SHOULD WE EXTEND TYPE A REPAIRS: PROXIMAL OR DISTAL

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Disclosures

Gore & Associates: Consultant, Site PI for TBE, Arise, Arise 2

Cook Medical: Consultant, Proctor/Instructor for Zenith, Alpha,

Terumo: PI, Consultant

Artivion: PI, Consultant, Steering committee

Edwards lifesciences: Consultant, Product development

Off-label use of devices

“Goals” of Acute Surgical Intervention

- **Primary Objective:** Immediate life preservation by preventing aortic rupture and cardiac tamponade.
- **Secondary Objectives:**
  - Resection of the primary intimal tear.
  - Correction of aortic valve insufficiency.
  - Restoration of true lumen perfusion to branch vessels.

The "Conservative" Paradigm (Proximal-Focused)

- **Scope:** Limited to supracoronary ascending aortic replacement or "hemiarch" repair.
- **Key Techniques:**
  - **Open Distal Anastomosis:** Performed under circulatory arrest to ensure a secure, visualized seal.
  - **Aortic Valve Resuspension:** Preferred over replacement if leaflet pathology is absent.
- **Pros:** Lower early operative mortality (approx. 2.9% in some series) and technical simplicity suitable for most cardiac surgeons.
- **Cons:** Leaves dissected arch and distal tissue in place; high rates of patent false lumen (FL) and late distal reoperation (15–25% at 10 years).

The "Aggressive" Paradigm (Distal Extension)

- **Scope:** Total arch replacement (TAR) often combined with a **Frozen Elephant Trunk (FET)**.
- **Key Techniques:**
  - **Frozen Elephant Trunk (FET):** Deploys a stent-graft into the descending thoracic aorta to promote false lumen thrombosis and remodeling.
  - **"Branch First" Repair:** Specific sequence to minimize cerebral ischemia.
- **Pros:** Improved distal aortic remodeling, lower risk of late reintervention, and potentially better mid-term survival for younger patients.
- **Cons:** Increased early mortality (approx. 10.4% in some series) and higher risk of neurologic complications due to longer circulatory arrest.

Decision Matrix – Choosing the Extent

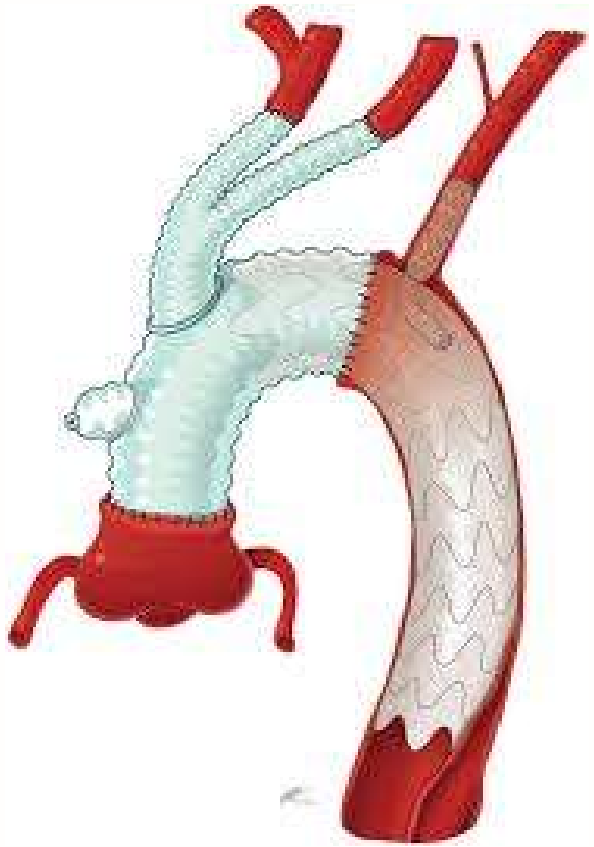
- **Patient Factors:**
  - **Age/Comorbidities:** Older, unstable patients benefit from the "life-saving" speed of proximal repair.
  - **Genetic Disorders:** Connective tissue diseases (e.g., Marfan) often mandate more extensive initial repair.
- **Anatomic Factors:**
  - **Intimal Tear Location:** If the tear is in the arch, total arch replacement is indicated.
  - **Malperfusion:** Distal extension (FET) may be required to expand a collapsed true lumen.

The "Arch Paradox"

Feature	FET (Frozen Elephant Trunk)	AMDS (Ascyrus Stent)	Zone 2 + Staged TEVAR
Primary Goal	Total Arch + Descending Remodeling	Malperfusion Relief + Arch Repair	De-risked Acute Repair + Future Options
Complexity	High (Deep Hypothermia, Long CPB)	Moderate (Adjunct to Hemiarch)	Moderate (easier than Zone 3)
SCI Risk	Elevated (4-5%)	Low	Lowest (if staged)
Evidence Base	Strong / Extensive	Limited / Emerging	Growing / Moderate

Why Zone 2?

- **Surgical Simplicity:**
  - Moves the distal anastomosis from the difficult Zone 3 to the more accessible Zone 2.
- **Reduced Ischemia:**
  - Significantly shorter circulatory arrest and cross-clamp times compared to TAR.
- **The "Landing Zone":**
  - Creates a 3–4 cm straight Dacron segment distal to the Left Common Carotid, perfect for a future TEVAR seal.



Experience with Zone 2 Arch Replacement Followed by Thoracic Endovascular Aortic Repair

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- **Sample Size:** 142 patients underwent open Zone 2 arch replacement.
- **Staged Completion: 38.7%** ($n=55$) of patients progressed to subsequent TEVAR.
- **Timing:** The median time to the second-stage TEVAR was **52 days**.
- **Spinal Cord Safety:** The rate of Spinal Cord Ischemia (SCI) was only **3.5%** (n=5), and notably, all of these patients had neurologic recovery by discharge.
- **Versatility:** The study concluded that Zone 2 repair "readily accommodates future TEVAR therapy".

Distal Remodeling

Table 4 Distal interventions

Characteristic	Aneurysm ($n = 37$)	Acute aortic syndrome ($n = 38$)	Residual dissection ($n = 67$)	Total ($n = 142$)
TEVAR	11 (29.73%)	13 (34.21%)	31 (46.27%)	55 (38.73%)
Time arch to TEVAR (d)	60 (3.5, 97.5)	37 (8, 90.25)	52 (14, 103)	52 (8, 98.5)
F/BEVAR	7 (18.92%)	0 (0%)	2 (2.99%)	9 (6.34%)
Arch endograft	6 (16.22%)	1 (2.63%)	5 (7.46%)	12 (8.45%)
Open thoracorepair	0 (0%)	0 (0%)	11 (16.42%)	11 (7.75%)

Abbreviations: F/BEVAR, fenestrated or branched thoracoabdominal endografts; TEVAR, thoracic endovascular aortic repair

Proximal vs Extensive Repair in Acute Type A Aortic Dissection Surgery

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Kai Wang, MD, PhD,[2,*] Bu-qing Ni, MD, PhD,[1,**] and Hong-jia Zhang, MD,[3,**] on behalf of the
Additive Anti-inflammatory Action for Aortopathy & Arteriopathy (5A) Investigators[†]

- 5510 Patients from 13 Chinese hospitals
- 2016 – 2021
- Proximal repair defined as hemiarch
- Extensive repair defined as total arch with FET

The 7 Key Risk Factors ("The Alphabet")

The model derives its name from the inclusion of several clinical and biochemical parameters:

- **A**ge
- **B**ody Mass Index (BMI)
- **P**latelet-to-leucocyte ratio
- **A**lbumin
- **H**emoglobin
- **S**erum creatinine (and urea nitrogen)
- **M**alperfusion (presence or absence)

Clinical Utility and Thresholds

- **Mortality Prediction:** The model showed an area under the curve (AUC) of **0.767** in derivation cohorts, indicating strong predictive power.
- **Treatment Selection:** A critical threshold of **4.5% predicted risk** has been identified:
    - **Below 4.5%:** Extensive repair carries a similar risk to proximal repair, potentially allowing for more comprehensive surgery to reduce future re-interventions.
    - **Above 4.5%:** Extensive repair carries a significantly higher risk of operative mortality (Odds Ratio: 2.164), suggesting a more conservative proximal repair may be safer.

Selective Aortic Arch and Root Replacement in Repair of Acute Type A Aortic Dissection

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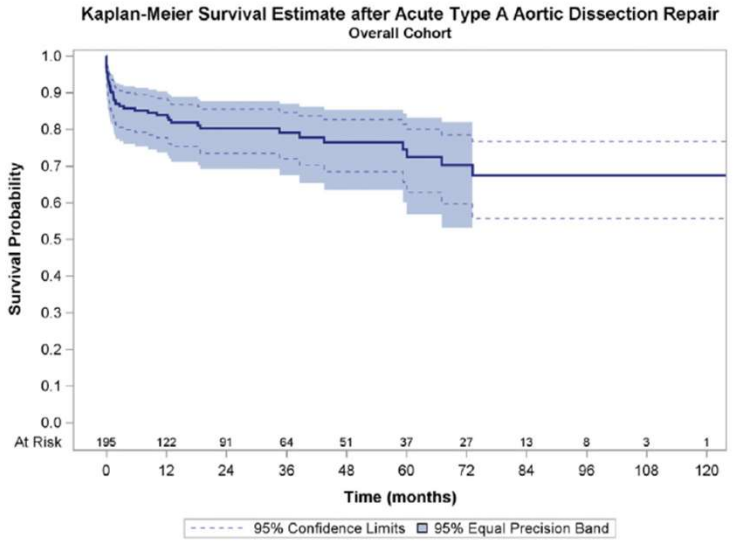
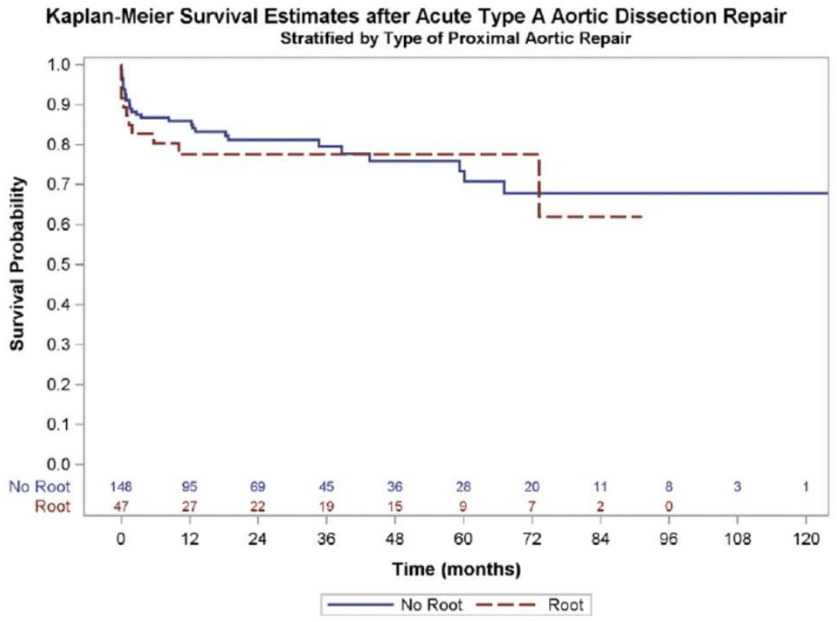
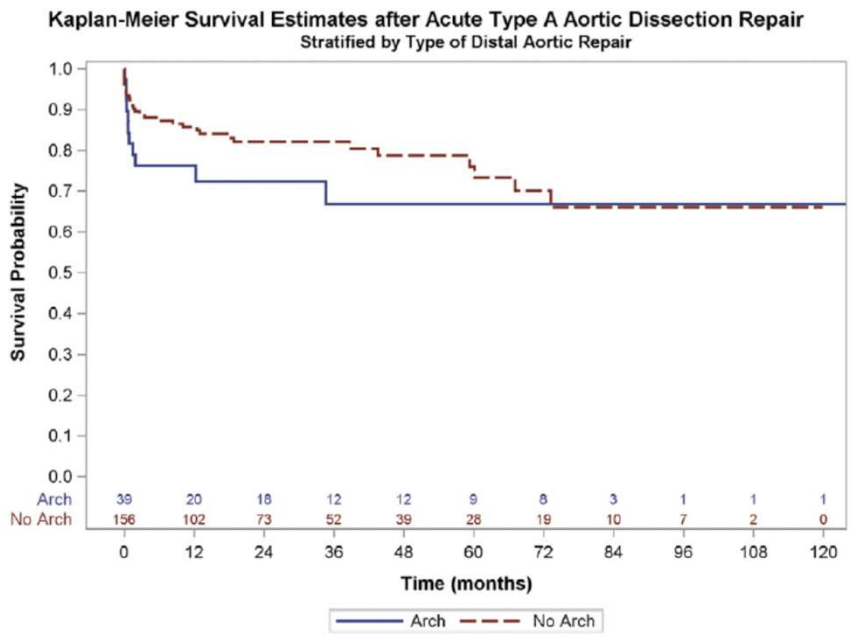
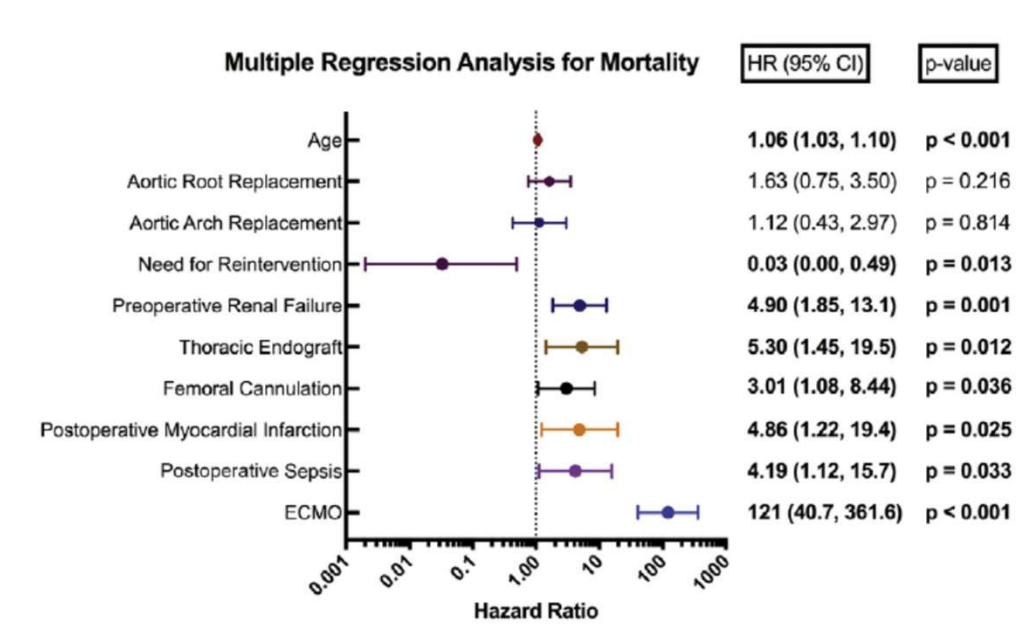
- 195 Patients
- Acute Type A dissection



Proximal vs Distal







Aorta: Research

Late Aortic Reinterventions After Surgery for Acute Type A Aortic Dissection

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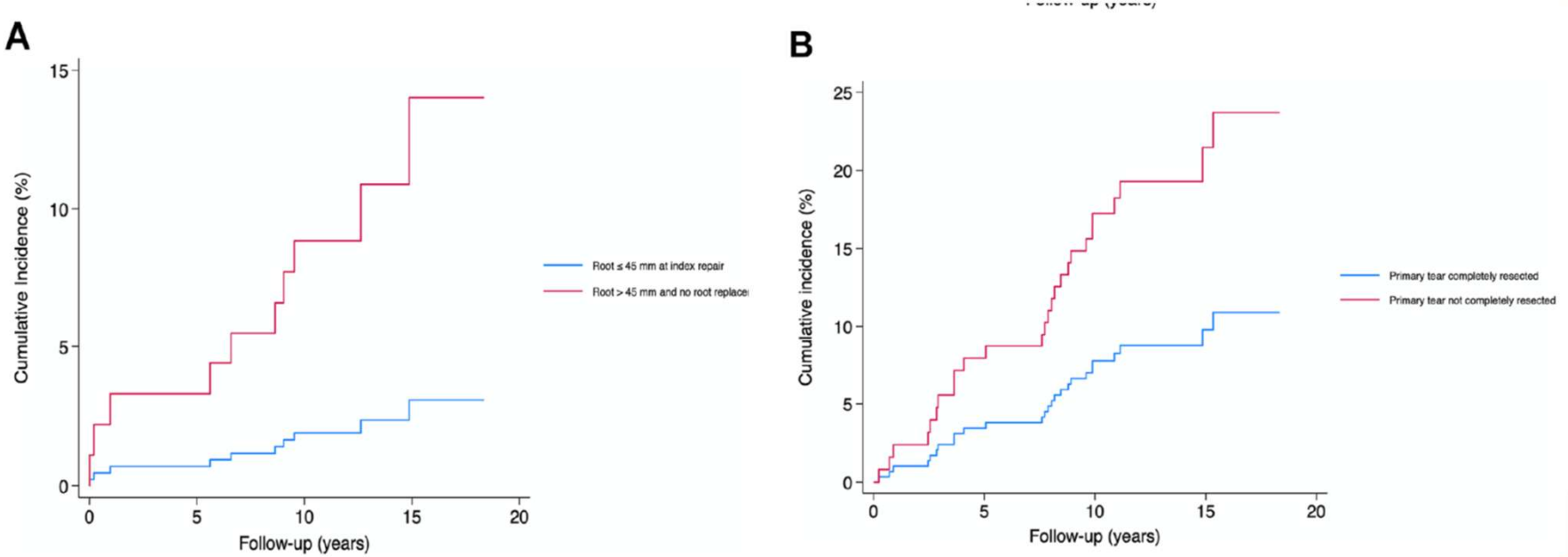

TABLE 3 Reintervention Characteristics

Variable	All patients (n = 37)	Reintervention		
		Proximal (n = 10)	Distal (n = 24)	Combined (n = 3)
Before reintervention				
Aortic root diameter, mean (SD), mm	45.8 (8.0)	55.0 (6.9)	42.1 (5.0)	49.0 (9.8)
Aortic arch diameter, mean (SD), mm	46.3 (7.8)	38.6 (5.9)	48.9 (5.8)	46.0 (13.9)
Proximal descending aortic diameter, mean (SD), mm	50.2 (14.8)	36.1 (7.7)	55.3 (13.8)	53.3 (13.6)
Descending diameter, mean (SD), mm	43.8 (13.8)	27.9 (2.7)	50.0 (11.9)	40.0 (7.9)
Indication				
Dilatation	31 (84)	5 (50)	23 (96)	3 (100)
Pseudoaneurysm	2 (5)	1 (10)	1 (4)	0 (0)
Redissection/rupture	3 (8)	0 (0)	3 (12)	0 (0)
Aortic regurgitation	10 (27)	8 (80)	0 (0)	2 (67)
Endocarditis	2 (5)	2 (20)	0 (0)	0 (0)
Other	3 (8)	1 (10)	1 (4)	1 (33)
Aortic valve replacement	2 (5)	1 (10)	...	1 (33)
Root replacement	11 (30)	9 (90)	...	2 (67)
Open aortic arch replacement	12 (32)	...	9 (38)	3 (100)
Thoracoabdominal aortic reconstruction	6 (16)	...	6 (25)	0 (0)
Endovascular arch	3 (8)	...	3 (13)	...
Open abdominal aortic reconstruction	2 (5)	...	2 (8)	...
Thoracic endovascular aortic repair	4 (11)	...	4 (17)	...
30-day mortality	0 (0)	0 (0)	0 (0)	0 (0)
Postoperative stroke	5 (14)	1 (10)	3 (12)	1 (33)
Time to first reintervention, y	7.9 (0.01-15.3)	7.6 (0.01-14.9)	7.8 (0.24-14.9)	8.9 (4.1-15.3)
Second reintervention	12 (32)	3 (30)	7 (29)	2 (67)
Third reintervention	2 (5)	...	2 (8)	...

Data are presented as n (%), median (full range), or as indicated otherwise as mean (SD).

Outcomes of Reoperative Aortic Root Replacement After Previous Acute Type A Dissection Repair

- *Albert J. Pedroza, MD, Alex R. Dalal, MD, Aravind Krishnan, MD, Nobu Yokoyama, MD,*
- *Ken Nakamura, MD, Emily Tognozzi, PA-C, Y. Joseph Woo, MD, John W. Macarthur, MD, and*
- *Michael P. Fischbein, MD, PhD*

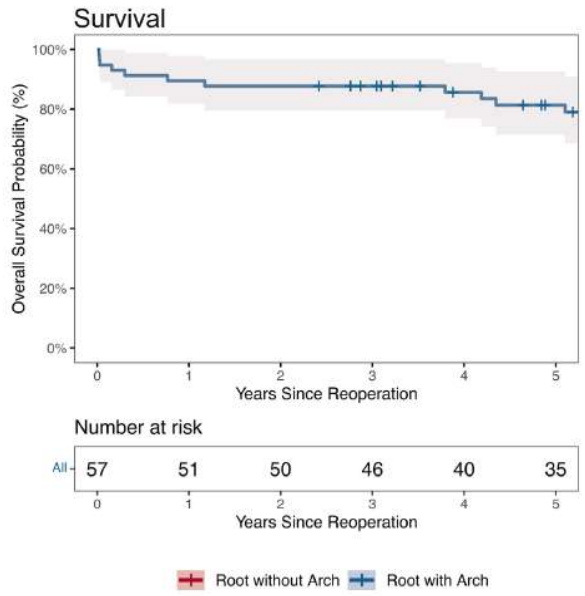

Table 4. Postoperative Morbidity and Mortality

Variable	N = 57*
Exploration of postoperative bleeding	9 (16%)
Mechanical ventilation > 24 h	26 (46%)
Tracheostomy	1 (1.8%)
Intra-aortic balloon pump	5 (8.8%)
ECMO	1 (1.8%)
Permanent Pacemaker	2 (3.5%)
Hemodialysis	3 (5.3%)
Hemorrhagic stroke	3 (5.3%)
In-hospital mortality	4 (7.0%)
ICU duration (days)	4 (3, 7)
Hospital duration (days)	10 (7, 16)

*n (%); Median (IQR).

Conclusion and Future Directions

- **Shift Toward Standardization:** High-volume centers are increasingly adopting "standard" extensive repairs for DeBakey Type I dissections to avoid the "ticking time bomb" of a patent distal false lumen.

- **Individualized Risk:** Tools like the "Alphabet Risk Model" help predict which patients can safely tolerate extensive repair.

- Future Endovascular options may swing the pendulum

- Situational awareness is necessary to risk stratify- more vs less
  - At the end of the day—Live patient
  - Redo risk has decreased precipitously
    - 4% for arch at major centers
    - 8% for root

- Mortality seems to be focused on proximal aorta
  - Redo root much higher mortality then redo Arch