Endo versus open arch repair; what is evidence, what is anecdote?

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Open and Endovascular management of arch pathology

Open surgery

Total endovascular approach

Open and Endovascular management of arch pathology

Open surgery

Total endovascular approach

Hybrid surgery

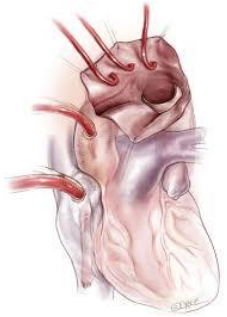
Therapeutic options in aortic arch disease 2017

- *Open Surgery Questions*
  - Hypothermic circulatory arrest
  - Cerebral protection strategy
  - Carrell patch v branched grafts
  - What are appropriate measures of outcome

Hypothermia and cerebral protection strategies in aortic arch surgery: a comparative effectiveness analysis from the STS Adult Cardiac Surgery Database

Brian R. Englum, Xia Heb, Brian C. Gulacka, Asvin M. Ganapathia, Joseph P. Mathewc, J. Matthew Brennanb, T. Brett Reeced, W. Brent Keelinge, Bradley G. Leshnowere, Edward P. Chene, Jeffrey P. Jacobsf, Vinod H. Thouranie and G. Chad Hughesa

Eur J Cardio-Thoracic Surgery 52 (2017) 492–498



- 12,521 Open Aortic Arch Replacements, 2011-2014

  Hemi or Total Arch for Aneurysm (46%) or Type A dissection(54%)

  Elective (36%) , Urgent (16%) , Emergent (46%)

- CompositeEndpoint : 30 day mortality, Neurological event

		30 Day †	Stroke
All patients		12%	8%
Deep hypothermia No Cerebral Protection		**15%**	**9%**
Mild hypothermia Antegrade Protection		7%	5%

Outcome of open total arch replacement in the modern era

Fabrizio Settepani, MD, Antioco Cappai, MD, Alessio Basciu, MD, Alessandro Barbone, MD, and Giuseppe Tarelli, MD,

J Vasc Surg 2016;63:537-45

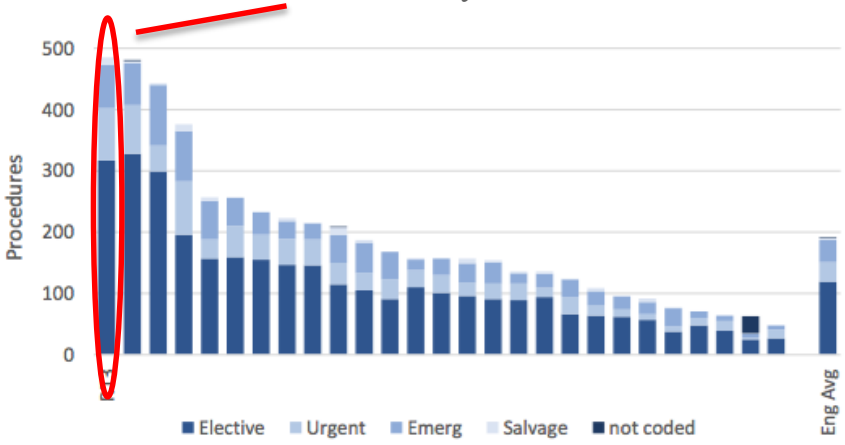
- Retrospective analysis, 21 global studies, 2004-14*.
- 2880 pts, Open Total Arch Replacement.
  - Elective(77%) & Emergency/Urgent (23%).
  - Aneurysmal (65%) & Dissection(35%).

- **Mild or Mod Hypothermia: 84%**
- **Cerebral Protection: 98% (Most bilateral or triple)**

	n	Operative†	Stroke
All patients	2880	5.3%	3.4%
Debranch Antegrade Protection	**1869**	**3.8%**	**?(1-2%)**
Other Techniques	1011	7.8%	?(3-5%)

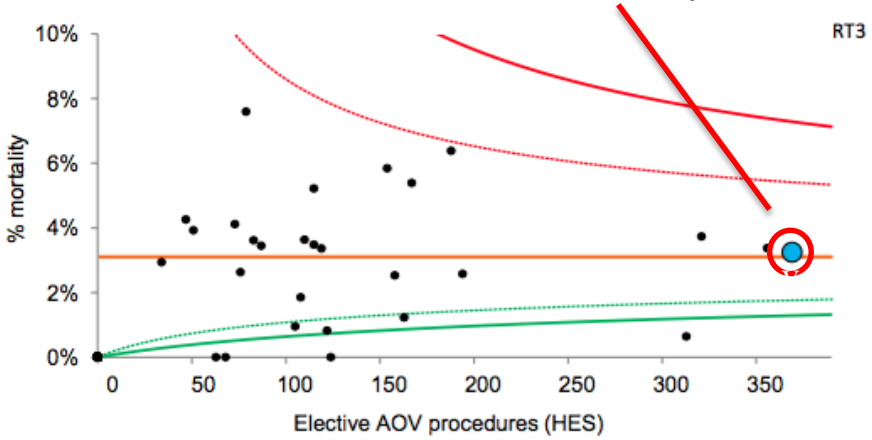
Royal Brompton & Harefield – Aorta Surgery Data

485 Aorta case in 3 yrs



Source and Year: NICOR Apr 2013 – Mar 2016

3.2% Mortality



Source and Year: HES Jan2013 – Dec2016

NHS Improvement

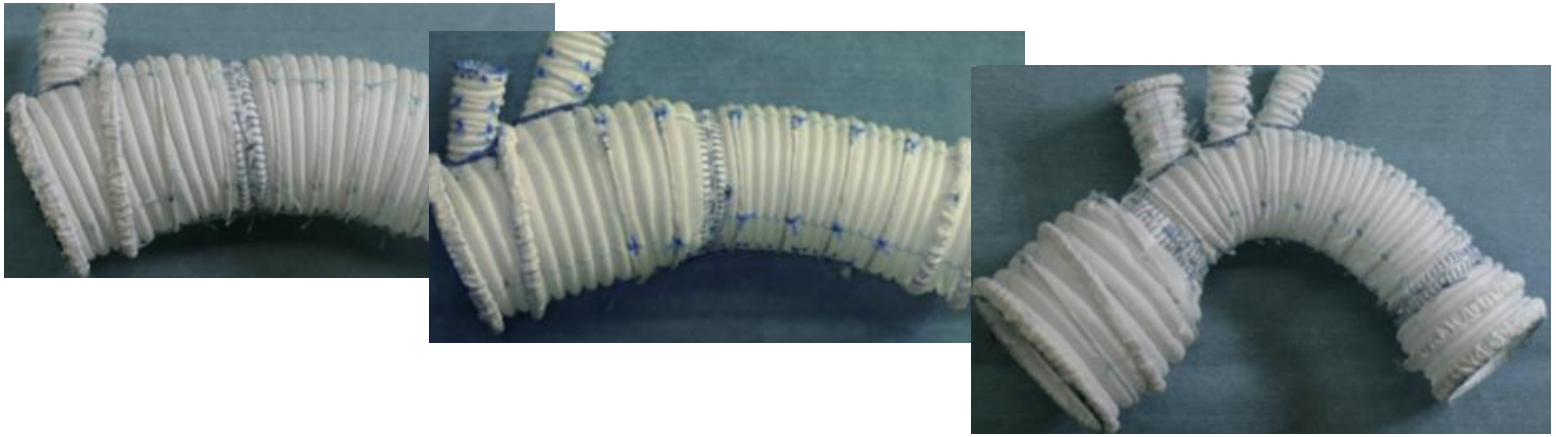
GIRFT GETTING IT RIGHT FIRST TIME

Thoracic endovascular aortic repair with branched Inoue Stent Graft for arch aortic aneurysms

Junichi Tazaki, MD,[a] Kanji Inoue, MD,[b] Hirooki Higami, MD,[c] Nobuya Higashitani, MD,[c] Masanao Toma, MD,[d] Naritatsu Saito, MD,[a] Masahide Kawatou, MD,[e] and Takeshi Kimura, MD,[a] Kyoto, Otsu, and Amagasaki, Japan

(J Vasc Surg 2017;1-9)

- Multicentre, retrospective Japanese study, 2003-13
- 89 pts, Arch Aneurysms, Branched ISG* (Single 64; Double 18; Triple 7)
- Early and Long term follow up data



	n	30 day †	Peri-procedural Stroke
All patients	89	4.5%	16%

Global experience with an inner branched arch endograft

Stéphan Haulon, MD, PhD,[a] Roy K. Greenberg, MD,[b] Rafaëlle Spear, MD,[a] Matt Eagleton, MD,[b] Cherrie Abraham, MD,[c] Christos Lioupis, MD,[c] Eric Verhoeven, MD, PhD,[d] Krassi Ivancev, MD,[e] Tilo Kölbel, MD, PhD,[f] Brendan Stanley, MD,[g] Timothy Resch, MD,[h] Pascal Desgranges, MD, PhD,[i] Blandine Maurel, MD,[a] Blayne Roeder, PhD,[j] Timothy Chuter, MD,[k] and Tara Mastracci, MD[b]

	n	30 day †	Peri-procedural Stroke/TIA
All patients	38	13.2%	15.8%

From the Society for Vascular Surgery

Complex endovascular repair of postdissection arch and thoracoabdominal aneurysms

Rafaëlle Spear, MD, PhD,[a] Adrien Hertault, MD,[a] Katrien Van Calster, MD,[a] Nicla Settembre, MD, PhD,[b] Matthieu Delloye, MD,[a] Richard Azzaoui, MD,[a] Jonathan Sobocinski, MD, PhD,[a] Dominique Fabre, MD,[c] Mark Tyrrell, MD,[d] *and* Stéphan Haulon, MD, PhD,[a,c] *Lille, Nancy, and Paris, France; and London, United Kingdom*

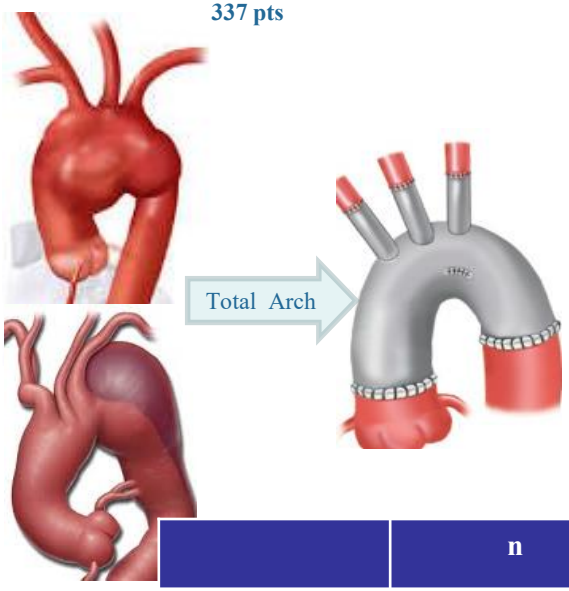
	n	30 day †	Peri-procedural Stroke/TIA
All patients	19	5.3%	10.5%

Objective analysis of midterm outcomes of conventional and hybrid aortic arch repair by propensity-score matching

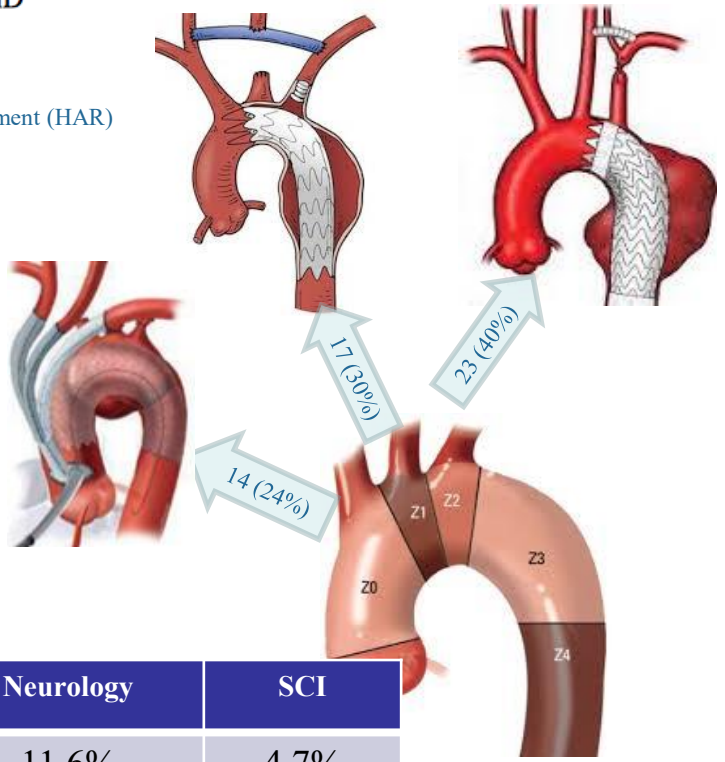
Arudo Hiraoka, MD, Genta Chikazawa, MD, PhD, Toshinori Totsugawa, MD, PhD, Kentaro Tamura, MD, Atsuhisa Ishida, MD, Taichi Sakaguchi, MD, PhD, and Hidenori Yoshitaka, MD, PhD

J Thorac Cardiovasc Surg 2017;154:100-6

Complete Total Arch Replacement (CTAR)
337 pts



Hybrid arch replacement (HAR)
58 pts



	n	Hospital†	Neurology	SCI
Hybrid Arch	43	14%	11.6%	4.7%
Open Arch	43	9.3%	0%	4.7%
P value		ns	0.006	ns

Current results of open total arch replacement versus hybrid thoracic endovascular aortic repair for aortic arch aneurysm: A meta-analysis of comparative studies

Umberto Benedetto, MD, PhD,[a] Giovanni Melina, MD, PhD,[a] Emiliano Angeloni, MD,[a] Massimiliano Codispoti, MD, FRCS,[b] and Riccardo Sinatra, MD,[a] Rome, Italy, and Cambridge, UK

JTCS 2013

Mortality

Study or Subgroup	Hybrid Events	Hybrid Total	Open Events	Open Total	Weight	Odds Ratio M-H, Random, 95% CI
Lee 2011	6	37	4	21	40.6%	0.82 [0.20, 3.32]
Milewski 2010	3	27	7	45	37.9%	0.68 [0.16, 2.88]
Murashita 2011	0	27	4	191	9.1%	0.76 [0.04, 14.46]
Murphy 2009	1	18	2	12	12.4%	0.29 [0.02, 3.67]
Total (95% CI)		**109**		**269**	**100.0%**	**0.67 [0.27, 1.63]**
Total events	10		17			

Heterogeneity: Tau² = 0.00; Chi² = 0.50, df = 3 (P = 0.92); I² = 0%
Test for overall effect: Z = 0.89 (P = 0.37)

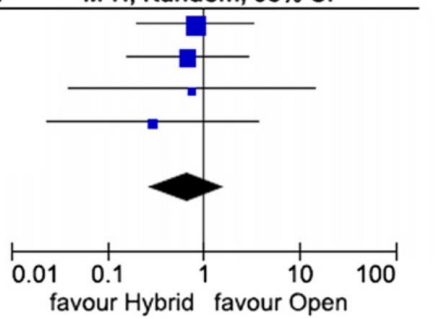


FIGURE 1. Meta-analysis for operative mortality of hybrid versus open approach. The odds ratios for death from each included study (*squares*) and from the pooled estimate (*diamond*) are plotted, each with 95% confidence interval (*CI*; line lengths and width of diamond). *M-H*, Mantel-Haenszel test.

Stroke

Study or Subgroup	Hybrid Events	Hybrid Total	Open Events	Open Total	Weight	Odds Ratio M-H, Random, 95% CI
Lee 2011	4	37	2	21	20.8%	1.15 [0.19, 6.89]
Milewski 2010	3	27	4	45	26.6%	1.28 [0.26, 6.22]
Murashita 2011	4	27	9	191	42.2%	3.52 [1.00, 12.34]
Murphy 2009	2	18	1	12	10.5%	1.38 [0.11, 17.09]
Total (95% CI)		**109**		**269**	**100.0%**	**1.93 [0.86, 4.37]**
Total events	13		16			

Heterogeneity: Tau² = 0.00; Chi² = 1.56, df = 3 (P = 0.67); I² = 0%
Test for overall effect: Z = 1.58 (P = 0.11)

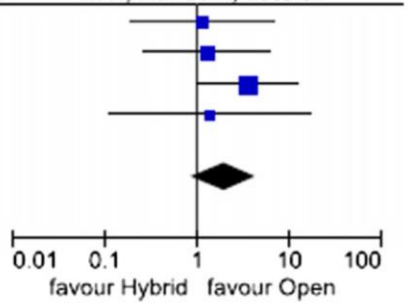


FIGURE 2. Meta-analysis for permanent neurologic deficit associated with hybrid versus open approach. The odds ratios for neurologic deficit from each included study (*squares*) and from the pooled estimate (*diamond*) are plotted, each with 95% confidence interval (*CI*; line lengths and width of diamond). *M-H*, Mantel-Haenszel test.

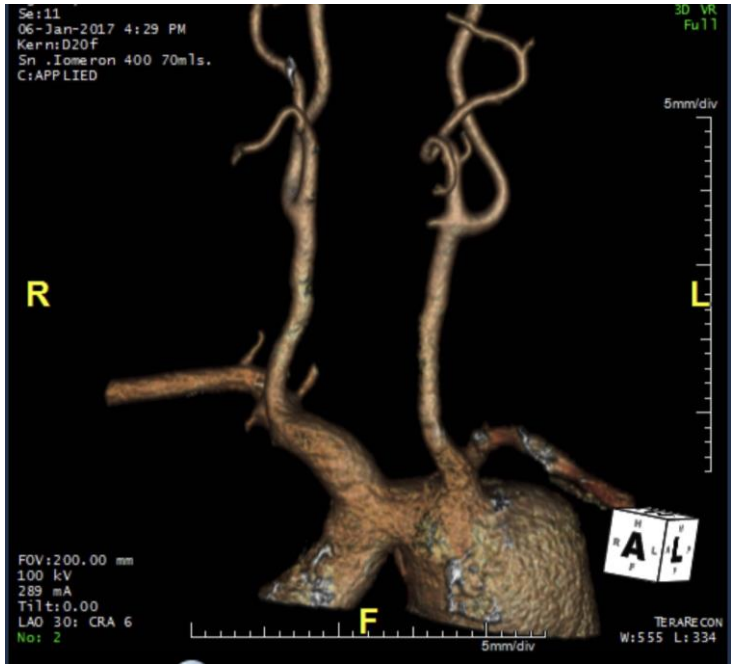
Summary of Literature Evidence

MORTALITY		Operative†	Stroke	Note	STROKE
	Open Arch (n=18,286)				
5 – 12%	Englum et al	12%	8%	Mild HCA & ACP > DHCA & no CP	0 - 8%
	Settepani e al	5.3%	3.4%	Triple ACP & Spielvogel > Other Techniques	
	Urbanski et al	8.8%	5.7%	? Low Vol. Centre, Age, &redo surgery → worse	
	Konstantinos et al	9.5%	6.2%	Equivalent results to Arch Hybrid	
	Hiraoka et al	4.7%	0%	Lower stroke rate with open surgery	
	Arch Hybrid (n=1,014)				
7 – 12%	Konstantinos et al	11.9%	7.6%	Equivalent results to Open Surgery	7 - 11%
	Hiraoka et al	7%	11.6%	Higher Stroke rate with Arch Hybrid	
	Total Endo (n=127)				
~~4 – 13%~~	Haulon et al	13.2%	15.8%	Results improve with experience (7% & 10%)	~~16%~~
	Tazaki et al	4%	16%	Single branch > Triple Branch	

Case – Totally endovascular?

Patient 1:

- 42year old male
- Previous Bentall for bicuspid valve
- Previous coarctation repair
- Redo root 2015 – ECMO 2 months
- Poor RV
- Patch blow out



Summary

- Open surgery
  - Still gold standard
  - What are your CP and HCA techniques?
  - What are your outcomes?
- Wholly Endo
  - Multiple branches not yet realistic for most patients
  - Series growing; outcomes as yet unknown
  - Chimneys/Scallops
- Hybrid
  - Even lesser debranching; stoke & SCI important
  - Embolisation protection?