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Neurological outcomes and mortality in patients with type A aortic dissection. Impact of intra-operative management

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The numbers of acute type A aortic dissection

Mortality without surgical treatment for Acute type A aortic dissection (ATAAD) is 1—2% per hour with less than 10% surviving 3 Days Anagnopoulos CE et al. Aortic dissections and dissecting aneurysms. Am J Cardiol 1972;30:263—73.

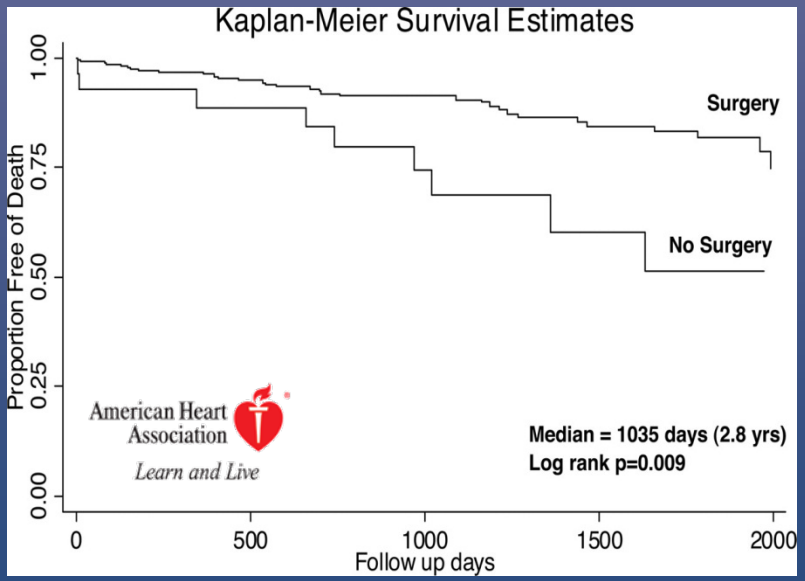
In a recent study the in-hospital mortality without operative management was 58%
The international registry of acute aortic dissection (IRAD): new insight into and old disease. JAMA 2000;283:897—903.

In-hospital mortality following surgical treatment of type A aortic dissection ranges from 9% to 32.5%

Surgery in ATAAD

Surgery converts a 90% mortality risk to at least a 70% survival chance

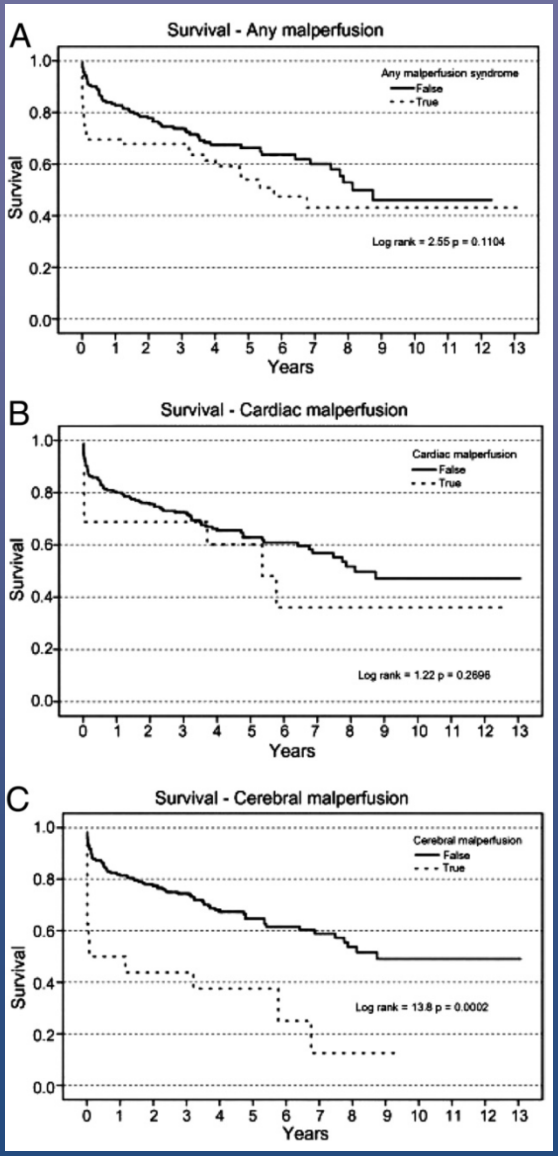
This magnitude of effect means that ATAAD is an accepted indication for surgery



Tsai T T et al. Circulation 2006;114:I-350-I-356

The survival advantage of surgery versus medical management continues in the longer term as survival curves continue to diverge

Impact of clinical presentation on outcome



Risk factors for surgery (IRAD):

age>70 years, pulse deficit, preoperative hypotension, shock/cardiac tamponade, signs of acute myocardial ischemia/infarct, intraoperative myocardial dysfunction

Malperfusion phenomena have an incidence of 16% to 33% and strongly affect in-hospital mortality and long term results especially if there is clinical evidence of coronary and cerebral involvement

Geirsson A et al. Eur J Cardiothorac Surg 2007;32:255– 62

A Clinical Classification for ATAAD the Pennsylvania Group Classification

European Journal of Cardio-thoracic Surgery 39 (2011) 519–522

Review

Classification of acute type a dissection: focus on clinical presentation and extent☆

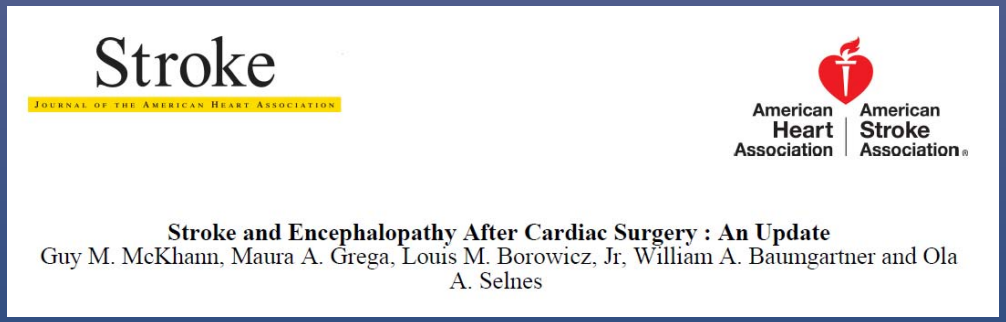
John G.T. Augoustides[a,*], Wilson Y. Szeto[b], Nimesh D. Desai[b], Alberto Pochettino[b], Albert T. Cheung[a], Joseph S. Savino[a], Joseph E. Bavaria[b]

Penn Classification summarizes the heterogeneity of clinical presentation of ATAAD in four ischemic profiles:

- Class a — absence of branch vessel malperfusion or circulatory collapse
- Class b — branch vessel malperfusion with ischemia
- Class c — circulatory collapse with or without cardiac involvement
- Class b+c — both branch vessel malperfusion and circulatory collapse

Neurologic outcome in cardiac surgery

Incidence of stroke in cardiac surgery varies depending on the procedure, ranging from 4.1% in CABG surgery to 8.7% in aortic surgery
In the last decade incidence of stroke and encephalopathy in cardiac surgery population tends towards an increase because of a more severe «stroke risk profile» of patients undergoing surgery


Stroke
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association | American Stroke Association

Stroke and Encephalopathy After Cardiac Surgery : An Update
Guy M. McKhann, Maura A. Grega, Louis M. Borowicz, Jr, William A. Baumgartner and Ola A. Selnes

McKhan GM et al. *Stroke*. 2006;37:562-571

TABLE 3. Impact of Stroke on Early Outcomes After Cardiac Surgery[23]

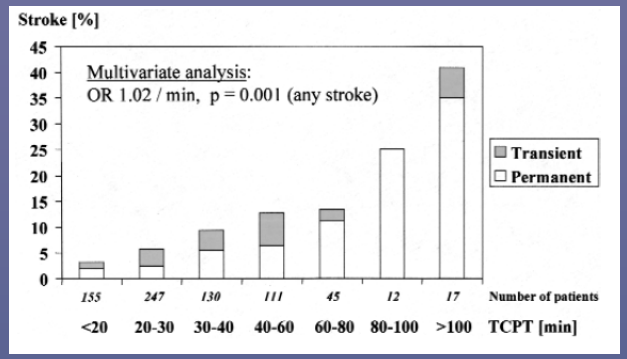
Variable	Stroke, (n=214)	No Stroke, (n=5757)	*P* Value
Intensive care unit length of stay, d	7.3	3.6	<0.0001
Postoperative hospital length of stay, d	25.2	9.7	<0.0001
Total hospital charges	$60 750	$30 705	<0.0001
Hospital mortality	41 (19%)	240 (4%)	<0.0001

Preexisting cerebrovascular disease, microembolization, hypoperfusion and post-operative atrial fibrillation are the causative factors

Literature reports: neurologic outcome

NEUROLOGIC OUTCOME AFTER ASCENDING AORTA–AORTIC ARCH OPERATIONS: EFFECT OF BRAIN PROTECTION TECHNIQUE IN HIGH-RISK PATIENTS

Hagl C et al. Thorac Cardiovasc Surg 2001;121:1107-1121



- Incidence of TND 30%, PND 9.0%
- Prolonged total cerebral protection time (TCPT) increases the risk of both TND and PND. Safe TCPT<40'.
- antegrade cerebral perfusion +TCPT =40'-80' is protective against TND but doesn't influence occurence of strokes

The incidence of transient neurologic dysfunction after ascending aortic replacement with circulatory arrest

Tatjana M. Fleck, Martin Czerny, Doris Hutschala, Herbert Koinig, Ernst Wolner and Martin Grabenwoger

Ann Thorac Surg 2003;76:1198-1202

- Incidence of TND 18% and PND 3%
- The prevalence and severity of TND was strongly related to DHCA duration, regardless of whether retrograde cerebral perfusion was used:
  14% in DHCA <30' versus 38% in DHCA >40' (p<0.05)

Monaldi Hospital Experience

Between January 2007 and July 2012, 140 patients with type A aortic dissection were treated with open surgery

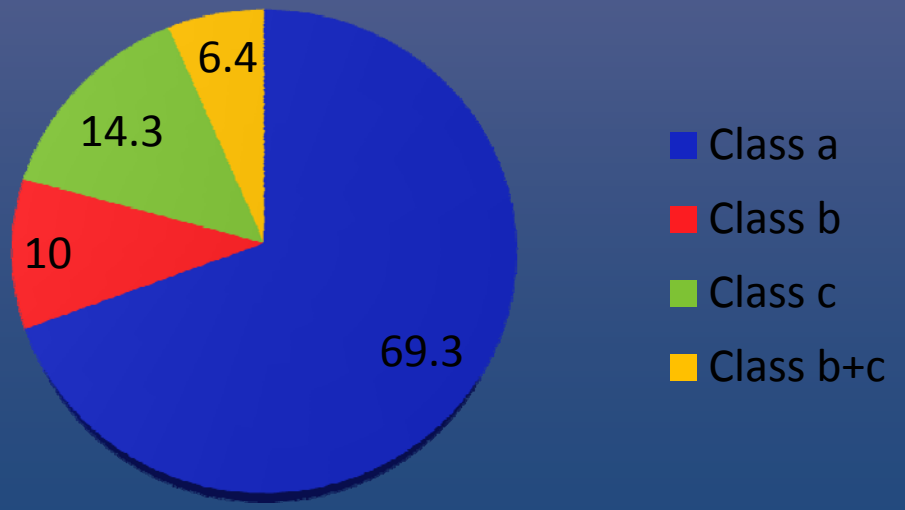
Pre-operative features

Age: 62.7 ± 11 years
Sex: 64.3% males
Presentation: 90.6% acute
Anatomic classification: 85.6% De Bakey type I
14.7% supra-aortic branches involvement
9.6% coronary involvement

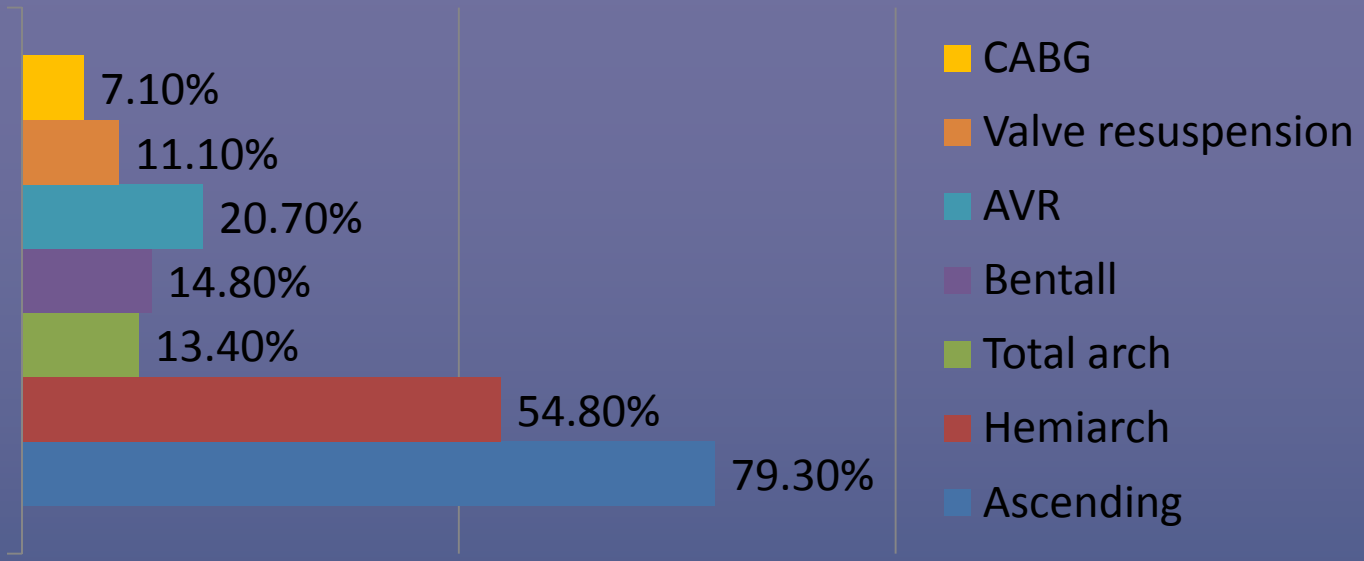
61.7% complicated ATAAD

- 32.1% pericardial effusion
- 15.7% shock
- 9.3% aortic regurgitation
- 6.4% miocardial infarction
- 4.3% stroke
- 4.9% visceral malperfusion

Penn Classification



Surgical features



- Arterial Cannulation: Right Axillary 41.4% Femoral 48.1%
- Mean CPB time: 192.76±70.1 min
- Mean minimum core temperature 23.8±2,3°C
- Circulatory arrest 83.6% , mean time 44.89±32.56 min
- Cerebral protection:
  - 53% Kazui
  - 29% ACP through right axillary artery
  - 5.4% ACP through right axillary artery+left carotid
  - 2.3% DHCA alone (min core temeprature 19.5°C)

Results

- Intra-Operative mortality: 18.8%
- In-hospital mortality: 35.1%

	Intra-op mortality *(p)*	In-hospital mortality *(p)*
Complications	30.6% *(p<0,001)*	44.3% *(p=0,015)*
Penn Class A	10.4% *(p<0,001)*	28.7% *(p=0.016)*
Penn Class B	7.7% (*p=0,25)*	21.4% *(p=0,2)*
Penn Class C	55% *(p<0,001)*	57.9% *(p=0,025)*
Penn Class B+C	44.4% *(p=0,04)*	85.7% *(p=0,004)*

Pre-operative neurologic damage, arterial cannulation site, kind of cerebral perfusion were not significantly associated to mortality

Pre-operative complications and Penn Classification are confirmed at multivariate analysis as intra-operative risk factors

Neurologic damage description

- Incidence of neurologic events: TND 7.9%, PND 13.6%
- Anatomic-Clinical Patterns: stroke (15.7%), encephalopathy(17.1%), watershed stroke(2.1%) and myelopathy(2.1%)
- Neurological outcomes didn't correlate to pre-operative clinical features
- TND was more frequent in axillary cannulation compared to femoral artery: 10.9% vs 4.7%, p=0.035
- No other statistical significant correlation appeared for total neurological events and intra-operative management

Bamford classification in our experience

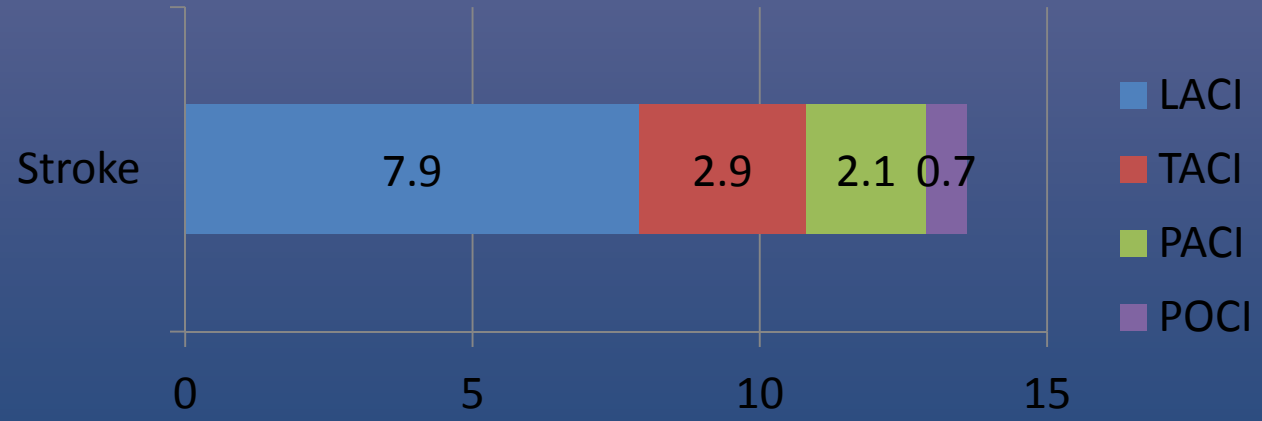
Lancet. 1991 Jun 22;337(8756):1521-6.

Classification and natural history of clinically identifiable subtypes of cerebral infarction.

Bamford J, Sandercock P, Dennis M, Burn J, Warlow C.

Department of Neurology, St James's University Hospital, Leeds, UK.

LACI: lacunar infarct –basal ganglia/pons
TACI: total anterior circulation infarct- proximal MCA
PACI: partial anterior circulation infarct- distal MCA/ACA
POCI: posterior circulaton infarct- vessels for stem/cerebellum/occipital lobes



Following Bamford classification for different clinical subtypes of strokes, we found peculiar neurologic damage depending on different surgical strategies

LACI and PACI were significantly more represented when axillary artery was cannulated.
Axillary artery was also significantly associated to lateral neurologic damage, more on the left side, compared to femoral artery perfusion.

	Axillary a. cannulation	Femoral a. cannulation	p value
LACI	14.5%	3.1%	0.029
TACI	1.8%	4.7%	
PACI	5.5%	0%	
POCI	0%	1.6%	
Left Side	14.5%	3.1%	0.021
Right Side	7.3%	4.7%	

Left sided strokes were also frequent when using single axillary or axillary+left carotid artery for antegrade cerebral perfusion, comparing to classic Kazui technique

	Axillary	Axillary+left carotid	Kazui	
Left Side	15.8%	28.6%	2.9%	0.048
Right Side	10.5%		4.3%	
Diffuse	73.7%	71.4%	92.8%	

Axillary artery cannulation: risk or benefit?

Does the Arterial Cannulation Site for Circulatory Arrest Influence Stroke Risk?
Lars G. Svensson, Eugene H. Blackstone, Jeevanantham Rajeswaran, Joseph F. Sabik, III, Bruce W. Lytle, Gonzalo Gonzalez-Stawinski, Poseidon Varvitsiotis, Michael K. Banbury, Patrick M. McCarthy, Gösta B. Pettersson and Delos M. Cosgrove
Ann Thorac Surg 2004;78:1274-1284

- Incidence of stroke 6.1%
- Indirect cannulation of axillary artery was associated with a lower risk of neurologic damage compared to direct arterial cannulation

STATE-OF-THE-ART PAPER

Evidence, Lack of Evidence, Controversy, and Debate in the Provision and Performance of the Surgery of Acute Type A Aortic Dissection

Robert S. Bonser, MD,*†‡ Aaron M. Ranasinghe, MD,*† Mahmoud Loubani, MD,‡§ Jonathan D. Evans, BMedSci,† Nassir M. A. Thalji, MB ChB,† Jean E. Bachet, MD,‖ Thierry P. Carrel, MD,† Martin Czerny, MD,‡¶ Roberto Di Bartolomeo, MD,‡# Martin Grabenwöger, MD,‡** Lars Lonn, MD, PhD,†† Carlos A. Mestres, MD, PhD,‡‡‡ Marc A. A. M. Schepens, MD,‡§§ Ernst Weigang, MD, PhD‡‖‖

«An RAxA/ScA cannulation, however, is not risk-free, and complications include brachial plexus injury and de novo or propagation of dissection, and the need for intra-operative brain monitoring remains important» *J Am Coll Cardiol. 2011 Dec 6;58(24):2455-74*

Conclusions

ATAAD surgery has two «black sheep»!

- Early mortality is strictly related to clinical pre-operative features, well predicted by Penn Classification also in our population
- Neurologic outcome may be influenced by surgical management
  - Cannulation of right axillary artery or femoral artery show different clincal pattern of neurologic sequelae
  - A more strict neurologic monitoring during cannulation of axillary artery should be considered, since the high incidence of focal neurologic events, but in an emergency setting this is not always available