



# **Diagnostic algorithms for endoleaks**

***Prof. Fabio Verzini, MD, PhD, FEBVS***

Vascular Surgery  
University of Perugia, Italy

# Conflicts of interest

## Disclosure

Speaker name: Fabio Verzini

.....

I have the following potential conflicts of interest to report:

X

- Receipt of grants/research support
- Receipt of honoraria and travel support

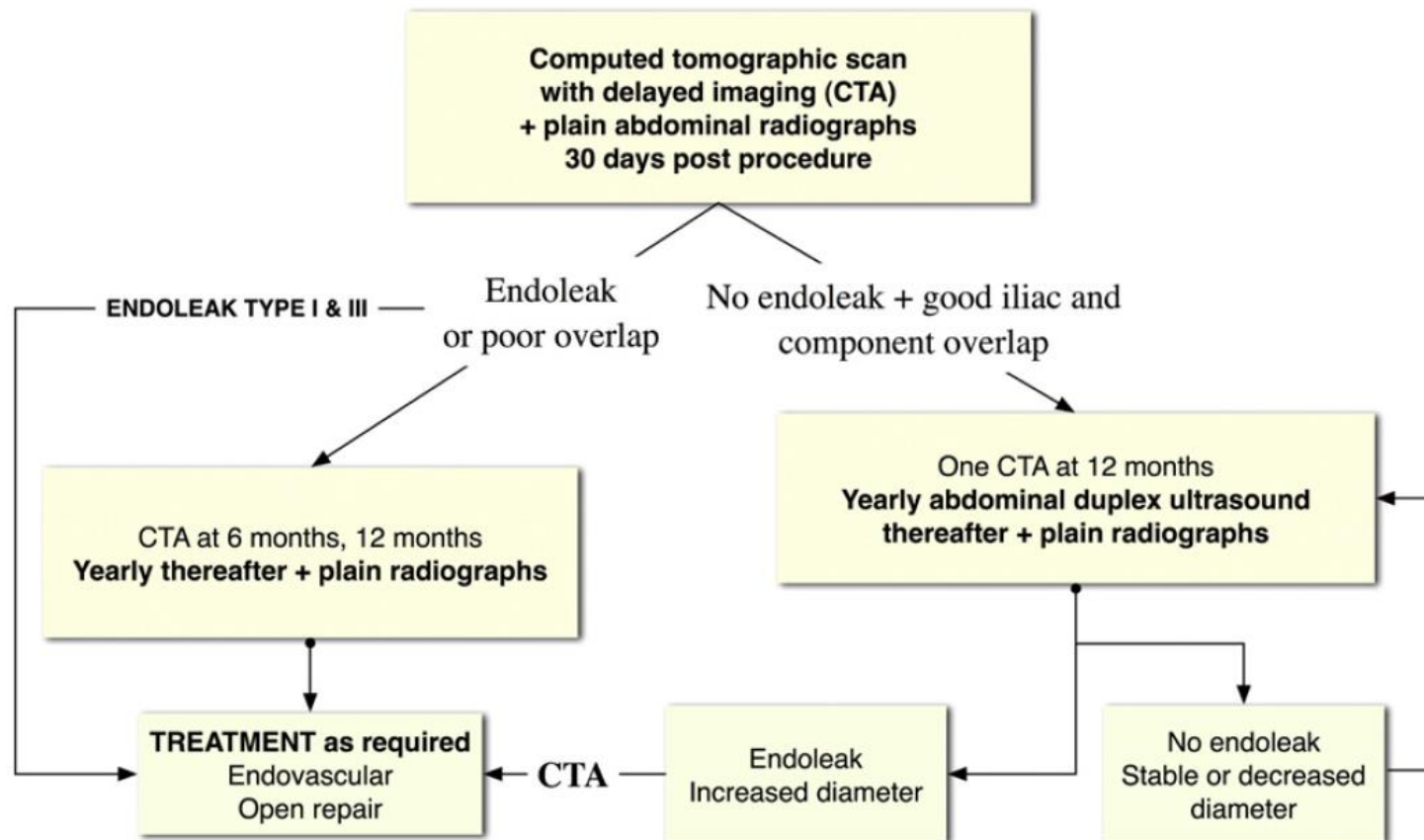
From: Cook, Gore, Medtronic

# Management of Abdominal Aortic Aneurysms

## Clinical Practice Guidelines of the European Society for Vascular Surgery

F.L. Moll <sup>a,\*</sup>, J.T. Powell <sup>b</sup>, G. Fraedrich <sup>c</sup>, F. Verzini <sup>d</sup>, S. Haulon <sup>e</sup>,  
M. Waltham <sup>f</sup>, J.A. van Herwaarden <sup>a</sup>, P.J.E. Holt <sup>g</sup>, J.W. van Keulen <sup>a,h</sup>,  
B. Rantner <sup>c</sup>, F.J.V. Schlösser <sup>h</sup>, F. Setacci <sup>i</sup>, J.-B. Ricco <sup>j</sup>

Eur J Vasc Endovasc Surg (2011) 41, S1–S58



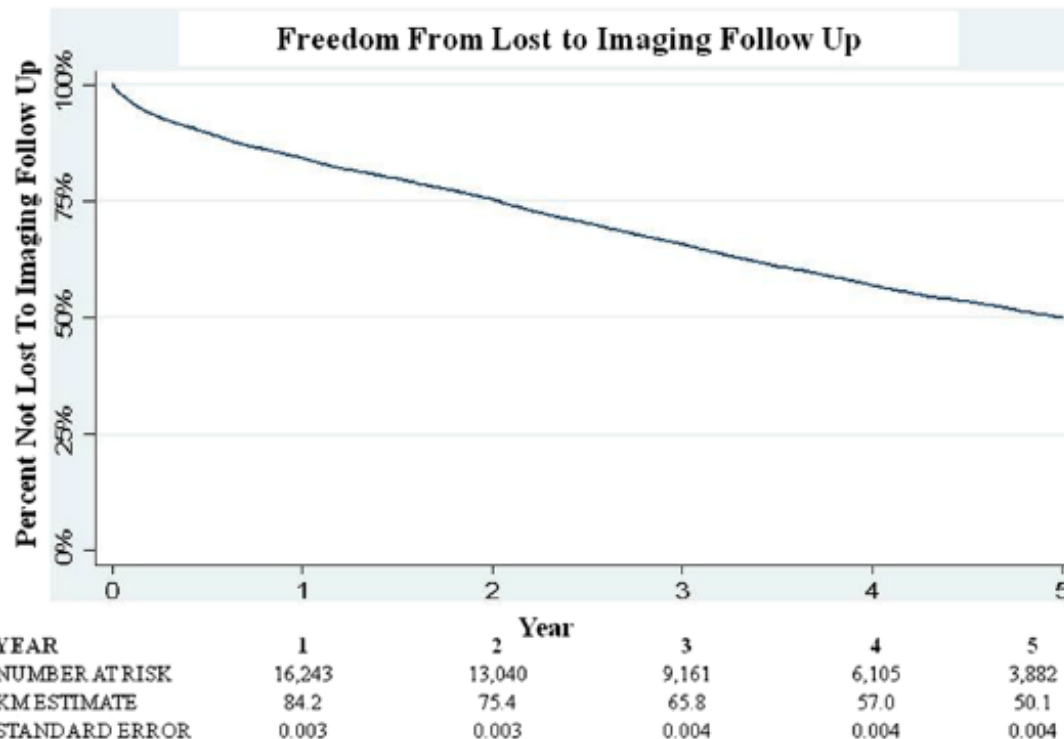


# Follow-up compliance after endovascular abdominal aortic aneurysm repair in Medicare beneficiaries

Andres Schanzer, MD,<sup>a</sup> Louis M. Messina, MD,<sup>a</sup> Kaushik Ghosh, PhD,<sup>b</sup> Jessica P. Simons, MD, MPH,<sup>a</sup> William P. Robinson III, MD,<sup>a</sup> Francesco A. Aiello, MD,<sup>a</sup> Robert J. Goldberg, PhD,<sup>a</sup> and Allison B. Rosen, MD, MPH, ScD,<sup>a,b</sup> Worcester and Cambridge, Mass

JOURNAL OF VASCULAR SURGERY  
Volume 61, Number 1

Among 19,962 patients who underwent EVAR, the incidence of loss to annual imaging follow-up at 5 years after EVAR was 50%.



**Fig 2.** Kaplan-Meier (KM) analysis of all patients who underwent endovascular aneurysm repair (EVAR) between 2001 and 2008 demonstrating the proportion of patients not lost to imaging follow-up.



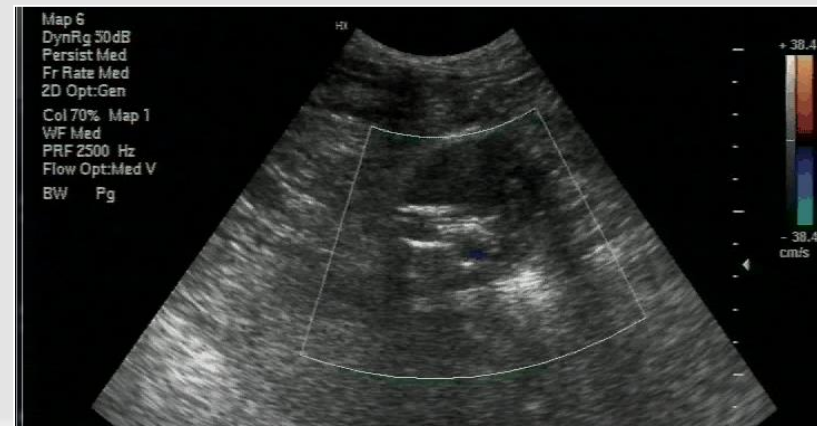
## Systematic review and meta-analysis of duplex ultrasonography, contrast-enhanced ultrasonography or computed tomography for surveillance after endovascular aneurysm repair

A. Karthikesalingam<sup>1</sup>, W. Al-Jundi<sup>2</sup>, D. Jackson<sup>3</sup>, J. R. Boyle<sup>4</sup>, J. D. Beard<sup>2</sup>, P. J. E. Holt<sup>1</sup> and M. M. Thompson<sup>1</sup>

25 studies = 3975 pts. DUS vs CT

11 studies = 961 pts. CEUS vs CT

Both CEUS and DUS were specific for detection of types 1 and 3 endoleak. Estimates of their sensitivity were uncertain but there was no evidence of a clinically important difference. DUS detects types 1 and 3 endoleak with sufficient accuracy for surveillance after EVAR

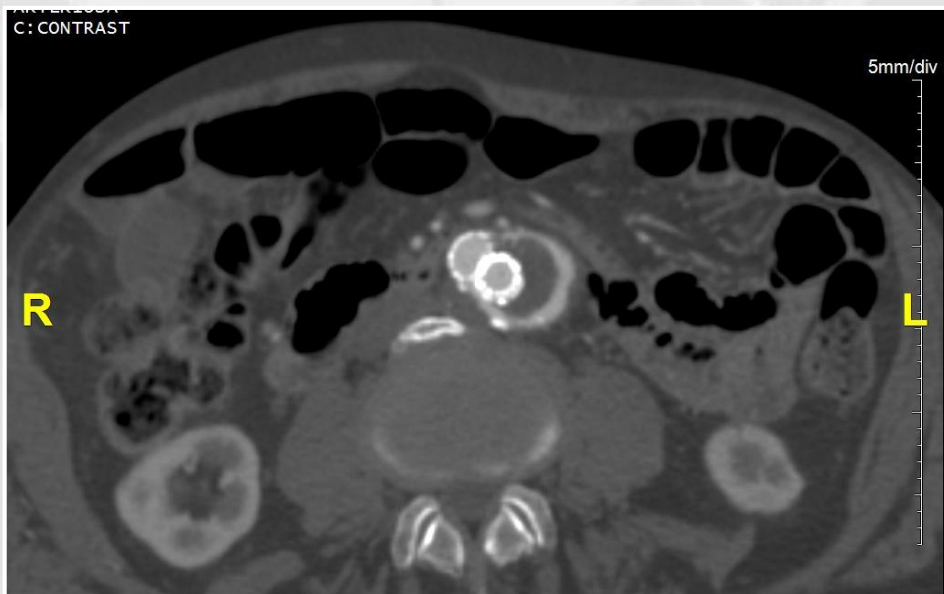
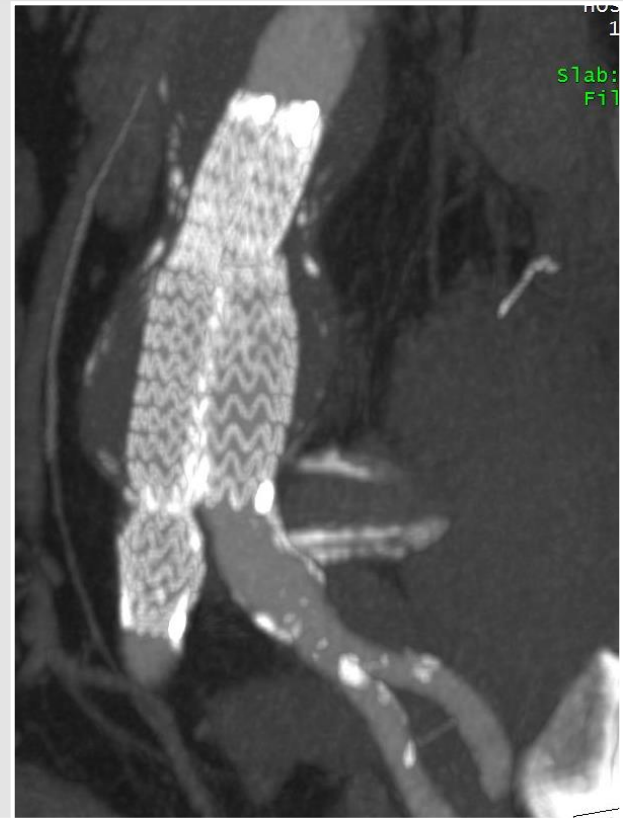




## Surveillance instruments

CT superior to US :

- stent-graft position
- integrity
- sealing zones
- infection



# Abdominal Aortic Endografting Beyond the Trials: A 15-Year Single-Center Experience Comparing Newer to Older Generation Stent-Grafts

Fabio Verzini, MD, PhD, FEBVS<sup>1</sup>; Giacomo Isernia, MD<sup>1</sup>; Paola De Rango, MD, PhD, FEBVS<sup>1</sup>;  
Gioele Simonte, MD<sup>1</sup>; Gianbattista Parlani, MD<sup>1</sup>; Diletta Loschi, MD<sup>1</sup>;  
and Piergiorgio Cao, MD, FRCS<sup>2</sup>

*J Endovasc Ther.* 2014;21:439–447

1,412 EVAR

Old vs New- generation devices @ 7 years:

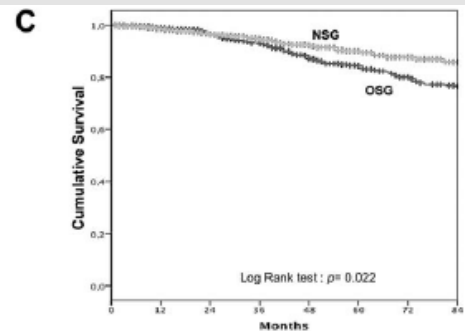
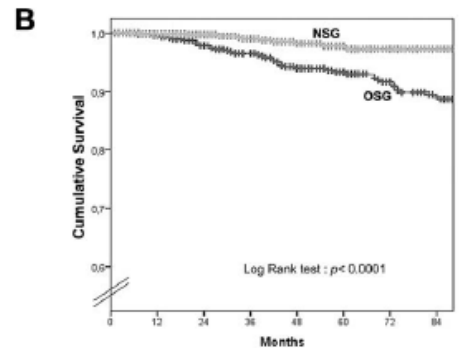
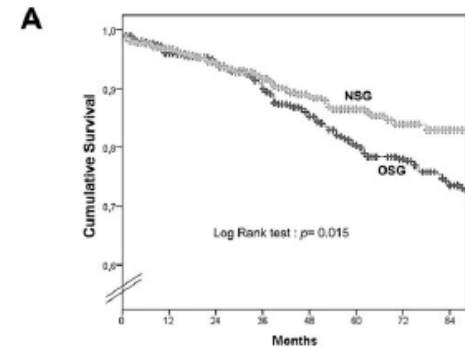
Freedom from late conversion: 96.1%vs. 89.1% ,  $p<0.0001$ ),  
reintervention: 83.6% vs. 74.2%;  $p=0.015$   
AAA diameter growth >5mm: 85.8% vs. 76.5%;  $p=0.022$ ,

**Were all significantly lower in the new generation group.**

New generation device = negative independent predictor for

reintervention (HR 0.67, 95% CI 0.49 - 0.93;  $p=0.015$ )

aneurysm growth (HR 0.63, 95% CI 0.45- 0.89;  $p=0.010.14$ ).



# Fourteen-year outcomes of abdominal aortic endovascular repair with the Zenith stent graft

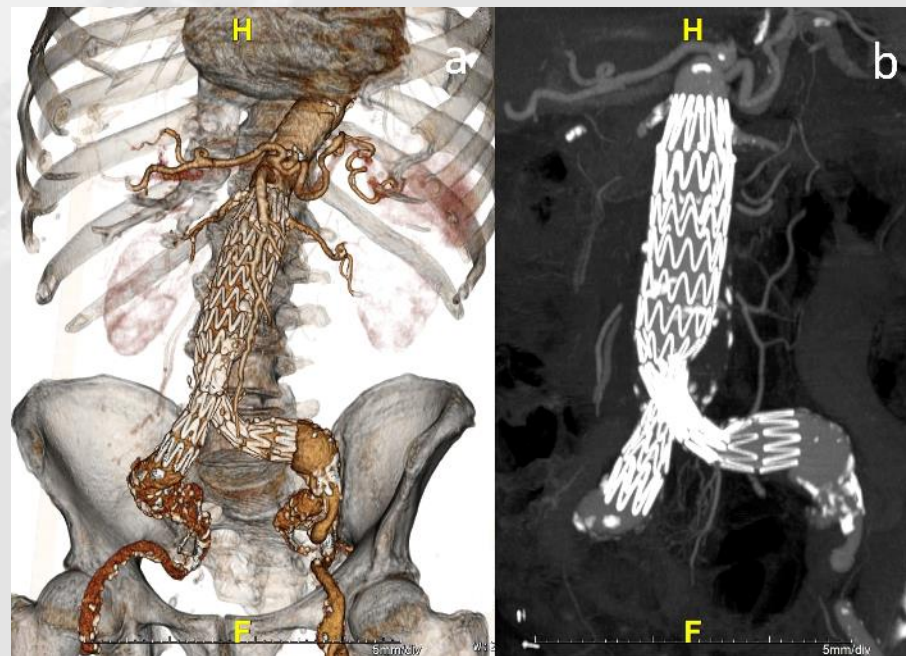


Fabio Verzini, MD, PhD, FEBVS,<sup>a</sup> Lydia Romano, MD,<sup>a</sup> Gianbattista Parlani, MD,<sup>a</sup> Giacomo Isernia, MD,<sup>a</sup> Gioele Simonte, MD,<sup>a</sup> Diletta Loschi, MD,<sup>a</sup> Massimo Lenti, MD, PhD,<sup>a</sup> and Piergiorgio Cao, MD, FRCS,<sup>b</sup>  
Perugia and Rome, Italy

(J Vasc Surg 2017;65:318-29.)

## Aim of the study

Long term performance of the Zenith Cook endograft, in a single center, tertiary care, University Hospital





# Long-Term Results

EVAR Failure:

AAA related mortality, AAA rupture, AAA growth > 5 mm,  
re-intervention

Cox regression analysis (backward stepwise)

AAA diameter  
Neck length <15 mm  
Age  
Smoking status  
Diabetes mellitus  
Hypertension  
Chronic pulmonary disease  
Coronary artery disease  
Renal disease  
Hyperlipidemia  
Peripheral arterial disease  
Anticoagulant therapy

Risk factor	HR	95 % CI
ASA 4	1.6	1-2.6
Type I or III Endoleak	10.8	7.2-16
Type II Endoleak	3.6	2.5-5.5



# Long-Term Results

Predictive factors of late reintervention:  
Cox regression analysis

**Common iliac diameter >18 mm (HR 2.2,  
p<0.001)**

Neck length

Neck diameter

AAA diameter

Iliac Branch Endograft



# Clinical Significance of Type II Endoleak after Endovascular Repair of Abdominal Aortic Aneurysm

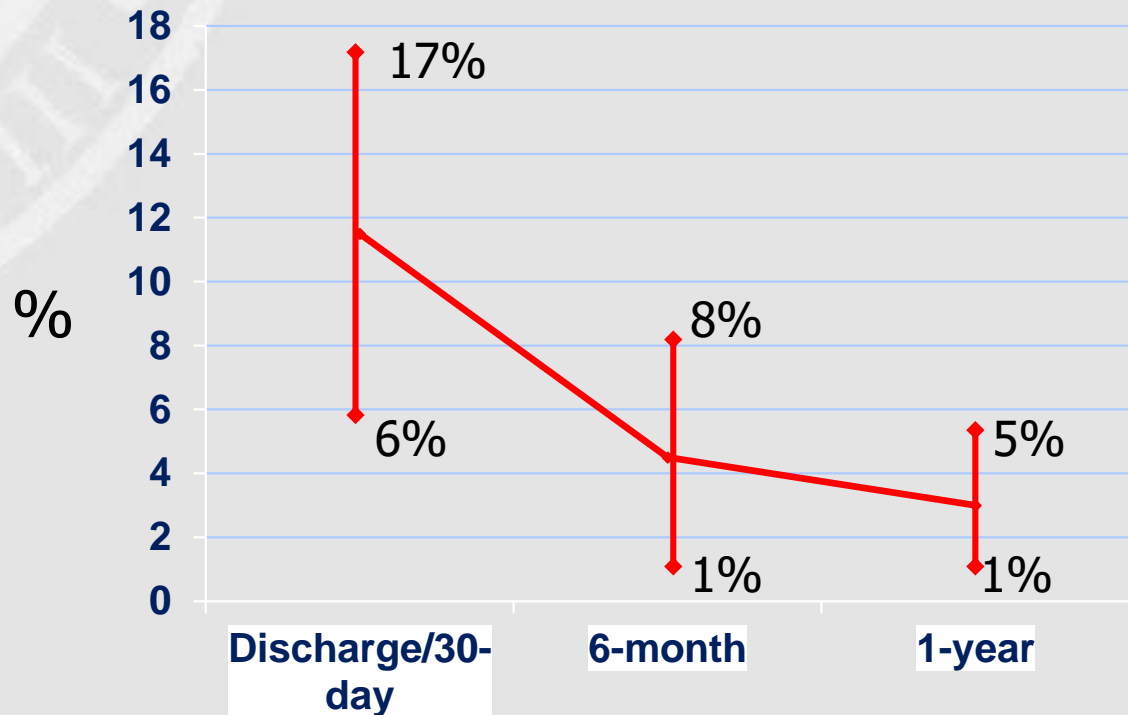
*Dmitri V. Gelfand, MD,<sup>1</sup> Geoffrey H. White, MD,<sup>2</sup> and Samuel E. Wilson, MD,<sup>1</sup>  
Orange, California and Sydney, Australia*

*Ann Vasc Surg 2006; 20: 69-74*

10 EVAR Trials (2000-2004)

2.617 patients

## Incidence of Type II endoleak



# Clinical Significance of Type II Endoleak after Endovascular Repair of Abdominal Aortic Aneurysm

*Dmitri V. Gelfand, MD,<sup>1</sup> Geoffrey H. White, MD,<sup>2</sup> and Samuel E. Wilson, MD,<sup>1</sup>  
Orange, California and Sydney, Australia*

*Ann Vasc Surg 2006; 20: 69-74*

10 EVAR Trials (2000-2004)

2,617 patients

Secondary Interventions	0.3-30% (4.7%)
Conversion	10 (0.4%)
Rupture	0

Success of Secondary Interventions 11-100% (70%)

# Persistent type 2 endoleak after endovascular repair of abdominal aortic aneurysm is associated with adverse late outcomes

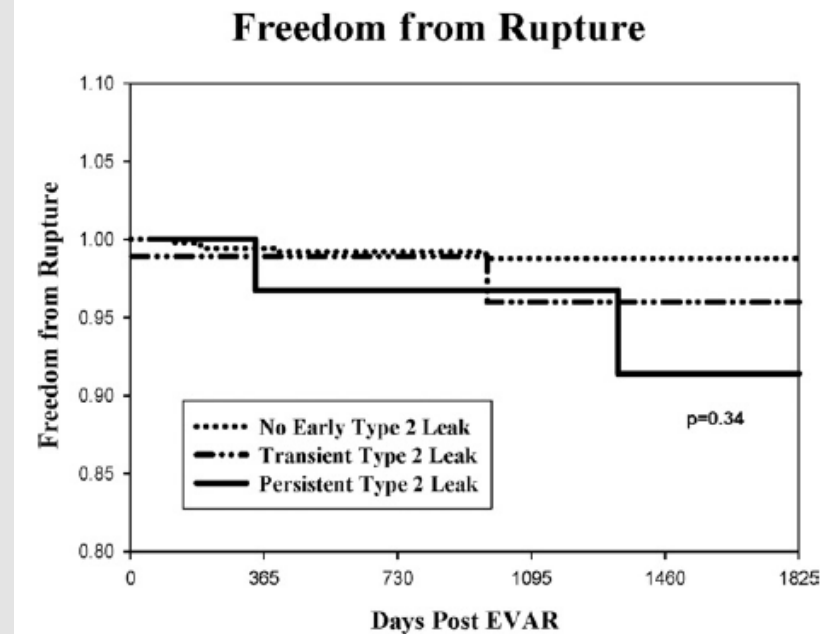
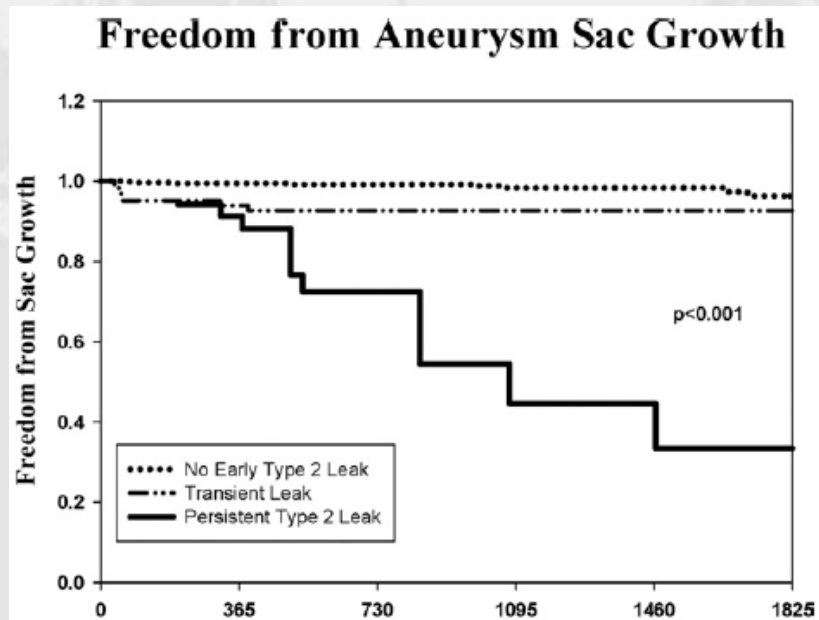
John E. Jones, MD, Marvin D. Atkins, MD, David C. Brewster, MD, Thomas K. Chung, MA, Christopher J. Kwolek, MD, Glenn M. LaMuraglia, MD, Thomas M. Hodgman, BA, and Richard P. Cambria, MD, *Boston, Mass*

J Vasc Surg 2007;46:1-8

873 patients

Aneurysm rupture. Aneurysm rupture in four patients with an early type 2 endoleak. As

Persistent Type II (3.8%)= significant predictor of rupture  $p=0.03$



## Type II endoleak after endovascular aneurysm repair

D. A. Sidloff<sup>1</sup>, P. W. Stather<sup>1</sup>, E. Choke<sup>1</sup>, M. J. Bown<sup>1,2</sup> and R. D. Sayers<sup>1</sup>

*British Journal of Surgery* 2013; 100: 1262–1270

21,744 pts; 1515 Type II

Incidence of type II 10%

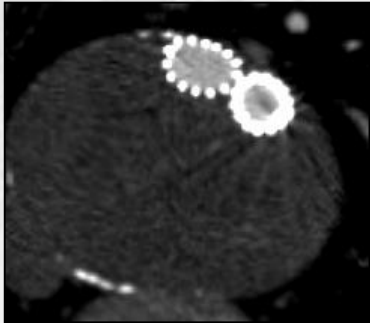
Spontaneous resolution 35%

Unsuccessful Tx 28%  
(trans lumbar better than trans arterial)

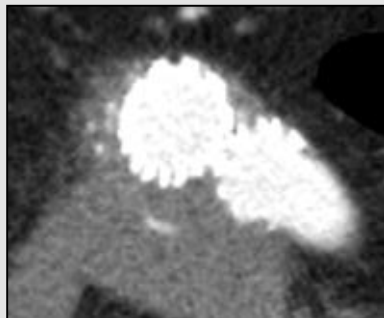
Rupture / type II 0.9%

# Type II endoleak

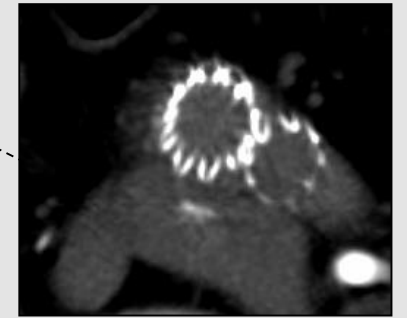
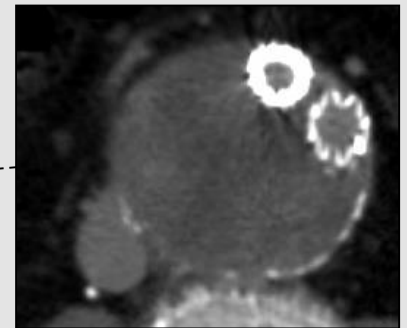
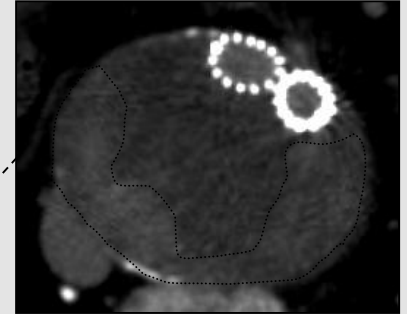
**Early phase**



Lum



**Late phase**



**+ poor distal sealing**

# Type II endoleak is an enigmatic and unpredictable marker of worse outcome after endovascular aneurysm repair

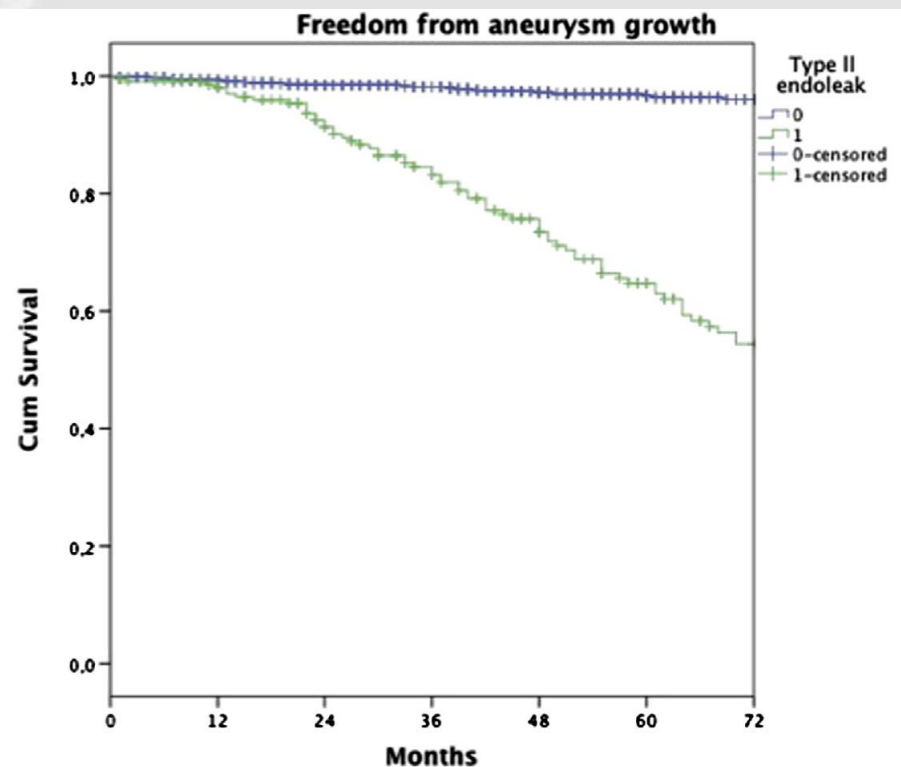
Enrico Cieri, MD, PhD,<sup>a</sup> Paola De Rango, MD, PhD,<sup>a</sup> Giacomo Isernia, MD,<sup>a</sup> Gioele Simonte, MD,<sup>a</sup> Andrea Ciucci, MD,<sup>a</sup> Gianbattista Parlani, MD,<sup>a</sup> Fabio Verzini, MD, PhD, FEBVS,<sup>a</sup> and Piergiorgio Cao, MD, FRCS,<sup>b</sup> *Perugia and Rome, Italy*

1450 patients

J Vasc Surg 2014;59:930-7.

17 Ruptures

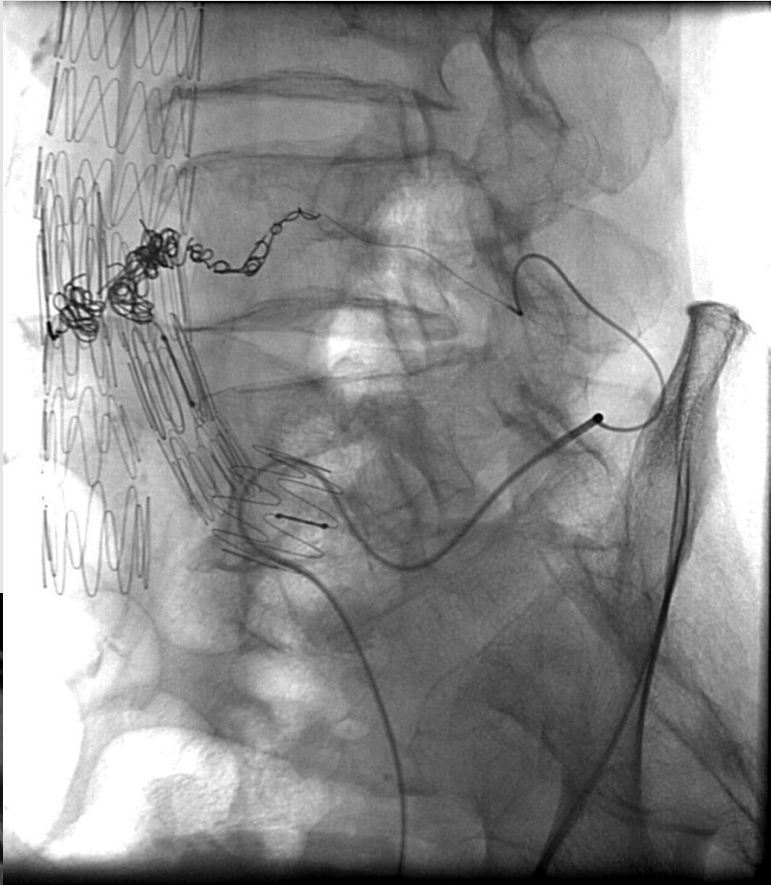
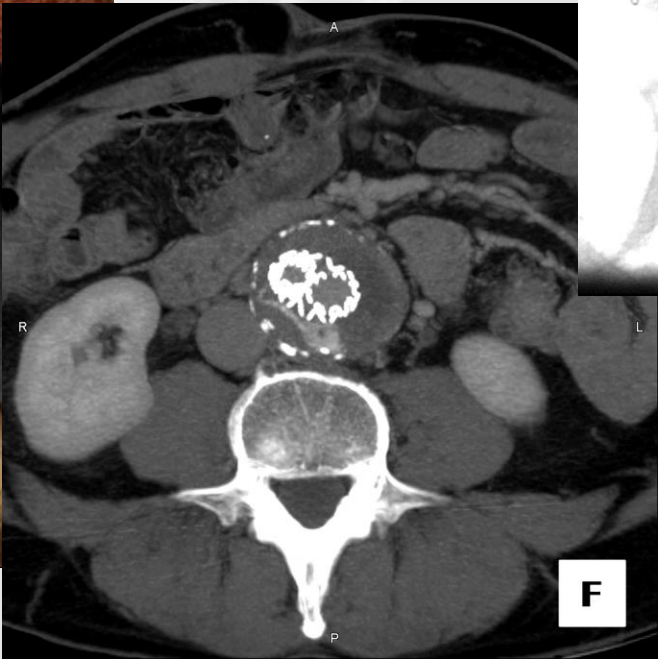
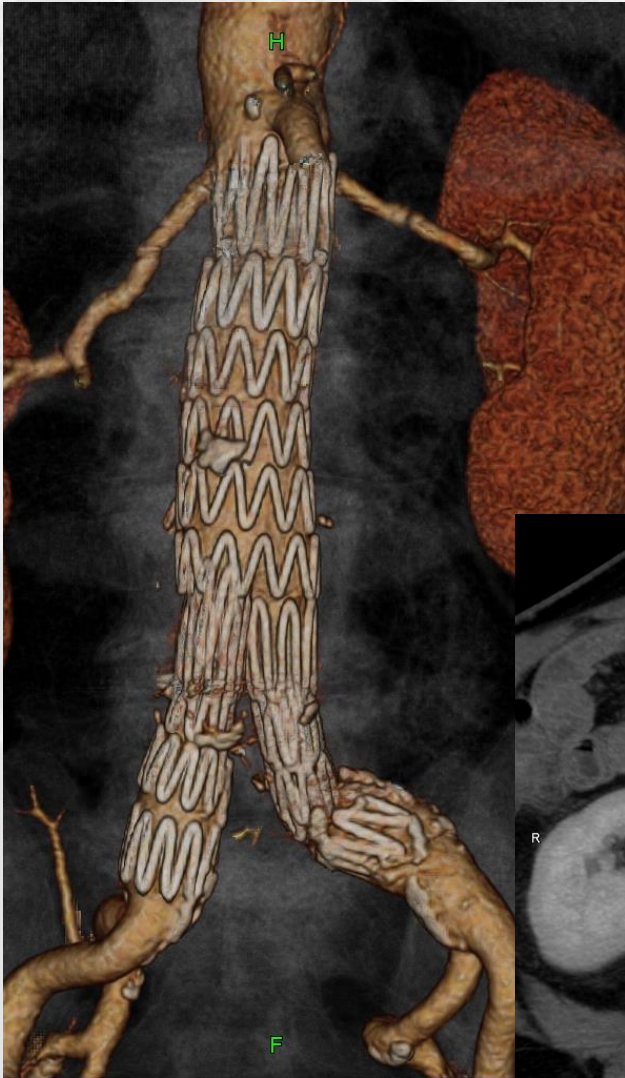
4 secondary to type II  
(0.27%)



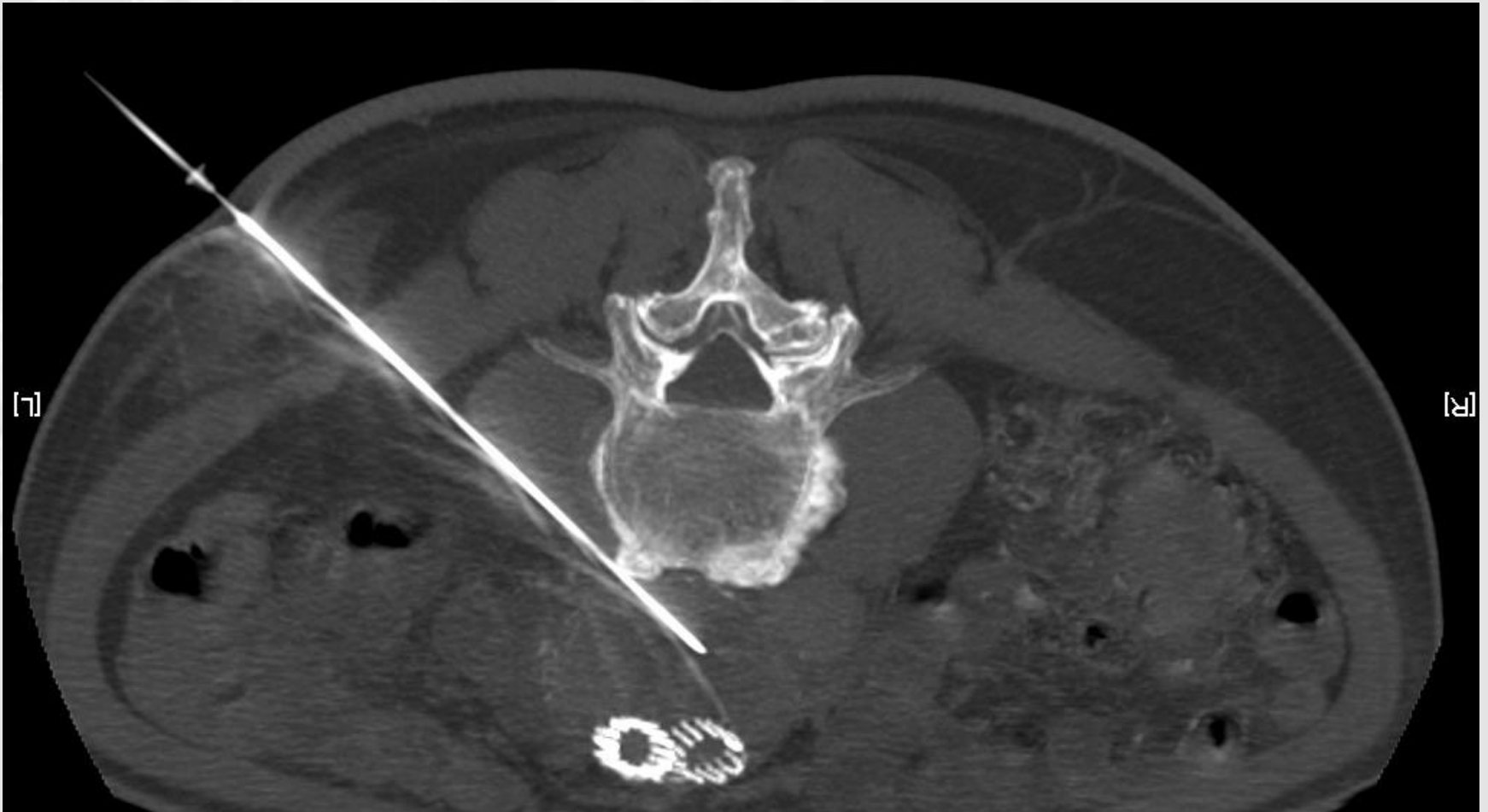


# Treatment of Type 2 endoleak

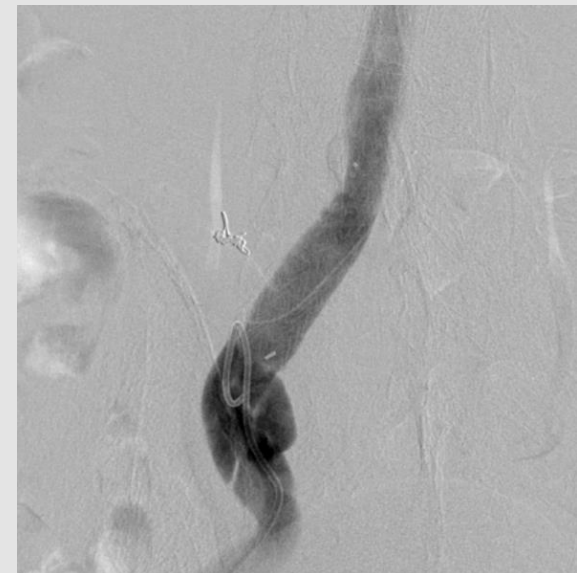
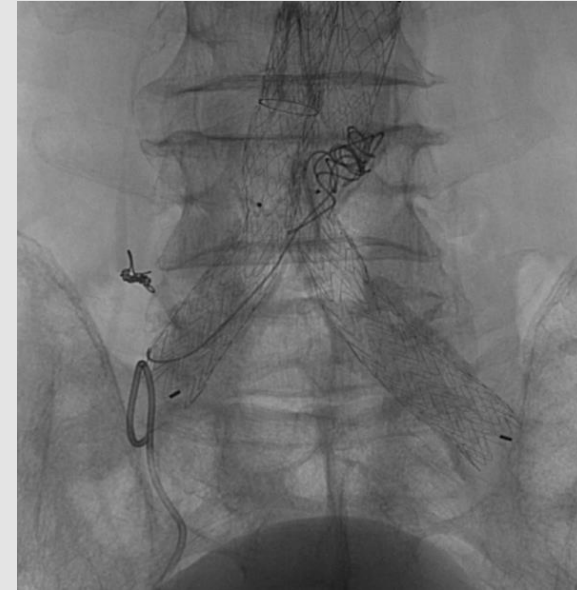
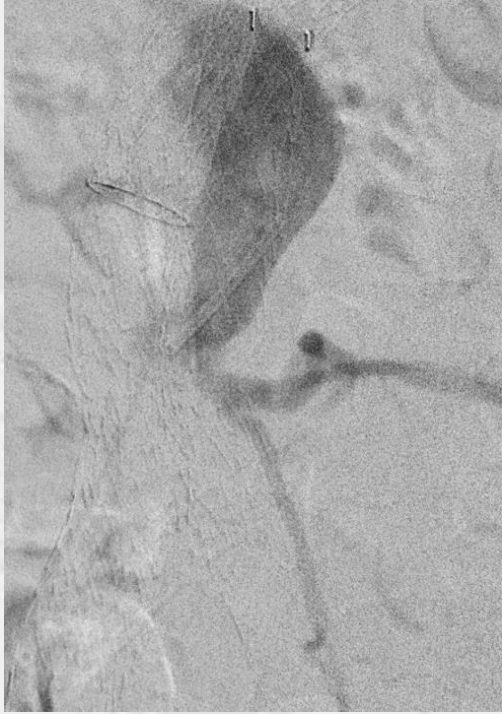
## Catheter embolization



# TC guided trans-lumbar AAA sac puncture



Type II b  
endoleak



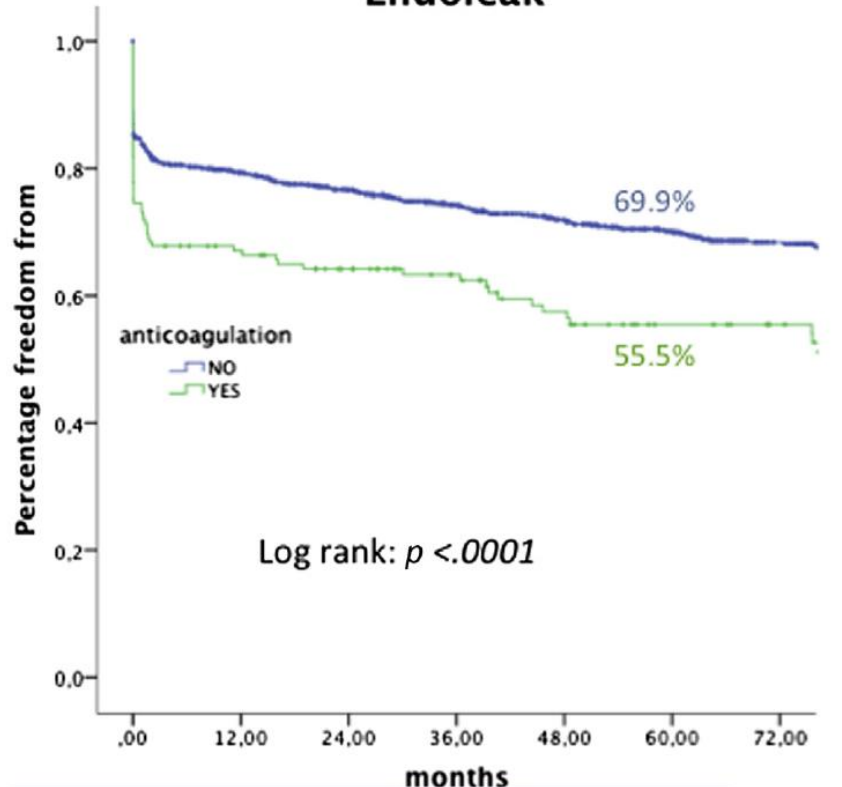
Peri-prosthetic  
(trans-sealing)  
lumbar embolization

# Safety of Chronic Anticoagulation Therapy After Endovascular Abdominal Aneurysm Repair (EVAR) **CME** ☆

P. De Rango <sup>a,\*</sup>, F. Verzini <sup>a</sup>, G. Parlani <sup>a</sup>, E. Cieri <sup>a</sup>, G. Simonte <sup>a</sup>, L. Farchioni <sup>a</sup>, G. Isernia <sup>a</sup>, P. Cao <sup>b</sup>

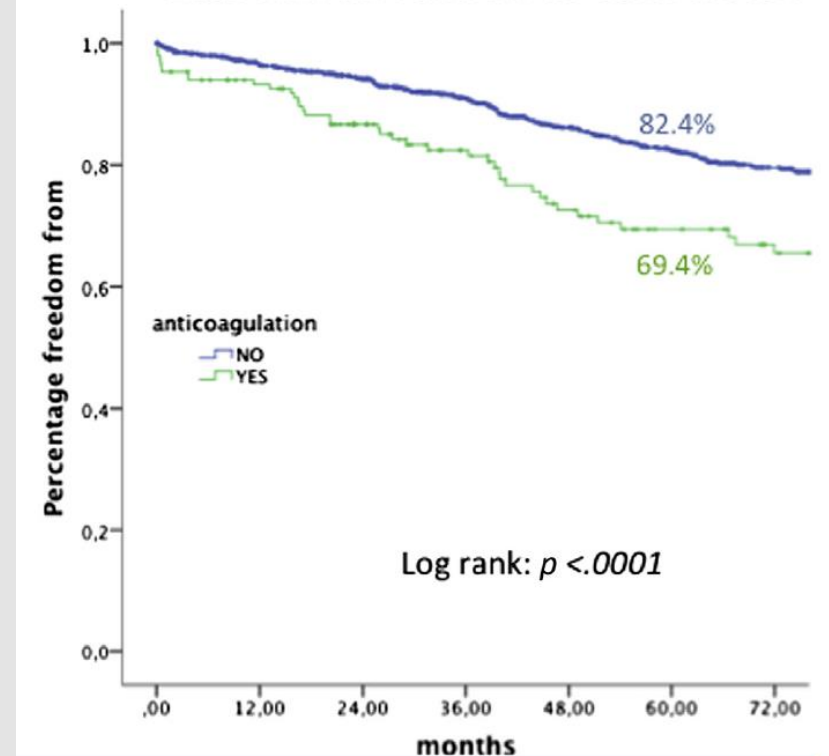
<http://dx.doi.org/10.1016/j.ejvs.2013.12.009>

## Endoleak

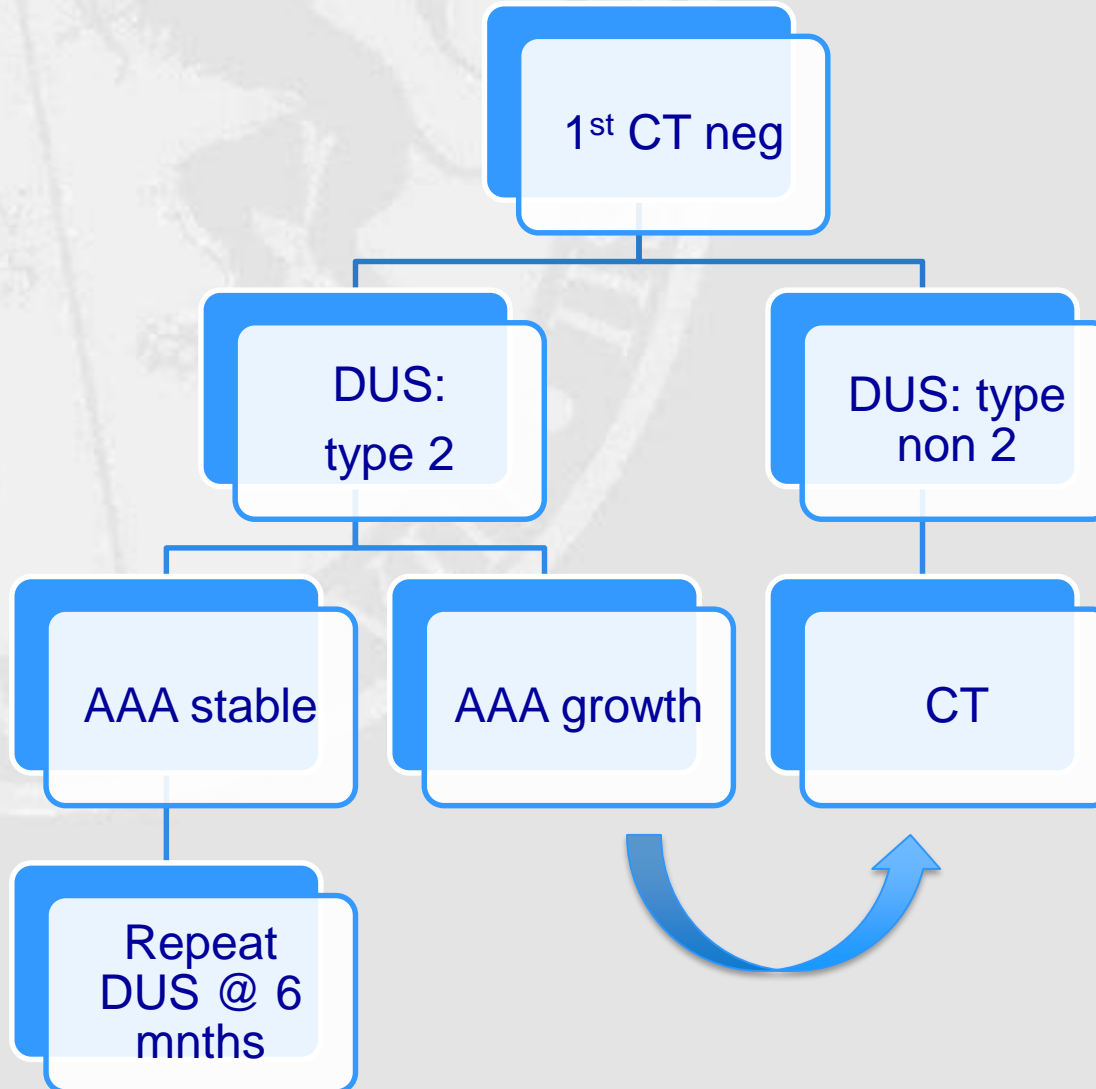


N=1409,  
Anticoagulated = 103

## Late reintervention or conversion



# Perugia Diagnostic algorithm



# Conclusions

- Lifelong surveillance is mandatory for all
- AAA growth: surrogate of intra-sac pressure and rupture risk
- Persisting endoleaks are associated with higher risks of complications

# Conclusions

- Last generation endografts perform well
- Precise EVAR procedure inside IFU may suggest a “relaxed” f-u schedule
- Prompt re-intervention in case of impending failure due to the chronic dilating disease

