KLINIK FÜR GEFÄSSCHIRURGIE
und ENDOVASKULÄRE CHIRURGIE
HEIDELBERG

CONTROVERSES ET ACTUALITÉS EN CHIRURGIE VASCULAIRE
CONTROVERSIES & UPDATES IN VASCULAR SURGERY
JANUARY 17-19 2013
MARRIOTT RIVE GAUCHE & CONFERENCE CENTER PARIS, FRANCE

CONTROVERSY on Transverse Arch Aneuryms

Debranching provides poor results

Dittmar Böckler
Department of Vascular and Endovascular Surgery
University of Heidelberg, Germany

My Friend, but Opponent

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„Debranching provides excellent results“

„Earth is a disc“

Faculty Disclosure

Dittmar Böckler

I disclose the following financial relationships:

Consultant for Endomax, Medtronic, WL Gore & Ass, Freudenberg

Employee none

Receive grant/research support from Maquet, WL Gore, Medtronic, Siemens

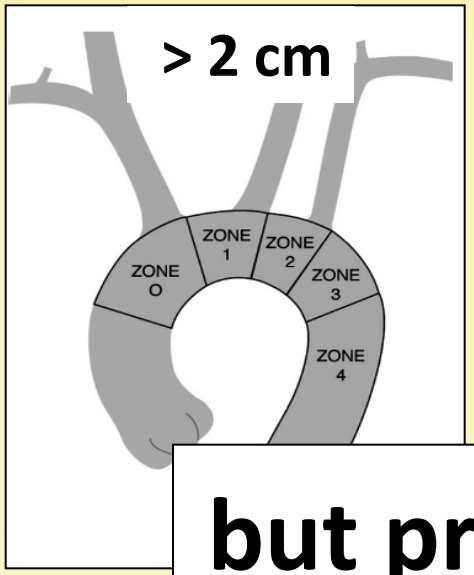
Advisory board of Endomax, Medtronic, WL Gore, Siemens

Paid speaker for Endologix, Maquet, Medtronic, WL Gore, Siemens

Major stockholder none

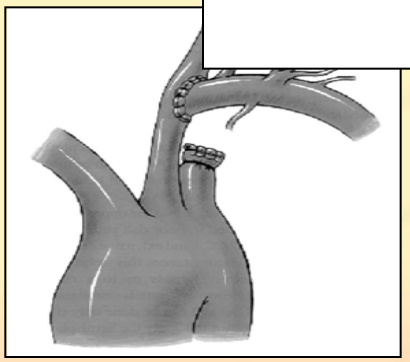
OR

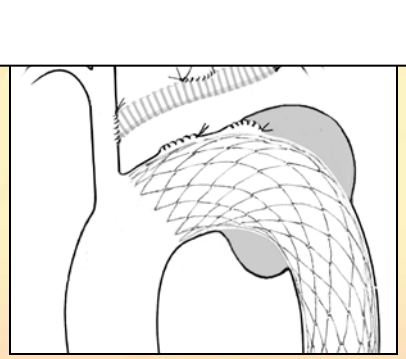
Debranching is feasible…

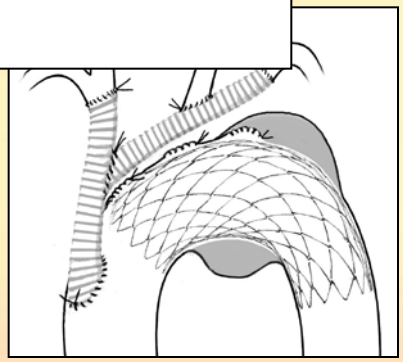


but provides poor results

with "room to improve"







Aortic Arch Pathologies

CONTROVERSES ET ACTUALITÉS EN CHIRURGIE VASCULAIRE
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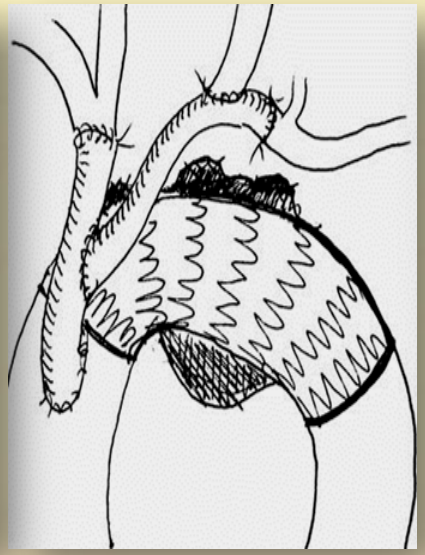
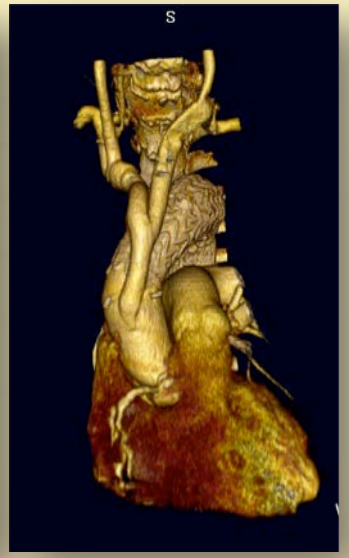
- Open surgery is the golden standard
- Hybrid procedures with debranching do work
- Debranching is an option for high risk patients




R. Chiesa's Experience

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Results: 19

1. **Hybrid** repair of aortic aneurysms and dissections: the European perspective.
Chiesa R, Tshomba Y, Logaldo D, Civilini E, Bertoglio L, Melissano G.
Tex Heart Inst J. 2011;38(6):687-90. No abstract available.
PMID: 22199437 [PubMed - indexed for MEDLINE] **Free PMC Article**

2. **Hybrid** procedures for the treatment of thoracoabdominal aortic aneurysms and dissections.
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PMID: 21124278 [PubMed - indexed for MEDLINE]

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Chiesa R, Melissano G, Tshomba Y, Civilini E, Marone EM, Bertoglio L, Calliari FM.
J Endovasc Ther. 2010 Feb;17(1):1-11. doi: 10.1583/09-2884.1.
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5. Escalating doses of donor lymphocytes for incipient graft rejection following SCT for thalassemia.
Frugnoli I, Cappelli B, **Chiesa R**, Biral E, Noè A, Evangelio C, Fossati M, Napolitano S, Ciceri F, Roncarolo MG, Marktel S.
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6. **Hybrid** procedures for thoracoabdominal aneurysms.
Melissano G, **Chiesa R**.
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PMID: 19702358 [PubMed - indexed for MEDLINE]

How to win this debate ?

Chiesa Roberto
Professore ordinario - Facoltà di Medicina

Published Evidence

Milano Experience

Heidelberg Experience

Global experience

Milano Experience

Results of Endografting of the Aortic Arch in Different Landing Zones

178 TEVAR-Procedures (mean FU 19 mths.)

64 Aortic arch Pathologies

37 Pat. received debranching

30 day mortality	6.3 %
Intraoperative death rate	1.6 %
Primary technical success	85.9%
Residual type IA endoleak	12.5%
Stroke	3.1 %

Ref.: EJVES 2007;33:561-66

Results according to LZ

Table 3. Results in the different proximal aortic landing zones

	Zone 0	Zone "1" $n = 12$	Zone "2" $n = 38$	Total $n = 64$	P
Technical success	13 (92.9%)	8 (66.7%)	34 (89.5 %)	55 (85.9%)	NS*
			(7.9%)	8 (12.5%)	NS*
			(2.6%)	1 (1.6%)	NS*
				0	NS*
			(5.3%)	4 (6.3%)	NS*
			(5.3%)	2 (3.1%)	NS*
				2 (3.1%)	NS*
			(2.6%)	1 (1.6%)	NS*
				1 (1.6%)	NS*
			(0–1) days	0 (0–2) days	<.0001**
			(3–5) days	5 (4–7) days	<.0001**
			(84.2%)	51 (79.7%)	NS*
			(2.6%)	1 (1.6%)	NS*
			(92.1%)	58 (90.6%)	NS*
			(7.9%)	7 (18.4%)	NS*
			(89.5%)	55 (85.9%)	
				0	
type I or III endoleak					
Aneurysm related deaths	0	2 (16.7%)	0	2 (3.1%)	
Open conversion	0	0	1 (2.6%)	1 (1.6%)	

*Chi-square test or the Fisher Exact test; **Kruskal-Wallis test.

Eur J Vasc Endovasc Surg Vol xx, Month 2006

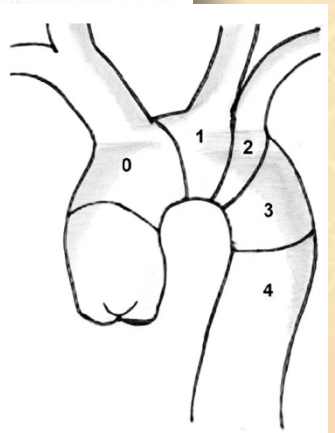
Technical success ↑↑ (93 %) n.s.

Type 1 EL ↓↓ (7.1%) n.s.

Stroke ↑↑ (14.3%) n.s.

Hospital mortality ↑↑ (14.3%) n.s.

Morbidity ↑↑ (7.1%) n.s.



Ref.: EJVES 2007;33:561-66

Milano Experience

N=64	LZ 0	LZ 1	LZ 2	total	p
Midterm clinical success	85.7 %	75 %	89 .5 %	85.9 %	NS

Conclusion:

Overall this study demonstrates that hybrid procedure for aortic arch pathology is feasible and relatively safe in patient at high risk for surgery with acceptable mortality and morbidity rate.

Ref.: EJVES 2007;33:561-66

Heidelberg Experience

◆ CLINICAL INVESTIGATION

Endovascular Aortic Arch Reconstruction With Supra-Aortic Transposition for Symptomatic Contained Rupture and Dissection: Early Experience in 8 High-Risk Patients

Hardy Schumacher, MD, PhD[1]; Dittmar Böckler, MD[1]; Hubert Bardenheuer, MD, PhD[2]; Jochen Hansmann, MD[3]; and Jens-Rainer Allenberg, MD, PhD[1]

Departments of [1]Vascular and Endovascular Surgery, [2]Anesthesiology, and [3]Radiodiagnostics, Ruprecht-Karls University Heidelberg, Germany.

Purpose: To report our initial experience with total and subtotal endovascular aortic arch reconstruction combined with supra-aortic vessel transposition in high-risk patients and to present a new morphological classification of thoracic aortic lesions for patient and procedure selection.
Methods: Among 80 patients treated with thoracic stent-grafts at our department between 1997 and 2003, 8 patients (6 men; mean age 71 years, range 45–81) unfit for open repair were not candidates for standard endovascular repair due to inadequate proximal landing zones on the aortic arch. Commercially available endografts (Excluder, Zenith, Endofit, Talent) were used to repair the arch after supra-aortic vessel transposition was performed. The endograft was implanted transfemorally or via an iliac Dacron conduit graft with standardized endovascular techniques and deployed during intravenous adenosine-induced asystole. The imaging data from all thoracic endograft patients was analyzed to classify thoracic and thoracoabdominal lesions according to a 4-level anatomical system.
Results: Deployment success was 100% after staged supra-aortic vessel transposition, but 1 patient died of endograft-related rupture of the proximal aortic arch. There was no neurological complication. Mean follow-up was 16 months (range 1–36). Patency of all endografts and conventional bypasses was 100%, and no migration was observed. One minor type II endoleak was demonstrated.
Conclusions: Initial results are encouraging for endovascular aortic arch repair in combination with supra-aortic transposition in selected high-risk patients with complex aortic pathologies.

J Endovasc Ther 2003;10:1066–1074

Key words: thoracic aortic aneurysm, aortic arch, dissection, contained rupture, vessel transposition, endovascular repair, stent-graft

Complications after aortic arch hybrid repair

Philipp Geisbüsch, MD,[a] Drosos Kotelis, MD,[a] Matthias Müller– Eschner, MD,[b] Alexander Hyhlik-Dürr, MD,[a] and Dittmar Böckler, MD, PhD,[a] *Heidelberg, Germany*

Objectives: To analyze early and midterm complications after hybrid aortic arch repair (HAR).
Methods: Between January 1997 and November 2009 among 259 patients receiving thoracic endovascular aortic repair, HAR has been performed in 47 patients (median age, 64.5 years; range, 41-84). A retrospective analysis was performed. Complete supra-aortic debranching was performed in 15 patients (32%) and partial debranching in 23 patients (49%). Isolated left subclavian artery revascularization prior to thoracic endovascular aortic repair has been used in nine patients (19%). Emergency procedures were performed in 34% of all patients.
Results: The overall in-hospital mortality was 19% (9/47 patients), 27% after complete and 15.6% after partial debranching. Postoperative complications occurred in 32 patients (68%). Cardiocirculatory complications were observed in seven patients (15%). Pulmonary complications occurred in 12 patients (26%). A total of five patients (11%) experienced renal complications

Total vs hemi-aortic arch transposition for hybrid aortic arch repair

Drosos Kotelis, MD,[a] Philipp Geisbüsch, MD,[a] Nicolas Attigah, MD,[a] Ulf Hinz, MSc,[b] Alexander Hyhlik-Dürr, MD,[a] and Dittmar Böckler, MD, PhD,[a] *Heidelberg, Germany*

Objective: **To compare the outcomes of total aortic arch transposition (TAAT) vs hemi-aortic arch transposition (HAAT) for hybrid aortic arch repair.**
Methods: **A systematic search was performed using PubMed between November 1998 and May 2010 by two independent observers. Studies included reporting on patients treated by TAAT or HAAT and stent grafting in a proximal landing zone 0 or 1 by Ishimaru, respectively. Further articles were identified by following MEDLINE links, by cross-referencing from the reference lists, and by following citations for these studies. Case reports and case series of less than five patients were excluded. Primary technical and initial clinical success, perioperative, and late morbidity and mortality were extracted per study and were meta-analyzed.**
Results: **Fourteen studies were included in the statistical analysis. The number of reported patients totaled 130 for TAAT/zone 0 and 131 for HAAT/zone 1. The primary technical success rate was significantly higher in zone 0 than 1 (95% vs 83%; odds ratio [OR], 4.0; 95% confidence interval [CI], 1.47-10.88; $P = .0069$), due to significantly higher primary type I or III endoleak rates in zone 1 (15.48% vs 3.97%; $P = .0050$). Reintervention rates were significantly higher in zone 1 (25.81% vs 12.00%; $P = .0321$). Initial clinical success rates were comparable between zone 0 and 1 (88% vs 85%; OR, 1.35; 95% CI, 0.61-3.02; $P = .5354$). In-hospital mortality was higher in zone 0 than 1 (8.46% vs 4.58%; $P = .2212$).**
Conclusion: **The more invasive TAAT allows a better landing zone at the cost of higher perioperative mortality, therefore, patient selection is crucial. (J Vasc Surg 2011;54:1182-6.)**

JETH 2003; JVS 2011, JVS 2012

Heidelberg Experience

Complications after aortic arch hybrid repair

259 TEVAR-Procedures (mean FU 21 mths.)
47 Aortic Arch Hybrid Repair

	HD	Milano
Primary technical success	85.9%	85 %
Type IA Endoleak	12.7%	12.5%
30 day mortality	19 %	6.3 %
Complication rate	68 %	30 %
Stroke	6.3 %	3.1 %
Reintervention rate	27.6%	

Ref.: JVS 2011;53:935-41

Heidelberg Experience

Reinterventions during midterm follow-up after endovascular treatment of thoracic aortic disease

Philipp Geisbüsch, MD, Simone Hoffmann, Drosos Kotelis, MD, Thomas Able, Alexander Hyhlik-Dürr, MD, and Dittmar Böckler, MD, *Heidelberg, Germany*

Variable	Odds ratio	95% CI	P -Value
CEAD	2.35	1.05 – 5.28	0.037
Hybrid Procedures	**2.11**	**1.11 – 4.01**	**0.023**
CTD	7.54	1.72-32.99	0.007

CEAD: chronic expanding aortic dissection; CTD: connective tissue disease

Ref.: JVS 2011;53:1528-33

Results according to LZ

ELSEVIER

Endografting in the Aortic Arch – Does the Proximal Landing Zone Influence Outcome?

P. Geisbüsch*, D. Kotelis, A. Hyhlik-Dürr, M. Hakimi, N. Attigah, D. Böckler

Department of Vascular and Endovascular Surgery, Ruprecht - Karls University Heidelberg, Im Neuenheimer Feld 110, 69120 Heidelberg, Germany

Submitted 22 July 2009; accepted 12 March 2010

Ref.: EJVES 2010;39:693-9

Results according to LZ

Geisbüsch P, Böckler D, et al, Eur J Vasc Endovasc Surg 2010;39:693-9

Table 3 Operative results, specified for different proximal landing zones.

	Zone 0 (n = 10)	Zone 1 (n = 25)	Zone 2 (n = 55)	Zone 3 (N = 88)	P value
30-day mortality	1 (10)	1 (4)	11 (20)	12 (13.6)	0.274
Perioperative morbidity	8 (80)	13 (52)	29 (53)	44 (50)	0.370
Stroke	0 (0)	2 (8)	1 (1.8)	3 (3)	
Paraplegia	0 (0)	1 (4)	1 (1.8)	3 (3)	
Cardiac complications	5 (50)	2 (8)	7 (13)	12 (14)	
Respiratory failure	4 (40)	4 (16)	15 (27)	18 (20)	
Renal failure	4 (40)	1 (4)	6 (11)	13 (15)	
Wound infection	1 (10)	3 (12)	2 (4)	8 (9)	
Open conversion					
- Early	0 (0)	0 (0)	0 (0)	1 (1)	
- Late	0 (0)	0 (0)	3 (5)	3 (3)	
ICU stay in d					
- Revascularisation	3 (1–60)	2 (1–12)	3 (0–5)	n.a.	
- TEVAR	3 (1–60)	2 (0–12)	2 (1–40)	2 (0–47)	
Endoleak: primary + secondary					
Type I	3 (33)	6 (24)	6 (11)	8 (9)	0.073
Type II	3 (33)	2 (8)	9 (16)	4 (5)	0.015
Type III	0 (0)	0 (0)	0 (0)	3 (3)	0.499
Re-intervention	5 (50)	9 (36)	10 (18)	17 (19)	

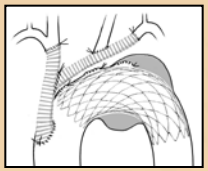
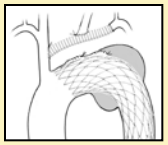
Values are presented as n (%) or median (range).

Ref.: EJVES 2010;39:693-9

Metaanalysis – Hybrid Arch Repair

n= 14 studies

Kotelis D, Böckler D, et al, J Vasc Surg 2011;54:1182-86

	Patients (n)	Technical success	Type I EL	In hospital mortality
Total Arch 	130	95 %	4 %	8.5%
Partial Arch 	131	83 %	15.5 %	4.6 %
P-value		0.007	0.005	0.22

Worldwide experience

Eur J Vasc Endovasc Surg (2010) 39, 683–690

ELSEVIER

REVIEW

Hybrid Treatment of Complex Aortic Arch Disease with Supra-aortic Debranching and Endovascular Stent Graft Repair

G.A. Antoniou [a], K. El Sakka [a], M. Hamady [b], J.H.N. Wolfe [a,*]

[a] Regional Vascular Unit, St Mary's Hospital, Praed Street, Imperial College Healthcare NHS Trust, London W2 1NY, UK
[b] Department of Interventional Radiology, St Mary's Hospital, Praed Street, Imperial College Healthcare NHS Trust, London W2 1NY, UK

Submitted 27 October 2009; accepted 3 February 2010
Available online 15 March 2010

KEYWORDS
Aortic arch;
Stent graft;
Hybrid procedure;
Aneurysm;
Endovascular treatment

Abstract *Background:* Aortic arch disease has conventionally been the domain of open surgical repair. Hybrid open and endovascular repair has evolved as an alternative, less invasive, treatment option with promising results. A systematic literature review and analysis of the reported outcomes was undertaken.
Methods: An Internet-based literature search using MEDLINE was performed to identify all studies reporting on hybrid aortic arch repair with supra-aortic branch revascularisation and subsequent stent graft deployment. Debranching should involve at least one carotid artery, so that patients merely requiring a carotid-subclavian bypass were not included. Only reports of five patients or more were included in the analysis. Outcome measures were technical success, perioperative, 30-day and late morbidity and mortality.
Results: Eighteen studies fulfilled our search criteria, and data from 195 patients were entered for the analysis. No comparative studies of hybrid aortic arch repair with other conventional or innovative treatment modalities were identified. Complete arch repair was performed in 122 patients (63%). The overall technical success rate was 86% (167/195). The most common reason for technical failure was endoleak (9%, 17/195). Overall perioperative morbidity and mortality rates were 21% (41/195) and 9% (18/195), respectively. The most common perioperative complication was stroke (7%, 14/195). Four aneurysm-related deaths were reported during follow-up (2%). No long-term data on hybrid aortic arch repair were identified.

* Corresponding author.
E-mail address: jwolfe@uk-consultants.co.uk (J.H.N. Wolfe).

doi:10.1016/j.ejvs.2010.02.002

REVIEW

State-of-the-Art of Hybrid Procedures for the Aortic Arch: A Meta-Analysis

George J. Koullias, MD, and Grayson H. Wheatley III, MD

Illinois Cardiac Surgery Associates, Peoria, Illinois; and Department of Cardiovascular Surgery, Arizona Heart Institute, Phoenix, Arizona

Questions have risen regarding procedural indications, techniques, and outcomes for hybrid arch procedures. We performed a meta-analysis to benchmark this innovative approach. Studies and case reports involving hybrid aortic arch procedures listed through May 2008 were reviewed (n = 718). End points were 30-day mortality, stroke, paraplegia, and endoleak rates. A total of 15 studies with 463 patients were included in the meta-analysis. Overall 30-day mortality was 8.3%. Endoleak rate was 9.2%, stroke was 4.4%, and paraplegia was 3.9%. Treated on-pump or off-pump did not affect any of the endpoints. Results compare favorably with standard operative repair. Long-term follow-up is needed.

(Ann Thorac Surg 2010;90:689–97)

Morbidity and mortality, as well as early clinical outcomes and overall survival for total aortic arch repair have improved significantly during the last 2 decades. Nevertheless, open surgical arch replacement still represents a high-risk procedure with increased morbidity and mortality [1–3]. Furthermore, many patients are sometimes denied surgical intervention secondary to their significant comorbidities.

Endovascular exclusion of aortic arch pathologies combined with an open surgical component effectively called "hybrid" have been recently introduced in an attempt to reduce morbidity and mortality [4, 5]. The emergence of new endovascular technologies for the thoracic aorta has led to the development of new, less-invasive techniques for addressing complex diseases of the aortic arch. At the same time, surgical results for open arch repair have been improving and newer techniques have been developed to address cerebral protection.

Because hybrid arch procedures have only just begun to enter the surgical paradigm, there is little information available regarding perioperative outcomes and no single center has developed a significant operative experience to benchmark outcomes. In addition, several different approaches to hybrid arch repair have been described. Therefore, we undertook a systematic review of the literature to identify all published studies, and from those we deducted all eligible studies for an extensive meta-analysis to evaluate the overall results of this new approach and identify successful operative techniques.

Material and Methods

Literature Search

Candidate studies in English were sought through a computerized search of the MEDLINE database (National Library of Medicine, Bethesda, MA) for the period of 1996 to May 2008. Key words entered in this search by both authors were the terms: "hybrid" and "combined," with aorta, aortic, arch, aneurysm, thoracic aneurysm, aortic arch aneurysm, aortic dissection, and Marfan.

Study Design

DEFINITION OF A HYBRID AORTIC ARCH PROCEDURE. By definition, a hybrid arch procedure should have an open, as well as an endovascular component. Procedures involving only left common carotid to the left subclavian artery bypass do not qualify as hybrid arch replacements. Similarly, landing of the covered portion of the thoracic stent-graft in zone 2 and distally (Ishimaru classification) (Fig 1) are not included in this procedure group. These procedures are hybrid, but not hybrid arch procedures. Furthermore, the thoracoabdominal aneurysm series using extrathoracic approaches, as well as series that included hybrid arch procedures, among others, but did not report specific data for the former, were not included.

SELECTION OF STUDIES, CRITERIA FOR META-ANALYSIS AND STUDY END POINTS. Retrospective studies and case reports involving hybrid aortic arch procedures were identified. A meta-analysis was conducted according to published guidelines for synthesis of information from the existing literature [6–8] using two statistical software packages. Meta-analysis differs from the usual literature review because it uses predetermined research protocols and has prerequisites on patient sample size (ie, the sample must be equal or more

Presented at the Forty-fifth Annual Meeting of The Society of Thoracic Surgeons, San Francisco, CA, Jan 26–28, 2009.

Address correspondence to Dr Koullias, Illinois Cardiac Surgery Associates, 515 NE Glen Oak Ave, Ste 202, Peoria, IL 61603; e-mail: gkoullias@yahoo.com.

Dr Wheatley discloses that he has financial relationships with W.L. Gore & Associates and Medtronic.

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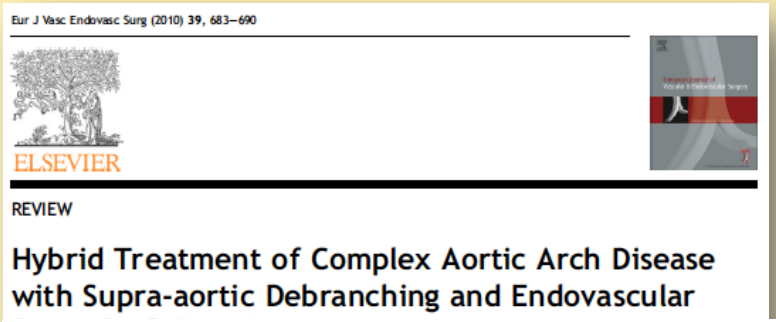
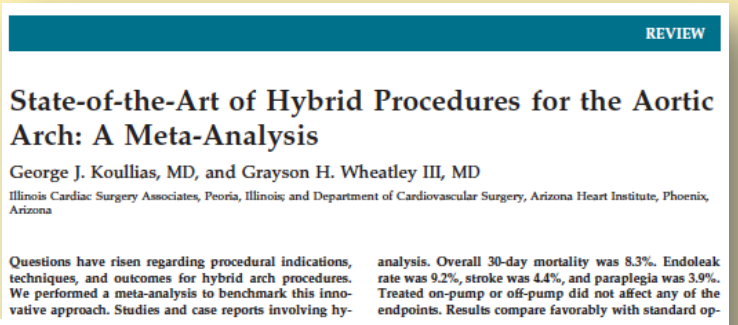
Worldwide experience


Eur J Vasc Endovasc Surg (2010) 39, 683–690
ELSEVIER
REVIEW

Hybrid Treatment of Complex Aortic Arch Disease with Supra-aortic Debranching and Endovascular


REVIEW

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analysis. Overall 30-day mortality was 8.3%. Endoleak rate was 9.2%, stroke was 4.4%, and paraplegia was 3.9%. Treated on-pump or off-pump did not affect any of the endpoints. Results compare favorably with standard op-

Published world wide experience:

18 single center studies with 195 patients
Overall technical success 86%
Perioperative morbidity and mortality is 21% and 9%
Stroke rate 7 %

No comparative studies
Level of Evidence C – Recommendation Class IIb

doi:10.1016/j.ejvs.2010.02.002

0003-4975/$36.00
doi:10.1016/j.athoracsur.2009.12.016

Summary

- Hybrid arch procedures are an alternative treatment for selected high risk
- Results of debranching procedures are poor, may be acceptable, but not excellent
- Extend of debranching influences outcome
- Small case series , no facts on longterm durability

  Evidence Level C, Level II b of Recommendation
- Further research required to consolidate outcome

J. Coselli, Houston, USA

"We are in a transition phase. Endovascular therapy of the aortic arch becomes the standard of care"

Conclusion

CONTROVERSES ET ACTUALITÉS EN CHIRURGIE VASCULAIRE
CONTROVERSIES & UPDATES IN VASCULAR SURGERY
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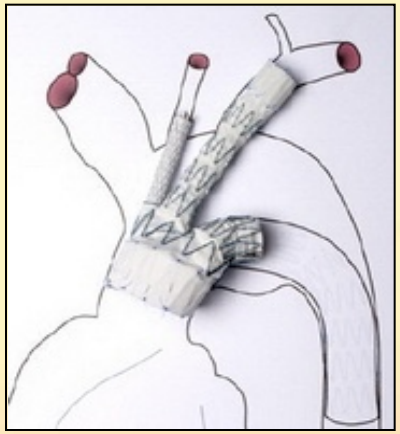
MARRIOTT RIVE GAUCHE & CONFERENCE CENTER PARIS, FRANCE

5TH INTERNATIONAL CONGRESS – MILANO, DECEMBER 13TH – 15TH, 2012

AORTIC SURGERY AND ANESTHESIA "HOW TO DO IT"

Tim Chuter, UCSF, USA

"The future of endovascular arch repair "



endo vs. open

endo vs hybrid (debranching)

unibody vs. **modular**

fenestrated vs. **branched**

total vs. **partial** (1 or 2 branches)

aneurysm vs. dissection

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