Suprarenal vs. infrarenal fixation in EVAR-devices

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NHS Foundation Trust

KING'S HEALTH PARTNERS

Disclosures

Cook Medical: Proctoring, Speaker's fees, Grant support

Getinge: Educational grant support

Lessons learned from the long-term follow-up of a first-generation aortic stent graft

Pierre Alric, MD,[a] Robert J. Hinchliffe, MB, BS,[a] Peter W. Wenham, FRCS, MD,[a]
Simon C. Whitaker, FRCR,[b] Timothy A. M. Chuter, MD,[c] and Brian R. Hopkinson, FRCS, MCh,[a]
Nottingham, United Kingdom; and San Francisco, Calif

- 1994-1995
- 23 patients
- 13 (56%) proximal stent graft migrations

Alric et al. J Vasc Surg 2003

358

J ENDOVASC THER
2001;8:358–371

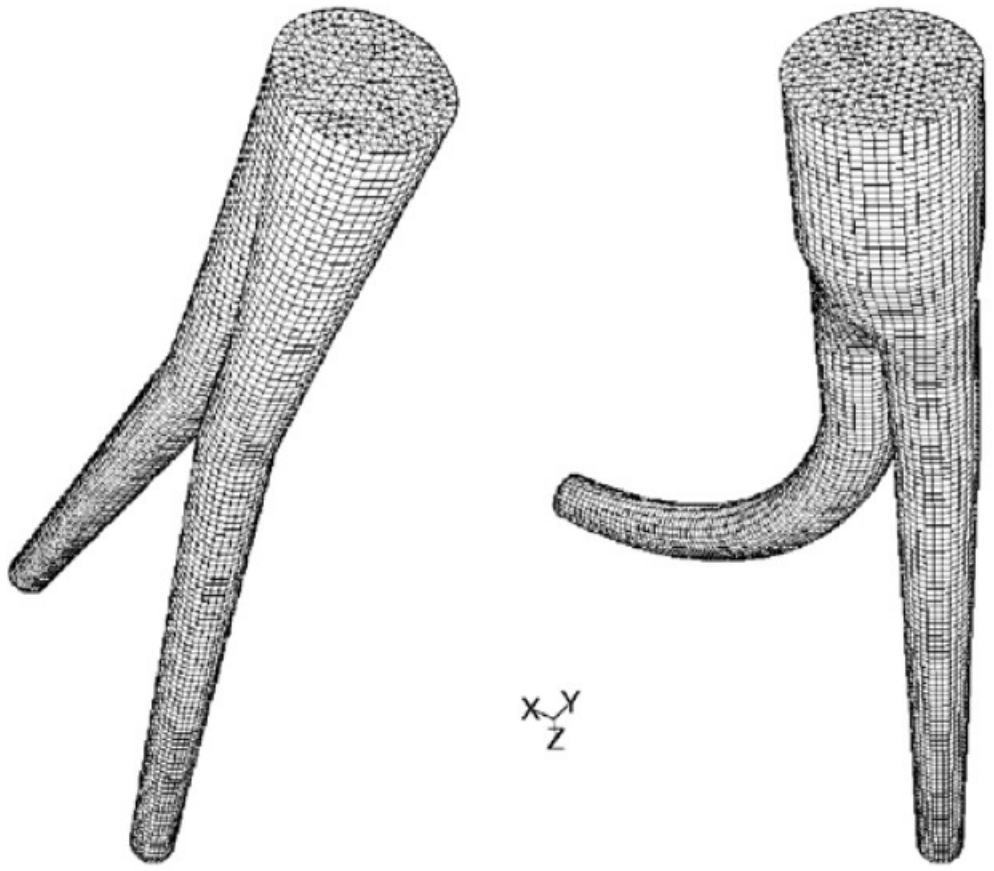
◆ EXPERIMENTAL INVESTIGATION ◆

Analytical Modeling and Numerical Simulation of Forces in an Endoluminal Graft

Kurt Liffman, PhD[1]; Michael M.D. Lawrence-Brown, FRACS[2]; James B. Semmens, PhD[3]; Anh Bui, PhD[1]; Murray Rudman, PhD[1]; and David E. Hartley, FIR[2]

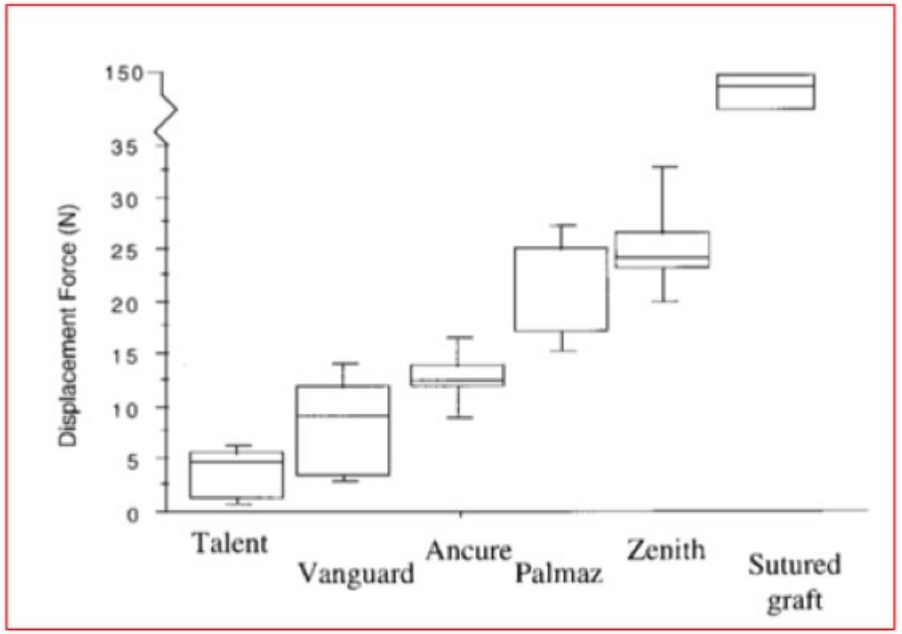
Fluid mechanics analysis:

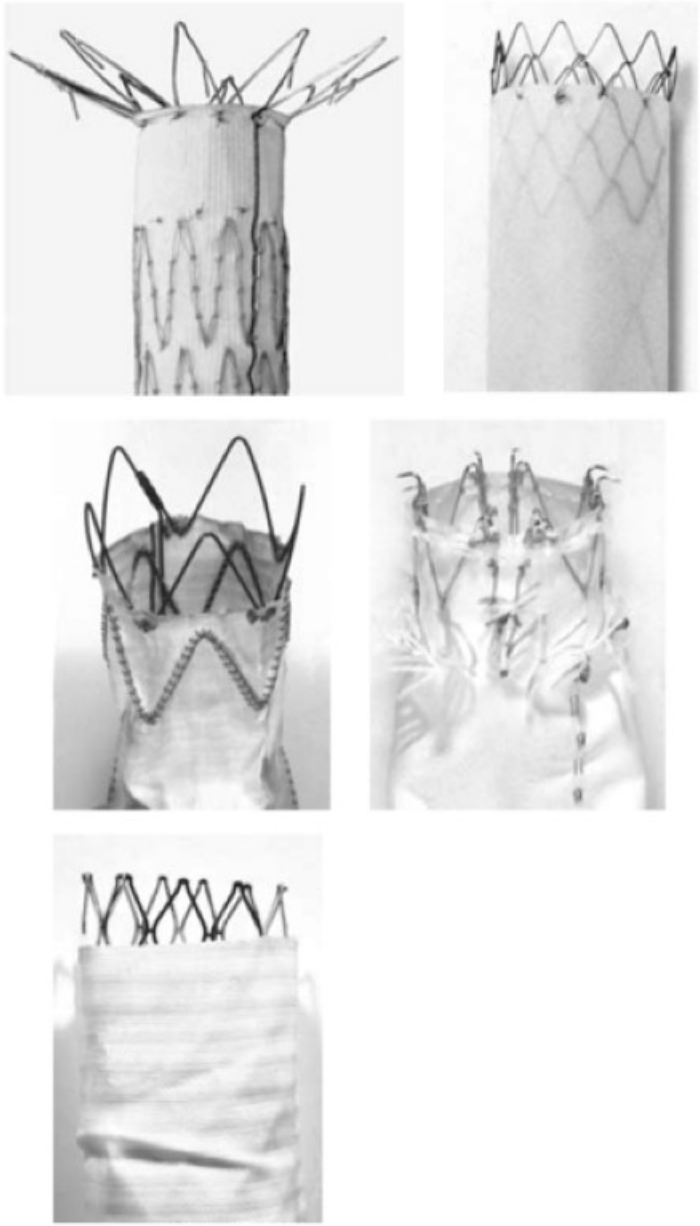
- Bifurcated graft
- 10N cyclical forces
- Acting to displace graft in caudal direction



The Impact of Stent Design on Proximal Stent-graft Fixation in the Abdominal Aorta: an Experimental Study

T. Resch*[1], M. Malina[2], B. Lindblad[2], J. Malina[3], J. Brunkwall[2] and K. Ivancev[1]





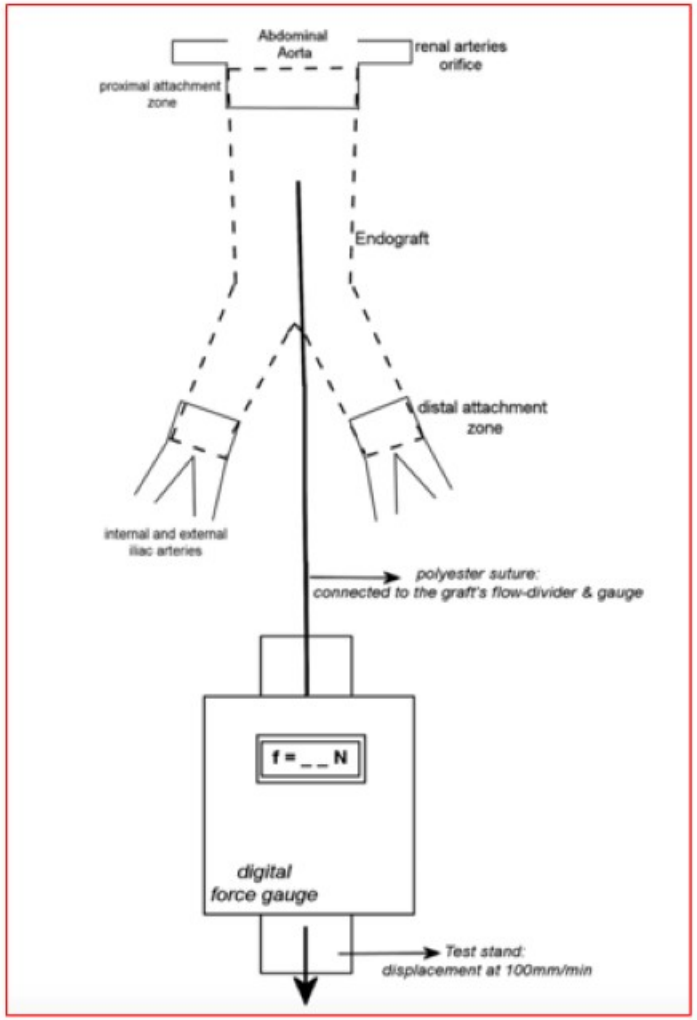
- Force to dislodge stent graft 6X less than sutured anastomosis.
- Longer/stronger barbs better fixation than shorter/weaker

Resch et al. EJVES 2000

Suprarenal fixation: Reduced migration and increased proximal support?

- Cadaveric model
- Fixation hooks/barbs: Higher DF
- Suprarenal support: No added effect on DF
- Balloon dilatation: Higher DF

	1 (Proximal)	2 (Distal)
Talent	16.18 ± 0.47	9.23 ± 1.25
Anaconda	36.16 ± 1.30	14.58 ± 0.68
Gore	22.58 ± 0.72	10.52 ± 0.40
AUI EndoFit	13.20 ± 0.75	8.83 ± 0.48
Zenith	39.30 ± 1.55	9.55 ± 1.52
Endurant	31.75 ± 2.27	9.65 ± 0.43
Endologix	14.80 ± 0.70	4.93 ± 0.50



Melas et al. EJVES 2010

Systematic review and meta-analysis of migration after endovascular abdominal aortic aneurysm repair

Vascular
2016, Vol. 24(3) 323–336

DOI: 10.1177/1708538115590065
vas.sagepub.com
SAGE

- Talent, Excluder, Aneurx, Zenith
- Factors associated with stent graft migration:
  - Aneurysm diameter
  - Neck length

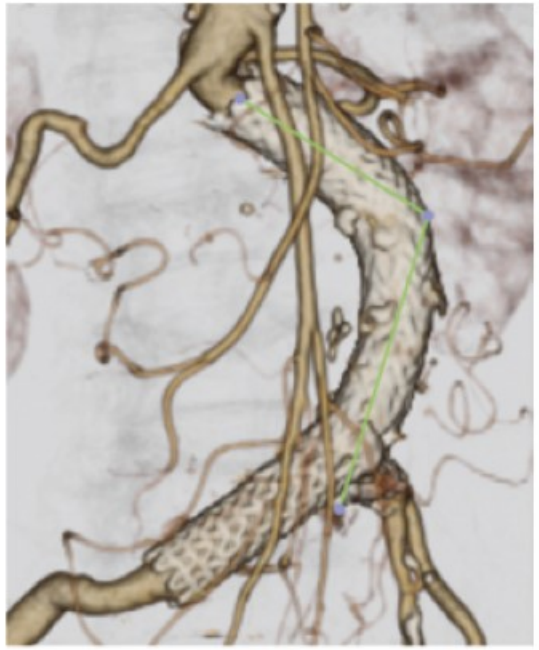
Spanos et al. Vascular 2016

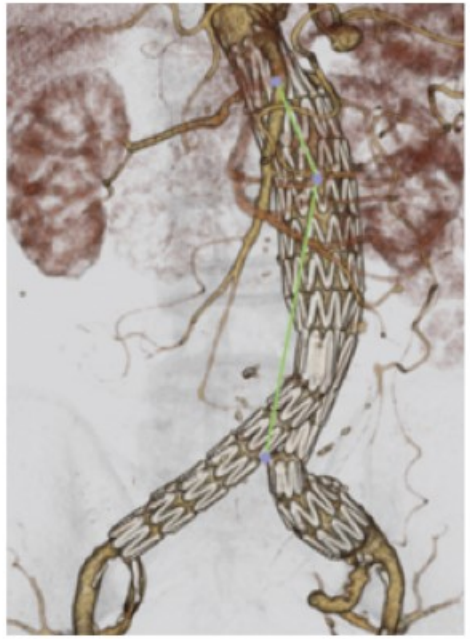
Outcomes and Morphologic Changes After Endovascular Repair for Abdominal Aortic Aneurysms With a Severely Angulated Neck

– A Device-Specific Analysis –

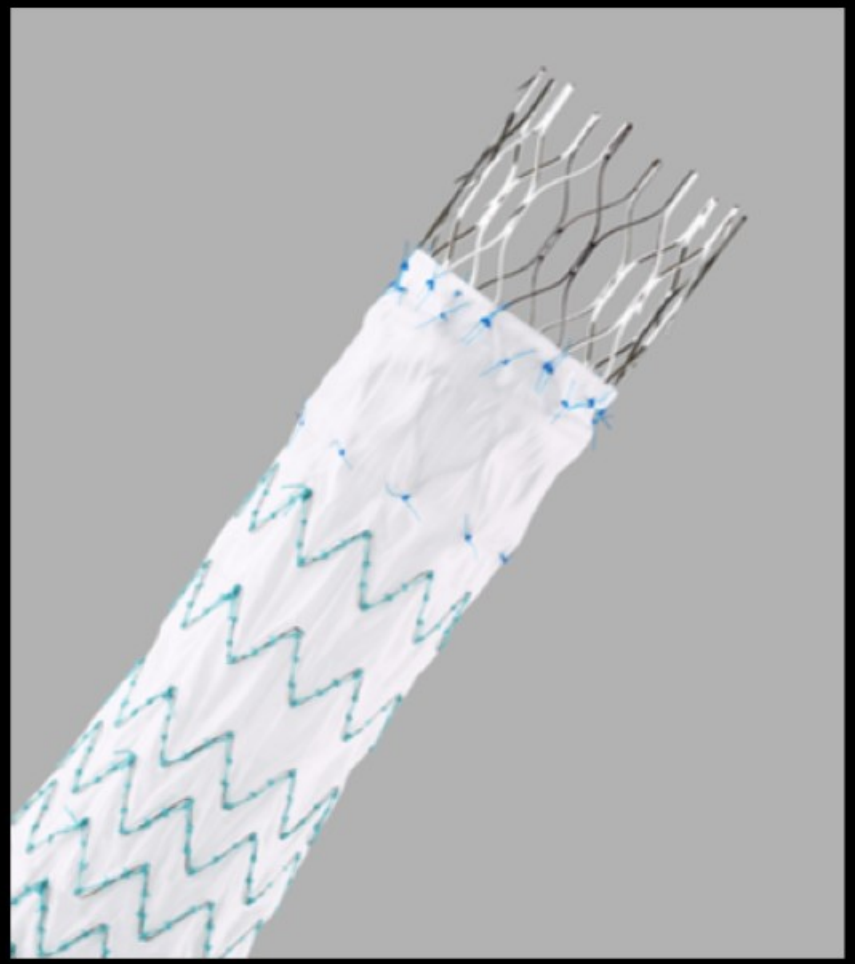
Katsuyuki Hoshina, MD, PhD; Takafumi Akai, MD; Toshio Takayama, MD, PhD; Masaaki Kato, MD, PhD; Tatsu Nakazawa, MD, PhD; Hiroyuki Okamoto, MD, PhD; Kunihiro Shigematsu, MD, PhD; Tetsuro Miyata, MD, PhD

- Severe neck angulation (>60 degrees)
- 34 Excluder
- 12 Zenith
- Differences in straightening of neck
- No caudal migration in either group





Hoshina et al. Circ J 2013

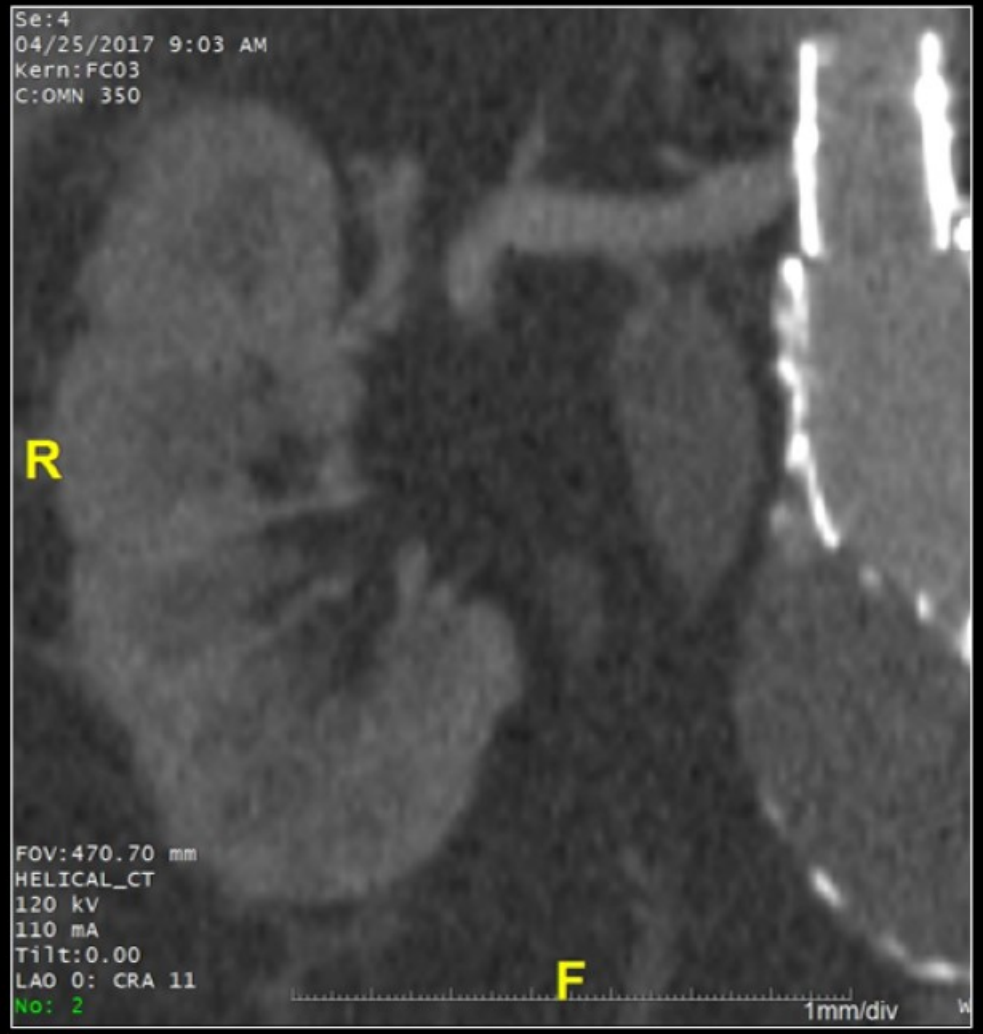


Real-world Performance of the New C3 Gore Excluder Stent-Graft: 1-year Results from the European C3 Module of the Global Registry for Endovascular Aortic Treatment (GREAT)

- 400 patients
- Follow up 16 months
- No stent graft migration

Verhoeven et al. EJVES 2015

Stent struts across renal artery origin: Impact on kidney function?



Effect of suprarenal fixation on long term kidney function

- Bare struts over renal ostium
  Effect on flow?
  Embolisation? → infarct/loss of parenchyma?

- Multiple reasons for renal dysfunction:
  - Contrast induced nephropathy
  - Atherosclerotic disease
  - Contrast surveillance/re-intervention

- Studies heterogenous: Need uniform reporting of renal outcomes

- Different formulae for renal function: e.g. eGFR vs Creatinine

The Impact of Suprarenal Fixation on Renal Function Following Endovascular Abdominal Aortic Aneurysm Repair: Meta-analysis Based on Estimated Glomerular Filtration Rate

T. Calderbank, M. Bown, A. Saratzis *

NIHR Leicester Biomedical Research Centre, University of Leicester, Leicester, UK

- Follow up duration 72hours to 5 years
- Endpoint: eGFR drop >20%
- 1 year: no difference SRF vs IRF
- Not appropriate to look beyond 1 year with data
- 5 years (one study): SRF 17% vs 10% (p=0.03), OR 1.77 [CI 1.04-3.02]

Calderbanck et al. EJVES 2018

REVIEW

Meta-analysis of Renal Function Following Infrarenal EVAR using Suprarenal or Infrarenal Fixation Devices

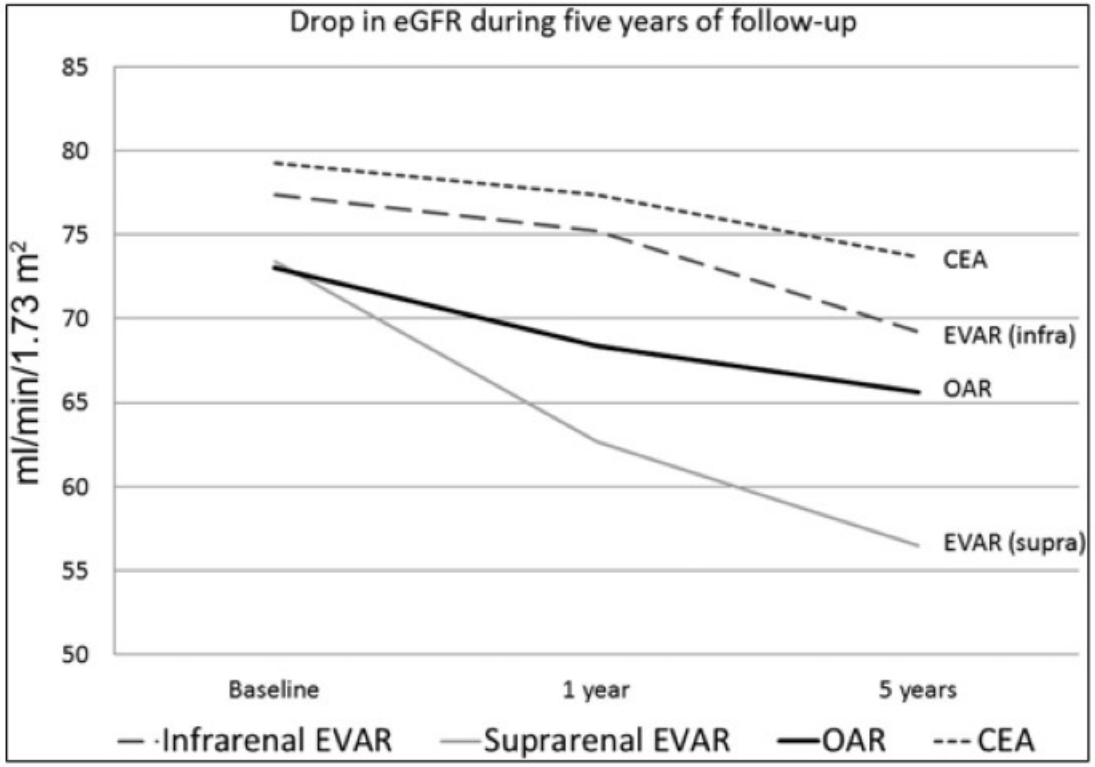
Philip W. Stather *, James Ferguson, Ayoola Awopetu, Jonathan R. Boyle

Department of Vascular Surgery, Cambridge University Hospital, Hills Road, Cambridge, UK

- Equivalent renal function at 12 months
- Renal impairment higher with SRF: 5.98% vs. 4.83% OR 1.29 [CI 1.18-1.4]
- Number needed to harm = 200
- Renal infarcts, stenosis and occlusion higher with SRF but effect size small
- No difference in rate of dialysis
- Heterogenous methodology: Any definition of renal decline allowed

Stather et al. EJVES 2018

Case matched eGFR after 5 years



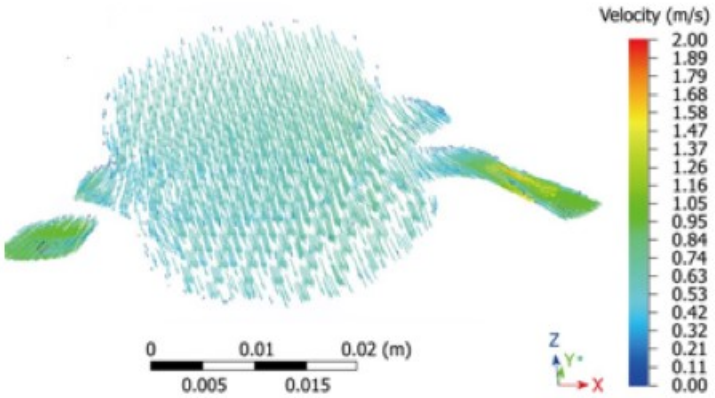
- Supra-renal fixation
- Infrarenal fixation
- Open aneurysm repair
- Carotid endarterectomy

- 5 year eGFR worse in suprarenal group
- No patient progressed to dialysis

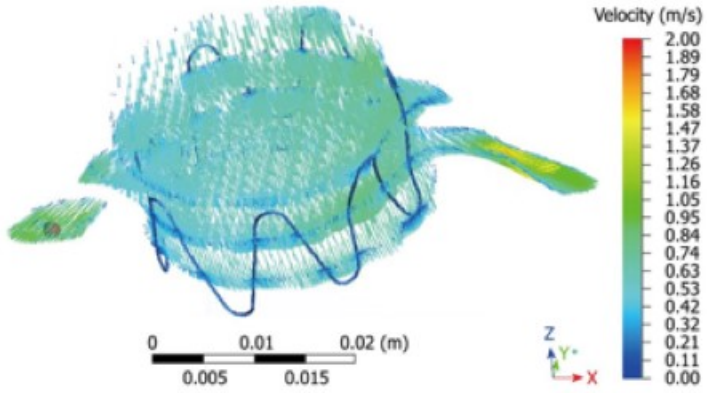
Sarastzis et al. Clin J Am Soc Nephrol 20

Computational Fluid Dynamics: 2mm thick fixation reduces flow by 30%

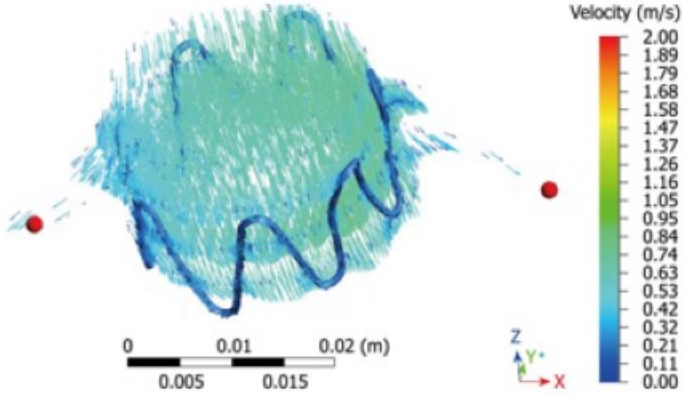
No fixation



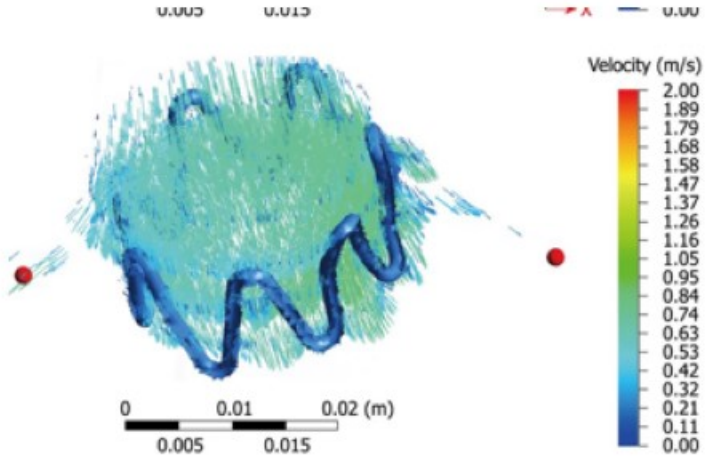
0.4 mm fixation



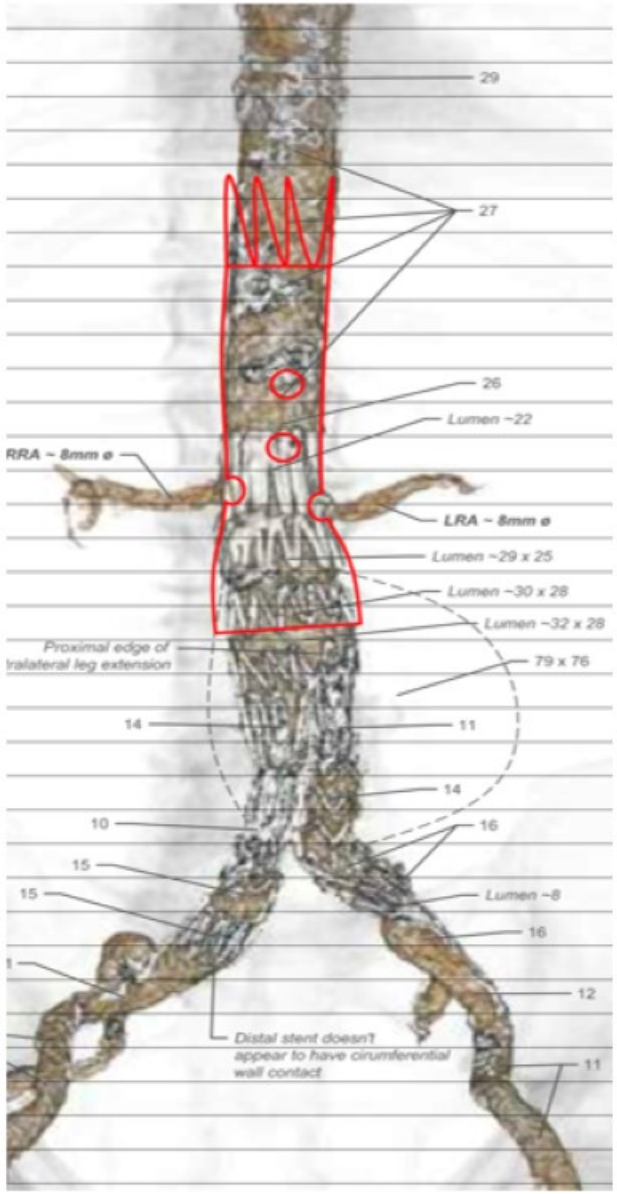
1 mm fixation

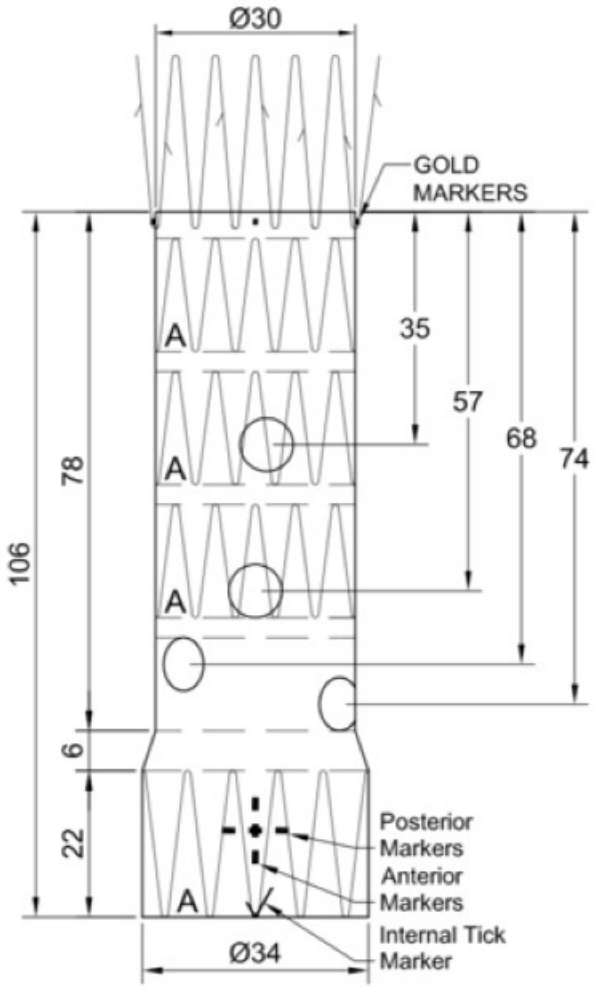


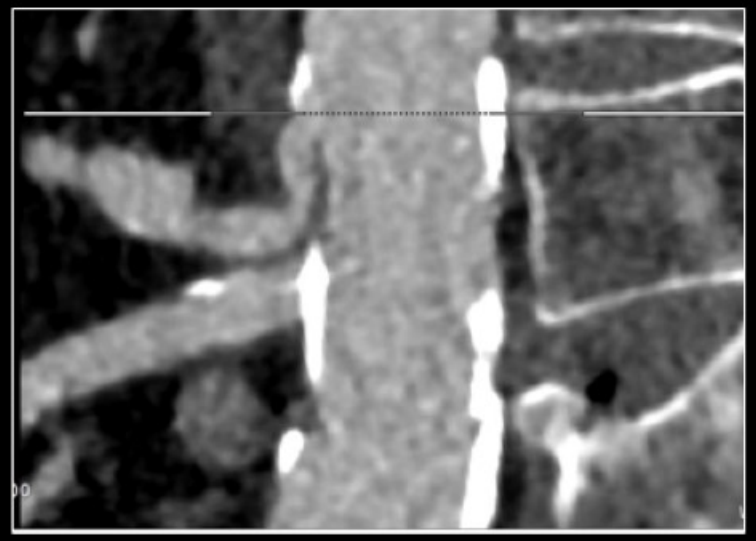
2 mm fixation

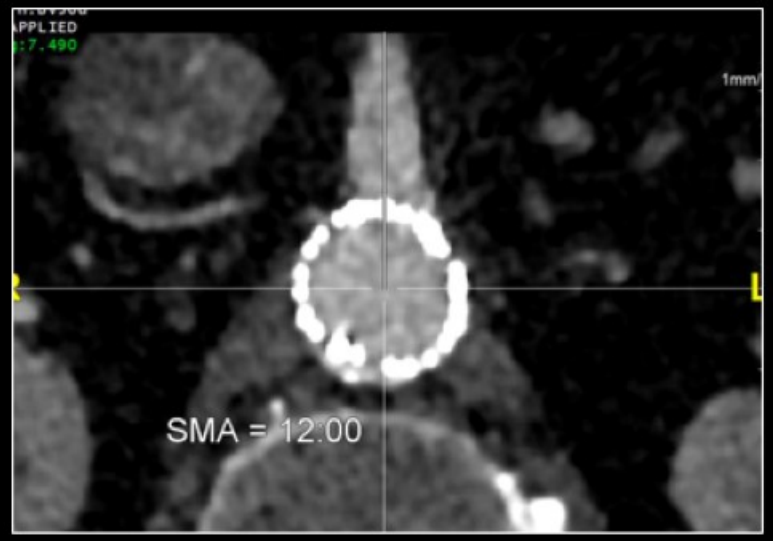


Suprarenal fixation: Impact on re-interventions





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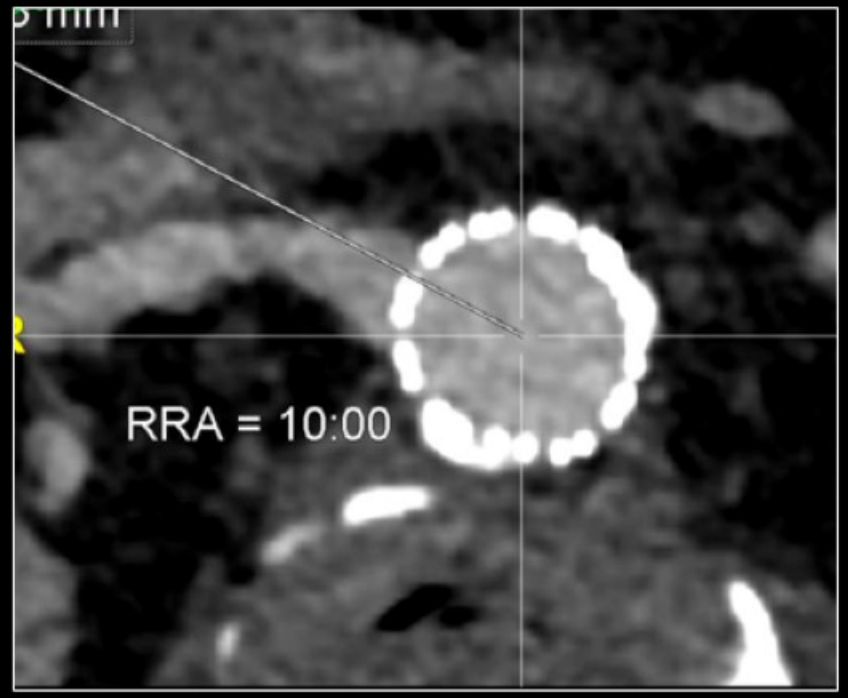
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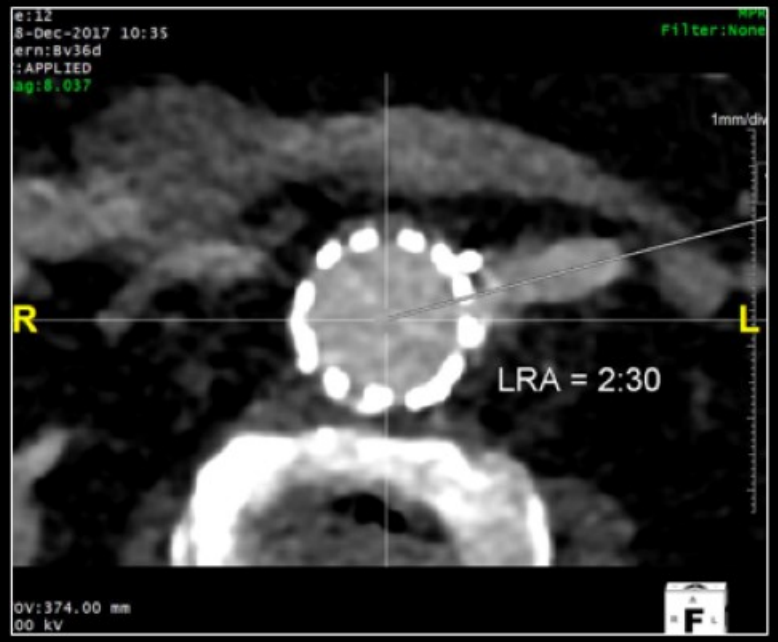
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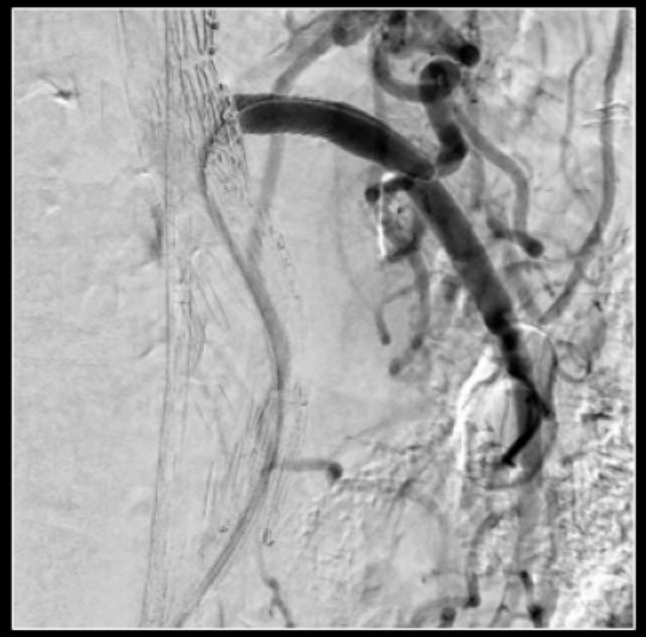

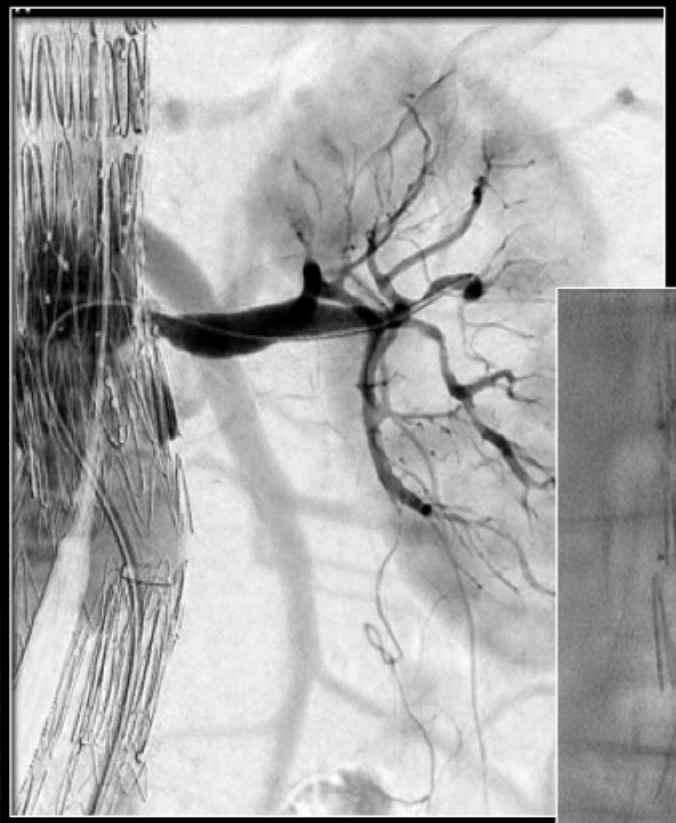

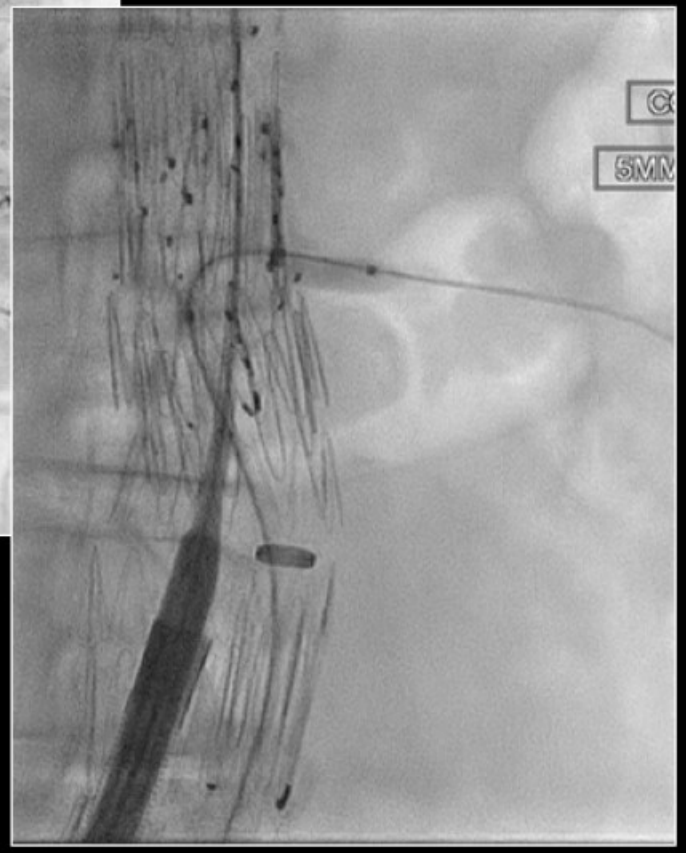
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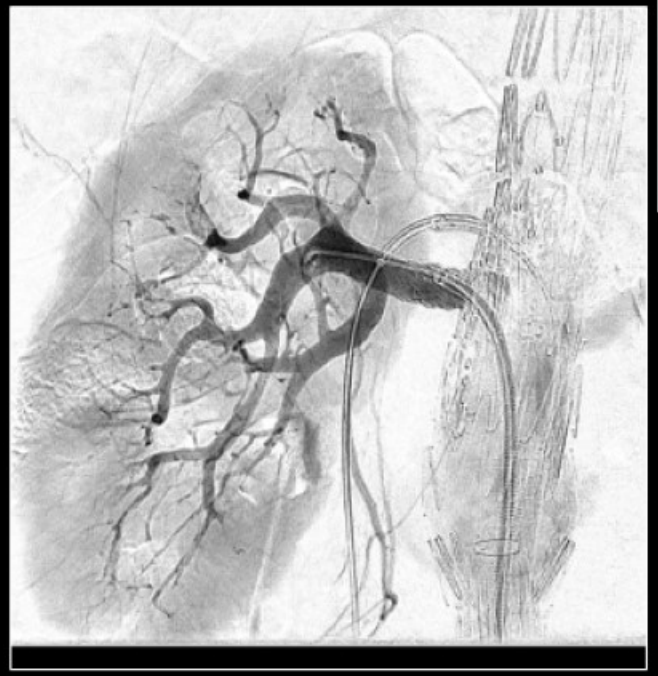
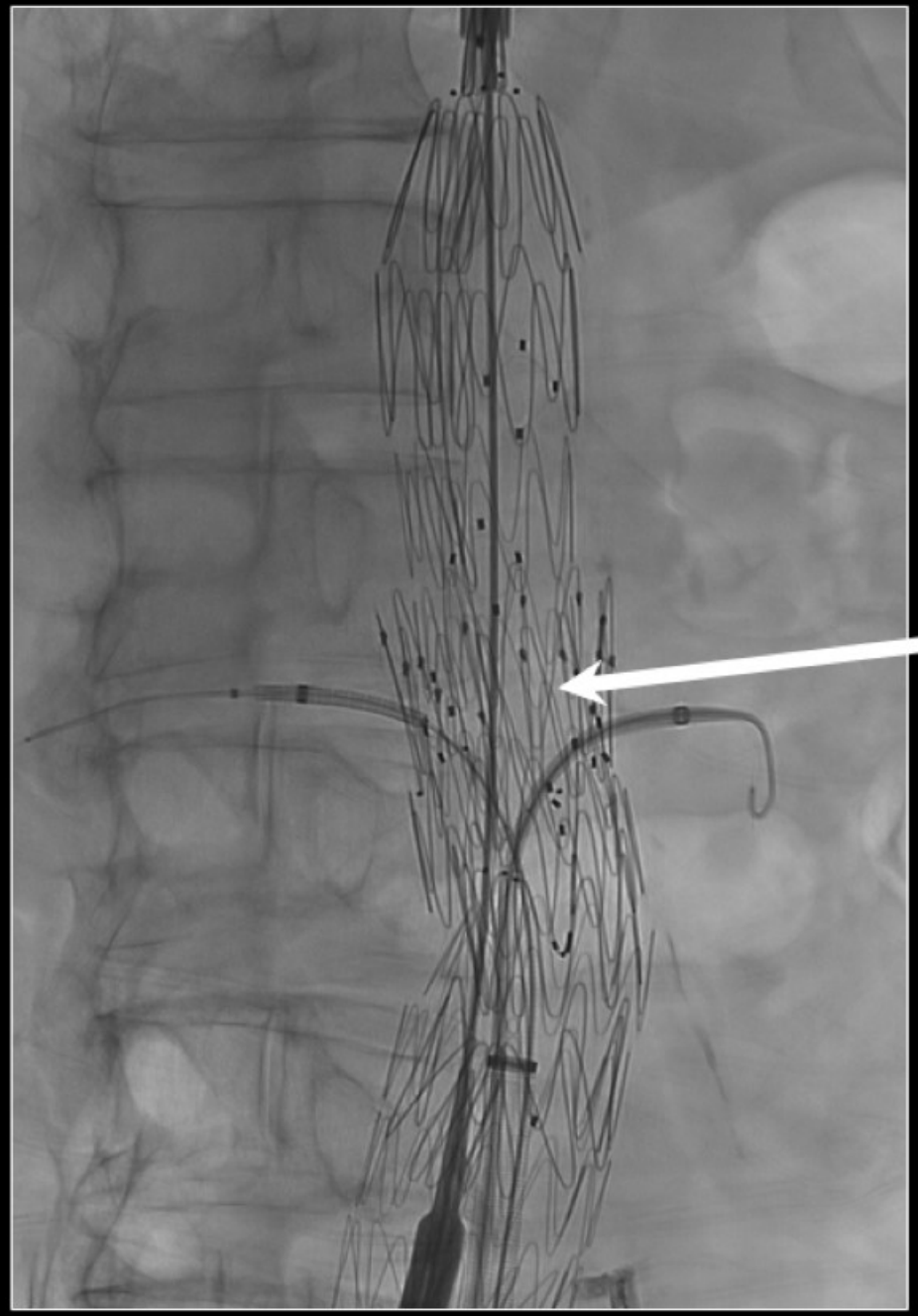
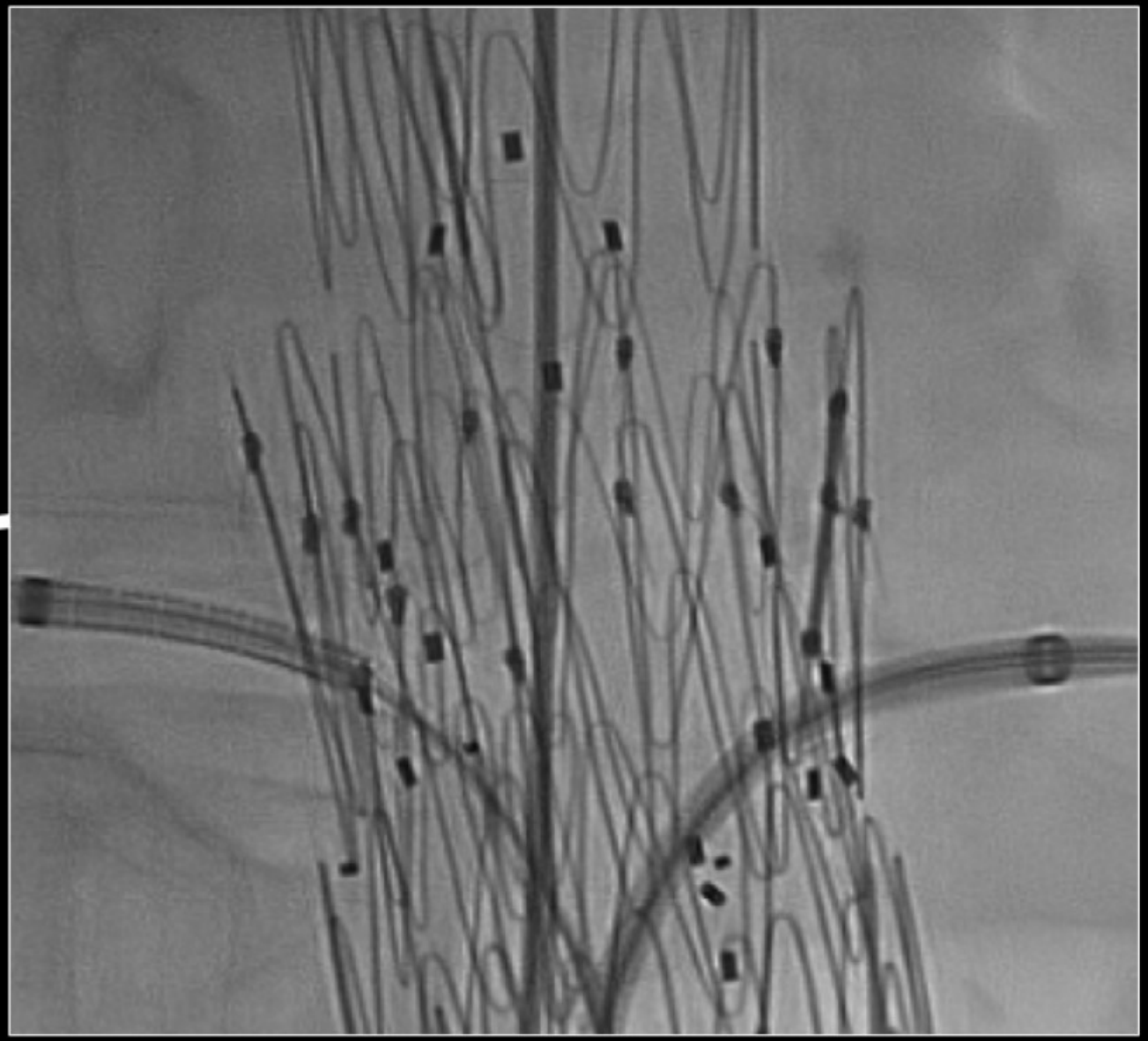






Fenestrated cuffs: St Thomas' Experience

Target Vessel	Fenestration	Scallop	Success
Left Renal	29	0	29 (100%)
Right Renal	29	0	29 (100%)
SMA	29	0	29 (100%)
Coeliac	26	3	22 (84.6%)
Total	**113**	**3**	**109 (96.2%)**

Late open conversion and explantation of abdominal aortic stent grafts

Clayton J. Brinster, MD, Ronald M. Fairman, MD, Edward Y. Woo, MD, Grace J. Wang, MD, Jerffrey P. Carpenter, MD, and Benjamin M. Jackson, MD, *Philadelphia, Pa*

- **AneuRx (6)**
- **Zenith (6)**
- **Talent (3)**
- **Excluder (2)**
- **Anaconda (1)**
- **Ancure (1)**
- **Quantum LP (1)**
- **Powerlink (1)**

Majority of cases need supracoeliac or suprarenal cross clamping

Brinster et al. JVS 2011

Strategies and outcomes for aortic endograft explantation

Dean J. Arnaoutakis, MD, MBA,[a] Gaurav Sharma, MD,[b] Stuart Blackwood, MD,[b] Samir K. Shah, MD,[b] Matthew Menard, MD,[b] C. Keith Ozaki, MD,[b] *and* Michael Belkin, MD,[b] *Gainesville, Fla; and Boston, Mass*

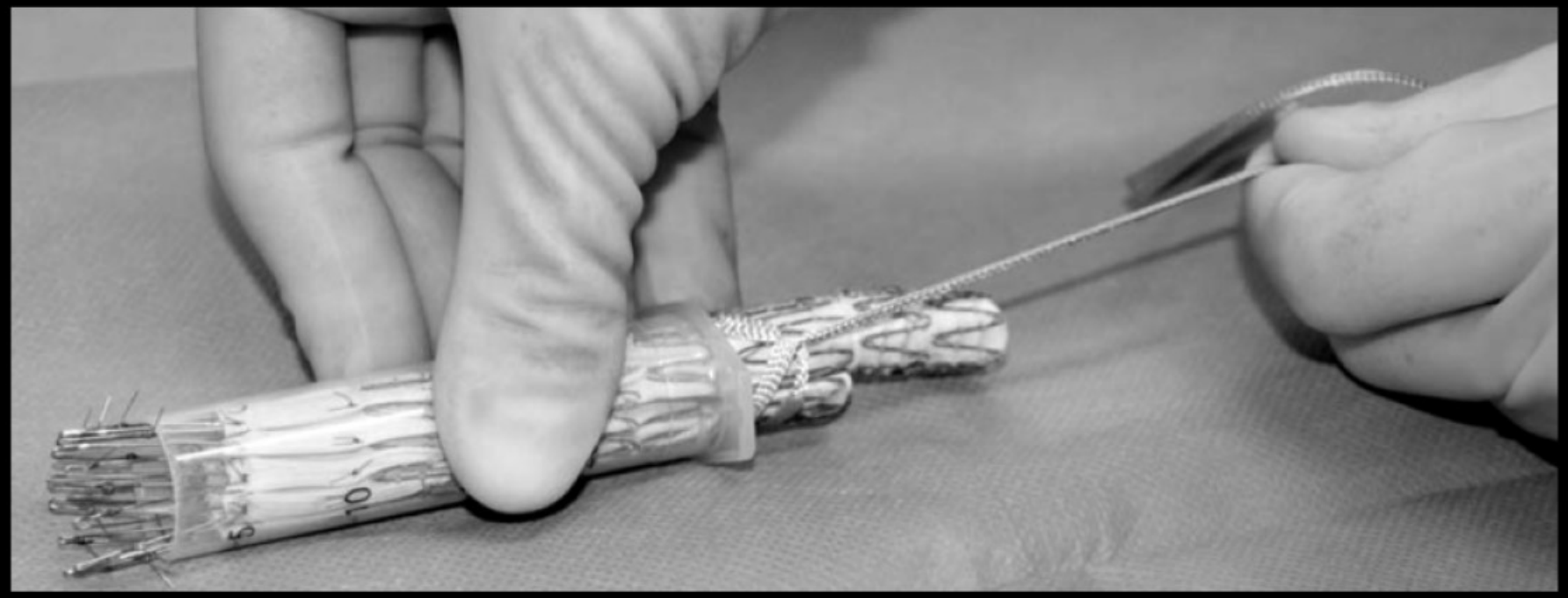
- Clamp position:
  - Supracoeliac (31%)
  - Suprarenal in 31%
  - Infrarenal (38%)
- Suprarenal fixation: More likely to have the upper main body left in situ (67% vs 17%; P=0.029)

	Type (N = 32), No. (%)
AneuRx[a]	9 (28)
Excluder[b]	9 (28)
Zenith[c]	3 (9)
Talent[a]	1 (3)
Powerlink[d]	1 (3)
Endurant[a]	4 (13)
Aorfix[e]	1 (3)
AFX[d]	2 (6)
Unknown	2 (6)

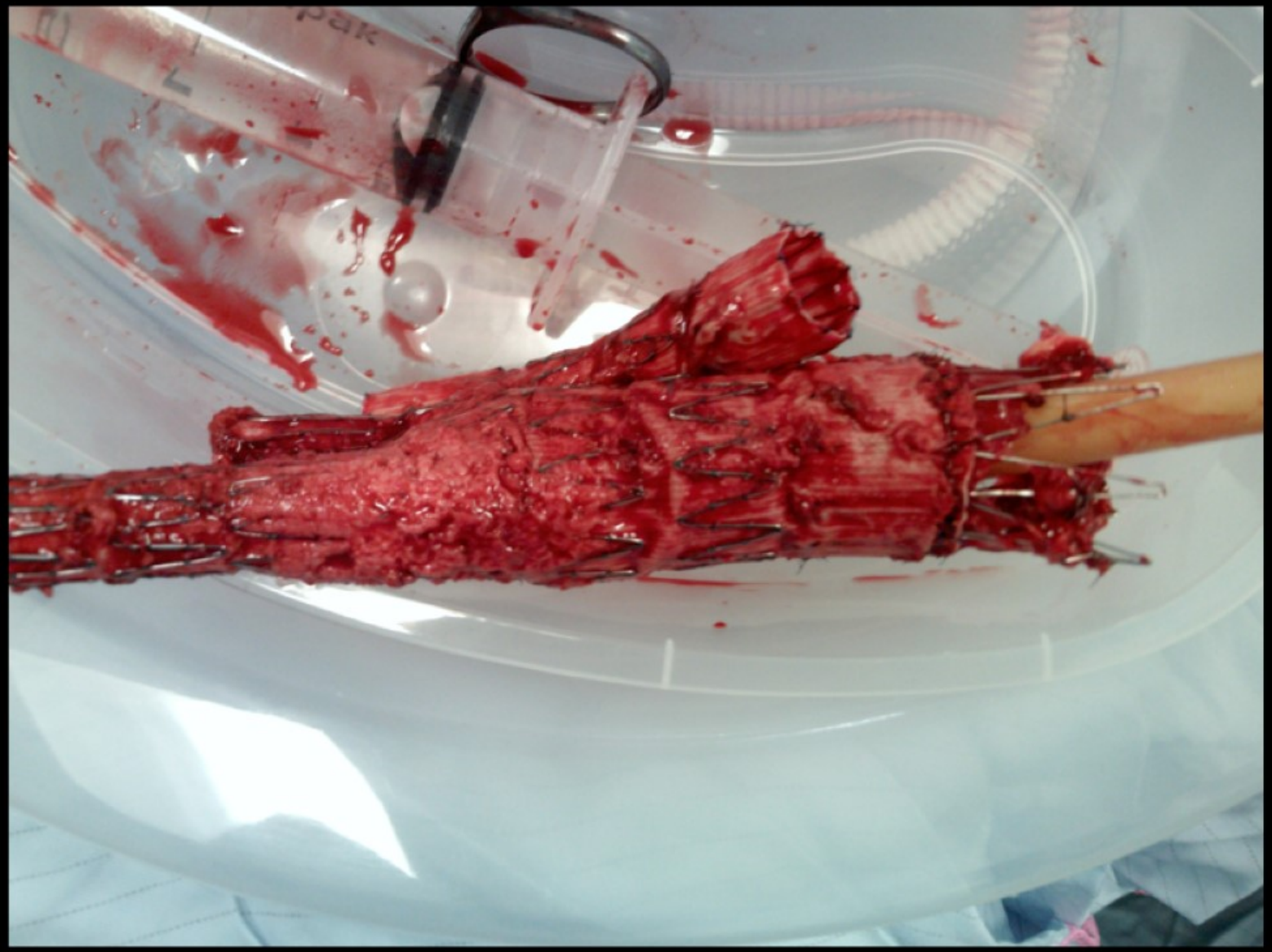
Arnaoutakis et al. JVS (ePub ahead of pri

Technique for safe removal of an aortic endograft with suprarenal fixation

Olivier H. J. Koning, MD, Jan-Willem Hinnen, MD, and **Jary M. van Baalen, MD, PhD,**
Leiden, The Netherlands



Koning et al. JVS 2006



Courtesy of Rachel Bell and Morad Sallam

Summary

- Fixation reduces migration
- Case selection is key regardless of supra/infra renal fixation
- Suprarenal fixation: Possible effect on long term renal function
- Effect on renal function clinically relevant?
- Suprarenal fixation does not preclude vessel cannulation


St. Thomas' Hospital

Eur J Vasc Endovasc Surg (2018) 55, 163–169

Editor's Choice – Late Open Surgical Conversion after Endovascular Abdominal Aortic Aneurysm Repair

Vinay Kansal [a], Sudhir Nagpal [b,c], Prasad Jetty [b,c,*]

[a] University of Ottawa, Faculty of Medicine, Ottawa, Ontario, Canada
[b] University of Ottawa, Division of Vascular Surgery, Ottawa, Ontario, Canada
[c] Ottawa Hospital Research Institute, Ottawa, Ontario, Canada

Device	
Medtronic Talent	8 (50.0%)
Medtronic Endurant	3 (18.8%)
Cook Zenith	4 (25.0%)
Terumo Anaconda	1 (6.2%)

1060 consecutive Infrarenal stent grafts
3 (Talent) explanted for migration