3-year outcomes of endosuture aneurysm repair in patients with wide neck abdominal aneurysm form the ANCHOR registry and the HERCULES RCT design

Michel M.P.J. Reijnen
Department of surgery, Rijnstate, Arnhem, and the Multi-Modality Medical Imaging Group, University of Twente, Enschede, the Netherlands

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Disclosure

Speaker name:
Michel Reijnen

I have the following potential conflicts of interest to report:

- [x] Consulting
- [ ] Employment in industry
- [ ] Stockholder of a healthcare company
- [ ] Owner of a healthcare company
- [ ] Other(s)

- [ ] I do not have any potential conflict of interest
Wide Necks associated with more complications

- Definition of wide necks varies in literature: ≥25mm up to ≥30mm
- Systematic reviews conclude patients with wide necks have higher risk of various graft related complications

### Endovascular aneurysm repair in patients with a wide proximal aortic neck: A systematic review and meta-analysis of comparative studies

<table>
<thead>
<tr>
<th></th>
<th>Hazard ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reintervention</td>
<td>2.06</td>
<td>0.006</td>
</tr>
<tr>
<td>Sac expansion</td>
<td>10.07</td>
<td>0.009</td>
</tr>
<tr>
<td>Type IA endoleak</td>
<td>6.69</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Rupture</td>
<td>5.10</td>
<td>0.01</td>
</tr>
</tbody>
</table>


### Systematic review and meta-analysis of endovascular abdominal aortic repair in large diameter infrarenal necks

<table>
<thead>
<tr>
<th></th>
<th>Wide neck</th>
<th>Normal neck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reintervention</td>
<td>17.4% (n=709)</td>
<td>12.3% (n=2295)</td>
</tr>
<tr>
<td>Sac regression</td>
<td>47.6% (n=412)</td>
<td>55.4% (n=841)</td>
</tr>
<tr>
<td>Type IA endoleak</td>
<td>11.3% (n=558)</td>
<td>3.1% (n=2251)</td>
</tr>
<tr>
<td>Migration</td>
<td>4.9% (n=450)</td>
<td>0.8% (n=2008)</td>
</tr>
</tbody>
</table>

Reinforce the proximal seal

Protect against neck dilatation

Promote greater sac regression

Predictors of early aortic neck dilatation after endovascular aneurysm repair with EndoAnchors

Apostolos K. Tassiopoulos, Kenneth Ouellet, and Nieuwenhuijzen, TP

ABSTRACT
Objective: Dilatation with late endoleaks deepening EVAR with longitudinal levels c
Methods: The study 257 consecutive pat EndoAnchors implant the initial EVAR with three levels with 130 repeat imaging at 120 analyses were perf ribs 0 month anatomic run in eg
Results: The mean 10 mm below the 0.5 mm above the 0 level 5 mm distal to stent patients (81%) were (prophylactic) neck or suprarenal stent.
Conclusions: Aortic EndoAnchors have...

ABSTRACT
Objective: The objective of this study was to examine whether prophylactic use of EndoAnchors (Medtronic, Santa Rosa, Calif) contributes to improved outcomes after endovascular aneurysm repair (EVAR) of abdominal aortic aneurysms through 2 years.

Methods: The Aneurysm Treatment Using the Heli-FX Aortic Sacummetry System Global Registry (ANCHOR) subjects who received prophylactic EndoAnchors during EVAR were considered for this analysis. Imaging data of retrospective subjects who underwent EVAR at ANCHOR enrolling institutions were obtained to create a control sample. Nineteen baseline anatomic measurements were used to perform propensity score matching, yielding 99 matched pairs.

Results: Freedom from type la endoleak was 97.0% ± 3.1% in the ANCHOR cohort and 94.1% ± 2.5% in the control cohort through 2 years (P = .34). The 2-year freedom from neck dilation in the ANCHOR and control cohorts was 90.4% ± 5.6% and 87.3% ± 4.3%, respectively (P = .66). 2-year freedom from sac enlargement was 97.0% ± 2.1% and 94.0% ± 3.0%, respectively (P = .67). No device migration was observed. Aneurysm sac regression was observed in 81.1% ± 15.9% of ANCHOR subjects through 2 years compared with 48.7% ± 59% of control subjects (P = .03). Cox regression analysis found an inverse correlation between number of hostile neck criteria met and later sac regression (P = .05). Preoperative neck thrombus circumference and infrarenal diameter were also variables associated with later sac regression, although not to a significant degree (P = .10 and P = .06, respectively). Control subjects with thrombus were significantly less likely to experience later sac regression than those without thrombus (8% and 43%, respectively; P = .001). In ANCHOR subjects, rate of regression was not significantly different in subjects with or without thrombus (53% and 36%, respectively; P = .82). Control subjects with wide aortic necks (>28 mm) were observed to experience sac regression at a lower rate than subjects with smaller diameter necks (10% and 44%, respectively; P = .004). Wide neck and normal neck subjects implanted with EndoAnchors experienced lesser sac regression at roughly equal rates (44% and 33%, respectively; P = .30).

Conclusions: A propensity-matched cohort of subjects undergoing EVAR the rate of sac regression in subjects treated with EndoAnchors was significantly higher. EndoAnchors may mitigate the adverse effect of wide infrarenal necks and neck thrombus on sac regression, although further studies are needed to evaluate the long-term effect of EndoAnchors. (J Vasc Surg 2018;67:1699-1707)
Purpose: To collect "real world" use of the Heli-FX™ EndoAnchor™ System over a broad spectrum of geographies, by a wide variety of practicing clinicians, and with a minimal degree of subject selection criteria.

ANCHOR registry (n=1032 AAA subjects enrolled)

Primary arm (n=771)

Not wide (n=699)

Wide neck (n=72)

Revision arm (n=261)

Wide neck defined as:
proximal neck diameter ≥28mm but ≤32mm
proximal neck lengths ≥ 10mm

Follow-up visits at 1, 12, 24, 36, 48 and 60 months

Multi-center, post-market, non-interventional, non-randomized, prospective study with enrollment from April 2012 to December 2019

Sponsor: Medtronic Vascular, Inc., California, USA

Principal Investigators

• Jean-Paul de Vries, Universitair Medisch Centrum Groningen, Netherlands
• William Jordan, Emory University, United States
Results: Baseline Characteristics of Wide Neck cohort (n=72)

- Tobacco use: 83.3%
- Hypertension: 80.6%
- Cardiac disease: 59.7%
- Hyperlipidemia: 55.6%
- Renal Insufficiency: 26.4%

- Hostile neck: 94.4%
- Infrarenal Angulation: 32.8 ± 28.2°
- Conical neck: 23.6%
- Max aneurysm diameter: 61.5 ± 11.7mm

11.1% Female
73.1 ± 8.6 years (n=72)
Results: Key Outcomes

### 3-year Kaplan Meier Analyses

<table>
<thead>
<tr>
<th>Event</th>
<th>Kaplan-Meier Estimate</th>
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<tbody>
<tr>
<td>FF All-Cause Mortality</td>
<td>72.4 ± 5.8%</td>
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<tr>
<td><strong>FF Aneurysm Related Mortality</strong></td>
<td>98.6 ± 1.4%</td>
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<td>FF Aneurysm Rupture</td>
<td>100%</td>
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<tr>
<td>FF Conversion</td>
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Kaplan-Meier estimate made at end of time interval. Number of subjects at risk at the beginning of interval.

One ARM on day 13 due to multisystem organ failure.
## Results: Key Outcomes

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Kaplan-Meier estimate made at end of time interval. Number of subjects at risk at the beginning of interval.

Graph: Days from Initial Procedure

- **FF Type IA Endoleak:** 98.5 ± 1.5%
- Number of subjects at risk: 72 to 62
- One Type IA EL at end of procedure, which self resolved
Results: ESAR Sac Dynamics

- Literature shows positive association between sac regression and long term survival\(^1\)
- ESAR shows consistent sac regression rates in the wide neck cohort

Summary ANCHOR analysis

• Literature demonstrates that patients with wide necks are at greater risk for Type Ia endoleaks, rupture, secondary procedures, and mortality

• Wide neck ANCHOR patients demonstrate positive outcomes through 3 years, comparable to standard EVAR in favorable anatomies

• A study with a head-to-head comparison is needed to clarify the role of ESAR in wide neck patients
Methods: HERCULES Trial Overview

Purpose: To compare ESAR to standard EVAR clinical outcomes in treatment of infrarenal AAA in patients having wide proximal aortic neck diameters (≥ 28 mm and ≤ 32 mm)

Randomization
1:1 stratified by ESAR/EVAR (up to 300 pts)

ESAR
Endurant II/IIIs with Heli-FX EndoAnchor implants

Primary: Composite based on core lab data from CT with contrast imaging of freedom from:
1. Type IA endoleak AND
2. Migration of proximal portion of stent graft ≥ 5 mm (compared to 1-month imaging) AND
3. Aneurysm sac growth ≥ 5 mm (compared to 1-month imaging)

Prospective, multicenter, global, randomized controlled post-market trial at 40 sites in EU and US

EVAR
Endurant II/IIIs only

The following secondary endpoints will be evaluated using core lab data:
• Freedom from Type Ia endoleaks
• Freedom from migration of the proximal portion of the stent graft ≥ 5 mm (compared to 1-month imaging)
• Freedom from aneurysm growth ≥ 5 mm (compared to 1-month imaging)
• Freedom from neck dilatation ≥ 3 mm

Follow-up visits at 1, 12, 24, 36, 48 and 60 months
Methods: Trial Administration

> Sponsor: Rijnstate, Arnhem, the Netherlands

> Collaborator: Medtronic Vascular, Inc., California, USA

> Principal Investigators
  
  • Michel Reijnen, Rijnstate, the Netherlands
  
  • Konstantinos Donas, Asklepios Clinic Langen, Germany

> NAMSA (Minnesota, USA)
  
  • Core Lab (imaging)
  
  • Electronic data capture (EDC) and monitoring activities
Methods: Trial Cohort

- Up to 300 patients with an infrarenal AAA having wide proximal aortic neck diameters (≥ 28 mm and ≤ 32 mm)
- Up to 40 sites (US and EU)

Countries selected to participate in the HERCULES Trial

<table>
<thead>
<tr>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>Switzerland</td>
<td>United Kingdom</td>
<td>United States</td>
</tr>
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</table>
Methods: Key Inclusion and Exclusion Criteria

Key Inclusion Criteria

• Infrarenal neck diameter $\geq 28 \text{ mm and } \leq 32 \text{ mm}$
• Proximal neck length $\geq 10\text{mm}$
• Eligible anatomy for treatment with the Endurant II/IIIs endograft and Heli-FX EndoAnchors **according to the IFU of both devices**

Key Exclusion Criteria

• Anatomy outside the IFU of the Endurant II/IIIs endograft and/or Heli-FX EndoAnchors
Methods: Patient Selection

Up to N=300 subjects to be randomized (1:1)

- ESAR Arm: Endurant II/IIs + Heli-FX EndoAnchors
- EVAR Arm: Endurant II/IIs only

Subject Screening:
Does patient meet all I&E criteria and provide informed consent?

Core Lab Screening Committee Review:
Does subject meet anatomical criteria?

Randomization:
1:1

Screening Failure

YES
YES
YES
ESAR
EVAR
Methods: Primary and Secondary Endpoints

Primary endpoint: Composite endpoint of one-year freedom from:

1. Type IA endoleak AND
2. Migration of proximal portion of stent graft ≥ 5 mm (compared to 1-month imaging) AND
3. Aneurysm sac growth ≥ 5 mm (compared to 1-month imaging)

Based on core lab-reported data from contrast-enhanced CT imaging

Secondary endpoints:
- Freedom from Type Ia endoleaks
- Freedom from migration ≥ 5 mm
- Freedom from aneurysm growth ≥ 5 mm
- Freedom from neck dilatation ≥ 3 mm
Methods: Follow Up and Trial Duration

• Clinical and Imaging follow-up adhere to local societal guidelines and IFU recommendations

• Follow-up visits at 1, 12, 24, 36, 48 and 60 months

• Assessments to be performed at each visit:
  • Physical exam and routine labs as per local standard of care
  • Adverse event and device deficiency assessment
  • CT scan with contrast (to be sent to the core lab)
Summary

• The HERCULES trial is a prospective, global, multicenter, randomized (1:1), superiority trial to compare ESAR to standard EVAR clinical outcomes in treatment of infrarenal AAA in patients having wide proximal aortic neck diameters (≥ 28 mm and ≤ 32 mm)

• It will be the first comparative trial of ESAR vs EVAR in treatment of patients with wide infrarenal AAA

• Site selection ongoing, first enrollment anticipated in Q2/Q3 2023
Methods: HERCULES Trial Overview

**Purpose:** To compare ESAR to standard EVAR clinical outcomes in treatment of infrarenal AAA in patients having wide proximal aortic neck diameters (≥ 28 mm and ≤ 32 mm)

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