Ruptured Aortic Aneurysm

Miss A. Prent MD, MSc, FEBVS
Complex aortic team
Royal Free Hospital London

the AORTIC team
Royal Free London

Disclosures of interest

- **Disclosure**
- Speaker name: Anna Prent
- I have the following potential conflicts of interest to report:
- Consulting
- Employment in industry
- Shareholder in a healthcare company
- Owner of a healthcare company
- Other(s)
- X I do not have any potential conflict of interest

Feel free o disagree….

Royal Free London

- Centralised Vascular Service

Case 1

- Call from Barts Hospital at 21pm

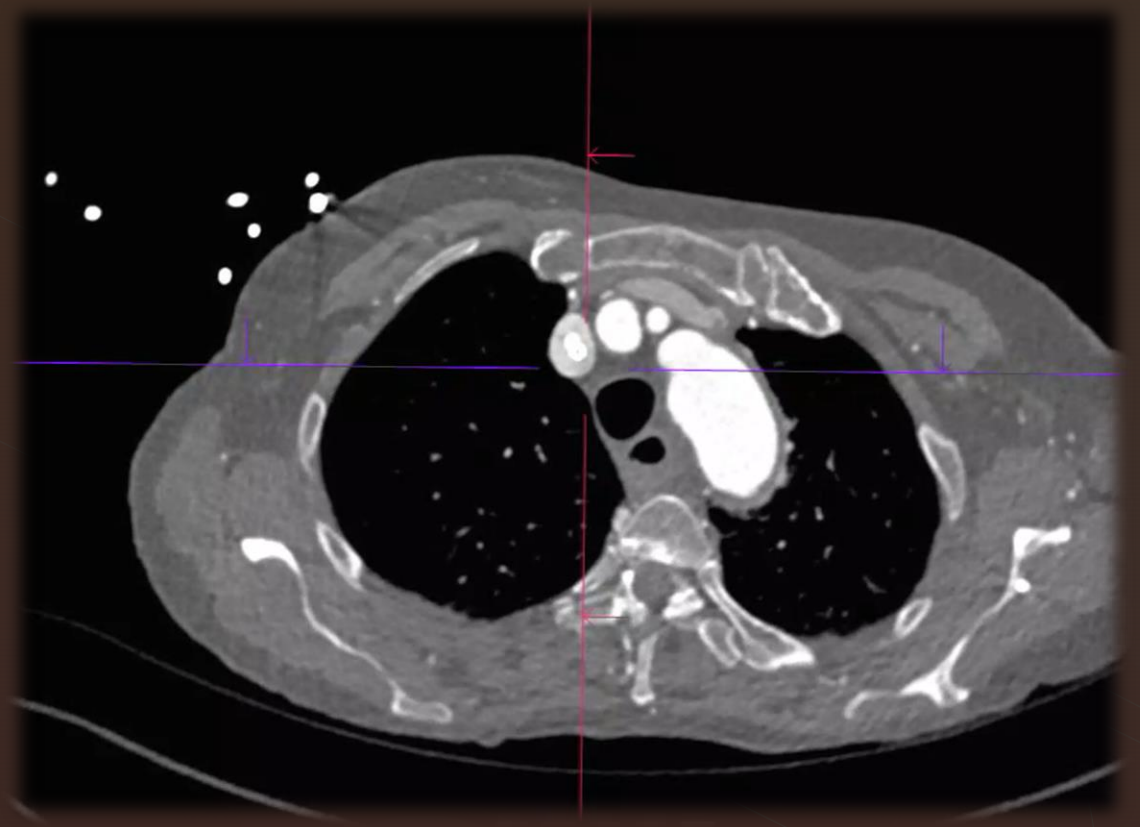
- ♀ DOB: 16-07-1940, 78 years
- MH: hypercholesteremia, ex-smoker, hypertension
- Functionally independent
- Known thoraco-abdominal AAA

Presentation 20-08-2018

- Severe abdominal pain
- Tachycardia, BP 80 systolic
- GCS 14/15 slightly confused
- Bloods: Hb 90, egfr 78 ml/min, normal lactate

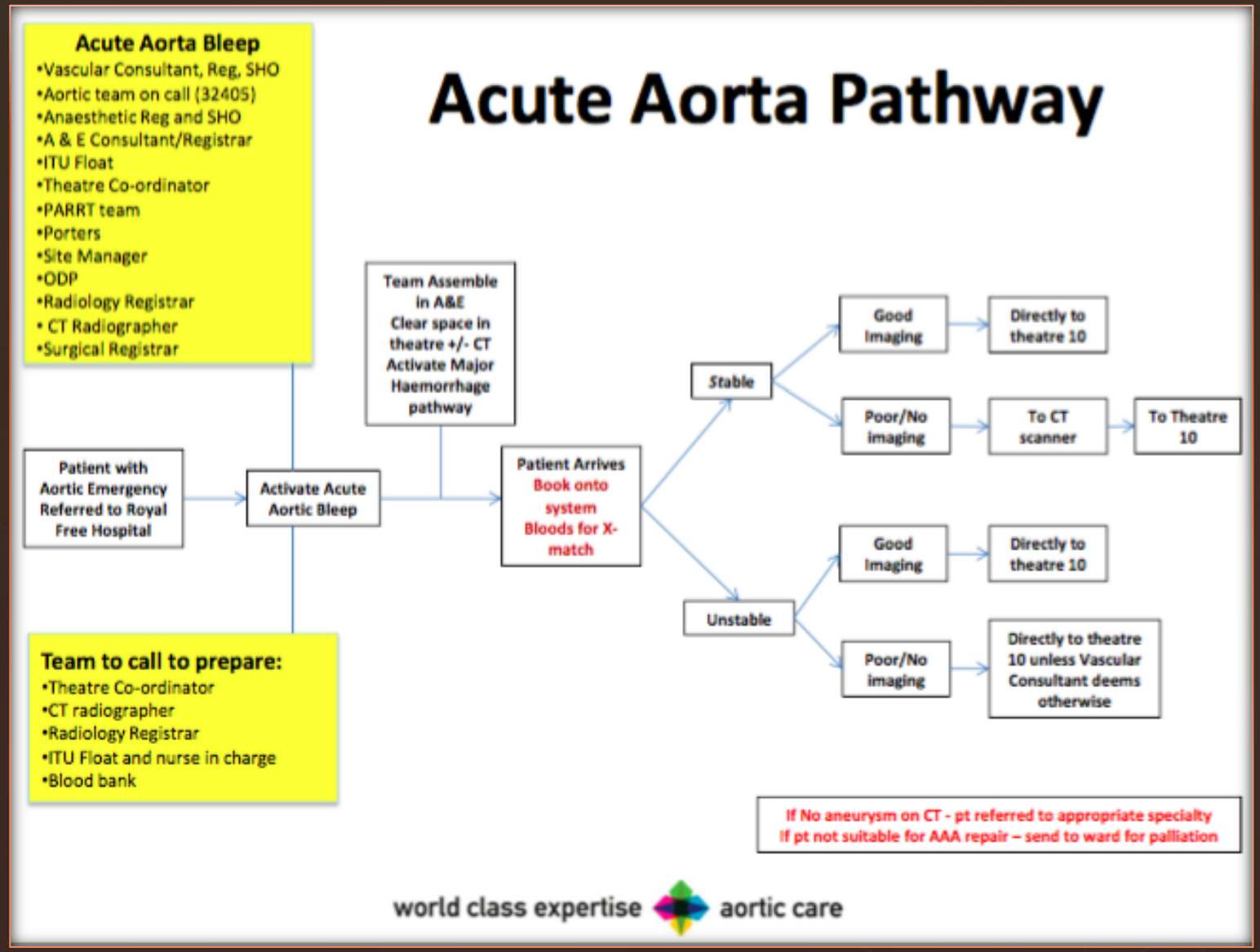
→ CTA

CTA 20-08-2018

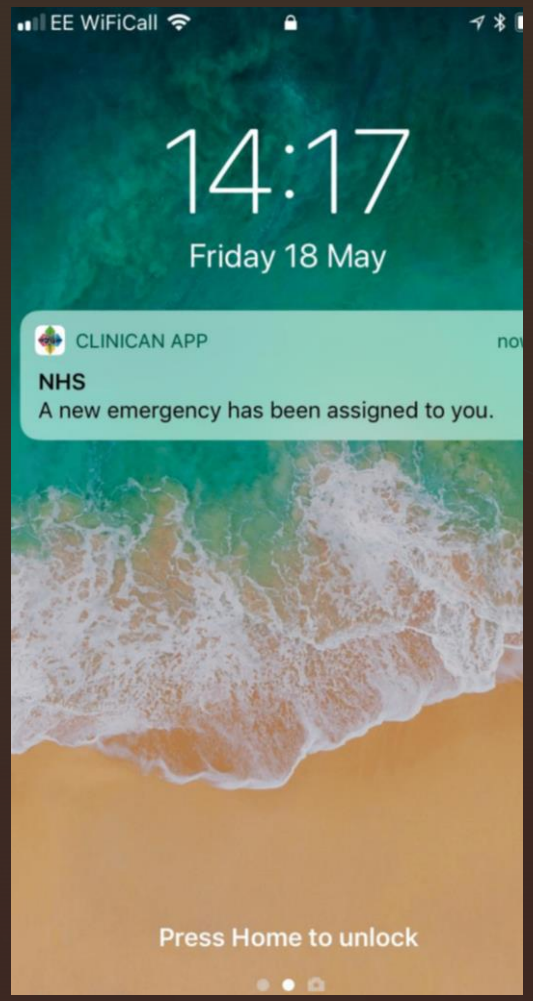


Technology of the future

Royal Free Acute Aorta Pathway



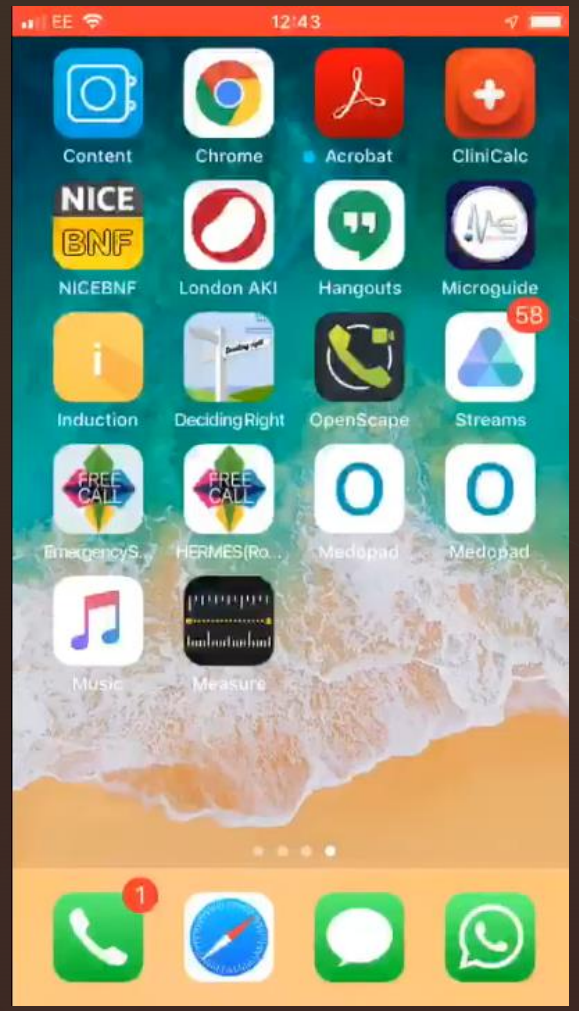
HERMES App



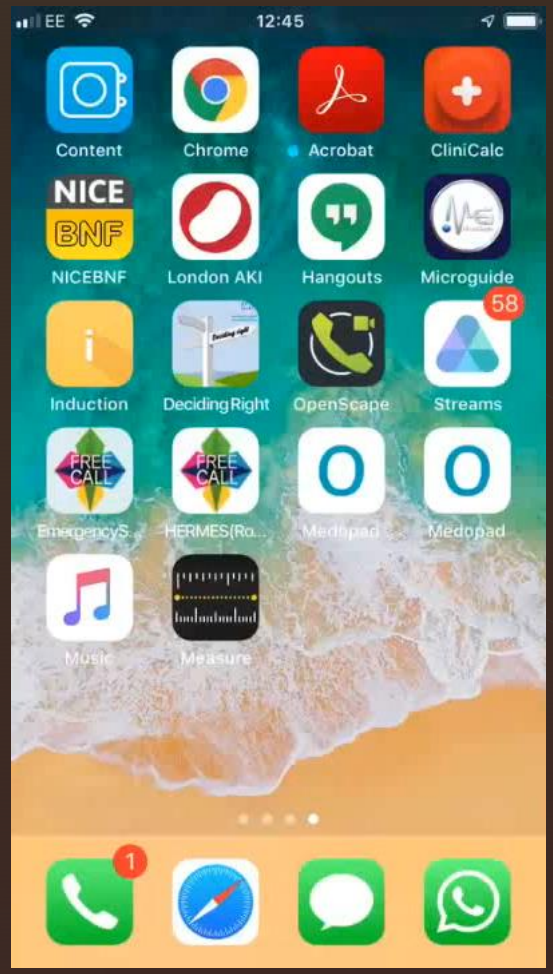
- **H**andheld
- **E**lectronic
- **R**eferral
- **M**anagement for
- **E**mergency
- **S**urgery

- Connects referrers and Royal Free, as well as members of RF, in an encrypted fashion
- Currently build for 2 different use cases
  - Aortic Rupture
  - Hand Trauma

How does it work referrals?



- Referring physicians download app and use NHS email address to log on
- During the ‘trial period’ no outside hospitals will have the app (need proof of safety first)

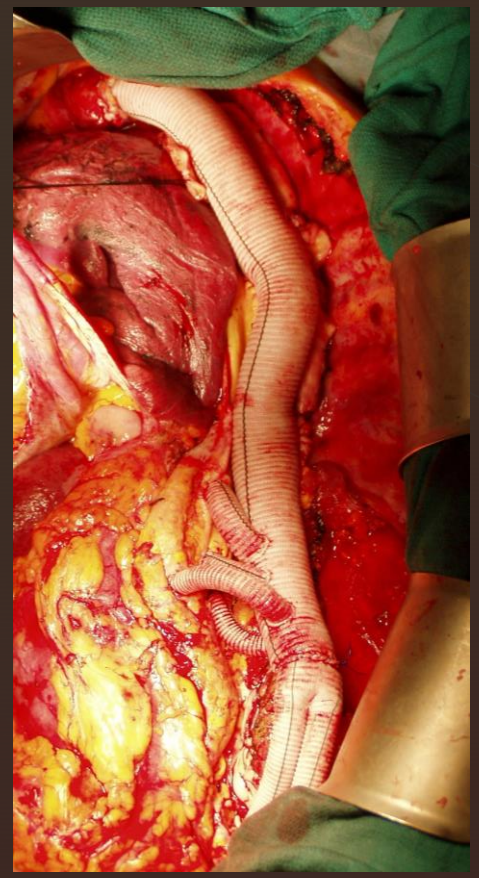


How does it work?

- Notification that referral has occurred
- Sees all info putted by the referring doc
- Opportunity to follow an algorithm to assign tasks
- Chat both with referral and home team

Treatment options

Treatment options

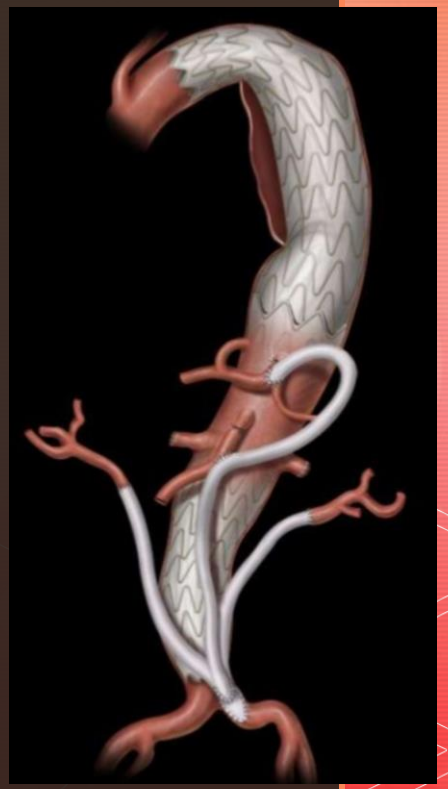


Nothing

Debranching Hybrid

Open repair

Endovascular repair



Open elective

Outcomes of 3309 thoracoabdominal aortic aneurysm repairs

Joseph S. Coselli, MD,[a,d,e] Ourania Preventza, MD,[a,d,e]
Kim I. de la Cruz, MD,[a,d,e] Denton A. Cooley, MD,[d] Matt D. Price, MS,[a,d] Alan P. Stolz, MEd,[a,d]
Susan Y. Green, MPH,[a,d] Courtney N. Arredondo, MSPH,[b] and Todd K. Rosengart, MD[a,c,d,e]

Patency of renal and visceral vessels after open thoracoabdominal aortic replacement

Marwan Youssef, MD,[a] Achim Neufang, MD, PhD,[a] Florian Jungmann, MD,[b]
Christian-Friedrich Vahl, MD, PhD,[a] and Bernhard Dorweiler, MD, PhD,[a] *Mainz, Germany*

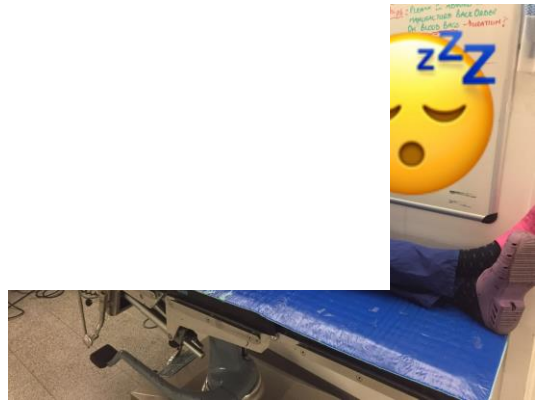
Objective: In thoracoabdominal aortic aneurysms (TAAAs), a paradigm shift is observed from open surgery tow
endovascular aortic repair using fenestrated and branched endografts. Whereas outcome after open replacement
of mortality and paraplegia has been evaluated extensively, no studies exist addressing long-term patency of vis
renal vessels. To enable comparison of target vessel patency between open and endovascular treatment, we anal
series of open TAAA replacements.

Methods: Our vascular surgery database was screened for patients who received open TAAA replacement betwe
and 2 tomogra
magn d vessel patency.
Resu or aneurysms of
Craw ularized by either
patch d the procedure,
result). The respective
paten d 83.7%, 81.3%,
and I zation (bypass or
trans as all selectively
revascularized vessels were patent. The respective patency rates for the celiac trunk, superior mesenteric artery, and left and right renal artery were 100%, 97.5%, 92.3%, and 90.3% at 5 years.

Conclusions: In our series of open thoracoabdominal aortic replacement, excellent patency rates for revascularized renal and visceral vessels were observed during long-term follow-up. We were able to provide a reference value of long-term target vessel patency that can and should be taken into account to judge the efficacy of endovascular repair in TAAA. (J Vasc Surg 2015;62:594-9.)

23 %
30 d Mortality

Is this real life outcome in most other centers?



Literature: open ruptured TAAA

- In hospital mortality 17-43%
- SCI 14-27%
- Renal impairment 18-36%
- Cardiac compl 9%
- Pulmonary compl 35-45%

- Selection bias
- Small case series
  - 19-51

"Open" repair of ruptured thoracoabdominal aortic aneurysm (experience of 51 cases)

Piero Paolo Zanetti[1], Marcin Krasoń[2], Ryszard Walas[2], Theodor Cebotaru[3], Calin Popa[3], Bogdan Vintila[3], Flaviu Steiu[3]

[1]Department of Cardiovascular and Thoracic Surgery, Center of Thoracic Aorta Surgery and Marfan Syndrome; Policlinic of Monza, Monza (MB), Italy
[2]Department of Cardiac, Endovascular Surgery and Transplantation, Medical University of Silesia in Katowice, School of Medicine with the Division of Dentistry in Zabrze, Silesian Center for Heart Diseases, Zabrze, Poland
[3]Ospitalul Monza, Center Cardiovascular, Bucaresti, Romania

Kardiochirurgia i Torakochirurgia Polska 2015; 12 (2): 119-125

LeMaire et al,J Vasc Surg 2002
Mastroroberto et al, Cardio-vasc Surg 1999
Zanetti et al, Kardiochir Torakochir Pol 2015

Literature: endo ruptured TAAA

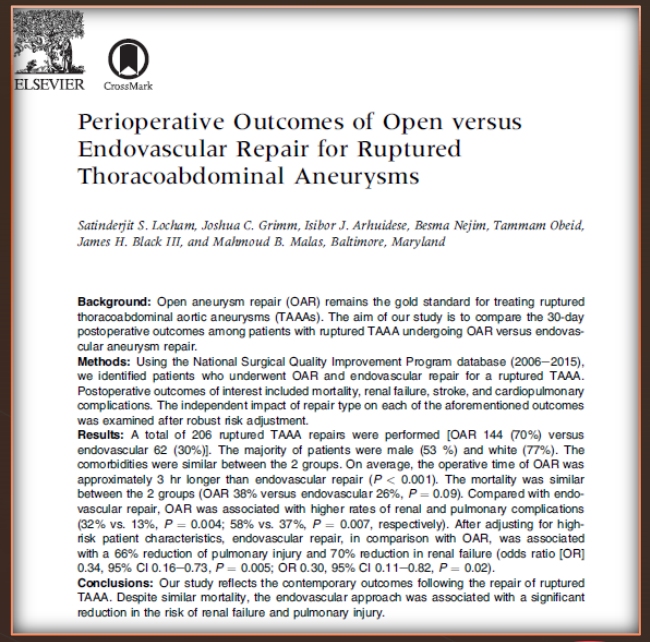
- In hospital mortality 25-40%
- SCI 10-40%
- Renal failure 8-10%
- Cardiac compl 8%
- Pulmonary compl 25%
- Endoleak 17%
- Re-intervention 33%

- Small case series
- Definitions
- Different techniques
  - Chimneys
  - Sandwich
  - T-branch

Verhoeven et al, J vasc Endovasc Surg 2015
Mascoli et al, Eur J Vasc Endovsc Surg 2018
Gallitto et al, Ann Vasc Surg 2019

Literature: open vs endo ruptured TAAAs

- ACS-NSQIP
- 2006-2015, Retrospective
- 206 ruptured TAAA
  - 144 OSR
  - 62 Endo
- 53% male
- OSR operative time longer
- Mortality similar
- Endo lower morbidity



ELSEVIER CrossMark

Perioperative Outcomes of Open versus Endovascular Repair for Ruptured Thoracoabdominal Aneurysms

Satinderjit S. Locham, Joshua C. Grimm, Isibor J. Arhuidese, Besma Nejim, Tammam Obeid, James H. Black III, and Mahmoud B. Malas, Baltimore, Maryland

Background: Open aneurysm repair (OAR) remains the gold standard for treating ruptured thoracoabdominal aortic aneurysms (TAAAs). The aim of our study is to compare the 30-day postoperative outcomes among patients with ruptured TAAA undergoing OAR versus endovascular aneurysm repair.

Methods: Using the National Surgical Quality Improvement Program database (2006–2015), we identified patients who underwent OAR and endovascular repair for a ruptured TAAA. Postoperative outcomes of interest included mortality, renal failure, stroke, and cardiopulmonary complications. The independent impact of repair type on each of the aforementioned outcomes was examined after robust risk adjustment.

Results: A total of 206 ruptured TAAA repairs were performed [OAR 144 (70%) versus endovascular 62 (30%)]. The majority of patients were male (53 %) and white (77%). The comorbidities were similar between the 2 groups. On average, the operative time of OAR was approximately 3 hr longer than endovascular repair ($P < 0.001$). The mortality was similar between the 2 groups (OAR 38% versus endovascular 26%, $P = 0.09$). Compared with endovascular repair, OAR was associated with higher rates of renal and pulmonary complications (32% vs. 13%, $P = 0.004$; 58% vs. 37%, $P = 0.007$, respectively). After adjusting for high-risk patient characteristics, endovascular repair, in comparison with OAR, was associated with a 66% reduction of pulmonary injury and 70% reduction in renal failure (odds ratio [OR] 0.34, 95% CI 0.16–0.73, $P = 0.005$; OR 0.30, 95% CI 0.11–0.82, $P = 0.02$).

Conclusions: Our study reflects the contemporary outcomes following the repair of ruptured TAAA. Despite similar mortality, the endovascular approach was associated with a significant reduction in the risk of renal failure and pulmonary injury.

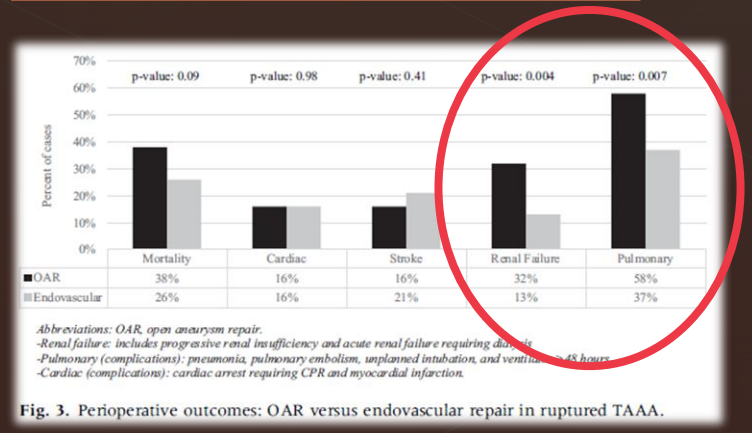


Fig. 3. Perioperative outcomes: OAR versus endovascular repair in ruptured TAAA.

Guidelines abdominal AAA

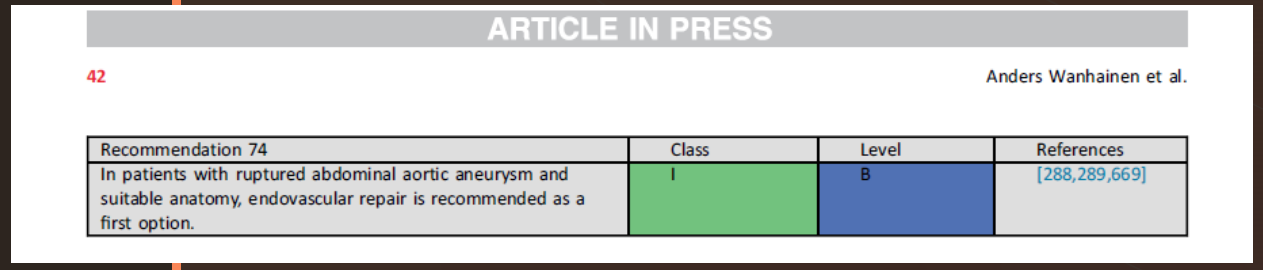
Eur J Vasc Endovasc Surg (2018) ■, 1—97

European Society for Vascular Surgery (ESVS) 2019 Clinical Practice Guidelines on the Management of Abdominal Aorto-iliac Artery Aneurysms

Anders Wanhainen [a,*], Fabio Verzini [a,†], Isabelle Van Herzeele [a], Eric Allaire [a], Matthew Bown [a], Tina Cohnert [a], Florian Dick [a], Joost van Herwaarden [a], Christos Karkos [a], Mark Koelemay [a], Tilo Kölbel [a], Ian Loftus [a], Kevin Mani [a], Germano Melissano [a], Janet Powell [a], Zoltán Szeberin [a]

ESVS Guidelines Committee [b], Gert J. de Borst, Nabil Chakfe, Sebastian Debus, Rob Hinchliffe, Stavros Kakkos, Igor Koncar, Philippe Kolh, Jes Lindholdt, Melina de Vega, Frank Vermassen

Document reviewers [c], Martin Björck, Stephen Cheng, Ronald Dalman, Lazar Davidovic, Konstantinos Donas, Jonothan Earnshaw, Hans-Henning Eckstein, Jonathan Golledge, Stephan Haulon, Tara Mastracci, Ross Naylor, Jean-Baptiste Ricco, Hence Verhagen



ARTICLE IN PRESS

Recommendation 74	Class	Level	References
In patients with ruptured abdominal aortic aneurysm and suitable anatomy, endovascular repair is recommended as a first option.	I	B	[288,289,669]

vascularnews

HOME LATEST NEWS FEATURES VENOUS NEWS PROFILES VIDEOS EVENTS SUPPLEMENTS PAST ISSUES SUBSCRIPTIONS

European vascular community continues to dispute draft NICE AAA guidelines amidst publication delays

10th February 2019 1301

Trusted. Reliable. Pr

Advanta V12 Balloon Expandi Covered Stent.

• Over 500,000 lives t for more than 15 ye

*Not available in US

GETIN

Most read in past 7 days

vascularnews SWEDEPAD trials

EVAR did not lose out all round, as the NICE draft guideline does allow for the consideration of EVAR for the repair of ruptured aneurysms, at least of the infrarenal kind. The guideline suggests that either EVAR or open surgical repair should be considered for repair of a ruptured infrarenal AAA. They advise that EVAR provides more benefit than open surgical repair for most people, especially for women and for men over the age of 70 years, and open surgical repair is likely to provide a better balance of benefits and harms in men under the age of 70 years.

ESVS Guidelines thoraco-abd AAA

Editor's Choice — Management of Descending Thoracic Aorta Diseases

Clinical Practice Guidelines of the European Society for Vascular Surgery (ESVS)

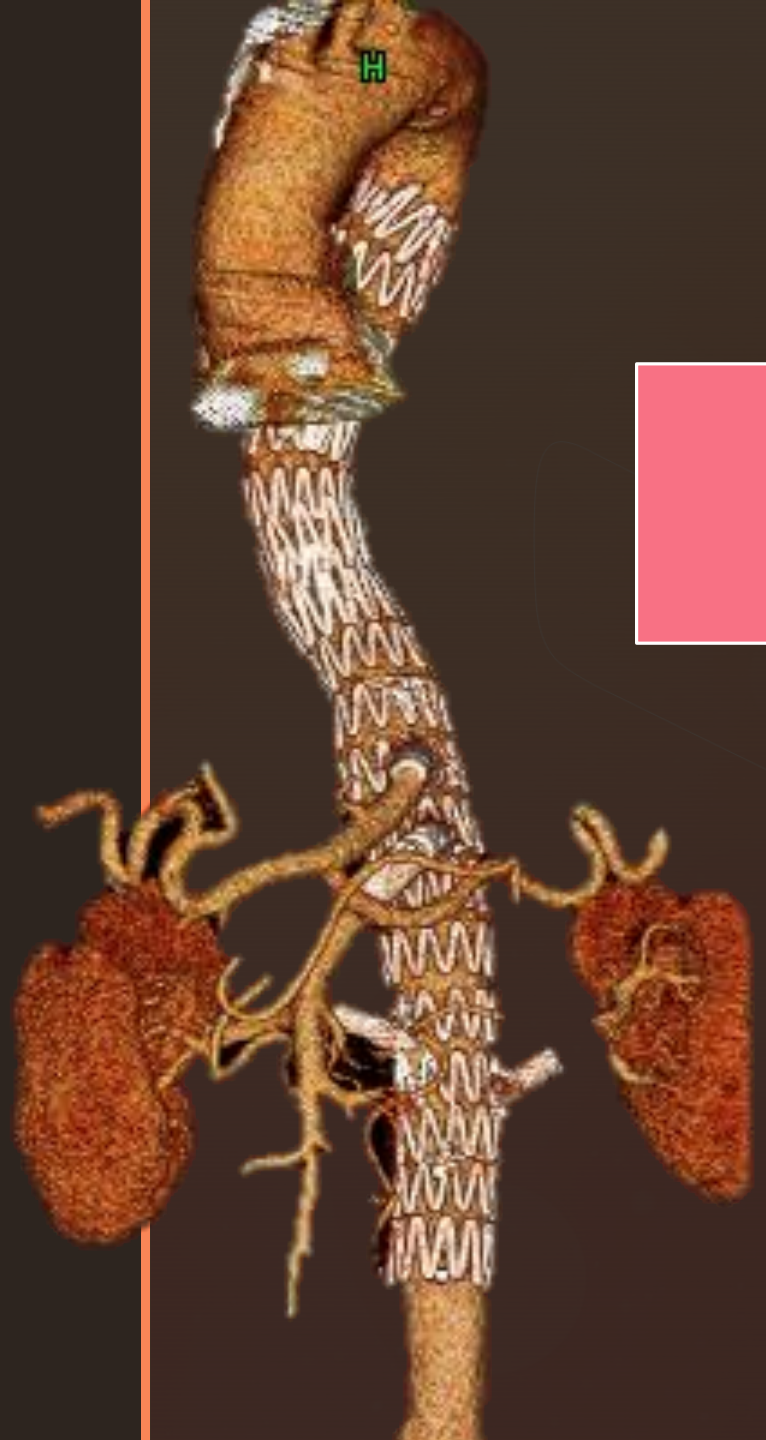
V. Riambau [a], D. Böckler [a], J. Brunkwall [a], P. Cao [a], R. Chiesa [a], G. Coppi [a], M. Czerny [a], G. Fraedrich [a], S. Haulon [a], M.J. Jacobs [a], M.L. Lachat [a], F.L. Moll [a], C. Setacci [a], P.R. Taylor [a], M. Thompson [a], S. Trimarchi [a], H.J. Verhagen [a], E.L. Verhoeven [a], ESVS Guidelines Committee [b] P. Kolh, G.J. de Borst, N. Chakfé, E.S. Debus, R.J. Hinchliffe, S. Kakkos, I. Koncar, J.S. Lindholt, M. Vega de Ceniga, F. Vermassen, F. Verzini, Document Reviewers [c] P. Kolh, J.H. Black III, R. Busund, M. Björck, M. Dake, F. Dick, H. Eggebrecht, A. Evangelista, M. Grabenwöger, R. Milner, A.R. Naylor, J.-B. Ricco, H. Rousseau, J. Schmidli

Keywords: Clinical practice, Descending thoracic aorta, Descending thoracic aortic management, Guideline, Recommendations, Thoracic aorta abnormalities, Thoracic aorta diseases, Thoracic aorta disorders, Thoraco-abdominal aorta

Recommendation 23	Class	Level of evidence	References
In patients with ruptured descending thoracic aortic aneurysm, endovascular repair should be the first treatment option when the anatomy is appropriate	I	B	127
Recommendation 24			
In emergency ruptured descending thoracic aortic aneurysm in patients with a patent left mammary to coronary bypass or with a dominant or single left vertebral artery, left subclavian artery revascularisation should be performed prior to left subclavian artery coverage	I	C	49

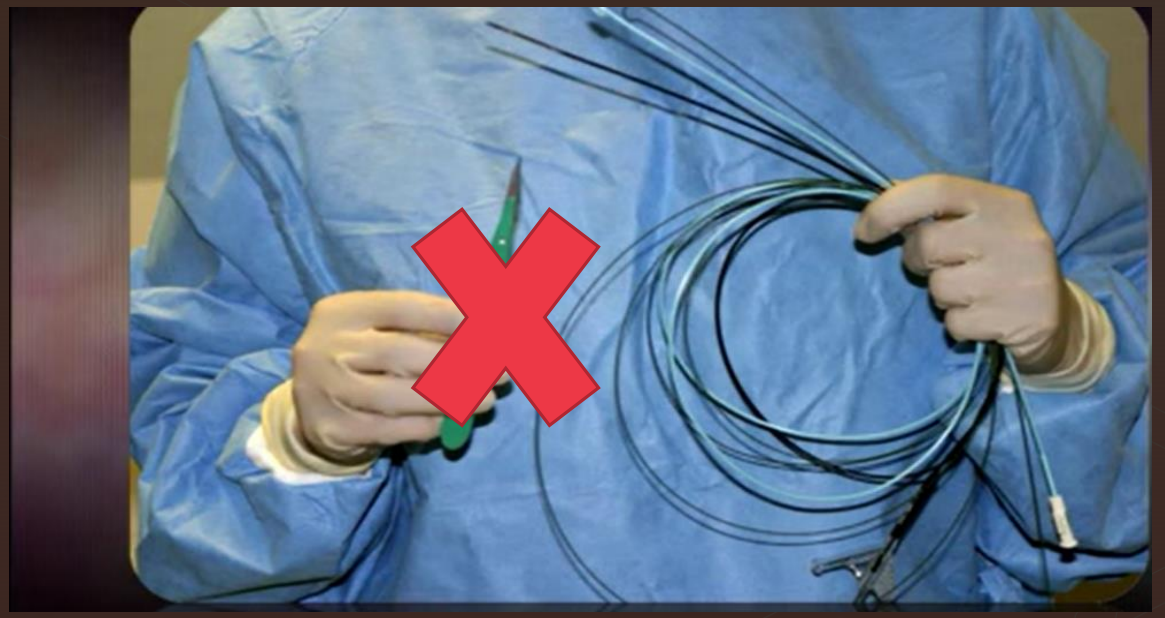
Recommendation 47	Class	Level	References
Open or endovascular repair should be considered for patients at low to moderate surgical risk, with an atherosclerotic or degenerative thoraco-abdominal aortic aneurysm of 60 mm or larger diameter, rapid aneurysm enlargement (>10 mm/year), or aneurysm related symptoms	IIa	C	223

- NO MENTION ON TREATMENT RUPTURED TAAA!

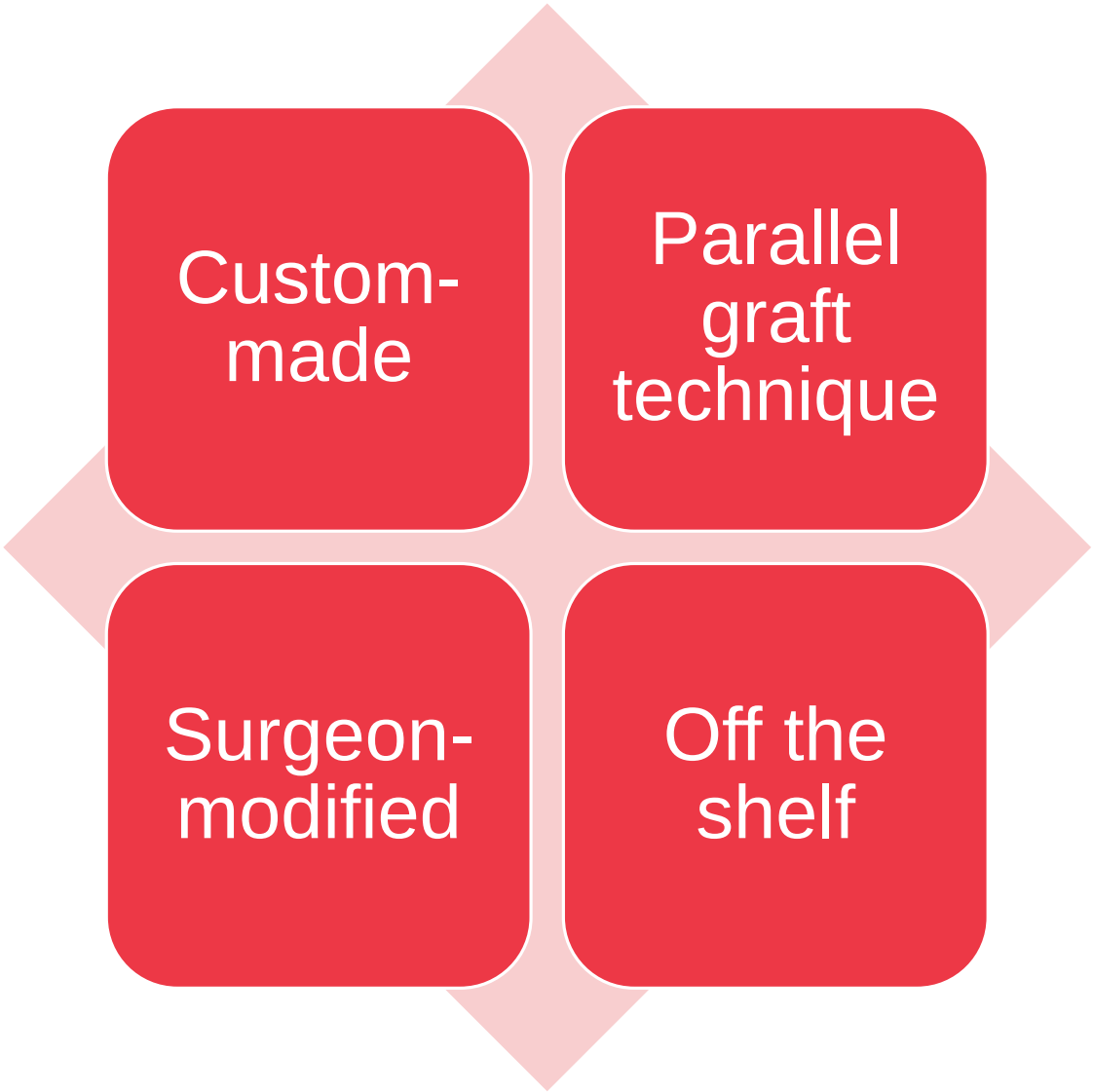


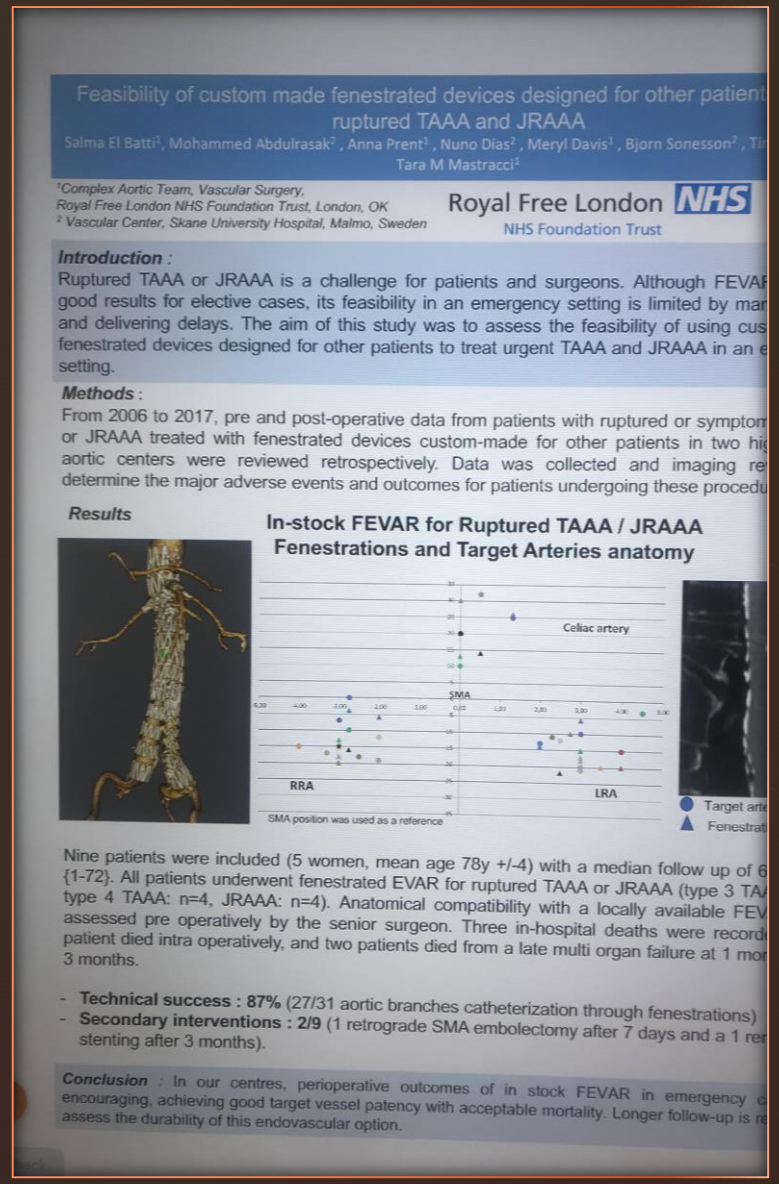
The Endovascular Era

EVAR → FEVAR/ BEVAR → TEVAR → Arch



Endo treatment options?





Feasibility of custom made fenestrated devices designed for other patient ruptured TAAA and JRAAA

Salma El Batti[1], Mohammed Abdulrasak[2], Anna Prent[1], Nuno Dias[2], Meryl Davis[1], Bjorn Sonesson[2], Ti
Tara M Mastracci[1]

[1]Complex Aortic Team, Vascular Surgery,
Royal Free London NHS Foundation Trust, London, OK
[2] Vascular Center, Skane University Hospital, Malmo, Sweden

Royal Free London NHS
NHS Foundation Trust

Introduction :
Ruptured TAAA or JRAAA is a challenge for patients and surgeons. Although FEVAR good results for elective cases, its feasibility in an emergency setting is limited by mar and delivering delays. The aim of this study was to assess the feasibility of using cus fenestrated devices designed for other patients to treat urgent TAAA and JRAAA in an e setting.

Methods :
From 2006 to 2017, pre and post-operative data from patients with ruptured or symptom or JRAAA treated with fenestrated devices custom-made for other patients in two hig aortic centers were reviewed retrospectively. Data was collected and imaging re determine the major adverse events and outcomes for patients undergoing these procedu

Results

In-stock FEVAR for Ruptured TAAA / JRAAA
Fenestrations and Target Arteries anatomy

Nine patients were included (5 women, mean age 78y +/-4) with a median follow up of 6 {1-72}. All patients underwent fenestrated EVAR for ruptured TAAA or JRAAA (type 3 TA type 4 TAAA: n=4, JRAAA: n=4). Anatomical compatibility with a locally available FEV assessed pre operatively by the senior surgeon. Three in-hospital deaths were record patient died intra operatively, and two patients died from a late multi organ failure at 1 mo 3 months.

- **Technical success : 87%** (27/31 aortic branches catheterization through fenestrations)
- **Secondary interventions : 2/9** (1 retrograde SMA embolectomy after 7 days and a 1 re stenting after 3 months).

Conclusion : In our centres, perioperative outcomes of in stock FEVAR in emergency c encouraging, achieving good target vessel patency with acceptable mortality. Longer follow-up is re assess the durability of this endovascular option.

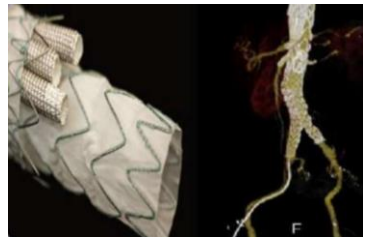
Custom made?

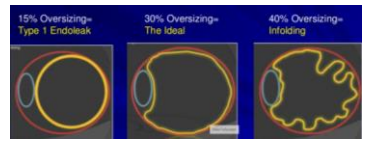
- NO time in rupture
- But sometimes stents from another patient
- 9 cases
- Technical success 87%
- 3 in hospital deaths

CHIPS?
CHIMPS?

- CHImney CHIMney
- Periscope

NON BELIEVERS !!



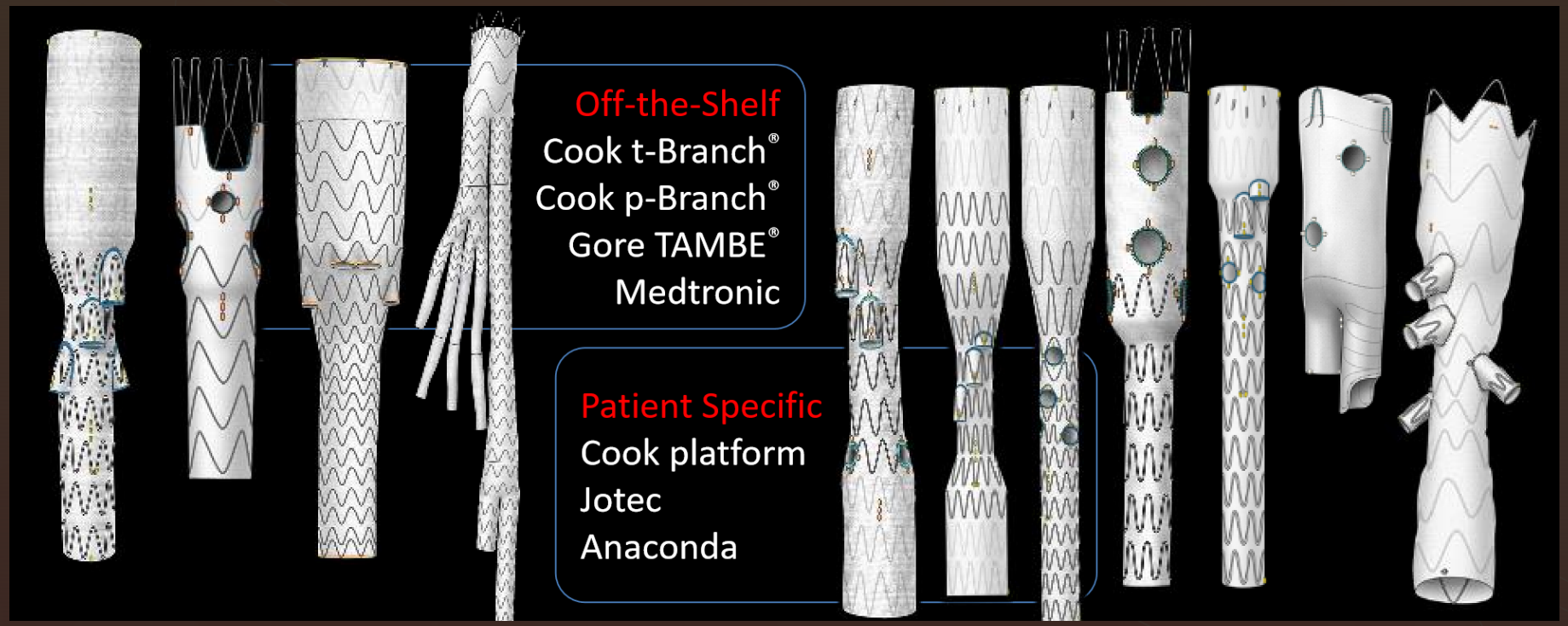


Lindblad et al, J Vasc Endovasc Surg 2015
Bin Jabr et al, J vasc Surg 2015
Donas et al, Ann Surg 2015

Surgeon Modified for Acute TAAA

	n	Acute TAAA	Technique	TV	SCI	RRT	30-day mortality
Ricotta	12	8	SMFEVAR	35	-	-	8 %
Scali	37	24	SMFEVAR	105	14 %	14 %	19 %
Dias	72	21	Fen/Br	276	31%	-	29% acute
		51 elective					7% elective
Anderson	14	3	SMFEVAR	-	7 %	14 %	0 %
Bisdas	46	8	Fen/Br	-	11%	-	4%
Shanzer	49	21	Fen/Br/SM	142	-	4 %	4 %
Cochennec	11	5	SMFEVAR	41	9 %	-	9 %
Sweet	24	3	SMFEVAR	88	13 %	0 %	4 %
Verhoeven	166	15	Fen/Br	600	9 %	-	8 %
TOTAL		108					20% acute

Off the shelf



COOK Zenith t-branch

Eur J Vasc Endovasc Surg (2018) 55, 377–384

Mid-term Outcomes of Endovascular Repair of Ruptured Thoraco-abdominal Aortic Aneurysms with Off the Shelf Branched Stent Grafts

Kiattisak Hongku [a,b,*], Björn Sonesson [a], Katarina Björses [a], Jan Holst [a], Timothy Resch [a], Nuno V. Dias [a]

[a] Department of Thoracic Surgery and Vascular Diseases, Vascular Centre, Skåne University Hospital, Malmö, Sweden
[b] Division of Vascular Surgery, Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

WHAT THIS PAPER ADDS

This paper demonstrates the feasibility and acceptable outcomes of branched EVAR (b-EVAR) of ruptured thoraco-abdominal aneurysms (rTAAAs) with off the shelf (OTS) devices. It also shows the need to use very liberal anatomical suitability criteria for this OTS device in rTAAAs that frequently have to be combined with adjunctive procedures. Moreover, less than optimal results are accepted to limit the magnitude of the procedure, but the consequences for the long-term remain uncertain. Finally, this paper suggests that emergency b-EVAR might be suitable only for clinically stable rTAAAs owing to the time consuming and technical complexity of the procedures, which poses demands on the available expertise.

Objective: To assess the mid-term outcomes and feasibility of branched endovascular repair (b-EVAR) of ruptured thoracoabdominal aortic aneurysms (rTAAAs).

Methods: All patients undergoing b-EVAR of rTAAAs between 2011 and 2016 were included. Pre-, intra and postoperative imaging was reviewed to assess technical success, outcomes, and feasibility of b-EVAR in the emergent setting.

Results: Eleven emergency b-EVAR of rTAAAs (10 aneurysms and 1 chronic dissection) were performed using off-the-shelf (OTS) branched stentgrafts. Only 18% of patients complied to the anatomical instruction-for-use of the OTS device; a small aortic lumen and occluded target vessels were the main violations. Median operative time was 430 (IQR 395-629) minutes. Technical failure was 36% including one intraoperative death, one target vessel catheterization failure, one type Ia and one type III endoleak. Thirty-day mortality was 27%. Only early re-intervention was for the type Ia endoleak. Spinal cord ischemia occurred in 4 patients (30%), of which 2 recovered completely. Median clinical follow-up were 15 (IQR 7-39) months respectively. The median clinical follow-up index (FUI) was 0.65 (0.32—0.95). Overall survival was 75 ± 21.7% at 18 months. Four branch occlusions occurred; one renal stent occlusion led to permanent hemodialysis. Branch patency was 87.5 ± 8.3% and 72.2 ± 12% at 1 and 2 years, respectively. One stent

Conclusion: Emergency b-EVAR of rTAAA with OTS device proper adjunctive procedures, it can be offered to most he complex procedures are not suitable for unstable patient emergency setting and reinterventions may be needed la the elective setting. These results need to be confirmed

Article history: Received 20 June 2017, Accepted 20 Nov

Keywords: Ruptured thoracoabdominal aortic aneurysms, branched stent graft, Anatomical suitability

Eur J Vasc Endovasc Surg (2018) 55, 92–100

Endovascular Repair of Acute Thoraco-abdominal Aortic Aneurysms

Chiara Mascoli [a], Massimo Vezzosi [a], Andreas Koutsoumpelis [a], Mauro Iafrancesco [b], Aaron Ranasinghe [b], Paul Clift [b], Jorge Mascaro [b], Martin Claridge [a], Donald J. Adam [a,*]

[a] Birmingham Complex Aortic Team, Heart of England NHS Foundation Trust, Birmingham, UK
[b] University Hospital Birmingham NHS Foundation Trust, Birmingham, UK

WHAT THIS PAPER ADDS

This paper represents the largest single centre series of total endovascular repair of acute thoraco-abdominal aortic aneurysm (TAAA). Three different endovascular techniques were used based on individual patient aortic morphology and achieved acceptable early and medium-term outcomes. This study is the first to assess the suitability of the off the shelf t-Branch device in the non-elective setting and, despite considering it as the first line option, only one third of patients were suitable.

Objectives: The outcome of endovascular repair (EVAR) for acute thoraco-abdominal aortic aneurysm (TAAA) is reported and the applicability of the t-Branch off the shelf (OTS) device is determined.

Methods: Interrogation of a prospectively maintained database identified all patients who underwent EVAR for acute TAAA between September 2012 (when the first non-elective t-Branch case was performed) and November 2015. Early and medium-term outcomes were analysed. Survival and re-intervention-free survival were calculated by Kaplan—Meier analysis.

Results: A total of 39 patients (27 men; mean ± SD age, 72 ± 8 years) were treated for acute symptomatic ($n = 29$) or ruptured ($n = 10$) TAAA (20 anatomical extent I—III, 19 extent IV). Fourteen patients had mycotic aneurysms. The mean aneurysm diameter was 80 ± 20 mm. The mean ± SD follow-up wa
Surgeon modified fenestrated EVAR was used in 24 patients, chimney/periscope EVAR in t
(33%) patients. Aortic coverage was greater than 40 mm above the coeliac axis in all pa
target vessels (TVs) were preserved (mean 3.3 per patient) and two occluded within 30 day
was 26%. Four (10%) patients developed spinal cord ischaemia (SCI): two with paraplegi
and two with paraparesis recovered completely with blood pressure manipulation and c
drainage. Estimated overall survival (±SD) at 12 and 24 months was 71.8 ± 7.2% and 63.
Estimated freedom from re-intervention at 12 and 24 months was 93 ± 4.8% and 85.3
ted with acceptable early and mid-term result
of these patients were suitable for the t-Bra
required to treat the majority of acute TAAA

of European Society for Vascular Surgery.
Accepted 7 November 2017, Available onlin
cute, Endovascular

CLINICAL RESEARCH STUDIES

From the Society for Vascular Surgery

Standard "off-the-shelf" multibranched thoracoabdominal endograft in urgent and elective patients with single and staged procedures in a multicenter experience

Roberto Silingardi, MD,[a] Stefano Gennai, MD,[a] Nicola Leone, MD,[a] Mauro Gargiulo, MD,[b] Gianluca Faggioli, MD,[b] Piergiorgio Cao, MD, FRCS,[c] Fabio Verzini, MD, PhD, FEBVS,[d] Arnaldo Ippoliti, MD,[e] Nicola Tusini, MD,[f] Carmelo Ricci, MD,[g] Michele Antonello, MD, PhD,[h] Roberto Chiesa, MD,[i] Enrico Maria Marone, MD,[j] Nicola Mangialardi, MD,[k] Francesco Speziale, MD,[l] Gian Franco Veraldi, MD,[m] Stefano Bonardelli, MD,[n] *and* Luigi Marcheselli, BA,[o] on behalf of the Italian mbEVAR study group.* *Modena, Bologna, Rome, Perugia, Reggio Emilia, Siena, Padua, Milano, Pavia, Verona, and Brescia, Italy*

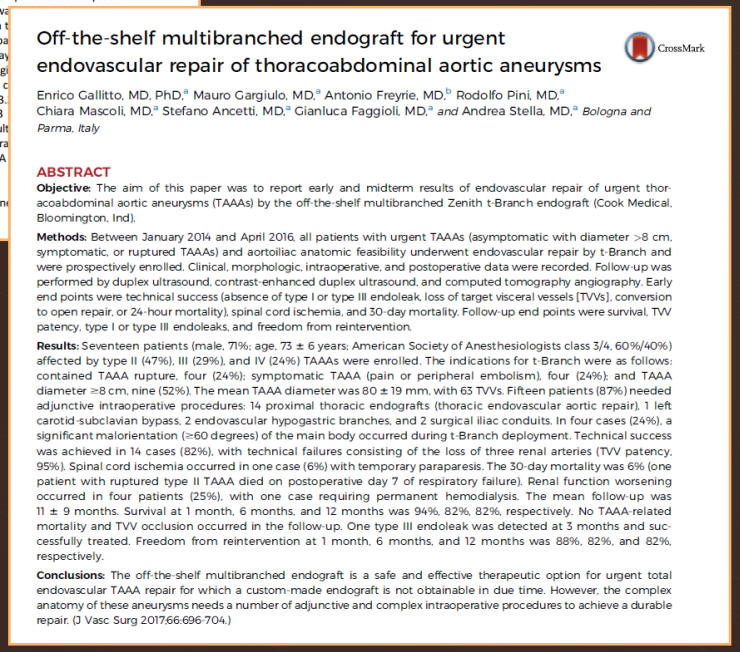
ABSTRACT

Objective: The objective of this study was to assess immediate and midterm outcomes for urgent/emergent and elective patients with thoracoabdominal aortic aneurysms (TAAAs) treated with the first commercially available "off-the-shelf" multibranched endograft for endovascular aneurysm repair, with a single-step or a staged surgical approach.

Methods: A multicenter, nonrandomized, retrospective study was conducted of TAAA patients grouped by urgent/emergent and elective treatment with multibranched endograft for endovascular aneurysm repair at 13 Italian centers from November 2012 to August 2016. Urgent/emergent repair was classified as rupture in 16%, impending rupture in 9%, pain in 53%, or a maximum TAAA diameter ≥80 mm in 22%. Study end points were technical success, mortality, spinal cord ischemia, target visceral vessel (TVV) patency, and procedure-related reinterventions at 30 days and at follow-up.

Results: Seventy-three patients (274 TVVs) were enrolled. Treatment was performed in elective (n = 41 [56%]) or urgent/emergent (n = 32 [44%]) settings, according to a single-step (n = 30 [41%]) or staged (n = 43 [59%]) approach. Technical success was 92%. Mortality within 30 days was 4% (n = 3 urgent/emergent patients) due to myocardial infarction. Spinal cord ischemia was recorded in two patients (3%; elective group). The primary patency of TVVs was 99% (three renal branch occlusions). Procedure-related reinterventions were required in five cases (7%). At least one adverse event from any cause ≤30 days was registered in 42% (n = 31). At a median follow-up of 18 months (range, 1-43 months), eight (11%) deaths (elective vs urgent/emergent, 2% vs 22%; $P = .018$), three (1%) cases of branch occlusion or stenosis, and five (7%) reinterventions were recorded. A survival of 88% (standard error [SE], 4%), 86% (SE, 4%), and 82% (SE, 5%) was evidenced at 12, 24, and 36 months, respectively. Urgent/emergent repair and female gender were identified as independent risk factors for all-cause mortality ($P < .001$ and $P = .015$, respectively), and the staged approach was identified as protective ($P = .026$). Freedom from reintervention was 86% (SE, 4%) and 83% (SE, 5%) at 12 and 24 months.

Conclusions: The first off-the-shelf multibranched endograft seems safe in both urgent/emergent and elective settings. The staged surgical approach appears to positively influence overall survival. This unique device and its operators will usher in a new treatment paradigm for TAAA repair. (J Vasc Surg 2018;67:1005-16.)



Off-the-shelf multibranched endograft for urgent endovascular repair of thoracoabdominal aortic aneurysms

Enrico Gallitto, MD, PhD,[a] Mauro Gargiulo, MD,[a] Antonio Freyrie, MD,[b] Rodolfo Pini, MD,[a] Chiara Mascoli, MD,[a] Stefano Ancetti, MD,[a] Gianluca Faggioli, MD,[a] *and* Andrea Stella, MD,[a] *Bologna and Parma, Italy*

ABSTRACT

Objective: The aim of this paper was to report early and midterm results of endovascular repair of urgent thoracoabdominal aortic aneurysms (TAAAs) by the off-the-shelf multibranched Zenith t-Branch endograft (Cook Medical, Bloomington, Ind).

Methods: Between January 2014 and April 2016, all patients with urgent TAAAs (asymptomatic with diameter >8 cm, symptomatic, or ruptured TAAAs) and aortoiliac anatomic feasibility underwent endovascular repair by t-Branch and were prospectively enrolled. Clinical, morphologic, intraoperative, and postoperative data were recorded. Follow-up was performed by duplex ultrasound, contrast-enhanced duplex ultrasound, and computed tomography angiography. Early end points were technical success (absence of type I or type III endoleak, loss of target visceral vessels [TVVs], conversion to open repair, or 24-hour mortality), spinal cord ischemia, and 30-day mortality. Follow-up end points were survival, TVV patency, type I or type III endoleaks, and freedom from reintervention.

Results: Seventeen patients (male, 71%; age, 73 ± 6 years; American Society of Anesthesiologists class 3/4, 60%/40%) affected by type II (47%), III (29%), and IV (24%) TAAAs were enrolled. The indications for t-Branch were as follows: contained TAAA rupture, four (24%); symptomatic TAAA (pain or peripheral embolism), four (24%); and TAAA diameter ≥8 cm, nine (52%). The mean TAAA diameter was 80 ± 19 mm, with 63 TVVs. Fifteen patients (87%) needed adjunctive intraoperative procedures: 14 proximal thoracic endografts (thoracic endovascular aortic repair), 1 left carotid-subclavian bypass, 2 endovascular hypogastric branches, and 2 surgical iliac conduits. In four cases (24%), a significant malorientation (≥60 degrees) of the main body occurred during t-Branch deployment. Technical success was achieved in 14 cases (82%), with technical failures consisting of the loss of three renal arteries (TVV patency, 95%). Spinal cord ischemia occurred in one case (6%) with temporary paraparesis. The 30-day mortality was 6% (one patient with ruptured type II TAAA died on postoperative day 7 of respiratory failure). Renal function worsening occurred in four patients (25%), with one case requiring permanent hemodialysis. The mean follow-up was 11 ± 9 months. Survival at 1 month, 6 months, and 12 months was 94%, 82%, 82%, respectively. No TAAA-related mortality and TVV occlusion occurred in the follow-up. One type III endoleak was detected at 3 months and successfully treated. Freedom from reintervention at 1 month, 6 months, and 12 months was 88%, 82%, and 82%, respectively.

Conclusions: The off-the-shelf multibranched endograft is a safe and effective therapeutic option for urgent total endovascular TAAA repair for which a custom-made endograft is not obtainable in due time. However, the complex anatomy of these aneurysms needs a number of adjunctive and complex intraoperative procedures to achieve a durable repair. (J Vasc Surg 2017;66:696-704.)

Silingardi et al,J Vasc Surg 2018
Gallitto et al, J vasc Surg 2017
Mascoli et al, Eur J Vasc Endovasc Surg 2018
Hungku et al, Eur J Vasc Endovasc Surg 2018

What to do and when to do it!

- Urgency

How much time do I have before death in ruptures?

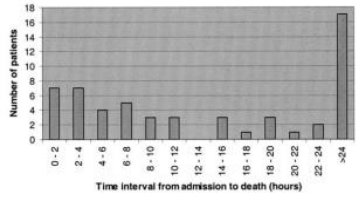


Fig 1. Time from admission to death in patients with ruptured abdominal aortic aneurysms.

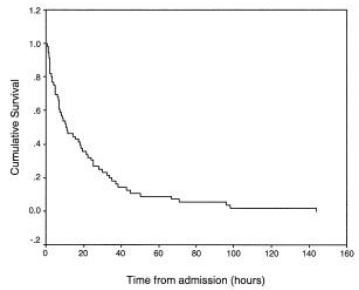


Fig 2. Survival curve shows cumulative survival after admission.

Table III. Symptoms of ruptured abdominal aortic aneurysm, and time from admission to death

Presenting symptoms	*n*	*%*	*Time from admission to death (median)*
Abdominal pain	13	23	19 h 25 min
Back pain	2	4	34 h 15 min
Abdominal and back pain	8	14	32 h 37 min
Abdominal pain and collapse	21	38	6 h 30 min
Back pain and collapse	1	2	1 h 55 min
Abdominal and back pain, and collapse	11	20	17 h 30 min

systolic blood pressure was 110 mm Hg, heart rate was 93 beats per minute, and hemoglobin concentration was 10.7 g/dL. The median time between admission and death in patients with systolic blood pressure less than 100 mm Hg was 11 hours 29 minutes, compared with 10 hours 45 minutes in patients with blood pressure 100 mm Hg or greater at admission.

Two hours after admission the 49 surviving patients had a median systolic blood pressure of 104 mm Hg (range, 55-170 mm Hg) and diastolic blood pressure of 60 mm Hg (range, 20-110 mm Hg). Twenty patients had systolic blood pressure less than 100 mm Hg, and 4 of these had systolic pressure less than 80 mm Hg.

DISCUSSION

These data demonstrate that most patients admitted to the hospital with a ruptured AAA survive for a number of hours. The median time between admission and death was 10 hours 45 minutes, and, of importance, 87.5% of patients survived longer than 2 hours after admission to the hospi-

Median interval between symptom onset and presentation was 2h 30m

JOURNAL OF VASCULAR SURGERY
April 2004

Table III. Symptoms of ruptured abdominal aortic aneurysm, and time from admission to death

Presenting symptoms	*n*	*%*	*Time from admission to death (median)*
Abdominal pain	13	23	19 h 25 min
Back pain	2	4	34 h 15 min
Abdominal and back pain	8	14	32 h 37 min
Abdominal pain and collapse	21	38	6 h 30 min
Back pain and collapse	1	2	1 h 55 min
Abdominal and back pain, and collapse	11	20	17 h 30 min

Median interval between admission and death was 10h 45m

Lloyd et al, J Vasc Surg 2004

What to do and when to do it!

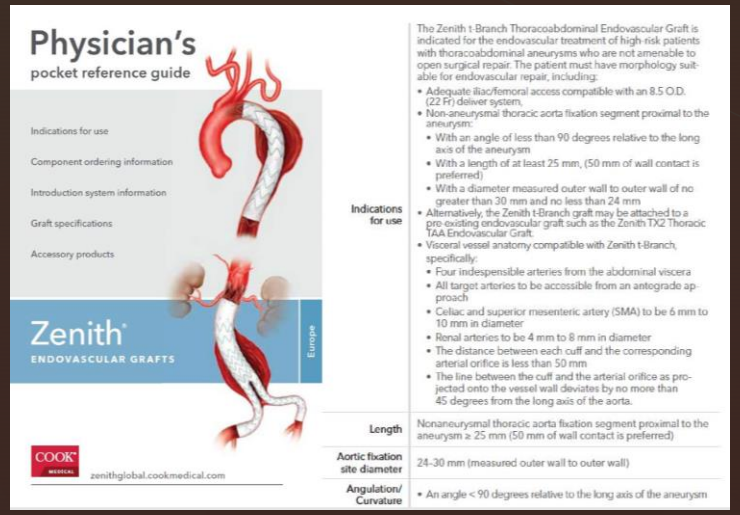
- Anatomy
- “Fitness” for surgery
- Expertise
- Infrastructure
- Device availability
- Patient preference

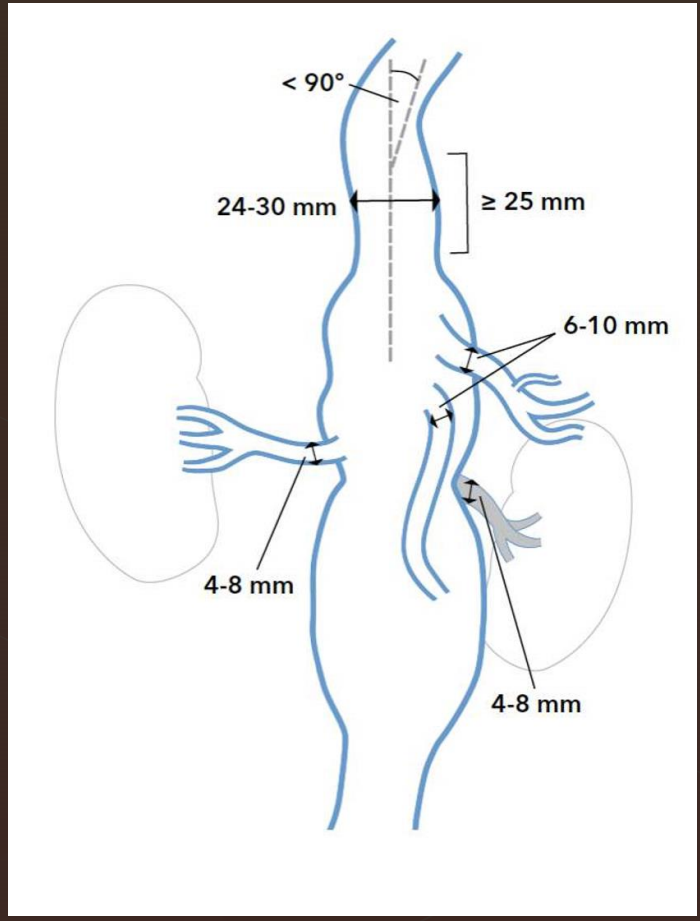
We have a plan!

The procedure

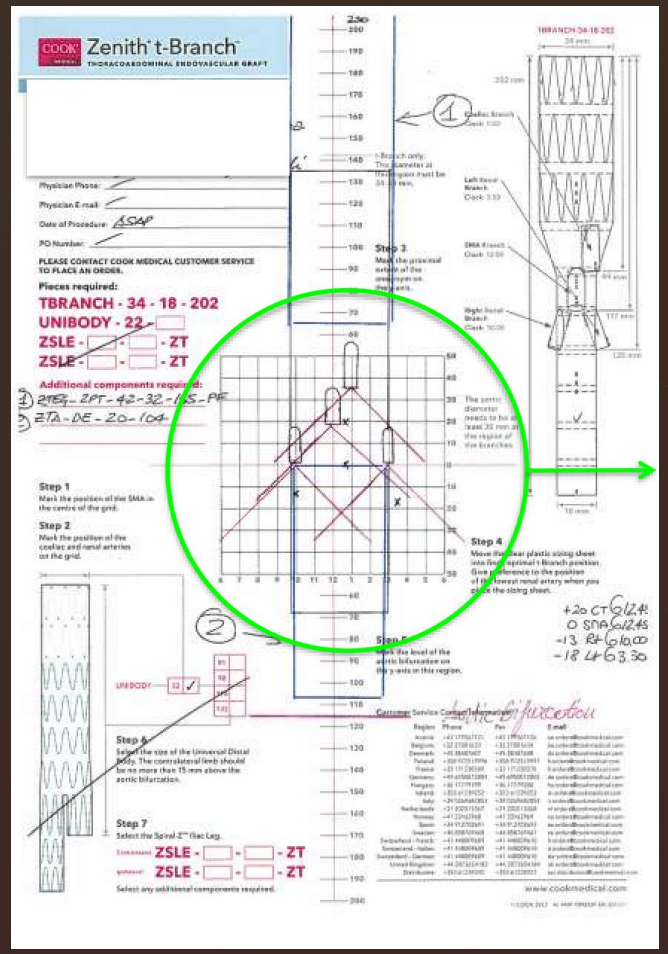
Requirement for T-branch Usage

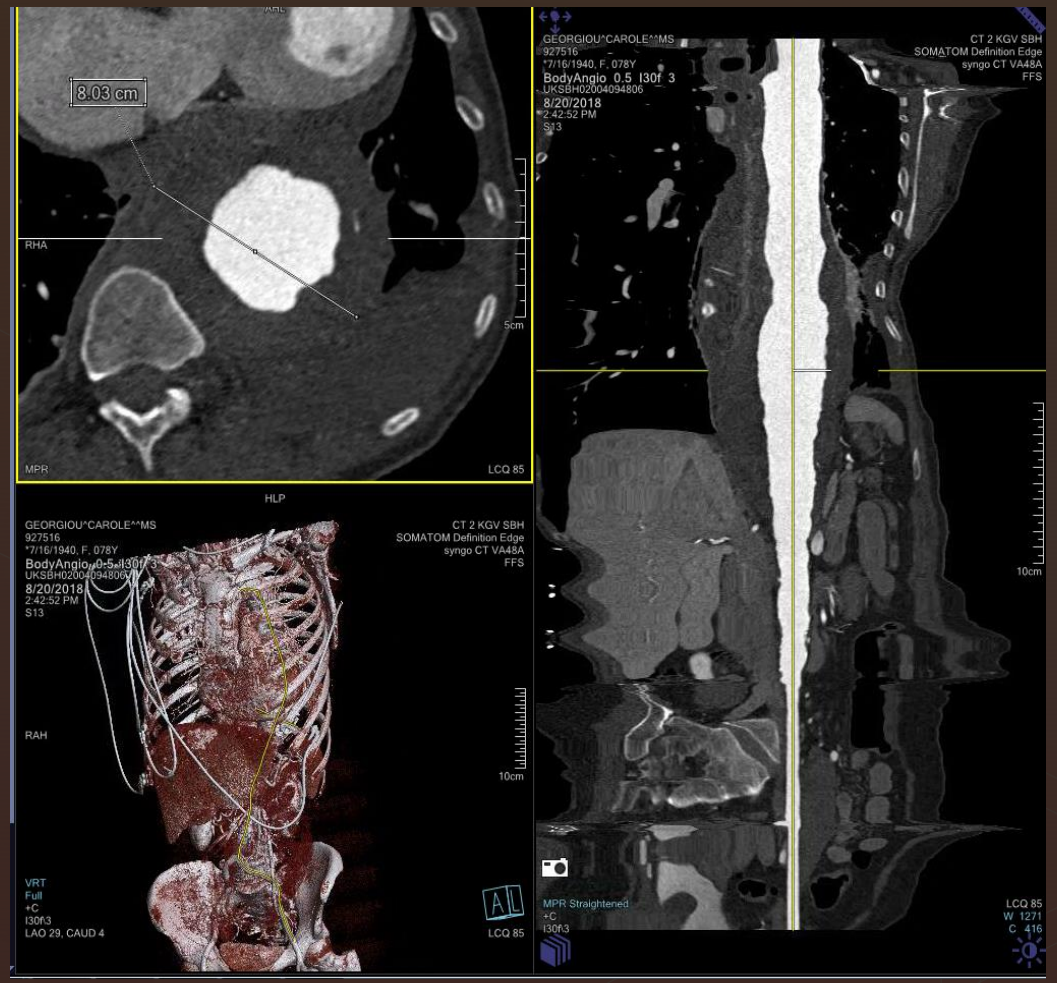
- Diameter at visceral arteries
- Angel of visceral arteries
- Number of target vessels
- Angle of thoracic aorta
- Length of infrarenal aorta
- Sufficient iliac vessels





3D Planning


Zenith t-Branch
THORACOABDOMINAL ENDOVASCULAR GRAFT
PLEASE CONTACT COOK MEDICAL CUSTOMER SERVICE TO PLACE AN ORDER.
Pieces required:
TBRANCH - 34 - 18 - 202
UNIBODY - 22
ZSLE - - - ZT
ZSLE - - - ZT
Additional components required:
Step 1
Step 2
Step 3
Step 4
Step 6
Step 7

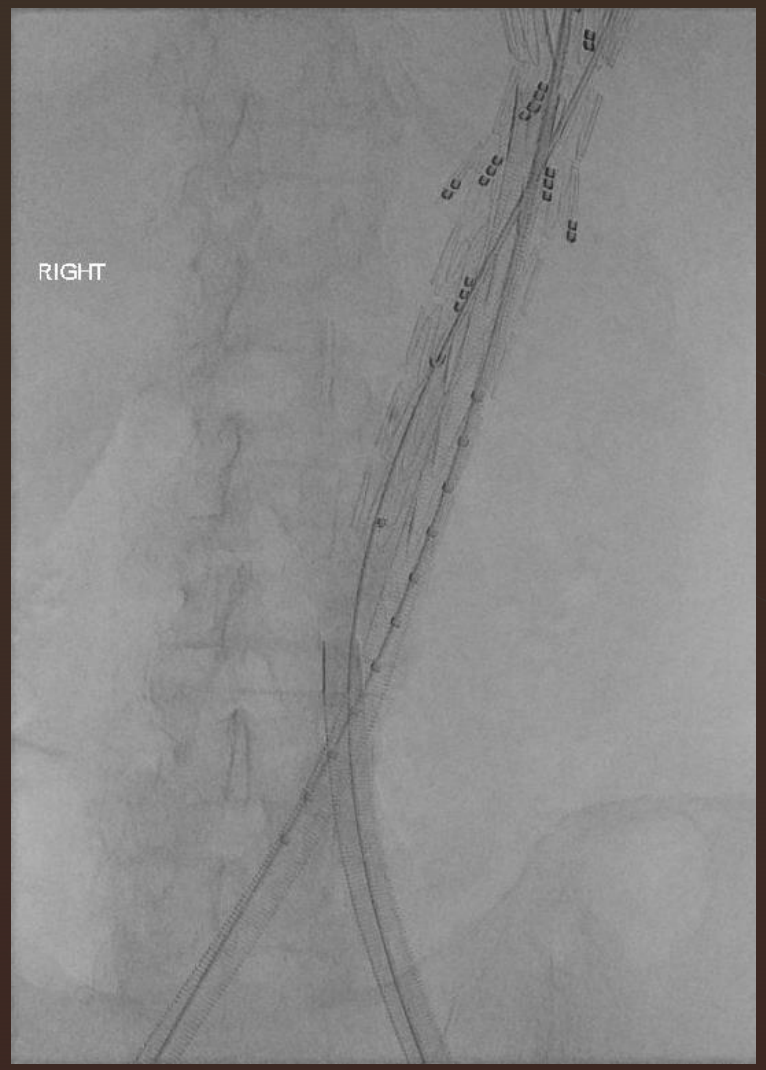

8.03 cm
RHA
MPR
LCQ 85
GEORGIOU^CAROLE^^MS
927516
*7/16/1940, F, 078Y
BodyAngio 0.5 I30f 3
UKSBH02004094806
8/20/2018
2:42:52 PM
S13
CT 2 KGV SBH
SOMATOM Definition Edge
syngo CT VA48A
FFS
HLP
RAH
VRT
Full
+C
I30f3
LAO 29, CAUD 4
MPR Straightened
10cm
W 1271
C 416

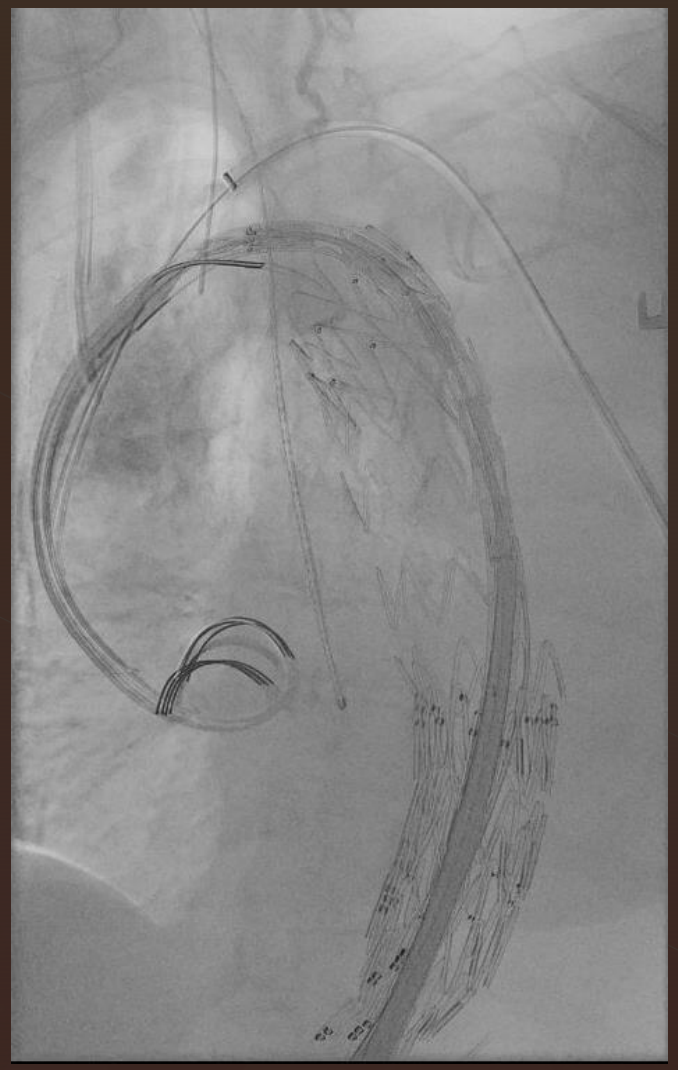
Consent

- In hospital mortality ~ 50%
- Major complications
  - Stroke
  - Paraplegia
  - Renal impairment
  - MI
  - Respiratory complications

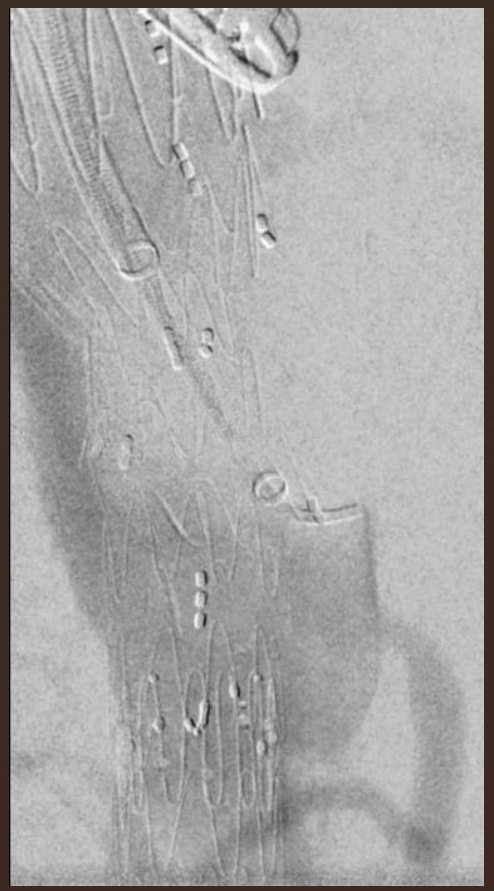
~50%

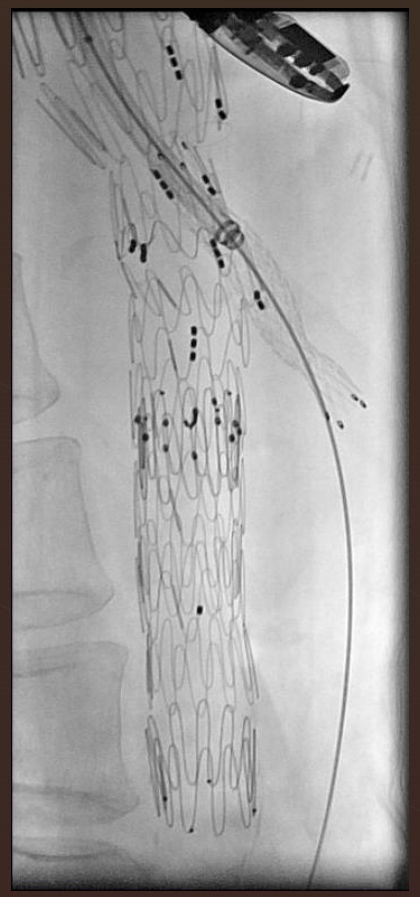
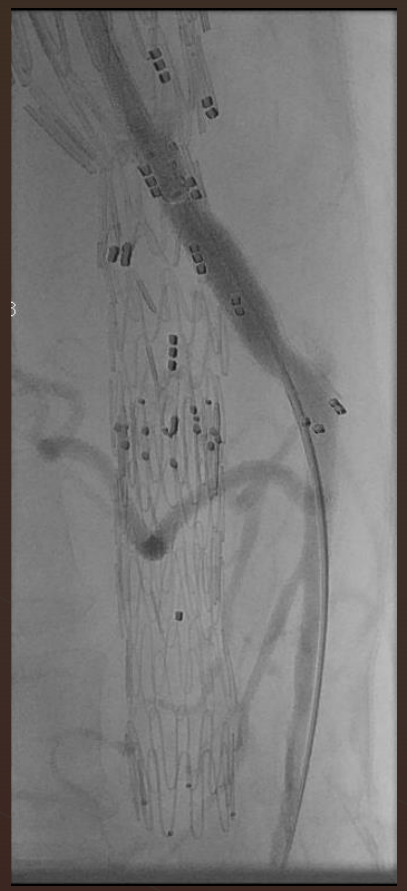
TEVAR
T-branch



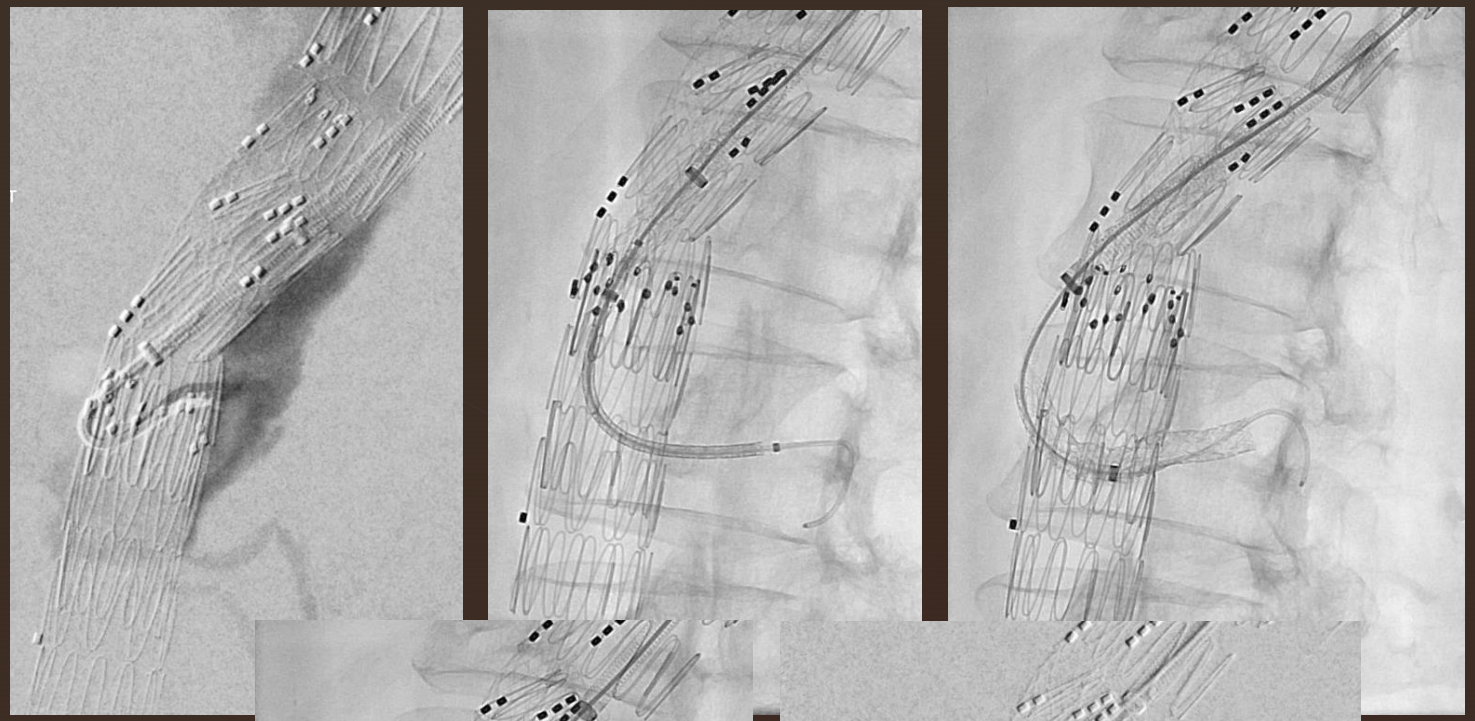


SMA

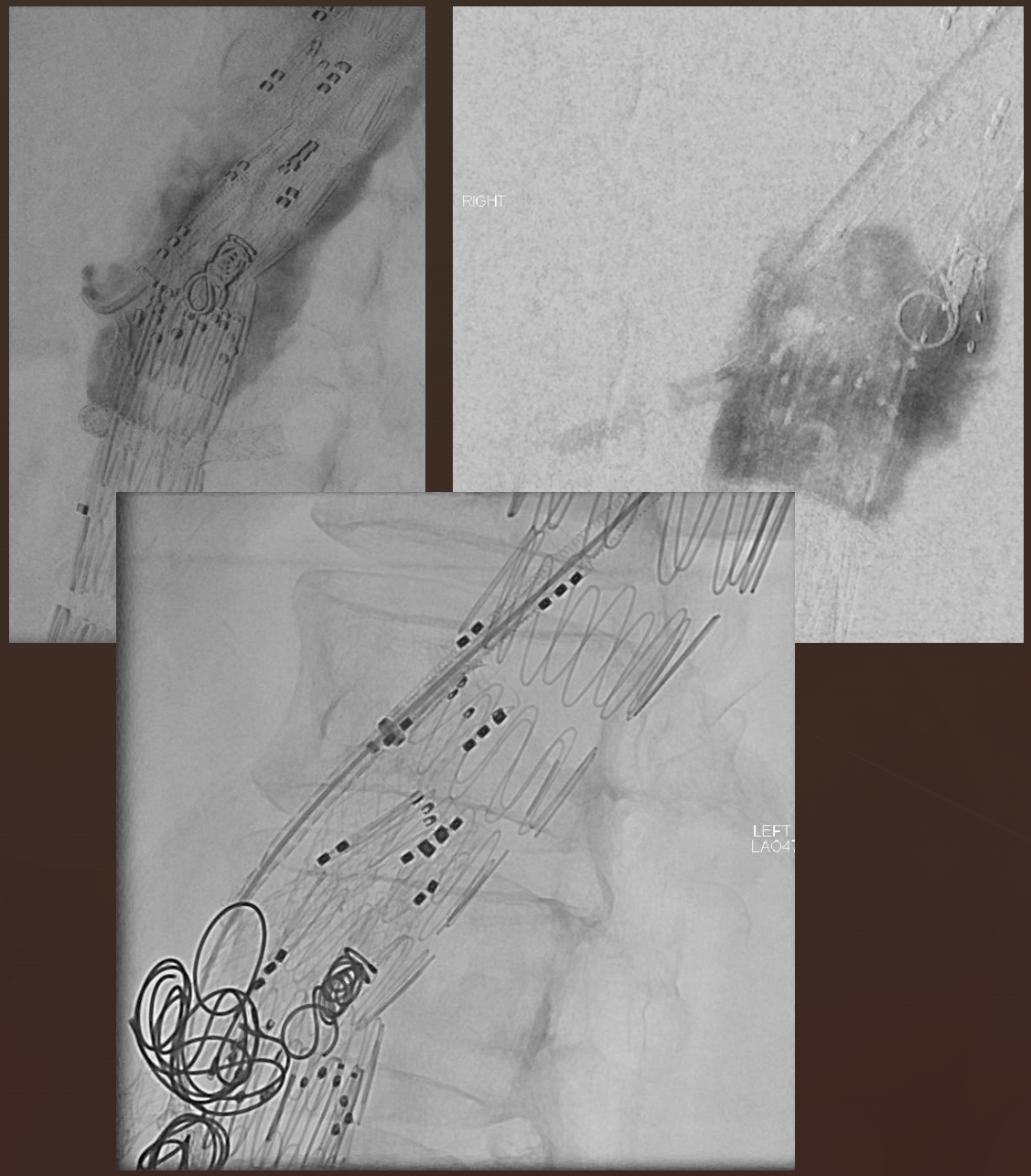


Left Renal



Right Renal Coeliac



Final Result

Post-op ITU

Post-op protocol

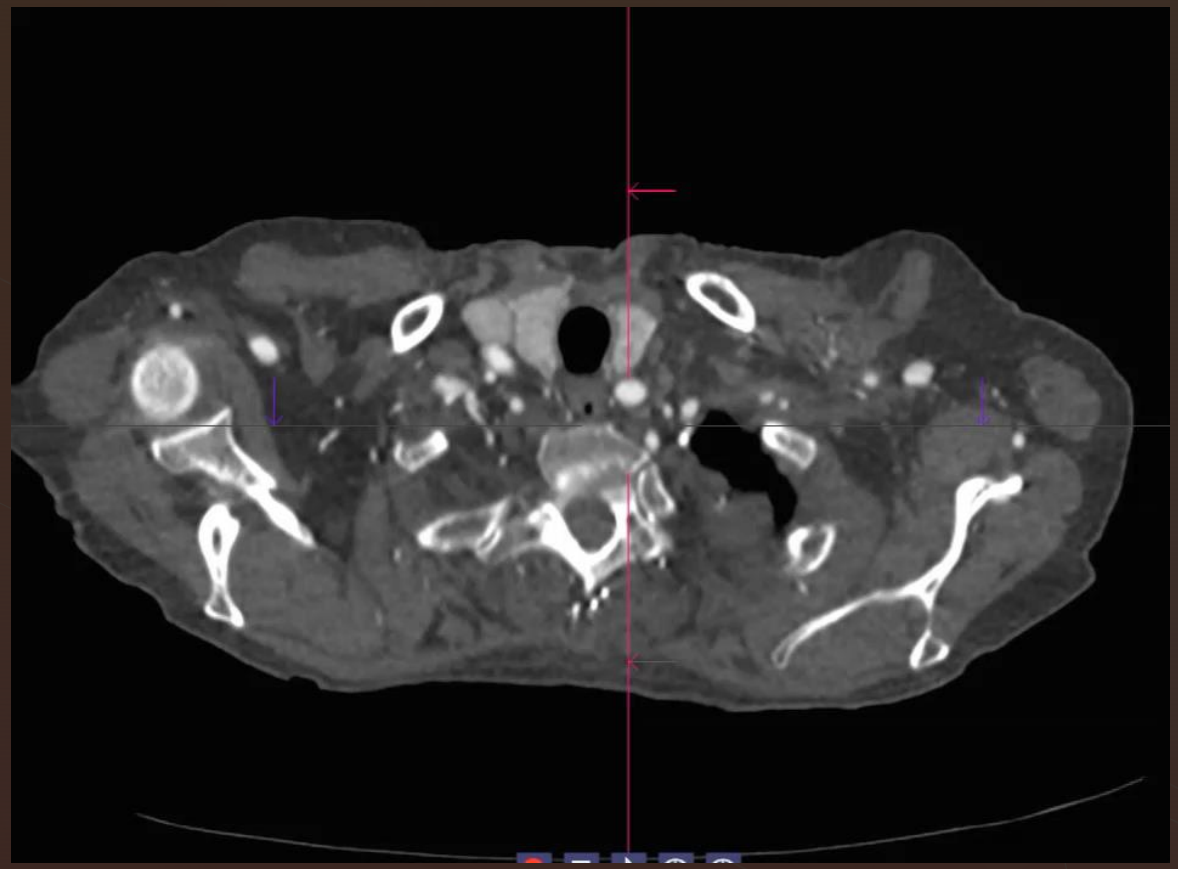
- Renal protocol
- MAP 80-100
- Hb >80
- 1 neurovasc obs
- 1 bloodgas
- 4 coagulation screen

Post-op complications

- Day 1 Left tension haemothorax → chest drain
- Day 2 Still intubated but signs of paraplegia
- Day 3 HAP → IV coamox → taz and gent
- Day 4 AKI and by day 4 CVVHF

4 month follow up in clinic

- Walks in
- Of dialysis
- Follow up CT



Quesitons

Literature: woman and ruptured AAA

European Journal of Cardio-Thoracic Surgery 55 (2019) 338–344
doi:10.1093/ejcts/ezy249 Advance Access publication 4 July 2018

ORIGINAL ARTICLE

Cite this article as: Rieß HC, Debus ES, Schwaneberg T, Sedrakyan A, Kölbel T, Tsilimparis N *et al.* Gender disparities in fenestrated and branched endovascular aortic repair. Eur J Cardiothorac Surg 2019;55:338–44.

Gender disparities in fenestrated and branched endovascular aortic repair

Henrik Christian Rieß[a], Eike Sebastian Debus[a], Thea Schwaneberg[a], Art Sedrakyan[b], Tilo Kölbel[a], Nikolaos Tsilimparis[a], Axel Larena-Avellaneda[a] and Christian-Alexander Behrendt[a,*]

[a] Department of Vascular Medicine, University Heart Center Hamburg, Working Group GermanVasc, German Aortic Center Hamburg, University Medical Center Hamburg-Eppendorf, Hamburg, Germany
[b] Healthcare Policy and Research, Weill Cornell Medical College, New York, NY, USA

* Corresponding author. Department of Vascular Medicine, University Heart Center Hamburg, Working Group GermanVasc, German Aortic Center Hamburg, University Medical Center Hamburg-Eppendorf, Hamburg, Germany. Tel: +49-40-741018087; fax: +49-40-74105484O; e-mail: behrendt@hamburg.de (C.-A. Behrendt).

Received 16 April 2018; received in revised form 10 June 2018; accepted 12 June 2018

Key question

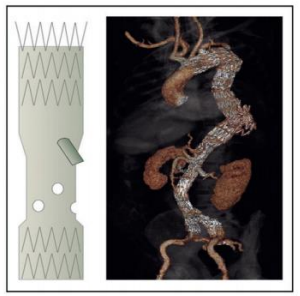
Are outcomes following complex endovascular aortic repair different in female versus male patients?

Key findings

Female patients were at a higher risk of in-hospital death, which led to lower long-term survival.

Take-home message

In complex endovascular aortic repair, women have more complications and worse in-hospital and, consequently, long-term survival.



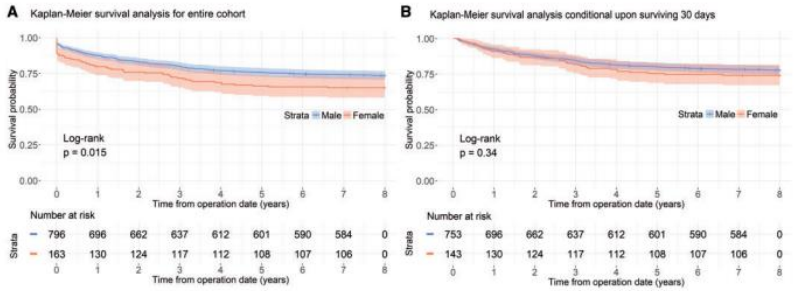
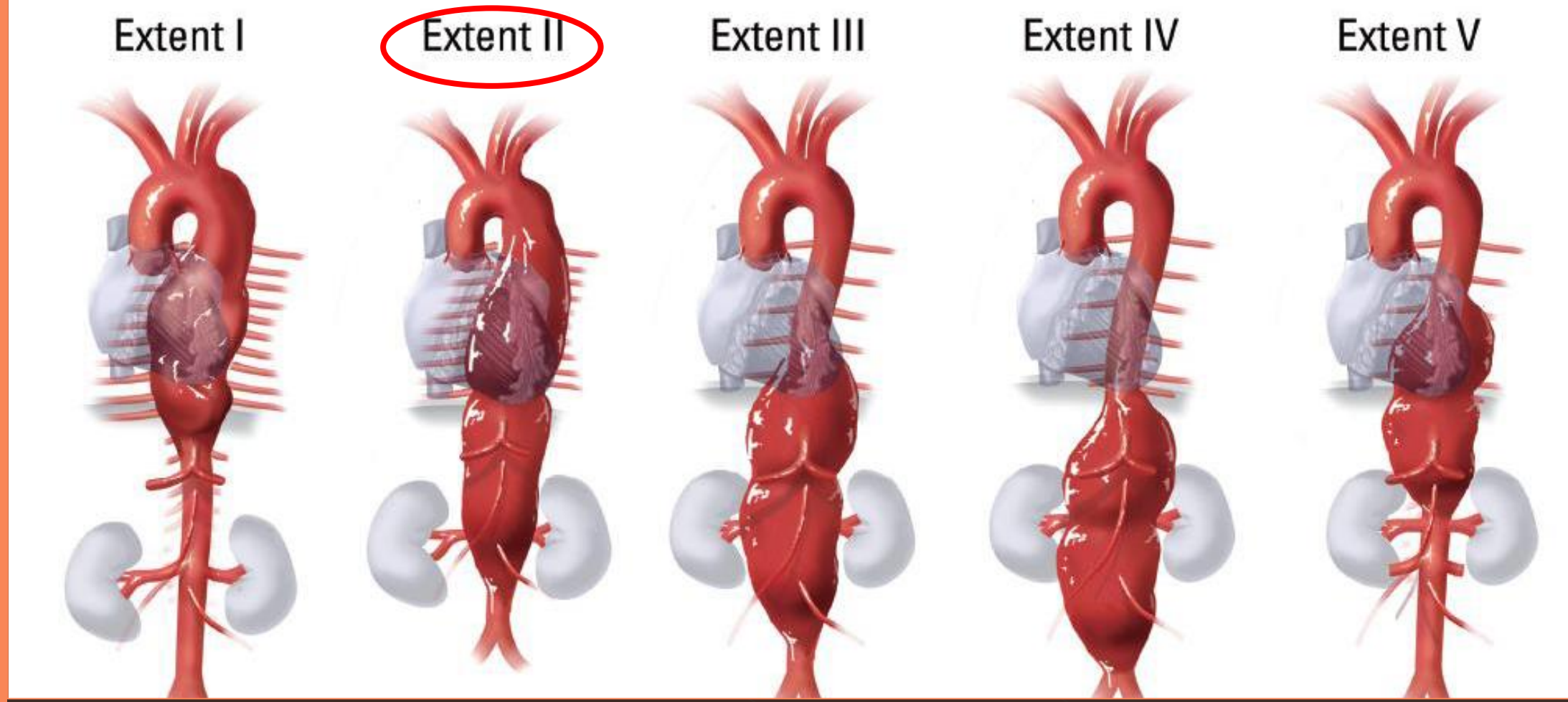


Figure 2: (**A**) Kaplan–Meier survival curves of 163 female and 796 male patients undergoing fenestrated or branched endovascular repair of intact thoraco-abdominal or abdominal aortic aneurysms or dissections. *P*-value was calculated using the log-rank test. (**B**) Kaplan–Meier survival curves of 143 female and 753 male patients undergoing fenestrated or branched endovascular repair of intact thoraco-abdominal or abdominal aortic aneurysms or dissections. *P*-value was calculated using the log-rank test.

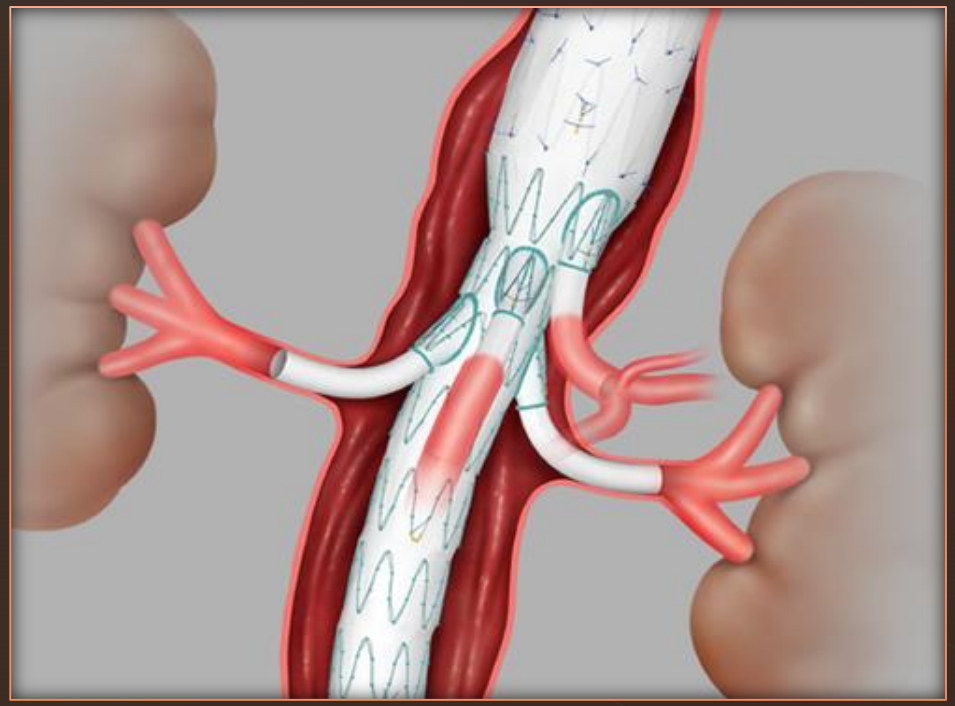
Table 4: Cox regression results for long-term survival for fenestrated or branched aortic repair by different risk factors

Variables	Fenestrated or branched endovascular aortic repair		
	Hazard ratio	95% CI	*P*-value
Older age of the patients (increase by 1 year)	1.040	1.023–1.058	**<0.001**
Female gender (vs male)	1.506	1.123–2.109	**0.006**
Van Walraven comorbidity score (increase by one point)	1.045	1.030–1.061	**<0.001**

Significant *P*-values are marked in bold.



Crawford classification



T-branch Procedure