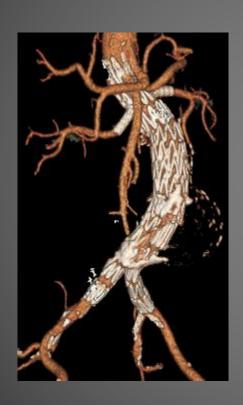
DEBATE? 3x-4x FEVAR is the Way to go





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Disclosures

- William Cook Europe/Cook Inc.
 - Research grants & Consulting
- Atrium Maquet
 - Consulting
- Bentley
 - Consulting

Lay-Out

Sensible Arguments

Practical Examples

Scientific Evidence

Is there a Debate?

- We owe our patients the best possible treatment but also a durable treatment
 - Not a choice....
 - Far too many patients with long-term unsuitable necks treated with standard EVAR
- Extension of disease
- A Man has to do what a Man has to do......

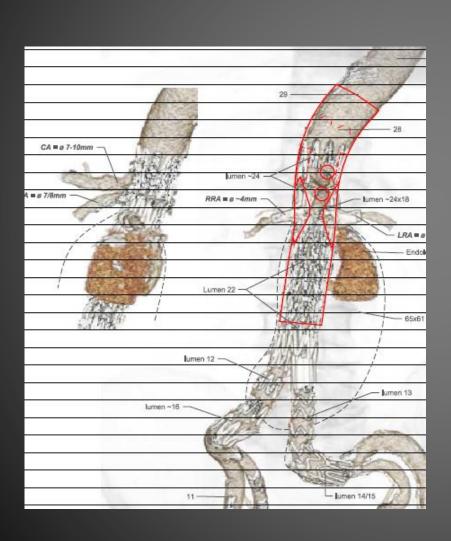
Key Issues

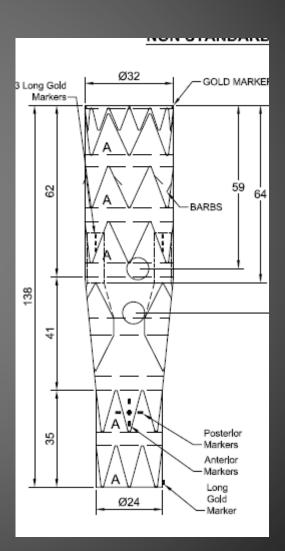
- Aortic Neck Dilatation (AND) after EVAR?
- Stability of suprarenal Aorta?

M&M after 3-4xFEVAR higher than 2xFEVAR?

Difficulty of repair of failed 2x-3xFEVAR

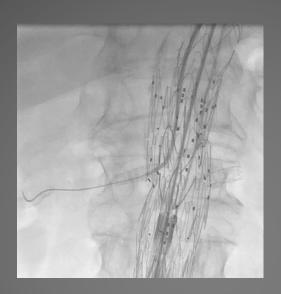
Case 1: Failed 2xFEVAR





Partial opening of graft...

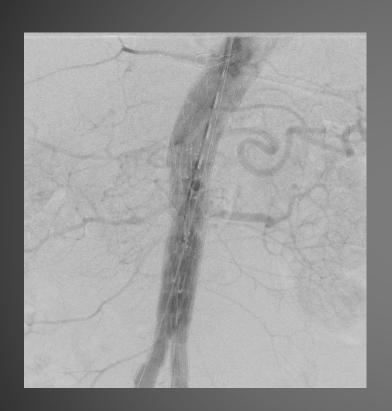


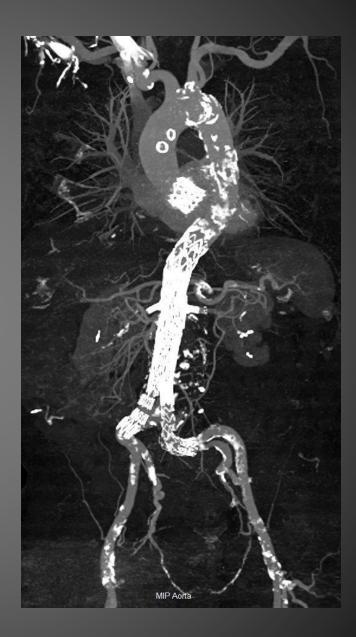












Case 2: 4xFEVAR

- 61 YO Male
- AAA 65mm
 - EVAR 4 yrs ago



Plan

- 4x FEVAR
 - Easy CT and SMA
 - Adequate sealing zone
 - Proximal extension still possible



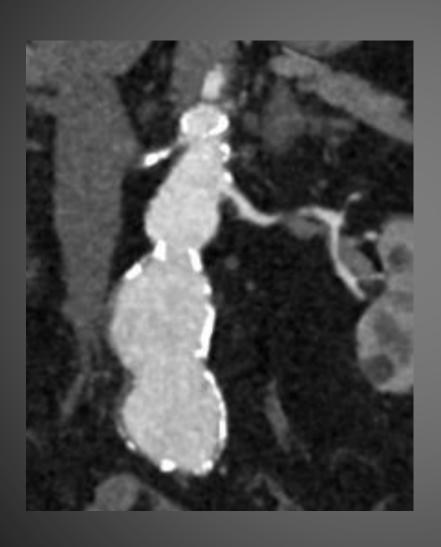
Case 3: 4xFEVAR (without stenting the celiac artery)

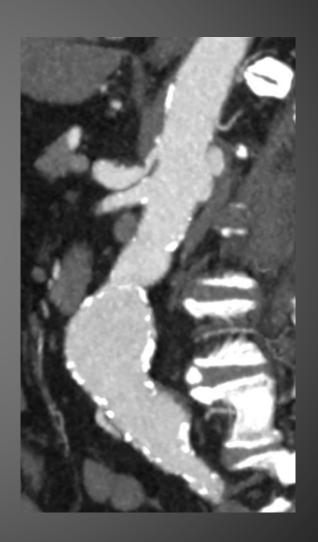
- 69 YO Male
- Juxtarenal AAA 58mm
 - Ulcer supraceliac Aorta

- Comorbidity
 - CAD
 - COPD



Preoperative CTA



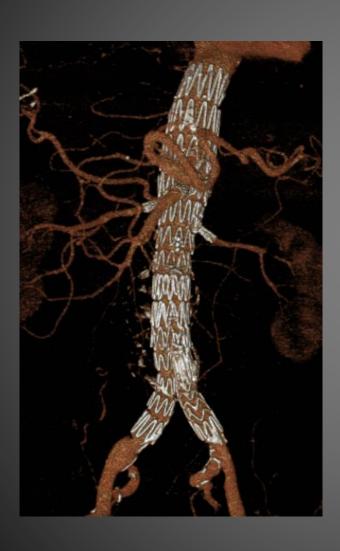


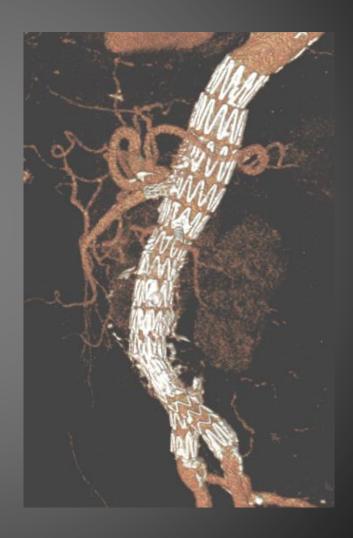
Plan

- 4x FEVAR
 - Adequate sealing zone
 - Unstented Celiac trunk



CTA 3 yrs Postop





Case 4: 3xFEVAR

- 65 YO Male
- Juxtarenal AAA
 - Dmax: 53 mm
 - Saccular
- Co-morbidity
 - CAD
 - PAD



Proximal Neck

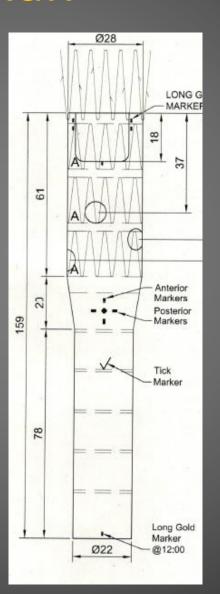




→ Proximal neck length: 0 or 40 mm?

Plan

• 3x FEVAR

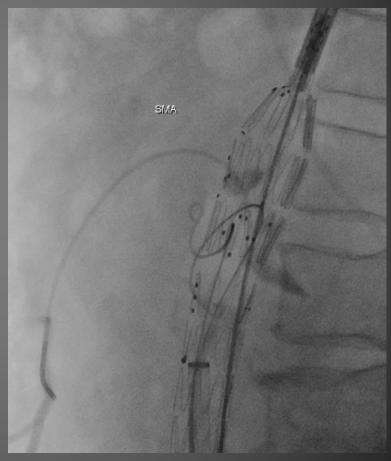








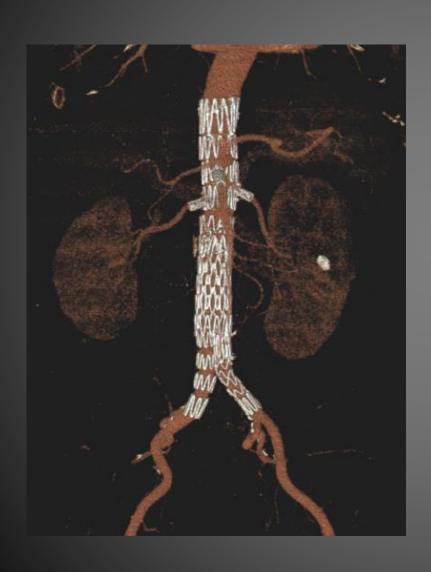








Postop CTA





Case 5: 3xFEVAR (wrong choice)

- 71 YO Male
- 2011
 - Juxtarenal AAA
 - Dmax: 54 mm

- Co-morbidity
 - CAD



Proximal Neck





→ Proximal neck length: 4-5mm, conical

Problem: Dilated Thoracic Aorta

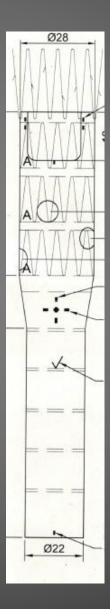


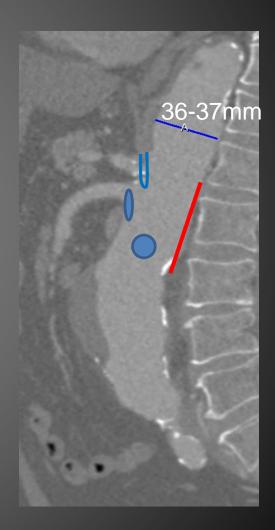


→ Dmax above Celiac trunk: 36-37mm...

Plan

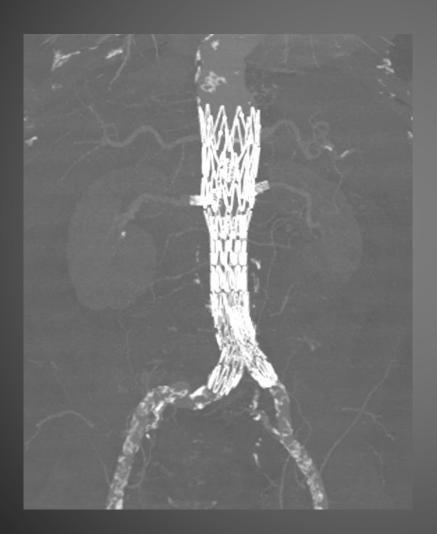
• 3x FEVAR







Postop CTA



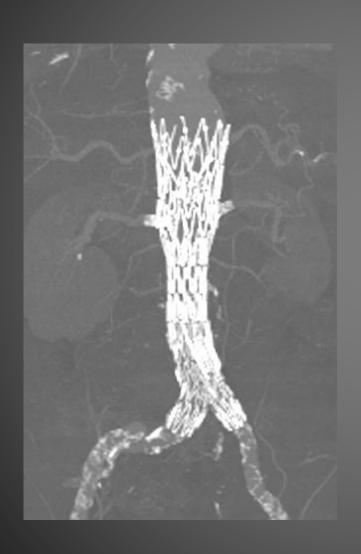


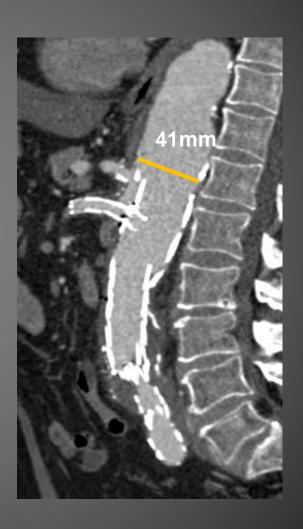
CTA @ 1 year





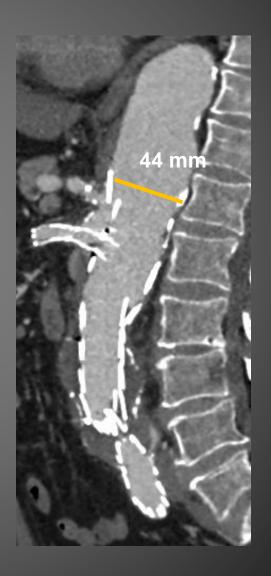
CTA @ 2 years





CTA @ 4 years





CTA @ 6 years





Treatment Plan

- Redo F/BEVAR
 - $-1x \downarrow Branch for CA$
 - 3x Fenestrations



AND after EVAR

- Meta-analysis
- Inclusion criteria
 - 1. To report AND after EVAR
 - 2. To include at least 5 patients
 - 3. To provided data on AND quantification

Meta-analysis



A Systematic Review of Proximal Neck Dilatation After Endovascular Repair for Abdominal Aortic Aneurysm

2017, Vol. 24(1) 59-67 © The Author(s) 2016 Reprints and permissions sagepub.com/journalsPermissions.nav DOI: 10.1177/1526602816673325 **S**SAGE

George N. Kouvelos, MD, MSc, PhD1, Kyriakos Oikonomou, MD1, George A. Antoniou, MD², Eric L. G. Verhoeven, MD, PhD¹,

ADSTRACT
Purpose: To provide an updated systematic literature review and summarize current evidence on proximal aortic neck Purpose: To provide an updated systematic literature review and summarize current evidence on proximal addition (AND) after endovascular aneurysm repair (EVAR). Methods: A review of the English-language medical literature dilatation (AND) after endovascular aneurysm repair (EVAR). Methods: A review of the English-language medical literature from 1991 to 2015 was conducted using MEDLINE and EMBASE to identify studies reporting AND after EVAR. Studies reporting AND after EVAR. Studies From 1991 to 2015 was conducted using PIEDLINE and EPIBASE to Identity studies reporting AND after EVAK. Studies considered for inclusion and full-text review fulfilled the following criteria: (1) reported AND after EVAK. (2) included at the studies of the stud considered for inclusion and full-text review fulfilled the following criteria: (1) reported AND after EVAR, (2) included at least 5 patients, and (3) provided data on AND quantification. The search identified 26 articles published between 1998 and 1998 a least 5 patients, and (3) provided data on AND quantification. The search identified 26 articles published between 1998 and 2015 that encompassed 9721 patients (median age 71.8 years; 9439 men). Results: AND occurred in 24.6% of patients (95% of patients). 2015 that encompassed 9/21 patients (median age /1.8 years; 9439 men). Nesults: AND occurred in 24.6% of patients (95% care of the aorta was reported by most etudias. The incidence of combined clinical across (and alot). CI 18.6% to 31.8%) over a period ranging from 13 months to 9 years after EVAX. No significant dilatation of the suprarerial part of the aorta was reported by most studies. The incidence of combined clinical events (endoleak type I, migration, distinct of the suprarerial wide and the suprarerial studies are suprarerial and suprarerial suprar part of the aorta was reported by most studies. The incidence of combined clinical events (endoleak type I, migration, CR 2R 7, 95% CI 5 43 to 151 67 not not). Conclusion: ANID affacts a considerable approach of EVAD actions and with a compared with 2% in the group without ANID affacts a considerable approach of EVAD actions and without and the compared with a considerable approach of EVAD actions and without ANID affacts a considerable approach of EVAD actions and without ANID affacts and actions and without ANID affacts a considerable approach of EVAD actions and without ANID affacts and actions and without ANID affacts and actions are actions as a considerable approach of EVAD actions and without ANID affacts and actions are actions as a considerable approach of EVAD actions and without ANID affacts are actions as a considerable approach and actions are actions as a considerable action and actions are actions as a considerable action and actions are actions as a considerable action. reintervention during follow-up) was higher in the ANID group (26%) when compared with 2% in the group without ANID (OR 28.7, 95% CI 5.43 to 151.67, p<0.001). Conclusion: ANID affects a considerable proportion of EVAR patients and was (OR 28.7, 95% CI 5.43 to 151.67, pc0,001), **Conclusion:** AND affects a considerable proportion of EVAR patients and was studies should focus on a better understanding of the pathophysiology conditions and risk factors of AND which could related to worse clinical outcome, as indicated by increased rates of type I endoleak, migration, and reinterventions. Future studies should focus on a better understanding of the pathophysiology, predictors, and risk factors of AND, which could studies to the pathophysiology of the pathophysiology of the pathophysiology.

secures another thomas warrant a different EVAR strategy and/or a closer post-EVAR surveillance strategy. related to worse clinical outcome, as indicated by increased rates of type I endolesk, migration, and relaterator. Which could studies should focus on a better understanding of the pathophysiology, predictors, and risk factors strategy, studies should focus on a better understanding of strategy and/or a closer post-EVAR surveillance strategy, indicated the pathophysiology and the pathophysiology of the pathophysiology of the pathophysiology. (OR 287, 95% CL5A5 to 151.67, periodit). Conclusion: with affects a considerable proportion of EVAR patients and was reinterventions. Future related to worse clinical outcome, as indicated by increased rates of type I endolest, migration, and risk factors of AND, which could subject to worse clinical outcome, as indicated by increased rates of type I endolests, and risk factors of AND, which could also also better understanding of the pathophysiology, predictors, and risk factors of AND, which could subject to a better understanding of the pathophysiology, predictors, and risk factors of AND, which could be a subject to worse clinical outcome, as indicated by increased rates of type I endolests. reintervention during follow-up) was higher in the AND group (46%) when compared with the interventions. Future (OR 28.7, 95% CI 5.43 to 151.67, p<0.001). Conclusion: AND affects a considerable proportion of reinterventions. Future (OR 28.7, 95% CI 5.43 to 151.67, p<0.001). Conclusion: AND affects a considerable proportion and reinterventions. Future (OR 28.7, 95% CI 5.43 to 16.1000). pair of the sorta was reported by most studies. The incidence of combined clinical events removed with 2% in the group without AND relativement during follow-up) was higher in the AND group (16%) when compared with 2% in the group without AND effects a considerable proportion of EVAR patients and was OR 287, 95% CL 543 to 151.67, p.c.0001). Conclusion: AND affects a considerable proportion of EVAR patients and was CITIEDS to STARIJ OVER a period ranging from 13 months to 3 years after EVARCING significant distance with a most studies. The incidence of combined clinical events (endolesk type I, migration, part of the acras was reported by most studies. The incidence of compared with 2% in the arrang without AND proup (26%) when compared with 2% in the arrang without AND results of the acras was reported by most studies. 2015 that encompassed 9721 patients (median age 7/18 years: 9459 men). Results: AND occurred in 74,6% of patients (median age 7/18 years: 959 men). Results: AND occurred in 74,6% of the supranent of the suprane least 5 patients, and (3) provided data on AND quantification. The search identified 2k articles published between 1990 and 185% of patients (95% of patients) and 18 patients (18 years, 9439 men). Results: AND occurred in 24.6% of patients (need an age 71.8 years, 9439 men). Results: AND significant distantion of the superarenal 2015 that encompassed 9721 patients (median age 71.8 years, after EVAR. No significant distantion of the superarenal C1 18.6% to 31.8%) over a period ranging from 15 months to 9 years after EVAR. No significant distantion of the superarenal c1 18.6% to 31.8%) over a period ranging from 15 months to 9 years after EVAR. No significant distantion of the superarenal contraction of th

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AND after EVAR

- √ 26 articles
- ✓ published between 1998 and 2015
- √9721 patients

Meta-analysis



A Systematic Review of Proximal Neck Dilatation After Endovascular Repair for Abdominal Aortic Aneurysm

Journal of Endovascular Therapy 2017, Vol. 24(1) 59-67 © The Author(s) 2016 Reprints and permissions: sagepub.com/journalsPermissions.nav DOI: 10.1177/1526602816673325 **S**SAGE

George N. Kouvelos, MD, MSc, PhD1, Kyriakos Oikonomou, MD1, George A. Antoniou, MD², Eric L. G. Verhoeven, MD, PhD¹,

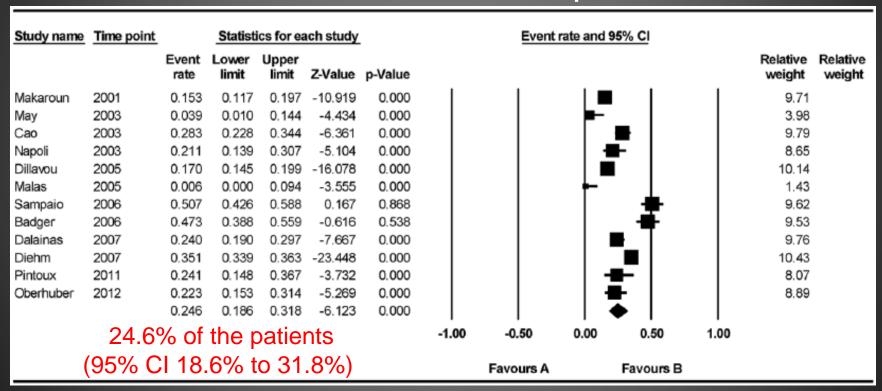
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Incidence of AND

12 studies – 8550 pts



Clinical Outcome during FU

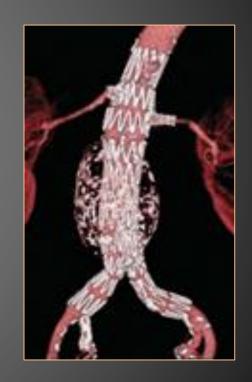
7 studies – 1759 pts

endoleak type I, migration, reintervention

| | Aortic neck dilatation | | No aortic neck dilatation | | Odds Ratio | | | Odds Ratio |
|-----------------------------------|--------------------------------|--------|------------------------------------|-------|------------|----------------------------|------|--|
| Study or Subgroup | Events | Total | Events | Total | Weight | M-H, Random, 95% CI | Year | M-H, Random, 95% CI |
| Makaroun | 1 | 48 | 0 | 266 | 11.4% | 16.83 [0.68, 419.35] | 2001 | |
| Napoli | 6 | 19 | 1 | 71 | 14.8% | 32.31 [3.59, 291.05] | 2003 | |
| May | 2 | 2 | 3 | 49 | 11.4% | 66.43 [2.64, 1670.67] | 2003 | |
| Cao | 13 | 65 | 5 | 165 | 18.4% | 8.00 [2.72, 23.51] | 2003 | |
| Dillavou | 10 | 124 | 20 | 605 | 19.1% | 2.57 [1.17, 5.63] | 2005 | |
| Dalainas | 49 | 58 | 0 | 184 | 12.5% | 1922.68 [109.99, 33608.86] | 2007 | · · |
| Oberhuber | 7 | 23 | 0 | 80 | 12.4% | 73.18 [3.98, 1345.13] | 2012 | |
| Total (95% CI) | 26% | 339 | 2% | 1420 | 100.0% | 28.70 [5.43, 151.67] | | |
| Total events | 88 | | 29 | | | | | |
| Heterogeneity: Tau ² = | 3.62; Chi ² = 34.03 | df = 6 | P < 0.00001); I ² = 829 | ó | | | Ļ | .01 0.1 1 10 100 |
| Test for overall effect: | Z = 3.95 (P < 0.00 | 01) | | | | | U | Favours dilatation Favours no dilatation |

Suprarenal AND?

- Suprarenal aorta does not seem to dilate significantly over time (5 studies)
- Differences in stiffness, thickness between suprarenal and infrarenal aorta
- Fenestrated EVAR has shown low rates of migration and type I endoleak, although AND following fenestrated EVAR has not been investigated adequately.



Comparison of outcomes for double fenestrated endovascular aneurysm repair versus triple or quadruple fenestrated endovascular aneurysm repair in the treatment of complex abdominal aortic aneurysms

Athanasios Katsargyris, MD,^a Kyriakos Oikonomou, MD,^a George Kouvelos, MD,^a Hozan Mufty, MD,^a Wolfgang Ritter, MD,^b and Eric L. G. Verhoeven, MD, PhD,^a Nuremberg, Germany

(J Vasc Surg 2017; ■:1-8.)

Standard (2x) FEVAR

VS

Complex (3x-4x) FEVAR







Stent-graft Design

- Standard (2x) FEVAR
 - N=202 (48.8%)

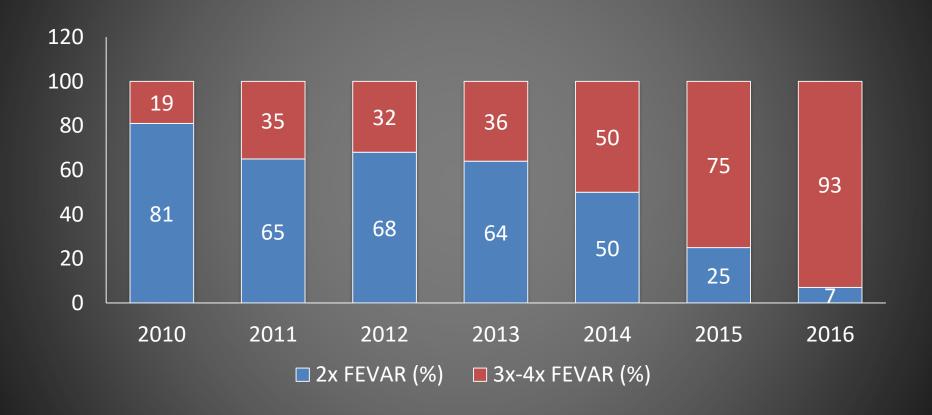
- Complex (3x-4x) FEVAR
 - N=212 (51.2%)





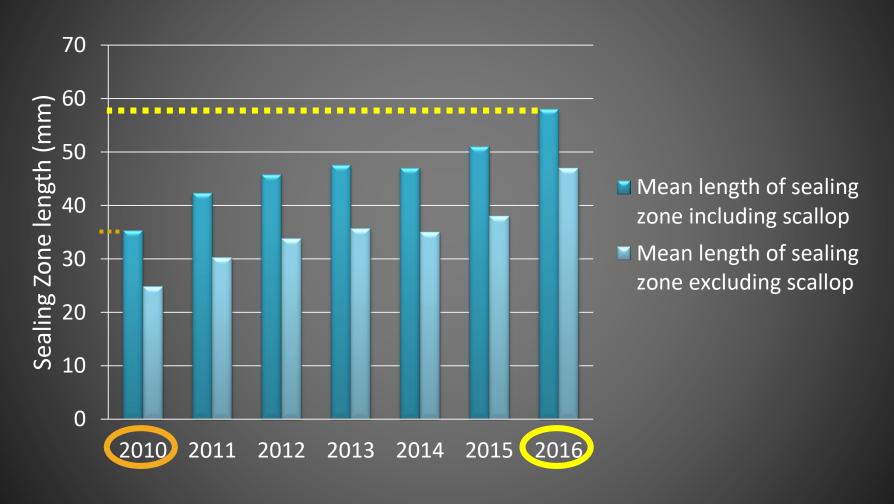


Evolution of Stent-graft Design



个 Use of Complex FEVAR over the years...

Evolution of Sealing Zone



个 Sealing zone length over the years...

Technical Success

Overall: N=403/414 (97.3%)

- Standard (2x) FEVAR
 - $-\overline{N}=198/202(98\%)$
- Complex (3x-4x) FEVAR
 - N=205/212 (96.7%)

30-Day Mortality

Overall: N=2/414 (0.5%)

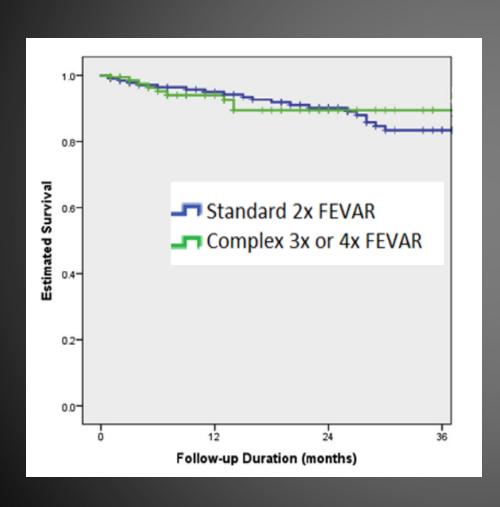
- Standard (2x) FEVAR
 - -N=1/202(0.5%)
- Complex (3x-4x) FEVAR
 - -N=1/212 (0.5%)

Major Complications

Overall: N=43/414 (10.4%)

- Standard (2x) FEVAR
 - -N=19/202 (9.4%)
- Complex (3x-4x) FEVAR
 - -N=24/212 (11.3%)

Estimated Survival



Standard (2x) FEVAR

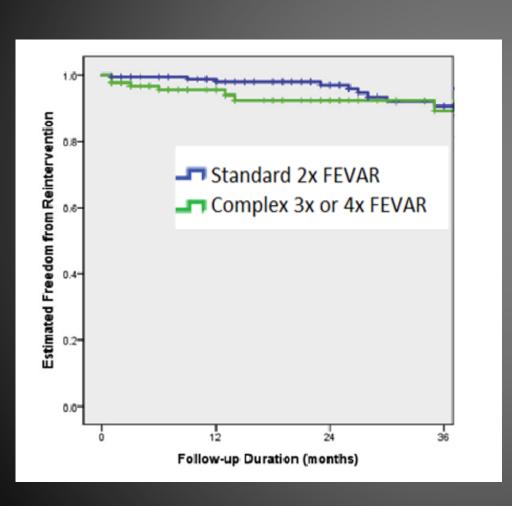
- 95 ± 1.7% at 1 year
- $-83.4 \pm 3.6\%$ at 3 years

Complex (3x-4x) FEVAR

- $-94 \pm 2.4\%$ at 1 year
- $-89.4 \pm 3.5\%$ at 3 years

P=0.96, NS

Freedom from Reintervention



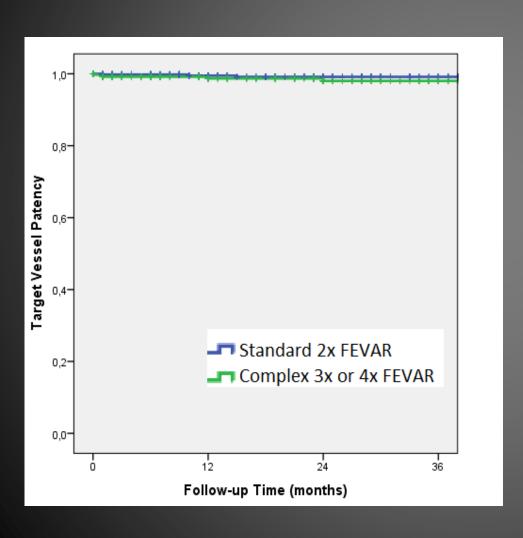
Standard (2x) FEVAR

- $-97.9 \pm 1.2\%$ at 1 year
- $-90.5 \pm 3.1\%$ at 3 years

Complex (3x-4x) FEVAR

- $-95.4 \pm 2.0\%$ at 1 year
- $-90.1 \pm 4.2\%$ at 3 years

Target Vessel Patency



Standard (2x) FEVAR

- $-99.2 \pm 0.4\%$ at 1 year
- $-98.6 \pm 0.6\%$ at 3 years

Complex (3x-4x) FEVAR

- $-98.7 \pm 0.6\%$ at 1 year
- $-98.0 \pm 0.9\%$ at 3 years

Take Home Message



- Standard EVAR only in good neck anatomy
- 3xFEVAR has replaced 2xFEVAR
- In dilated thoracic aorta/bulging of suprarenal aorta in sagital view: 4x FEVAR

- GOAL
 - more durable results
 - easier repair in case of extension of disease....