

The logo for LING, featuring the letters 'LING' in a white, sans-serif font. The letters are positioned over a stylized graphic of three curved, overlapping brushstrokes in dark blue, red, and yellow. The background of the slide is light blue with large, faint, curved brushstrokes in a darker shade of blue.

LING

Midterm outcome of Endoanchors for prevention of endoleak and migration in challenging necks

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The Vascular Experts, CT, USA

Disclosure

Consultant

- Medtronic
- Cook
- Endologix

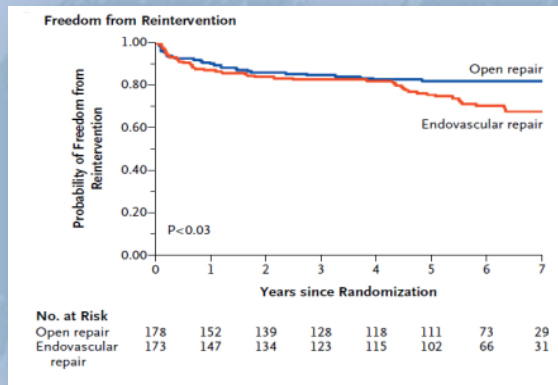
Research grants

- Cook
- Endologix

Major Studies Show Higher 2nd Interventions in EVAR vs. Open Repair

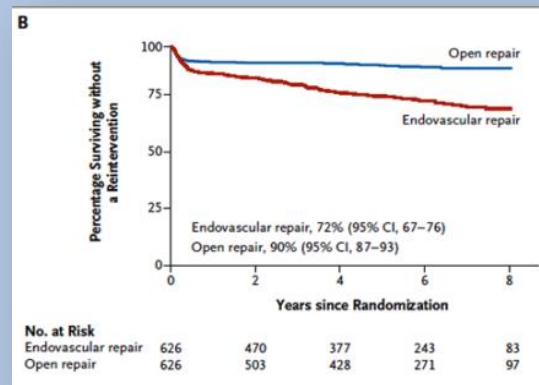
DREAM

De Bruin *et al.* NEJM 2010



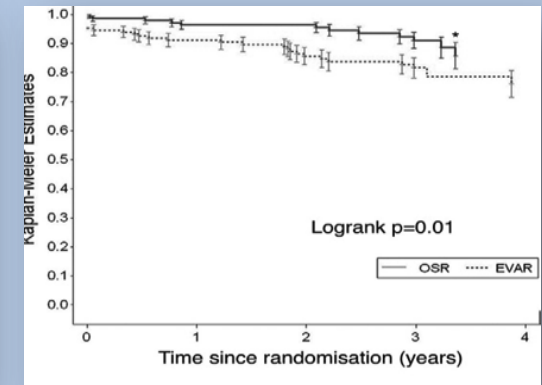
EVAR-1

Greenhalgh *et al.* NEJM 2010



ACE

Becquemin *et al.* JVS 2011



- Late ruptures in EVAR, none in open surgery
- Unlike open repair, endoleaks and migration are major complications of EVAR
 - Predictors for rupture, and risks increase with time
- Open surgery remains a ‘more durable option’
 - In ACE, 16% re-interventions in EVAR vs. 2.4% for open repair at 3 yr median f/u

Hostile proximal necks further challenge EVAR

Meta-Analysis of 7 major studies in EVAR by Antoniou et al¹ compared outcomes in hostile vs. friendly neck anatomies (total patients N = 1559)

| Study | Sample Size | Endografts |
|------------------------|-------------|----------------------------------|
| Torsello et al, 2011 | 177 | Endurant |
| AbuRahma et al, 2010 | 238 | AneuRx, Excluder, Zenith, Talent |
| Hoshina et al, 2010 | 129 | Excluder, Zenith |
| Abbruzzese et al, 2008 | 565 | AneuRx, Excluder, Zenith |
| Choke et al, 2006 | 147 | Talent, Zenith, Excluder, AneuRx |
| Fulton et al, 2006 | 84 | AneuRx |
| Fairman et al, 2004 | 219 | Talent |

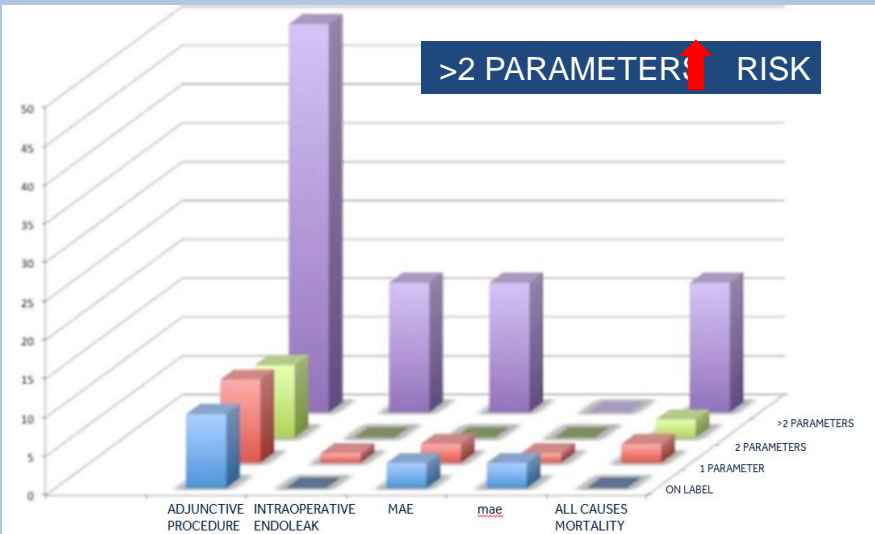
- **Type I endoleaks 4.5x more likely at 1-year** after endograft implantation in hostile proximal aortic neck anatomy (P = .010)
- **Aneurysm-related mortality risk 9x greater** in hostile neck anatomy (P= .013)

¹Antoniou GA et al. JVS. 2013;57(2):527-38.

Influence of multiple hostile neck parameters

Speziale et al. shows greater proximal seal complication risks as the number of hostile neck parameters increases

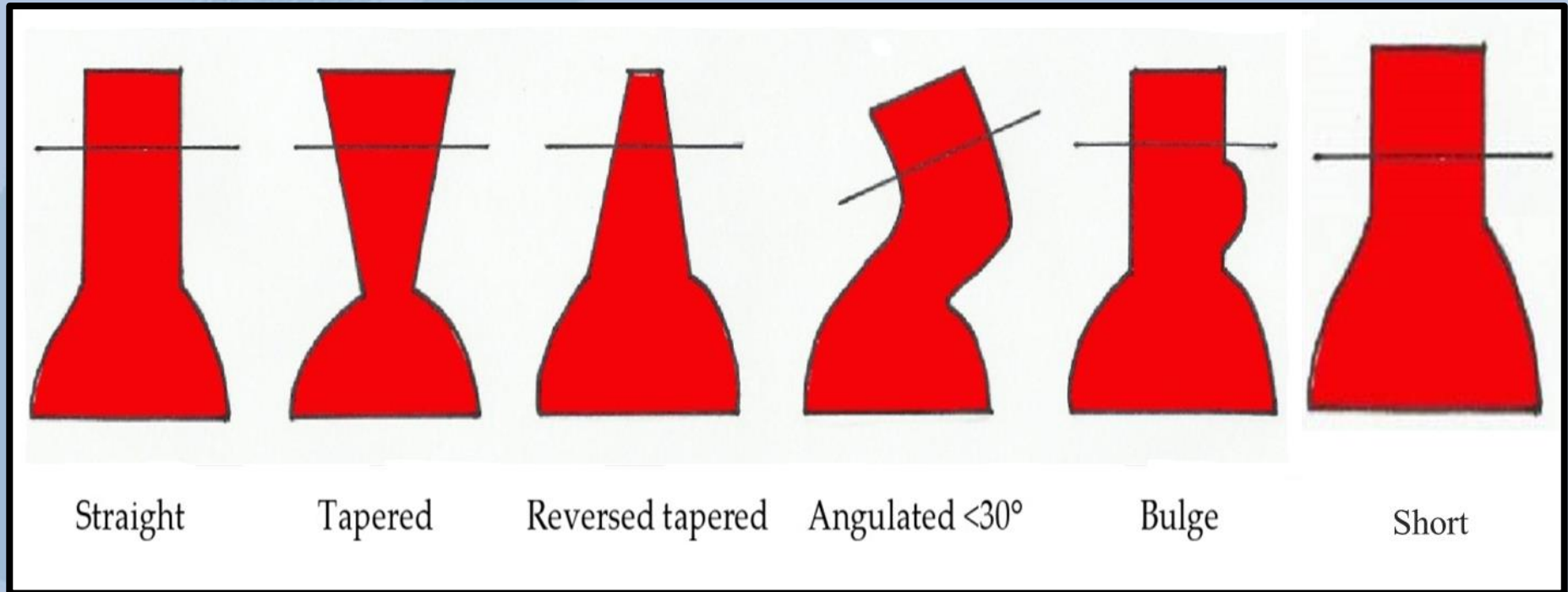
| Neck hostility | Intra-op adjunctive procedure | Intra-op endoleaks | All cause mortality |
|----------------------------|-------------------------------|--------------------|---------------------|
| On label | 9.9% | 0.5% | 1.1% |
| 2 hostile neck parameters | 26.7% | 6.7% | 13.3% |
| >2 hostile neck parameters | 50% | 16.7% | 16.7% |



Greater than 1 hostile neck parameter *substantially* increases mortality, major adverse events, intra-op endoleaks and adjunctive procedures

Speziale et al, Annals VS. 2014

NOT ALL NECKS ARE THE SAME

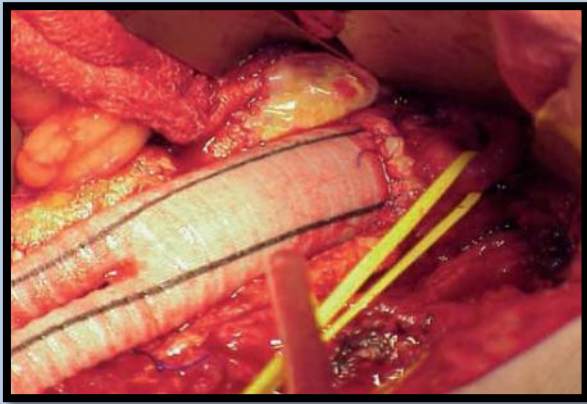
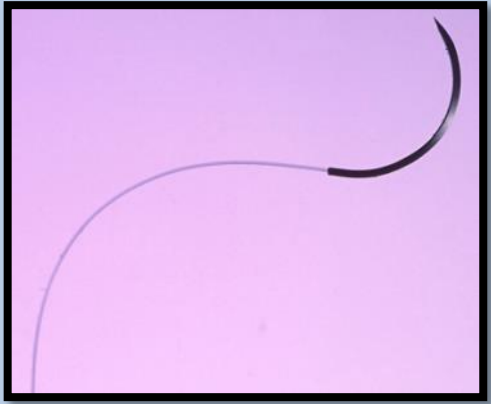


Source: Ionel Droc, Dieter Raithel and Blanca Calinescu (2012). Abdominal Aortic Aneurysms - Actual Therapeutic Strategies, Aneurysm, Dr. Yasuo Murai (Ed.), ISBN: 978-953-51-0730-9, InTech, DOI: 10.5772/48596

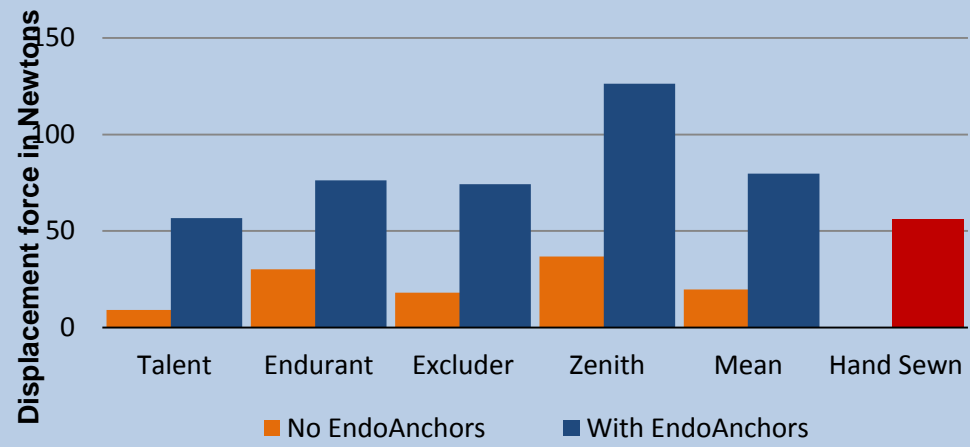
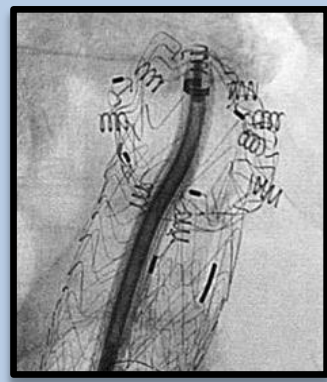
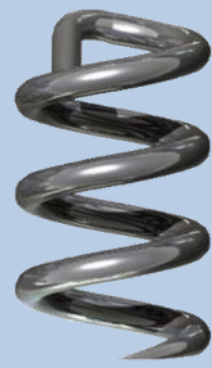
Tailored Seal and Fixation of EndoAnchors

Create the stability of a surgical anastomosis in EVAR and TEVAR

Surgical Anastomosis



EndoAnchoring



Melas et al. JVS 2012;55(6):1726-33

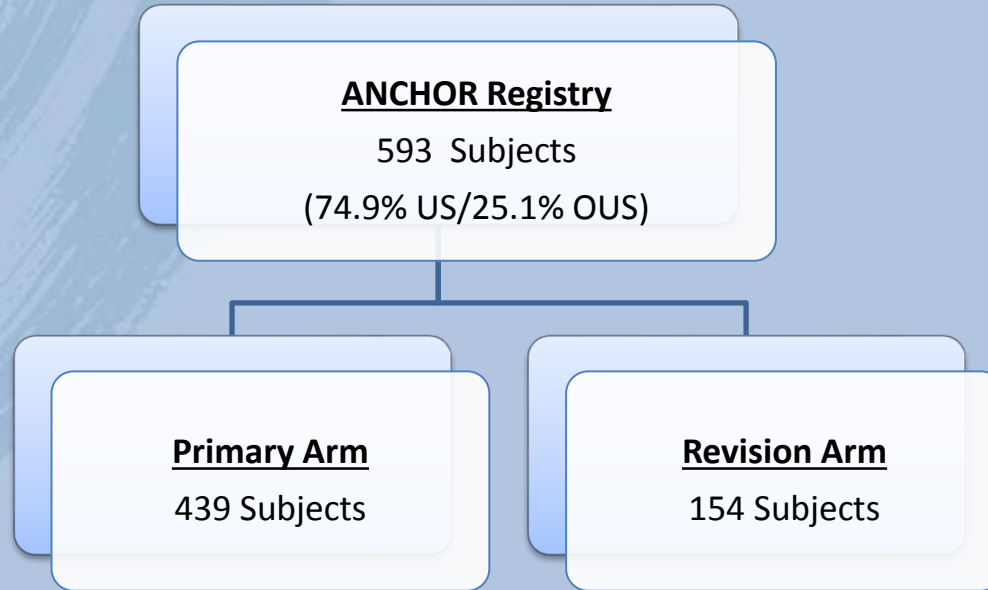
Case images from John Aruny MD, Bart Edward Muhs, MD, PhD.

ANCHOR registry capturing real-world usage

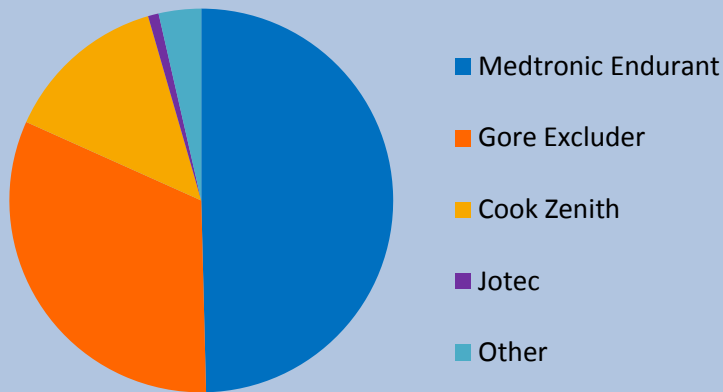
| | |
|----------------------------------|--|
| Registry Principal Investigators | Europe: Dr. Jean-Paul de Vries – Chief of Vascular Surgery, St. Antonius Hospital |
| | US: Dr. William Jordan – Chief of Vascular Surgery/Endovascular Therapy, Emory University School of Medicine |
| Registry Design | Prospective, observational, international, multi-center, dual-arm Registry |
| Treatment Arms | “Primary” – Up to 1000 pts, Prophylactic |
| | “Revision” – Up to 1000 pts, Therapeutic |
| Enrollment & Duration | Enrollment began 2012 and patients will be followed for 5 Years |
| Follow-up | Per Standard of Care at each center & discretion of Investigator |

Over 600 Patients enrolled as of November 2015

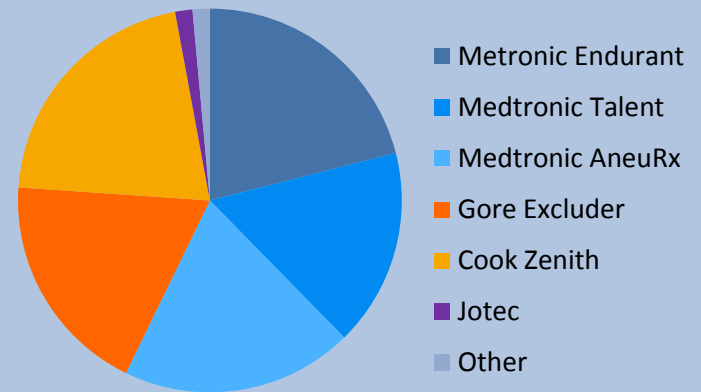
ANCHOR Registry – Enrollment Status (data cut Aug 10, 2015)



Stent Grafts - Primary Arm



Stent Grafts - Revision Arm

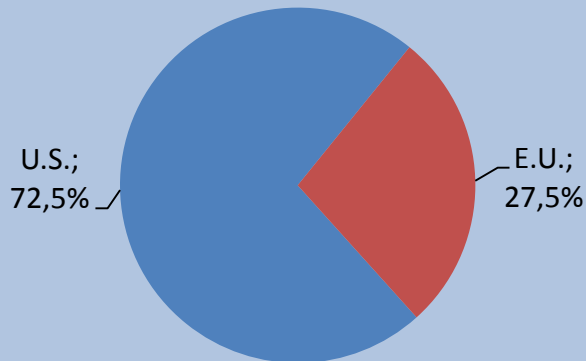


ANCHOR Registry – Prophylactic Use Data Highlights

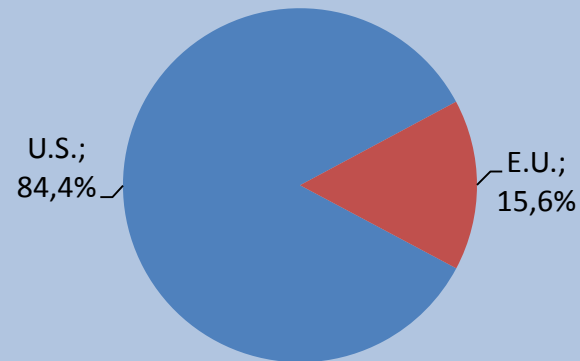
Prophylactic Use

- This analysis will summarize the outcome in **269** patients
- Clinical follow-up: **21.3 months** (0 – 39 months)
- CT follow-up: **8.2 months** (range 0 – 27 months)
- Excludes revisions or treatment of Type Ia endoleaks at Index
- 11.2% urgent cases (rupture or symptomatic)

Sites



Subjects

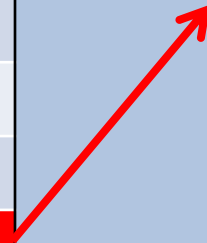


ANCHOR Registry – Prophylactic Subjects

Baseline Characteristics & aneurysm measurements

| Baseline Characteristics | |
|------------------------------------|-----------------|
| Male (n/n, %) | 77.7% (209/269) |
| Age | 74.4 |
| Aneurysm Measurements (Core Lab) | |
| Number with Baseline CT Scans | 205 |
| Aneurysm Diameter | 55.5 mm |
| Proximal Neck Length | 16.6 mm |
| Infrarenal Diameter | 25.7 mm |
| Suprarenal Angulation | 15° |
| Infrarenal Angulation | 35° |
| Average Neck Calcium Thickness | 1.1 mm |
| Conical Neck (>10%/10mm) | 41.0% |
| Hostile Necks | 77.6% |

| Definitions for Hostile Neck Criteria | Threshold |
|---------------------------------------|-----------|
| Aortic Diameter at Renals | 28 |
| Proximal Neck Length | 10 |
| Infrarenal Angulation to Bifurcation | 60 |
| Neck Thrombus Avg Thickness | 2 |
| Neck Thrombus Circum >1mm | 180 |
| Neck Calcium Avg Thickness | 2 |
| Neck Calcium Circum >1mm | 180 |



ANCHOR Registry – Prophylactic Subjects

PROXIMAL ENDOLEAKS AND MIGRATION

MEAN FOLLOW-UP 8.2 MONTHS

| Type Ia Endoleaks | All Primary Cases | | |
|-------------------|-------------------|-----|------|
| | 1a ELs | CTs | % |
| | 3 | 177 | 1.7% |

| Endograft Migration (>10mm) | All Primary Cases | | |
|-----------------------------|-------------------|-----|------|
| | Migration | CTs | % |
| | 0 | 112 | 0.0% |

Migration was assessed in comparison to the 1-month CT scan

ANCHOR Registry – Prophylactic Subjects

SAC DIAMETER CHANGES

| Sac Diameter Changes | | Patients |
|--|--|--------------------------|
| All Prophylactic Patients <i>Mean 8 months</i> | >5mm Regression | 42 27.3% |
| | >5mm Enlargement | 1 0.6% |
| | Patients | 154 |
| | Prophylactic Patients with 1-Year CTs <i>9-12 month window</i> | >5mm Regression 64.1% |
| | >5mm Enlargement 0 0.0% | |
| | Patients | 39 |

*Sac regression/enlargement was assessed in comparison to the 1-month CT scan.
Analysis includes only those patients with a 1-month CT and at least one more CT obtained after 1 month.*

ANCHOR Registry – Prophylactic Subjects

WHEN TO USE ENDOANCHORS *TO PREVENT/MITIGATE TYPE 1A ENDOLEAKS*

- To improve durability of EVAR for “hostile” necks
 - Calcium, thrombus, angulated, conical, short
- Current ANCHOR registry analysis demonstrates no migration and <2% Type 1a EL in Primary Prophylactic cases (8.2 month mean f/u)

Do EndoAnchors have value in preventing proximal neck complications in patients with challenging neck anatomy?

The EVAR Durability Question and a Potential Solution

- In absence of randomized clinical trial, propensity matched analysis of Study vs Control EVAR groups can provide insight.
- Two patient cohorts:
 - **EndoAnchor group** – the current “Primary Prophylaxis” cohort from the ANCHOR registry (235 patients)
 - **Control group** – 115 patients treated over the 4 years prior to EndoAnchor availability at three institutions

The EVAR Durability Question and a Potential Solution

Methodology

- Pre-EVAR baseline CTs evaluated by Core Lab for both groups
- 19 baseline variables entered into a propensity matching algorithm (SPSS v22; binary logistic regression with group as the independent variable)
- Match:
 - 103 patients in each group
 - Well-matched by the 19 baseline variables
- Analysis:
 - Primary Endpoint is a composite indicative of “proximal neck failure”
 - Including Type Ia EL, Sac Enlargement, Migration, Neck Dilatation

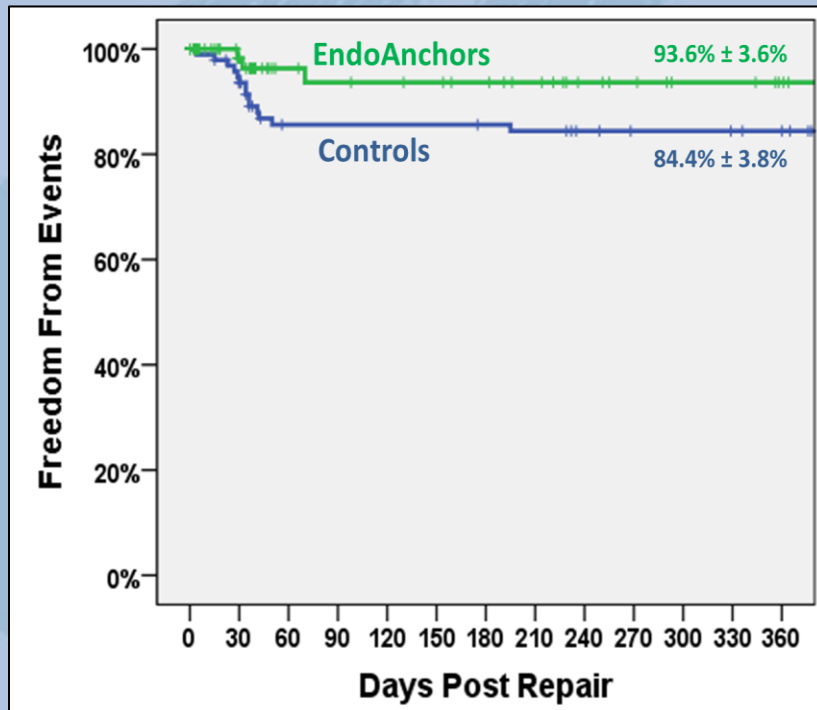
The EVAR Durability Question and a Potential Solution

Baseline anatomy in propensity-matched cohorts

| Anatomic Measures for Propensity Matching | Controls N = 103 | EndoAnchors N = 103 | P Value |
|---|---------------------|------------------------|---------|
| Max AAA Diameter | 56 ± 13 mm | 56 ± 10 mm | .674 |
| Suprarenal Diameter | 27 ± 4 mm | 27 ± 3 mm | .999 |
| Diameter at Lowest Renal | 25 ± 4 mm | 26 ± 4 mm | .458 |
| Proximal Neck Length | 23 ± 14 mm | 20 ± 13 mm | .093 |
| Suprarenal Angulation | 16 ± 11° | 17 ± 13° | .664 |
| Infrarenal Angulation | 37 ± 16° | 37 ± 18° | .885 |
| Neck Thrombus | 23 ± 54° | 38 ± 71° | .107 |
| Neck Calcium | 20 ± 29° | 19 ± 30° | .845 |
| Necks <10mm Length | 18.4% | 26.5% | .097 |

The EVAR Durability Question and a Potential Solution

Initial results: Composite endpoint of proximal neck failure



Mean follow-up only 6 months (range 1-12 months)

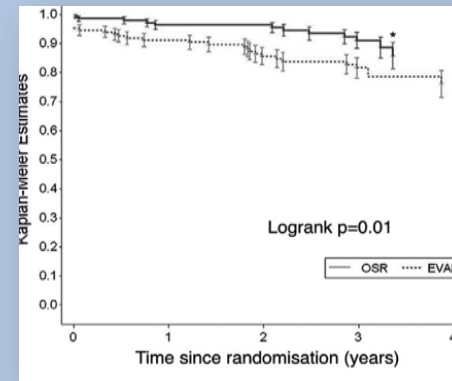
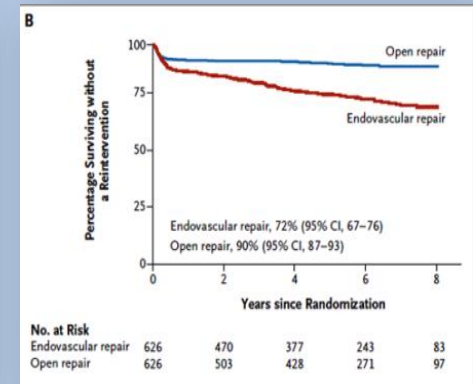
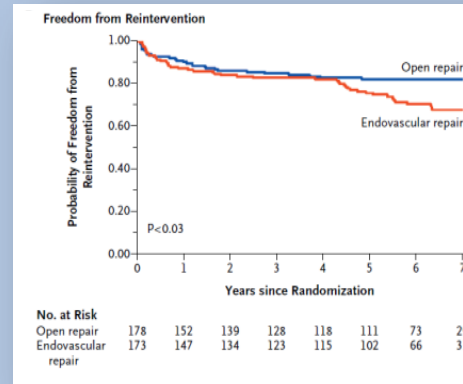
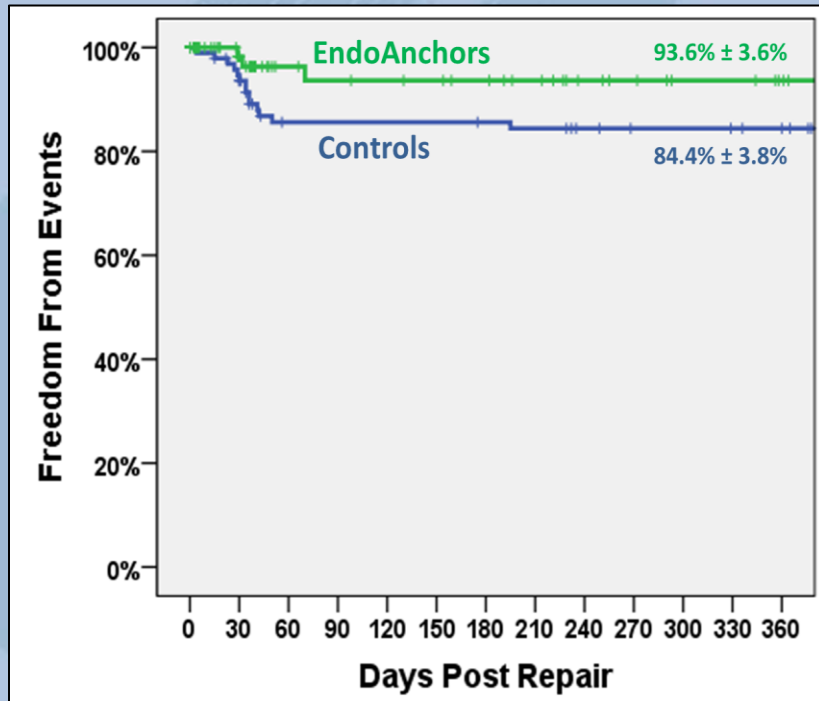
No statistical tests performed, pending longer term data in the ANCHOR test group

Initial observations:

- While the numbers are small, there are trends toward reduction in Proximal Neck Failure in EndoAnchor group
- Definitive results forthcoming, with full 12-month data for both groups

The EVAR Durability Question and a Potential Solution

Initial results:
Composite endpoint of proximal neck failure



The EVAR Durability Question and a Potential Solution

Conclusions

- In absence of randomized clinical trial, a historical control group with patient-level data allowed a propensity analysis to be performed
- An adequate match was obtained with EndoAnchor Primary Prophylactic group and a historical control group of patients undergoing EVAR at three institutions
- Initial observations suggest the methodology is feasible, but longer term data required to compare outcomes in patients undergoing EVAR with and without EndoAnchors



Thank you

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LING

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