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em Medicina
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The Village Praia
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Hybrid repair of the aortic arch: the CHULN experience.

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FACULDADE DE
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LISBOA

DISCLOSURES (LMP):

- **Proctorship for Cook Medical.**



AORTIC ARCH ANEURYSMS- Open Surgery.

- **Sternotomy.**
Isolated arch repair / Elephant trunk.
- **Cardiopulmonary Bypass (CPB).**
- Moderate / deep **hypothermy.**
- **Circulatory arrest.**
- Antegrade cerebral perfusion.
- Staged open repair.

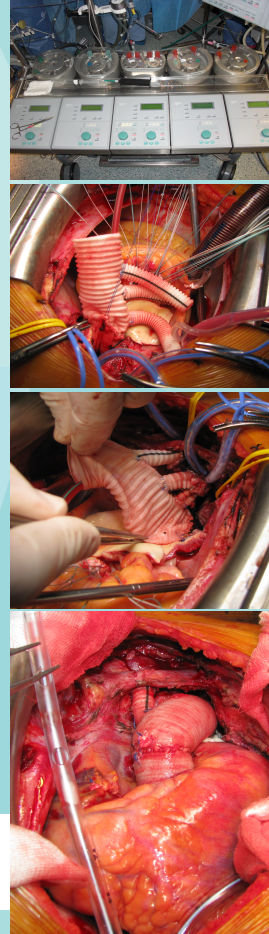
(Courtesy Dr. Angelo Nobre)

- **Mortality:**
0.9-9.3% (Single-centre series).
15-20% (National Inpatient Sample Database).
(Medicare Provider Analysis and Review).

- **Stroke: 6-9%**
Milewski, Bavaria et al ; 2009 AATS; JTCVS 2010
Kumral, 2001; Jakob, 2011.

- **LOW RISK PATIENTS.**

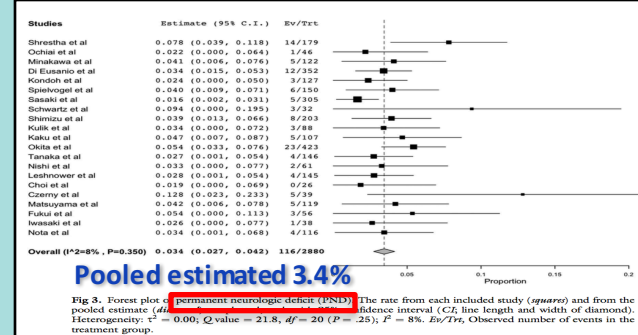
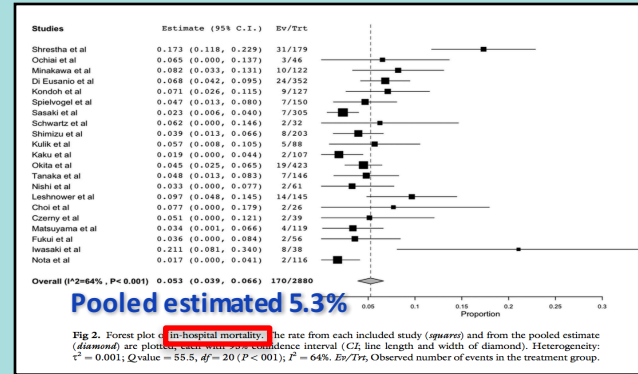
Hybrid repair of the aortic arch: the CHULN experience.



Outcome of open total arch replacement in the modern era

Fabrizio Settepani, MD, Antiocho Cappai, MD, Alessio Basciu, MD, Alessandro Barbone, MD, and Giuseppe Tarelli, MD, *Rozzano, Milan, Italy*

(J Vasc Surg 2016;63:537-45.)



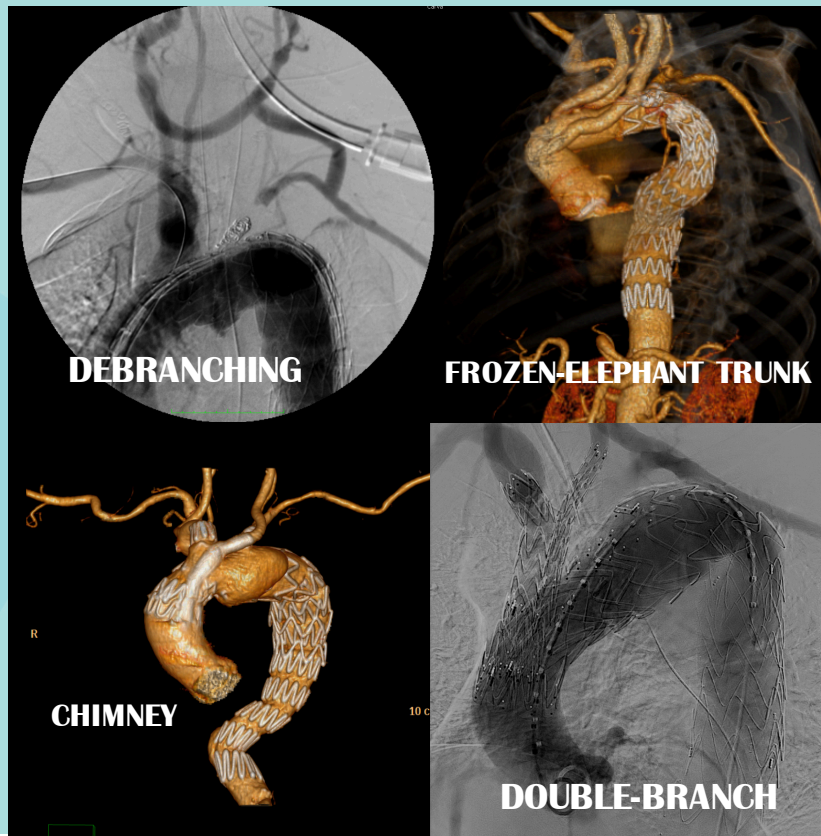
TECHNIQUES

- **HYBRID REPAIR**

- Debranching procedures + TEVAR.
- Frozen elephant trunk + TEVAR.

- **ENDOVASCULAR REPAIR**

- Parallel grafts.
- Fenestrated / branched arch endografts.

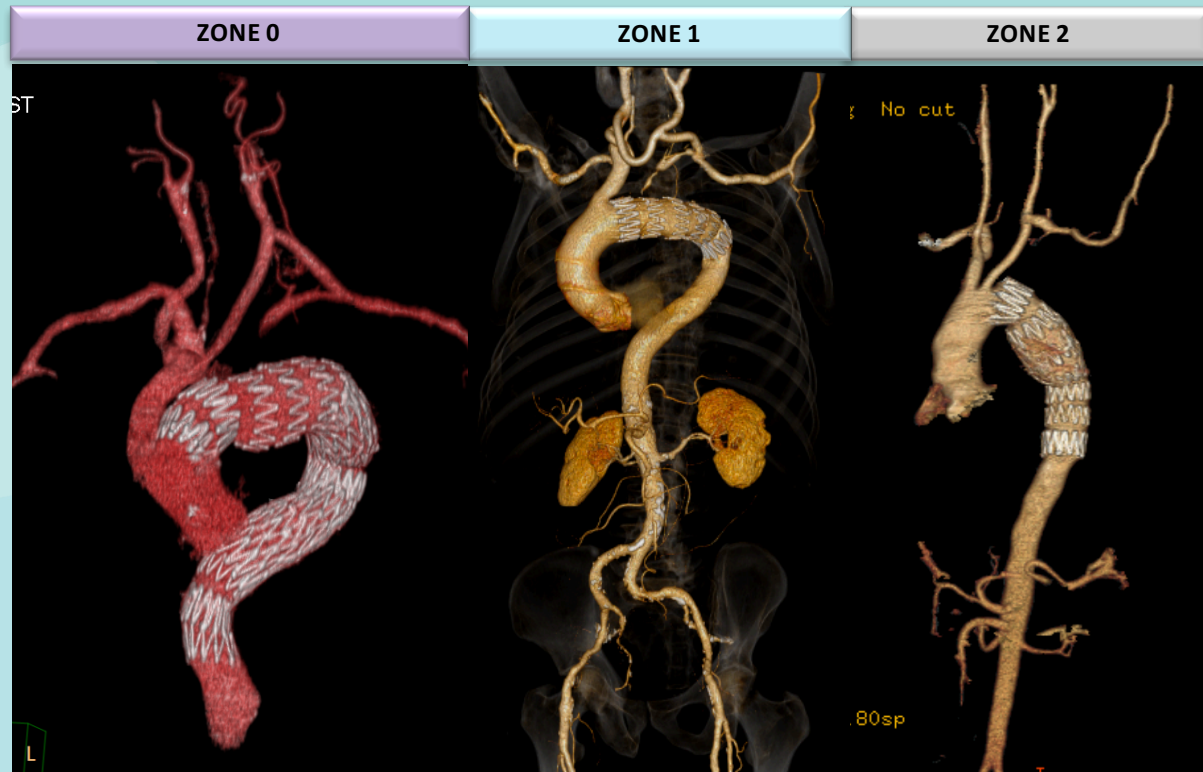
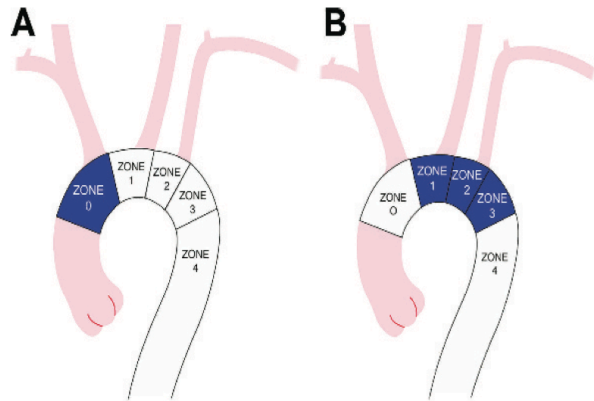


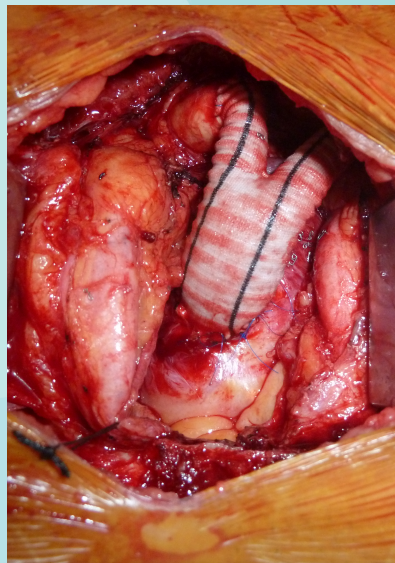
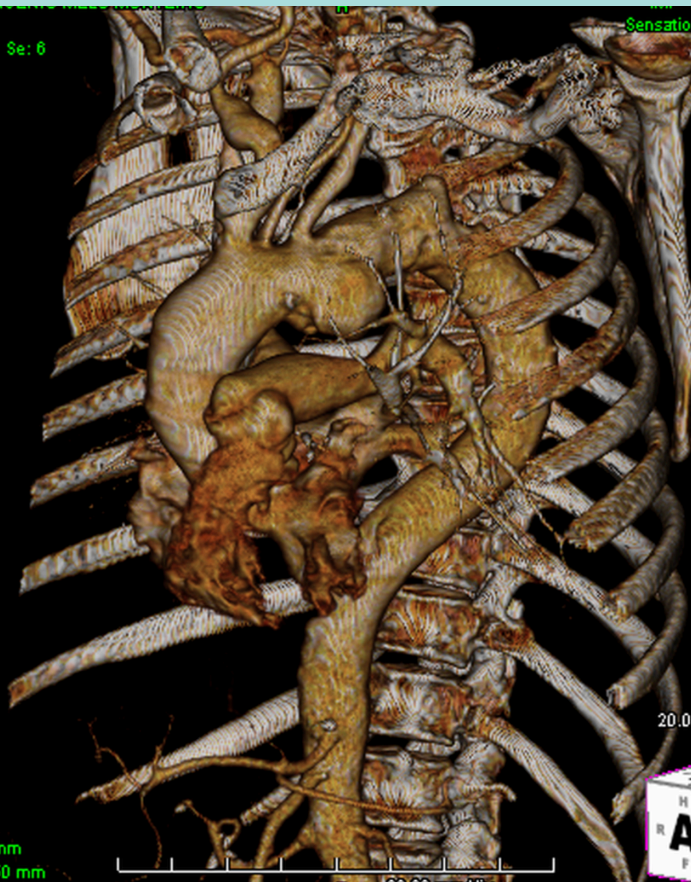
AORTIC ARCH ANEURYSMS: ENDOVASCULAR / HYBRID APPROACH.

GOALS:

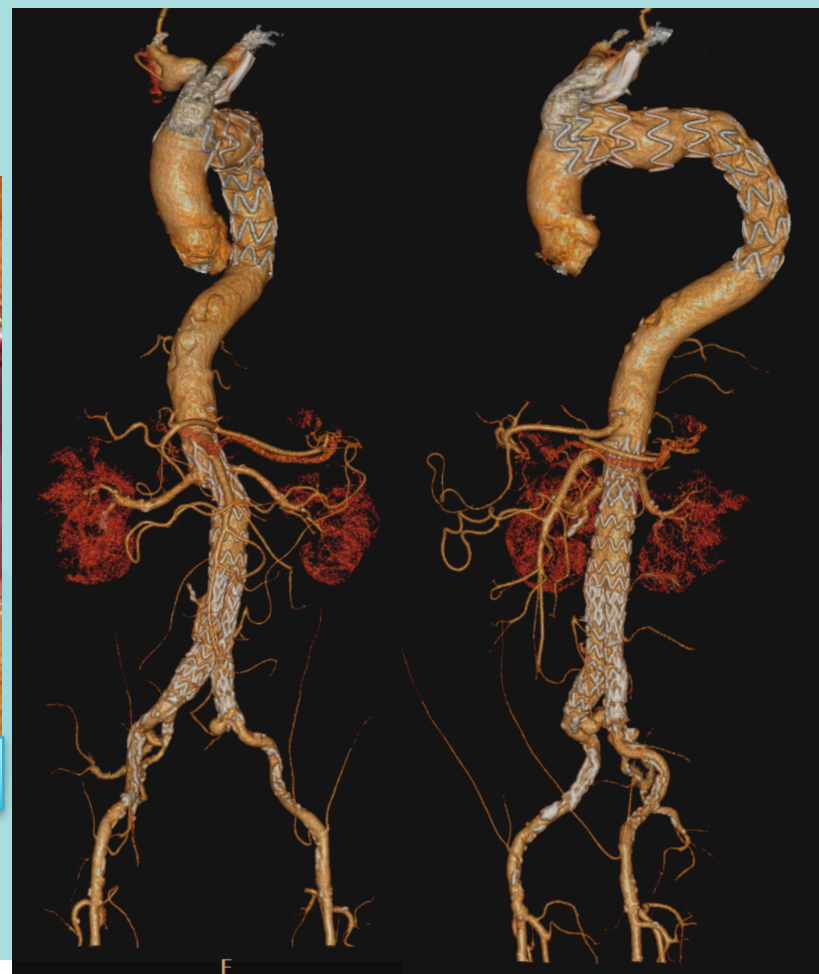
- Reduce invasiveness.
- Decrease mortality associated to hypothermic circulatory arrest.
- Applicable to **MODERATE TO HIGH RISK PATIENTS.**
- **DURABLE?**
- **THE GOLD STANDARD?**

ISHIMARU ZONES





MINI-STERNOTOMY



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N=35 cases
2010-2018

CHLN-HSM

Elective cases (n=25)
Urgent cases (n=10)

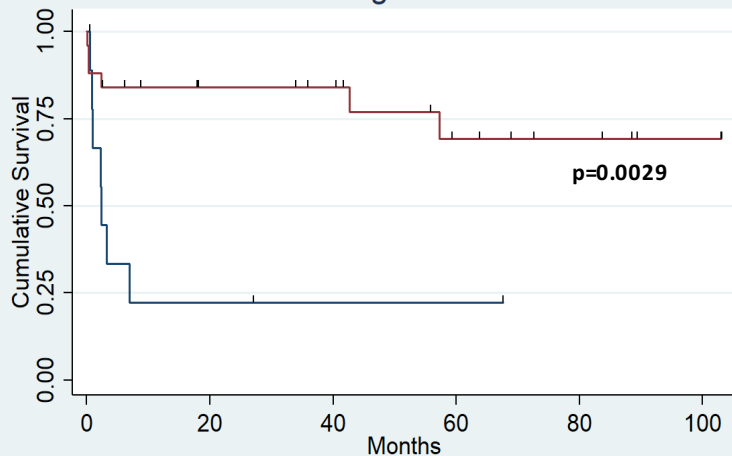
Median follow-up: 30.3 (2.4-63.5)
months.

- Degenerative: 15
- Post-traumatic chronic: 6
- Aortic dissection: 9
- Pseudo-aneurysm: 3
- Type 1-A endoleak: 2

	n	Paraplegia	Stroke	Mortality
ELECTIVE REPAIR				
Debranching + TEVAR:				
• Zone 0 + 1	9	0	2	2
• Zone 2	16	0	1	0
TOTAL	25	0	3 (12%)	2 (8%)
URGENT REPAIR				
Debranching + TEVAR:				
• Zone 0 + 1	6	0	0	2
• Zone 2	4	0	1	1
TOTAL	10	0	1 (10%)	3 (33%)

URGENT *versus* ELECTIVE

Survival Urgent vs Elective



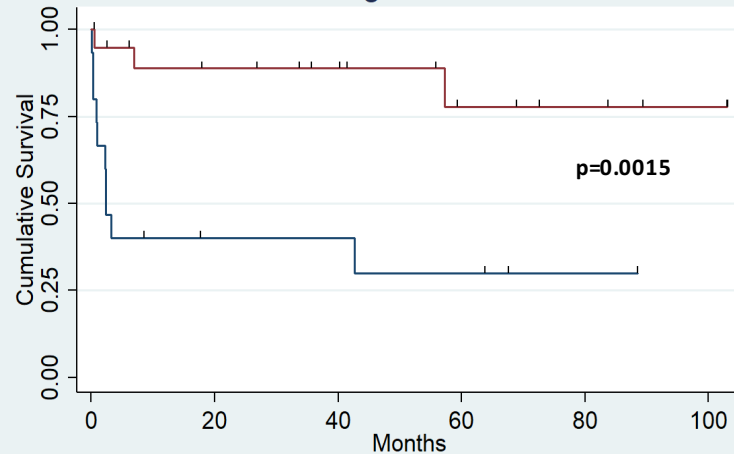
Number at risk

electivo = 0	10	(7)	2	(0)	2	(0)	1	(0)	1	(0)	1	(0)	0	(0)	0	(0)	0
electivo = 1	25	(4)	18	(0)	16	(0)	14	(1)	11	(1)	8	(0)	6	(0)	4	(0)	2

— Urgent — Elective

ISHIMARU CLASSIFICATION

Survival according Ishimaru classification



Number at risk

zone2 = 0	15	(9)	5	(0)	4	(0)	4	(1)	3	(0)	3	(0)	1	(0)	1	(0)	0
zone2 = 1	20	(2)	15	(0)	14	(0)	11	(0)	9	(1)	6	(0)	5	(0)	3	(0)	2

— Zone 0 + 1 — Zone 2

PROCEDURAL RISK

Systematic Review

A systematic review and meta-analysis of hybrid aortic arch replacement

Ann Cardiothorac Surg 2013;2(3):247-260

Konstantinos G. Moulakakis^{1,2}, Spyridon N. Mylonas³, Fotis Markatis¹, Thomas Kotsis³, John Kakisis¹, Christos D. Liapis¹

Stroke in AD group

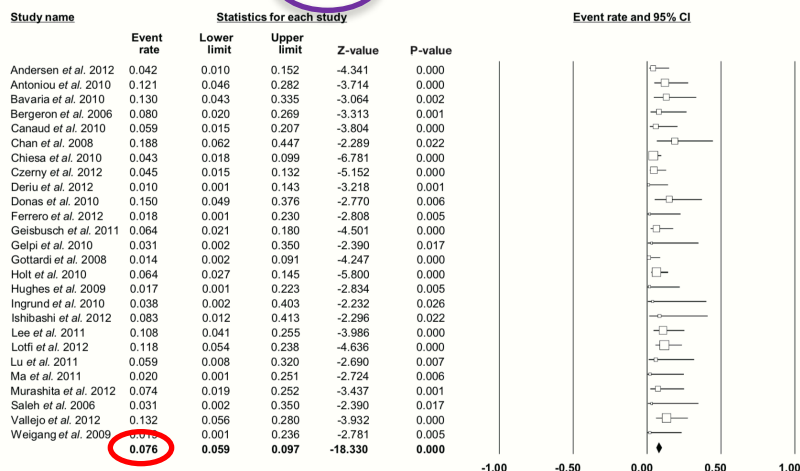


Figure 5 Forest plot of stroke rate in the arch debranching group. AD, arch debranching

30-day/in-hospital mortality in AD group

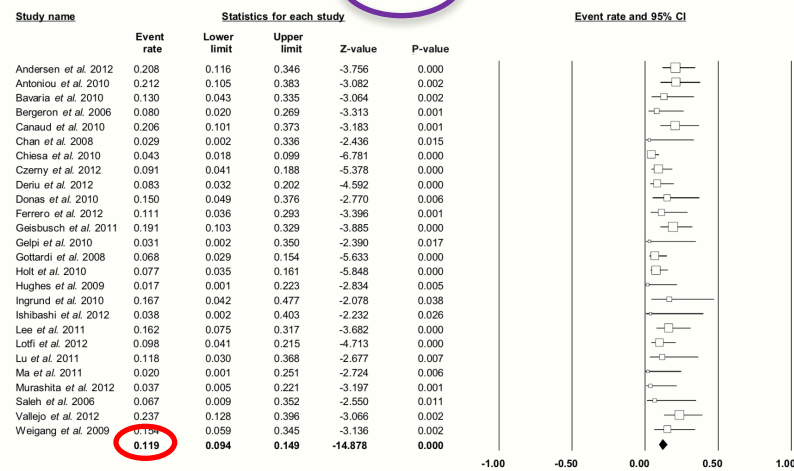


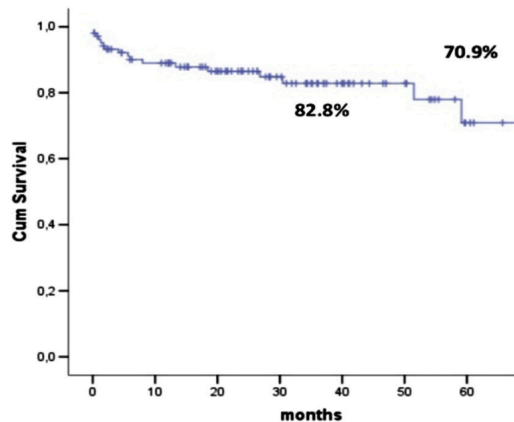
Figure 4 Forest plot of mortality rate in the arch debranching group. AD, arch debranching

Acceptable surgical mortality, even in high risk patients.

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LONG-TERM OUTCOME

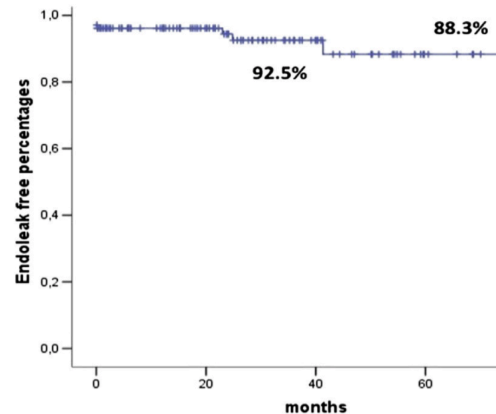


months	0	12	24	36	48	60
N at risk	104	81	55	34	19	9
Survival %	100	89	86.5	82.8	82.8	70.9
St. Error %	-	3.1	3.5	4.2	4.2	8.8

Fig 4. Survival in 104 patients with aortic arch debranching.

Aortic arch debranching and thoracic endovascular repair (J Vasc Surg 2014;59:107-14.)

Paola De Rango, MD, PhD,^b Piergiorgio Cao, MD, FRCS,^a Ciro Ferrer, MD,^a Gioele Simonte, MD,^b Carlo Coscarella, MD,^a Enrico Cieri, MD, PhD,^b Gabriele Pogany, MD,^a and Fabio Verzini, MD, PhD,^b Rome and Perugia, Italy

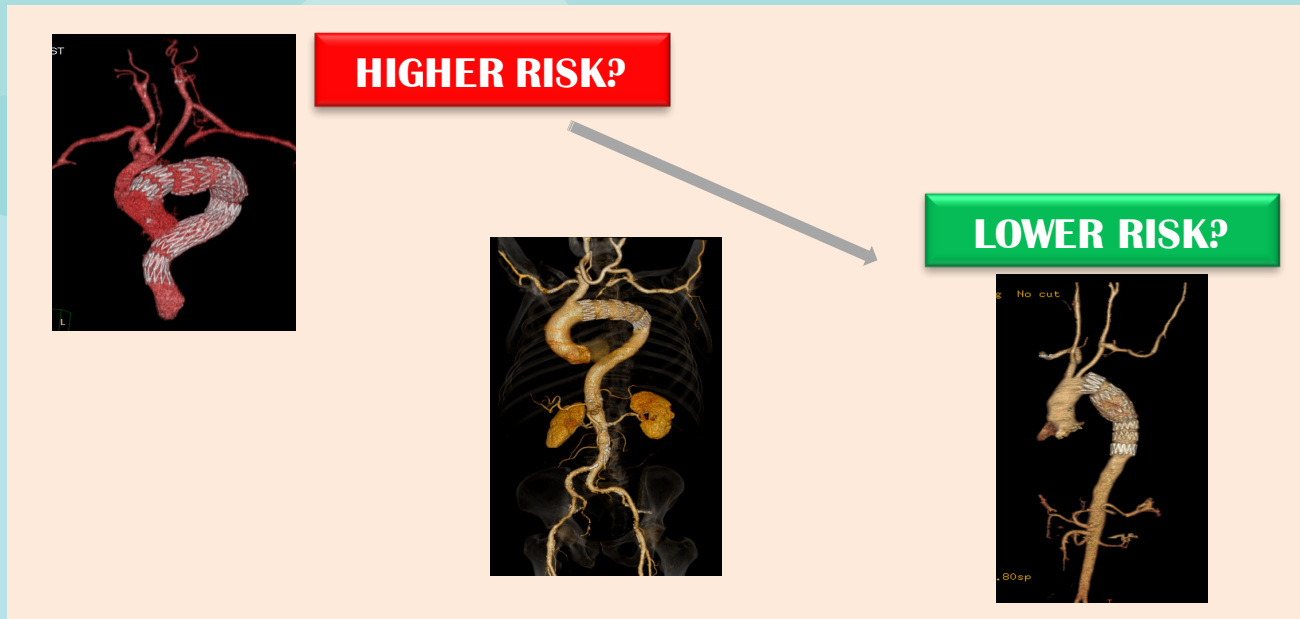


months	0	12	24	36	48	60
N at risk	100	77	51	31	17	6
free %	100	96.1	94.4	92.5	92.5	88.3
St. Error %	-	1.9	2.5	3.1	3.1	5.1

Fig 5. Freedom from persisting endoleak after aortic arch debranching.

Long-term aneurysm-related mortality seems to be low.

INFLUENCE OF THE TYPE OF DEBRANCHING



The more proximally we go in the arch, the higher the risk (risk versus stability)?

Yes- Melissano (EJVES 2007;33:561-566); Büngrer (JVS 2013;58:1490-6); Andersen (JVS 2013;57:655-67); De Rango (JVS 2014;59:107-14); Hiraoka (JVS2015;61:88-95).

No- Geisbusch (EJVES 2010;39:693-69); Ockert (JVS 2015;62:907-13); Kang (EJVES 2016;52:173-178).

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Evolving practice pattern changes and outcomes in the era of hybrid aortic arch repair

Ehsan Benrashed, MD,^a Hanghang Wang, MD,^a Jeffrey E. Keenan, MD,^a Nicholas D. Andersen, MD,^a James M. Meza, MD,^a Richard L. McCann, MD,^b and G. Chad Hughes, MD,^a Durham, NC

(J Vasc Surg 2016;63:323-31.)

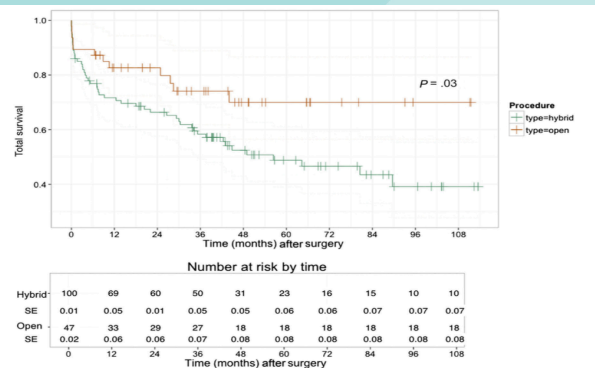


Fig 2. Kaplan-Meier overall survival according to procedure type. Unadjusted long-term survival was significantly worse ($P = .03$) after hybrid compared with open transverse arch repair. SE, Standard error.

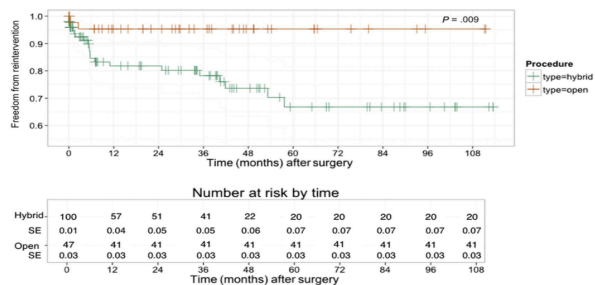


Fig 1. Kaplan-Meier freedom from re-intervention after hybrid vs open transverse arch repair. Freedom from re-intervention was significantly greater after open repair ($P = .009$). SE, Standard error.

Comparative study open vs hybrid.
N=148 (Hybrid- 101 / Open- 47).

- Selection:

- Higher risk patients- **HYBRID**.
- Younger and fit- **OPEN**.

- Median follow-up: 34 months.

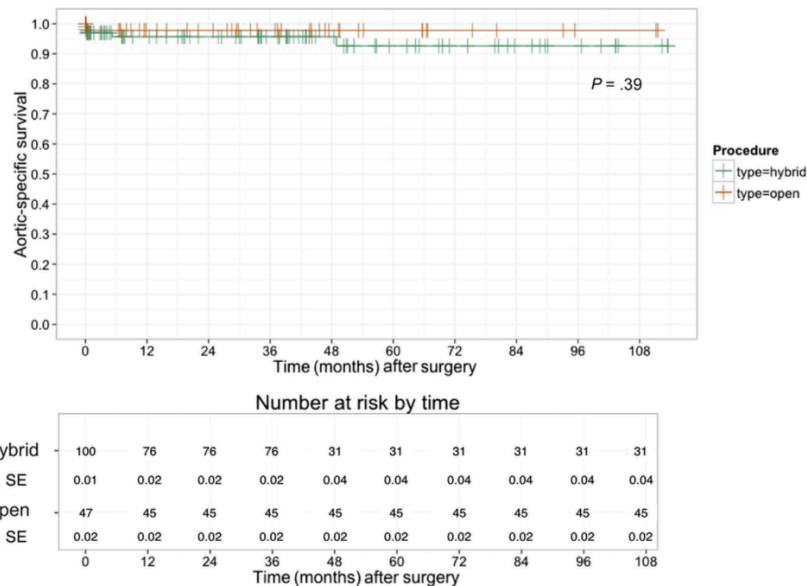


Fig 3. Aorta-specific survival according to procedure type. On long-term follow-up, there was no difference in aorta-specific survival between hybrid and open transverse arch repairs ($P = .39$). SE, Standard error.

CONCLUSIONS

- In **good risk patients** open surgery is still the gold standard.
- In **higher risk patients** hybrid procedures are less invasive options associated to **significant**, but **acceptable**, mortality and morbidity and may be considered the gold standard.
- Direct comparative studies between open and hybrid techniques are not available due to **selection bias**.
- **CAREFUL PATIENT SELECTION.**