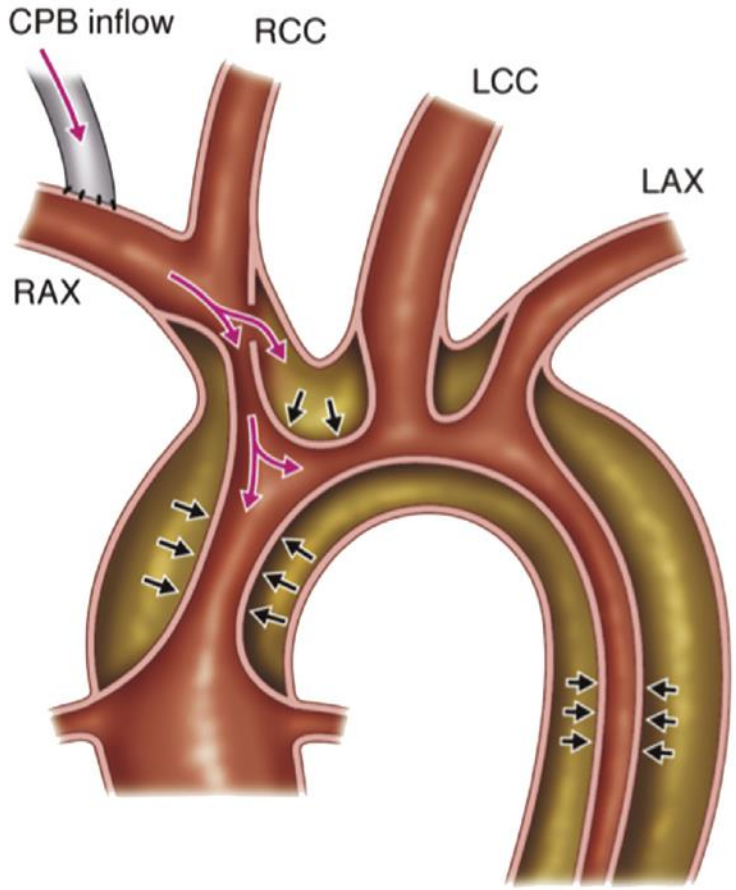
ABV

+ Use of non-dissected vessel
+ Arterial cannulation prior to opening pericardium (instant CPB if rupture)
+ ACP set-up prior to HCA
+ Can resolve static cerebral MP
– Longer time to CPB
– May be difficult if dissection into all arch branch vessels

MICHIGAN MEDICINE

ABV = arch branch vessel
ACP = antegrade cerebral perfusion
CPB = cardiopulmonary bypass
MP = malperfusion

Rt axillary artery cannulation is safe in patient with involvement of innominate artery dissection ?



Is right axillary artery cannulation safe in type A aortic dissection with involvement of the innominate artery?

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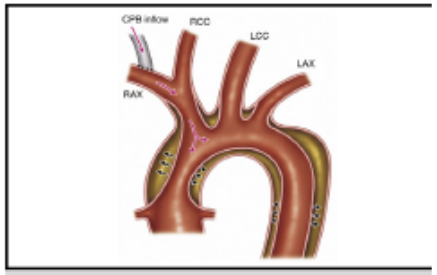
ABSTRACT

Objective: In patients with acute type A aortic dissection involving the innominate artery, it is unclear whether right axillary artery cannulation for arterial inflow is safe. We evaluated the surgical outcomes of patients with dissected innominate artery according to different arterial cannulation sites.

Methods: From 2005 to 2014, of 416 patients with acute type A aortic dissection and preoperative computed tomography angiography in 2 centers, 186 (aged 63 ± 13 years; 43% were female; 95% with DeBakey type I) had dissected innominate artery (84%, 9%, and 7% involving its entire length or more or less than half of its length, respectively). Neurologic complications, in-hospital mortality, and survival were compared between patients with right axillary (N = 84) and non–right axillary (N = 102) cannulation sites. Median follow-up was 30 months (range, 0-130 months).

Results: In-hospital mortality was 9.5% and 10.8% ($P = .97$) for patients with right and non–right axillary cannulation, respectively. Seven patients (8.3%) with right axillary cannulation and 9 patients (8.8%; $P = .89$) with non–right axillary cannulation had a new-onset postoperative stroke. The axillary artery was cannulated (although dissected) in 8 patients. None of them had a new-onset stroke or died perioperatively. The innominate artery remodeling was observed on follow-up computed tomography in 12% of right axillary cases and 14% of non–right axillary cases ($P = .82$). Survival did not differ between right axillary and non–right axillary cases, and measured 92% ± 3% versus 87% ± 4% and 85% ± 5% versus 73% ± 9% at 1 and 5 years, respectively (log rank, $P = .29$).

Conclusions: The right axillary artery is safe to cannulate for arterial inflow in patients with type A aortic dissection with dissected innominate artery. (J Thorac Cardiovasc Surg 2016;152:801-7)



Axillary artery cannulation in case of dissected innominate artery.

Central Message

The RAX artery is safe to cannulate for arterial inflow in patients with type A dissection with dissected innominate artery.

Perspective

This study evaluates the safety of RAX artery cannulation in case of a dissected innominate artery. We did not observe inferior outcomes in these patients when compared with other cannulation sites. These results may encourage cardiac surgeons to use the RAX artery for arterial inflow for the heart-lung machine regardless of innominate artery involvement in the dissection process.

See Editorial Commentary page 808.

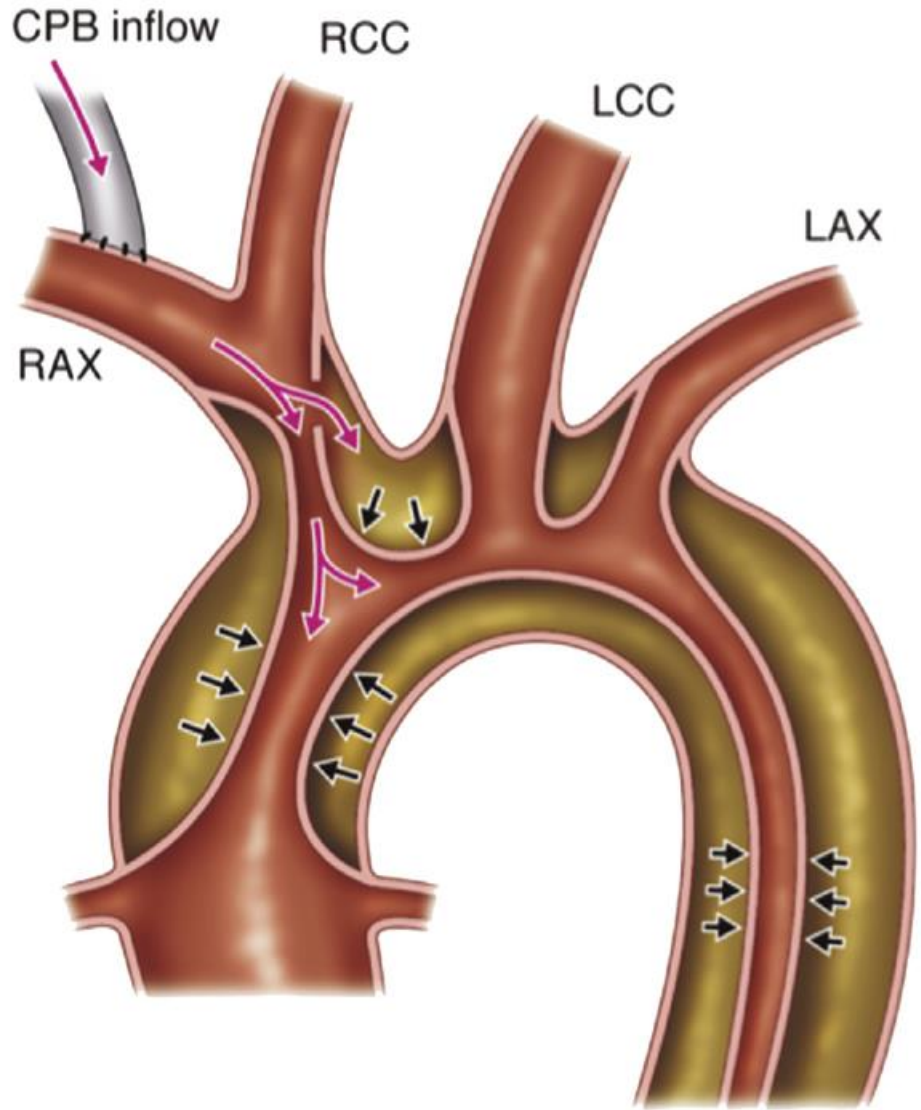


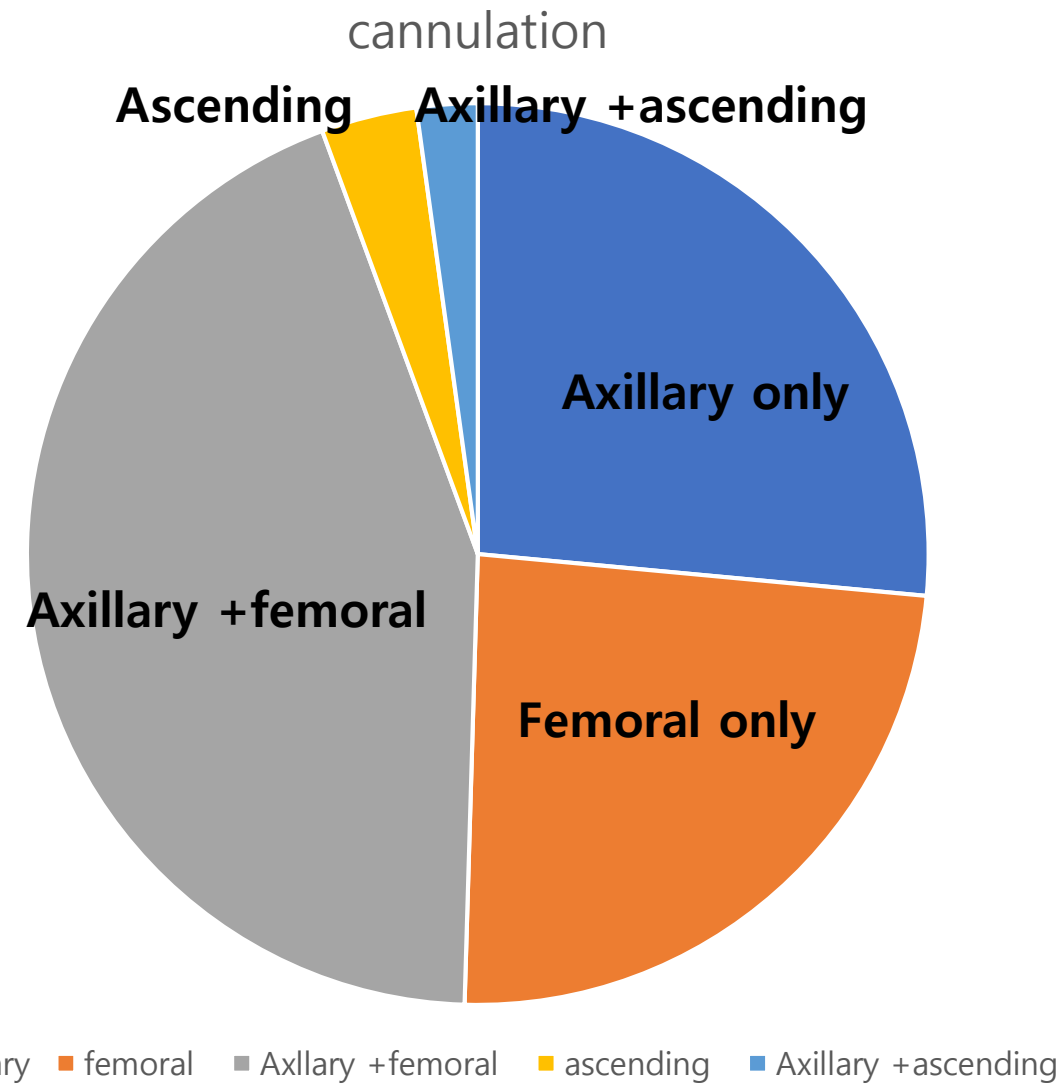
TABLE 3. Surgery for type A aortic dissection details and outcomes

	All (n = 186)	RAX cannulation (n = 84)	Non-RAX cannulation (n = 102)	*P* value
Proximal repair				
Supracoronary ascending replacement	155 (83.3)	67 (79.8)	88 (86.3)	.310
Aortic root replacement	30 (16.1)	16 (19.0)	14 (13.7)	.434
David operation	1 (0.5)	1 (1.2)	0	.922
Distal repair				
Isolated ascending replacement	118 (63.4)	53 (63.1)	65 (63.7)	.949
Hemiarch replacement	38 (20.4)	16 (19.0)	22 (21.6)	.809
Total arch replacement	30 (16.1)	15 (17.9)	15 (14.7)	.703
Antegrade TEVAR	2 (1.1)	1 (1.2)	1 (1.0)	.565
CPB time (min)	166 (123; 217)	178 (125; 237)	156 (121; 203)	.075
CX time (min)	102 (82; 137)	107 (84; 146)	98 (81; 133)	.299
HCA time (min)	29 (19; 37)	27 (0; 38)	29 (24; 37)	.121
Antegrade cerebral perfusion	79 (42.5)	48 (57.1)	31 (30.4)	<.001
Deep hypothermic circulatory arrest	107 (57.5)	36 (42.9)	71 (69.6)	<.001
Lowest body temperature (°C)	20.0 (18.6; 22.4)	20.6 (18.9; 23.3)	19.9 (18.6; 21.2)	.184
Reexploration for bleeding	15 (8.1)	6 (7.1)	9 (8.8)	.882
Stroke, new onset	18 (9.7)	8 (9.5)	10 (9.8)	.853
TND	16 (8.6)	9 (10.7)	7 (6.9)	.503
Renal failure	17 (9.1)	6 (7.1)	11 (10.8)	.991
Respiratory failure	86 (46.2)	41 (48.8)	45 (44.1)	.570
ICU time	6 (4; 10)	6 (3; 10)	6 (4; 10)	.866
In-hospital time	20 (14; 28)	21 (14; 29)	20 (14; 28)	.739
In-hospital mortality	19 (10.2)	8 (9.5)	11 (10.8)	.969

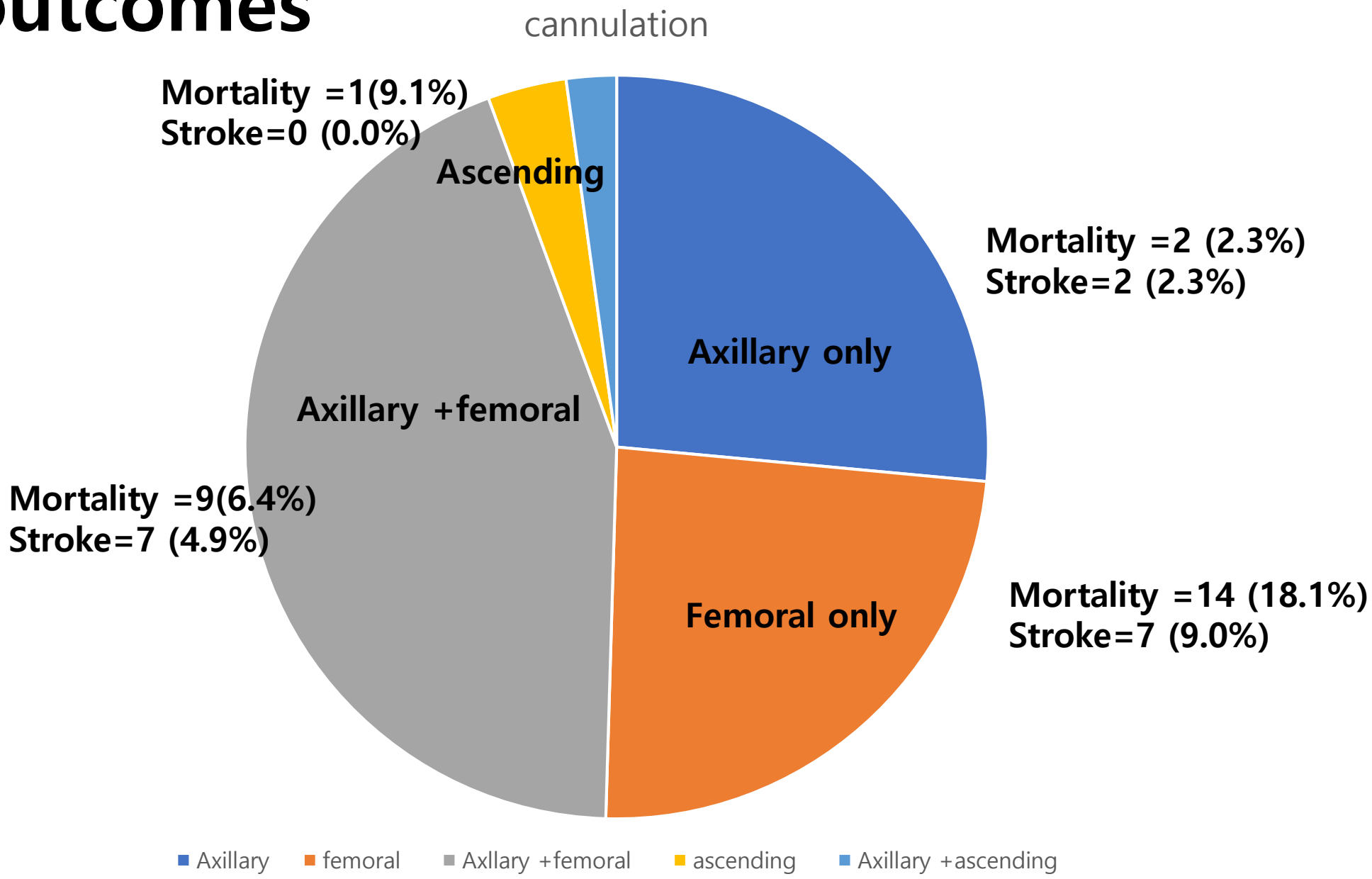
Yonsei experience

- 2001~2024
- TAAAD (N=331)

- Types of Cannulation
  - Axillary only (N= 85)
  - Femoral only (N=77)
  - Axillary +femoral (N=141)
  - Ascending (N=11)
  - Axillary +ascending (N=7)
  - Ascending +femoral (N=1)



Early outcomes



Axillary artery cannulation reduces early embolic stroke and mortality after open arch repair with circulatory arrest

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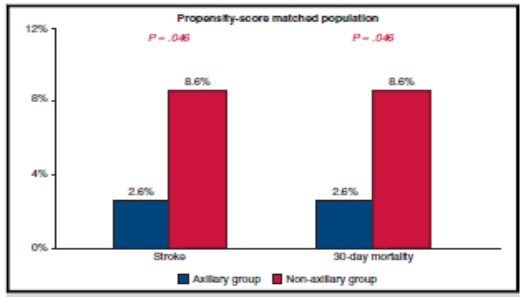
ABSTRACT

Objective: To evaluate the efficacy of axillary artery cannulation for early embolic stroke and operative mortality, we retrospectively compared the outcomes between patients with or without axillary artery cannulation during open aortic arch repair with circulatory arrest.

Methods: Between January 2004 and December 2017, 468 patients underwent open aortic arch repair with circulatory arrest using antegrade cerebral perfusion and were divided into 2 groups according to the site of arterial cannulation: the axillary artery (axillary group, n = 352) or another site (nonaxillary group, n = 116) groups. Embolic stroke was defined as a physician-diagnosed new postoperative neurologic deficit lasting more than 72 hours, generally confirmed by computed tomography or magnetic resonance imaging.

Results: After propensity score matching, the patients' characteristics were comparable between the groups (n = 116 in each). The incidences of acute type A dissection, aortic rupture, shock, or emergency operation were similar between groups. The incidence of early embolic stroke was significantly lower in axillary group (n = 3 [2.6%] vs n = 10 [8.6%]; $P = .046$). Also, 30-day mortality (n = 3 [2.6%] vs n = 10 [8.6%]; $P = .046$) and in-hospital mortality (n = 3 [2.6%] vs n = 11 [9.5%]; $P = .027$) occurred significantly lower in the axillary group.

Conclusions: Axillary artery cannulation reduced the early embolic stroke and early mortality after open arch repair with circulatory arrest. Axillary artery cannulation as the arterial cannulation site during open arch repair with circulatory arrest may be helpful in preventing embolic stroke and reducing early mortality. (J Thorac Cardiovasc Surg 2020;159:772-8)



Incidences of stroke and 30-day mortality in axillary and nonaxillary groups.

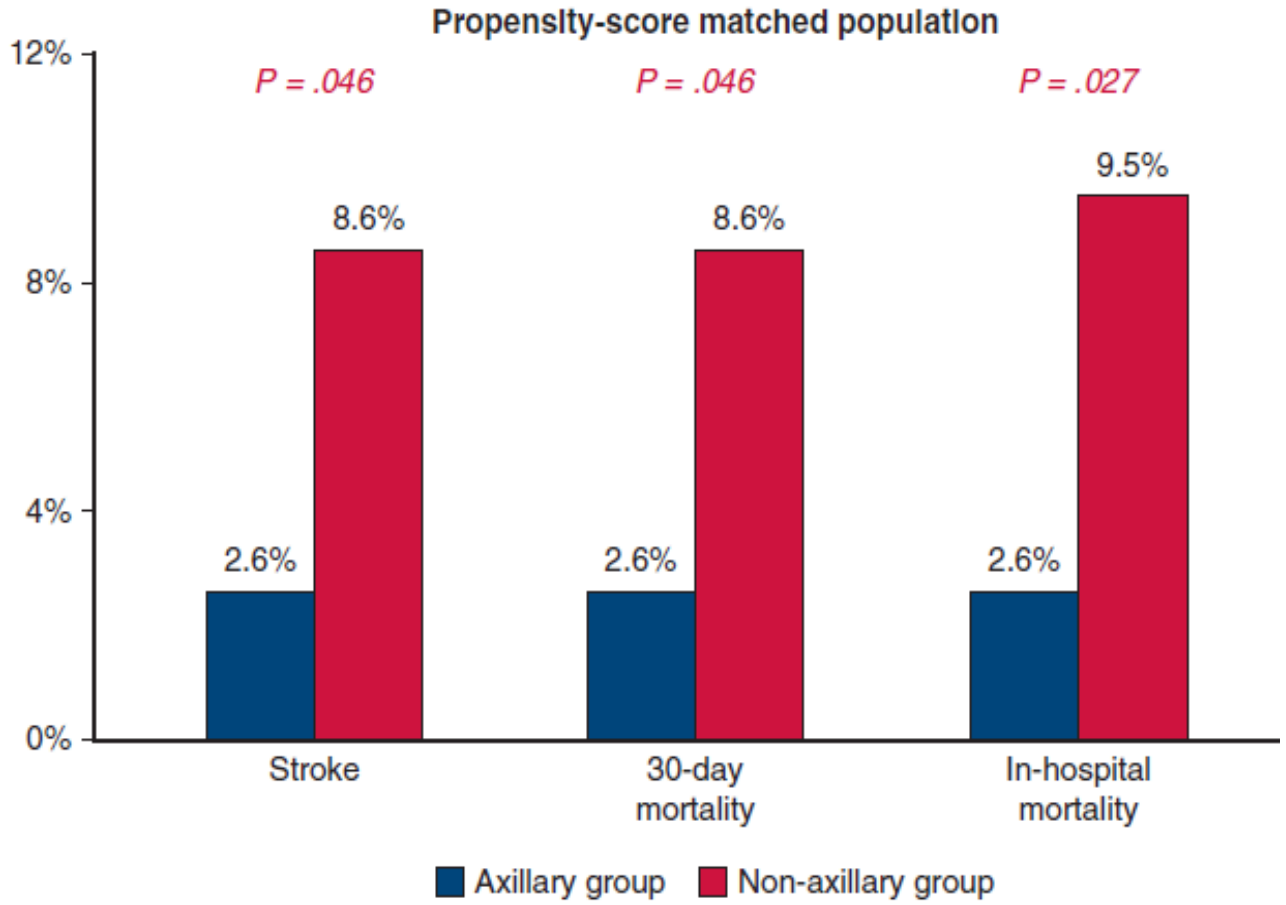
Central Message

In patients undergoing open aortic arch repair with circulatory arrest using antegrade cerebral perfusion, axillary artery cannulation could reduce the early embolic stroke and early mortality.

Perspective

Despite the wide use of axillary artery cannulation, a general recommendation for the use of the axillary artery at the time of open aortic arch repair has not yet been advocated. This study evaluated the efficacy of axillary artery cannulation for early embolic stroke and operative mortality after open arch repair with circulatory arrest.

See Commentaries on pages 779 and 781.



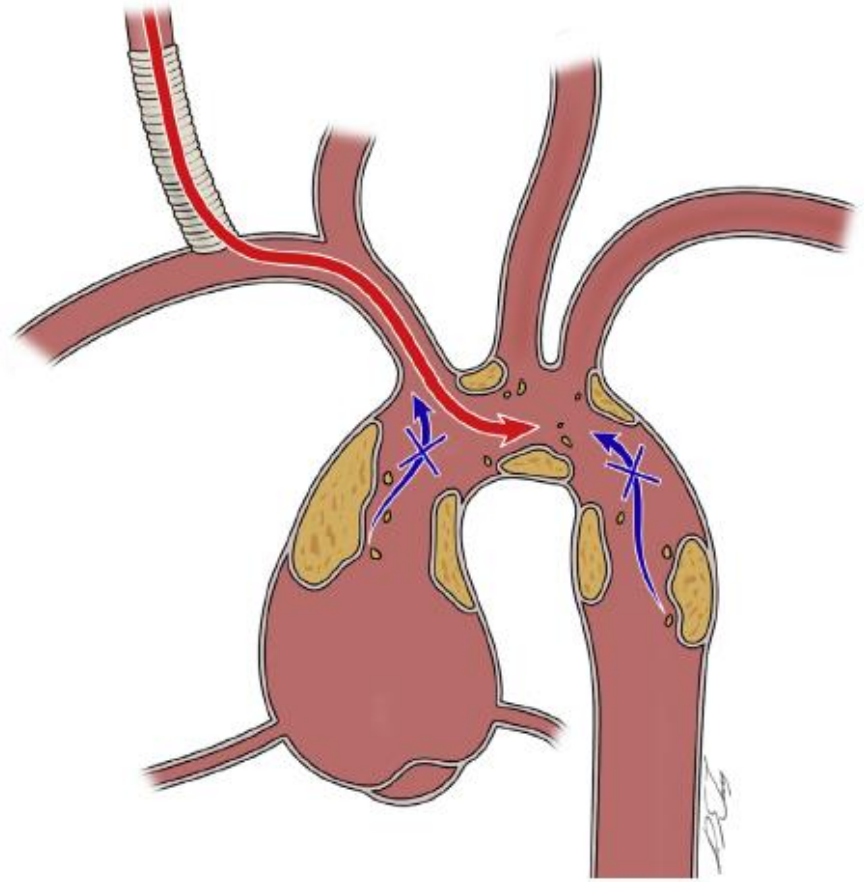
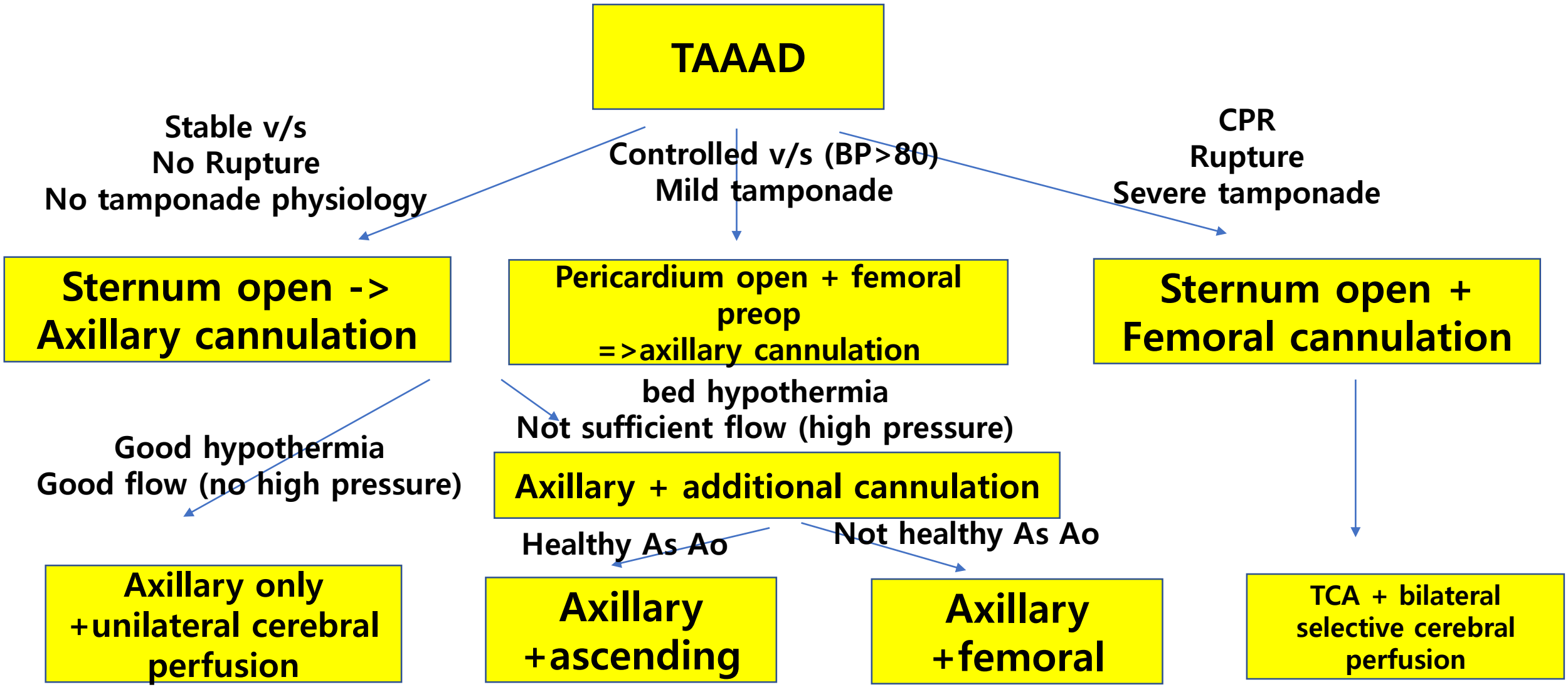


FIGURE 3. Mechanism of preventing embolic stroke of axillary artery cannulation during open arch repair. Continuous antegrade flow of axillary artery cannulation can prevent the retrograde embolism from the distal aorta and sandblasting effect from the ascending aorta.

Current Yonsei strategy



Conclusion

- **CPB with antegrade flow is better than CPB with retrograde flow**
- **Axillary artery cannulation was good choice for type I dissection without severe unstable hemodynamics**
- **Femoral cannulation was first choice for unstable patient with type I aortic dissection (shock, CPR, rupture)**
- **Central cannulation is good option for selective patient with ascending aortic wall with relatively good condition**