

# **Chimney technique for juxtarenal AAA: delicate**

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# Disclosure

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Speaker name:

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I have the following potential conflicts of interest to report:

- 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

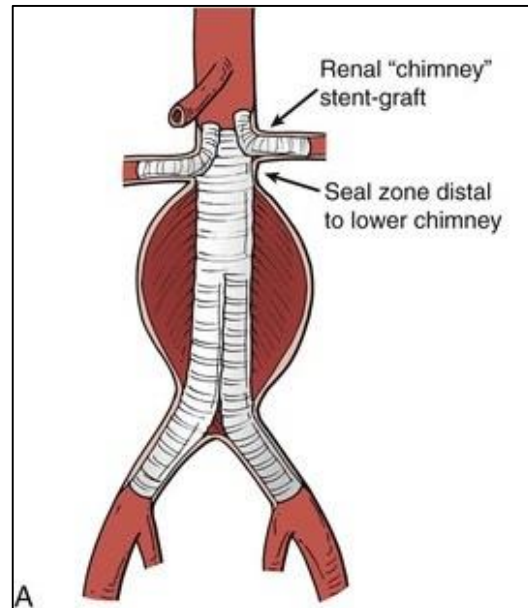
# IFU of stent grafts

- All stent grafts have their own specific IFUs
- According to manufactures' IFUs, AAA with a short neck (<10 mm) or severe angulation (>60°) should not be treated by standard EVAR
- Several investigators have reported their experiences of standard or modified EVAR with off-label use

Product	Infrarenal neck length	Infrarenal angle
Endurant II	≥10 mm	≤60°
Endologix AFX	≥15 mm	≤60°
Excluder	≥15 mm	≤60°
Zenith Flex	≥15 mm	≤60°
Nellix	≥10 mm	≤60°
Ovation	≥7 mm	≤60°

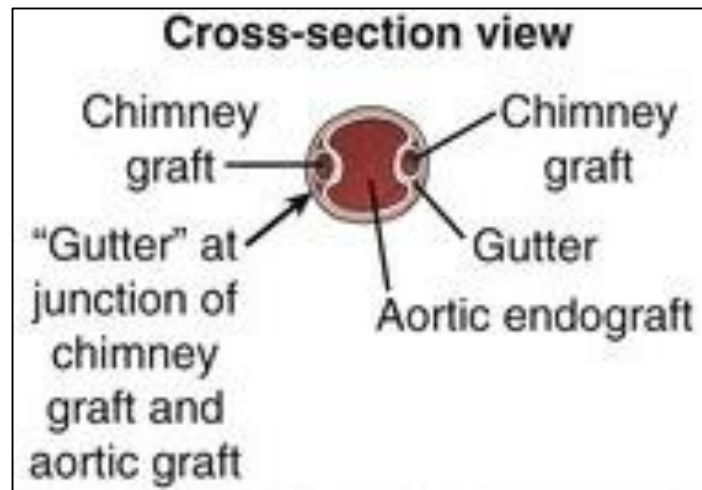
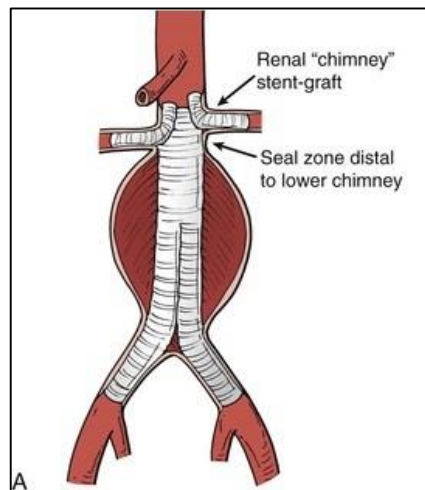
# CHIMNEY EVAR

- Snorkel, periscope, or parallel stent graft
- A stent graft deployed into the SMA or renal artery parallel to the main aortic stent graft, like a chimney, to preserve flow to vital branches covered by the aortic stent graft
  - ✓ Extended the length of the proximal aortic neck
  - ✓ High technical success & primary patency rates
  - ✓ No waiting time for a specific SG
  - ✓ Cost effectiveness compared to fenestrated SG



# CHIMNEY EVAR

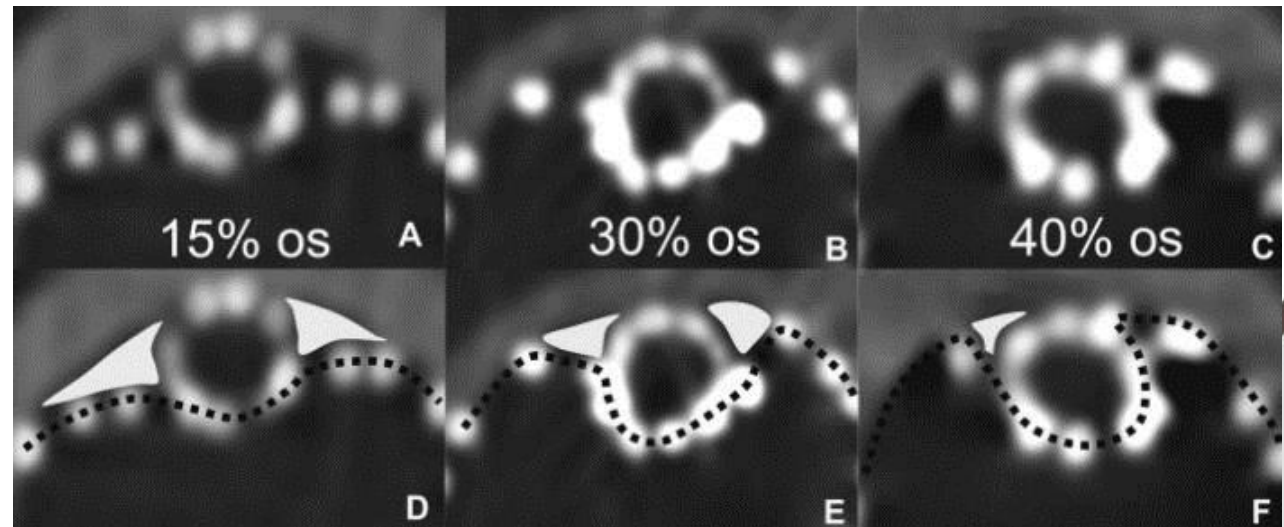
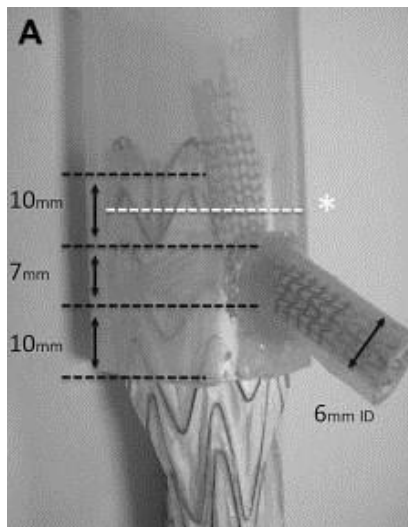
1. The target artery to be stented should be cannulated from arm access, then a sheath and a chimney stent advanced into the artery
  2. Main aortic device is delivered from the conventional CFA access
    - ✓ 20-30% oversizing of main aortic device (c.f. 10-20% oversizing for C-EVAR)
  3. Deploy a main aortic device first, and then deploy a chimney stent
    - ✓ Place a chimney stent 5~10 mm above a main aortic device
  4. Inflate molding balloons simultaneously
- Access a. injury, gutter type Ia endoleak, & chimney stent occlusion
  - Limited availability of covered stents for chimney



# The best conditions for parallel stenting during EVAR: An vitro study

Mestres G, Eur J Vasc Endovasc Surg 2012

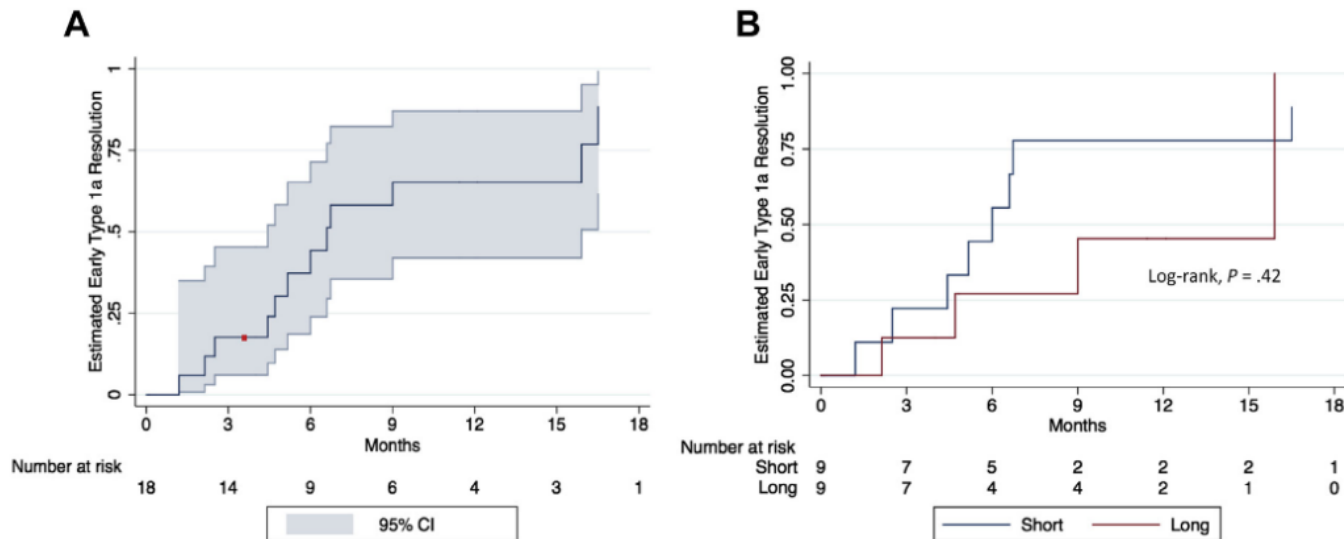
- To identify what degree of oversizing, in combination with what type of parallel stent, may result in the most adequate fit in a juxtarenal AAA
  - ✓ Endurant/Excluder + 6 mm viabahn or V12
  - ✓ Increasing diameter oversizing (15%, 30%, 40%) significantly decreased gutter area ( $p < 0.001$ )
  - ✓ Detect main body infolding of 40% oversized stent graft
  - ✓ Excluder + V12: lower stent compression but wider gutters
  - ✓ Endurant + viabahn: maximum stent compression
  - ✓ Better apposition was achieved when using **30%** endograft oversizing



# Natural history of gutter-related type Ia endoleak after chimney EVAR

Ullery BW, J Vasc Surg 2017

- 60 patients with 111 chimney EVAR (97 renal, 12, SMA, & 2 celiac)
- Early gutter type Ia endoleak: 30% (n = 18)
- Spontaneous resolution in 44%, 65%, and 88% at 6, 12, & 18 mo. F/U
- Reintervention related to persistent gutter endoleak: 2 patients (3%)
- Gutter endoleak was not associated with long-term anticoagulation, degree of oversizing, & stent type and diameter



**Fig 3.** Spontaneous resolution of early (<30-day) type Ia gutter endoleaks following chimney endovascular aneurysm repair (ch-EVAR): entire cohort **(A)** and long vs short gutter endoleaks **(B)**. Red square indicates solitary patient who required early type Ia endoleak-associated secondary intervention performed at 4 months postprocedure). CI, Confidence interval.

- Prospective collected data; Endurant + iCast V12
- 187 chimney stents in 128 patients
- TS 100%
- Mean radiologic F/U: 25 ± 17 mo.
- Late new onset type Ia endoleak 1.6%
- Primary chimney stent patency at 2 years FU: 96%
- Freedom from chimney stent-related reintervention: 93%

Table III. Overview of complications and therapeutic modalities for the PROTAGORAS cohort

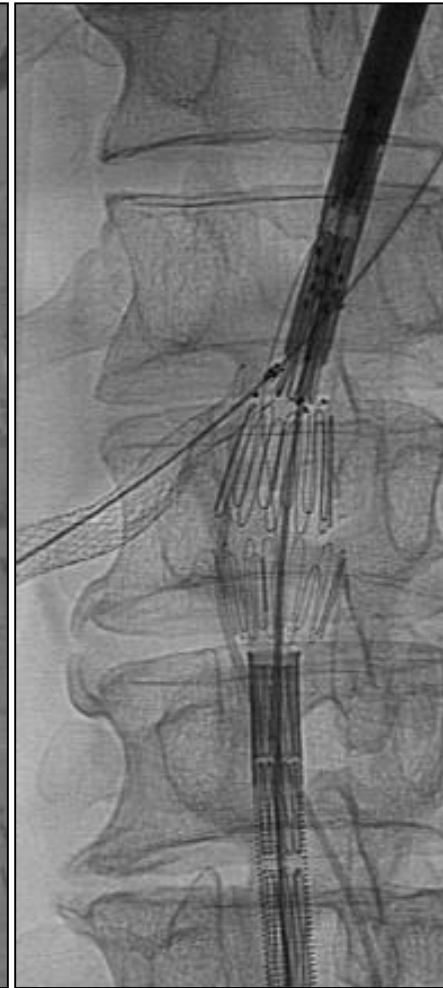
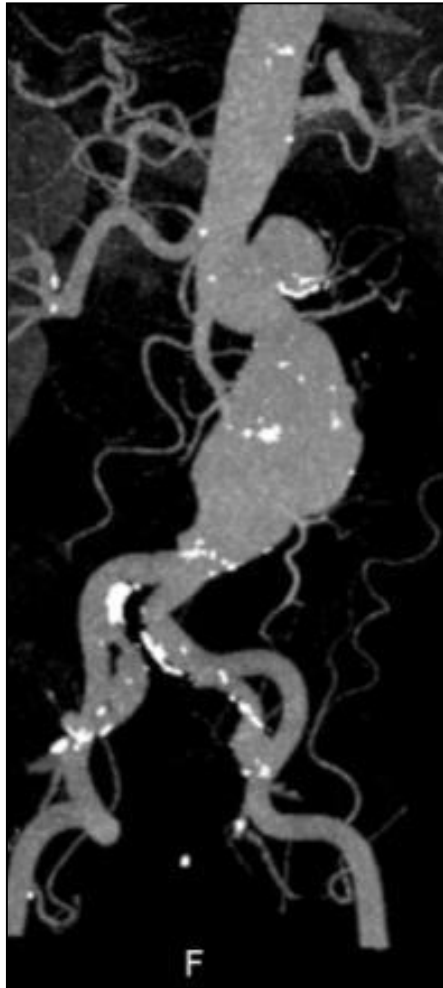
<i>Complication</i>	<i>Reintervention</i>	<i>Target vessels, %</i>	<i>Patients, %</i>
High-grade stenosis of renal chimney	Endovascular management	6 (3)	6 (4.6)
Chimney graft occlusion	Endovascular management	6 (3)	4 (3.2) <sup>a</sup>
	Iliorenal extra-anatomic bypass	1 (0.5)	1 (0.8)
	Conservative treatment	1 (0.5)	1 (0.8)
Endotension	Surgical ligation of the aneurysm sac		1 (0.8)
Endoleak Ia	Transformation of single to multiple chimneys and tube placement <sup>b</sup>		2 (1.6)
Endoleak Ib	Distal iliac limb extension		1 (0.8)
Endoleak Ib and infection	Surgical conversion		1 (0.8)
Endoleak type III	Iliac limb placement		2 (1.6)
Inadvertent coverage of the SMA	Endovascular management		1 (0.8)



- Retrospective study
- 898 chimney stents in 517 patients from USA & European centers
  - ✓ 692 renal, 156 SMA, & 50 celiac chimney stents
  - ✓ Stents: 49% BECS, 40% SECS, 11% BEBMS
- 94% primary patency at 17 mo. F/U
- Persistent type Ia endoleak, 0.4%; gutter type Ia endoleak 2.9%
- These results support ch-EVAR as a valid off-the-shelf and immediately available alternative in the treatment of complex abdominal EVAR.

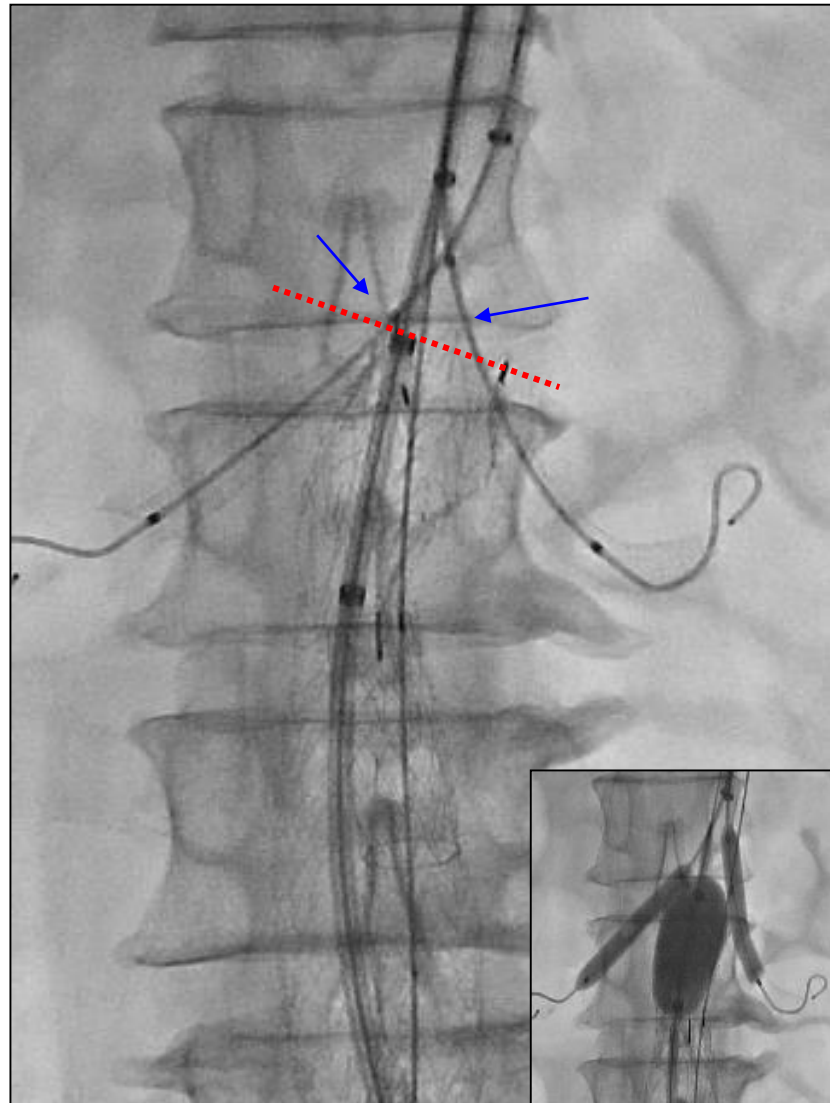
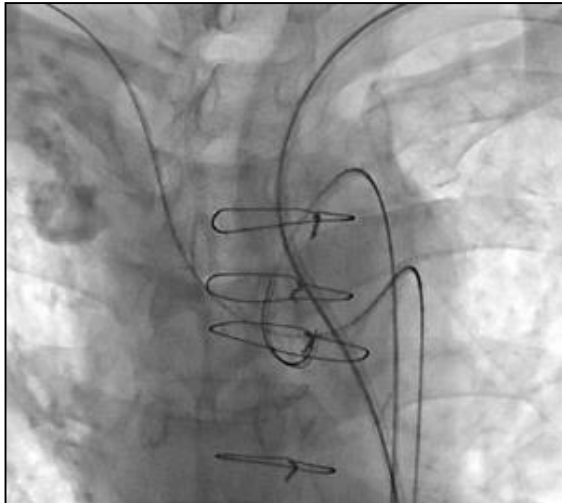
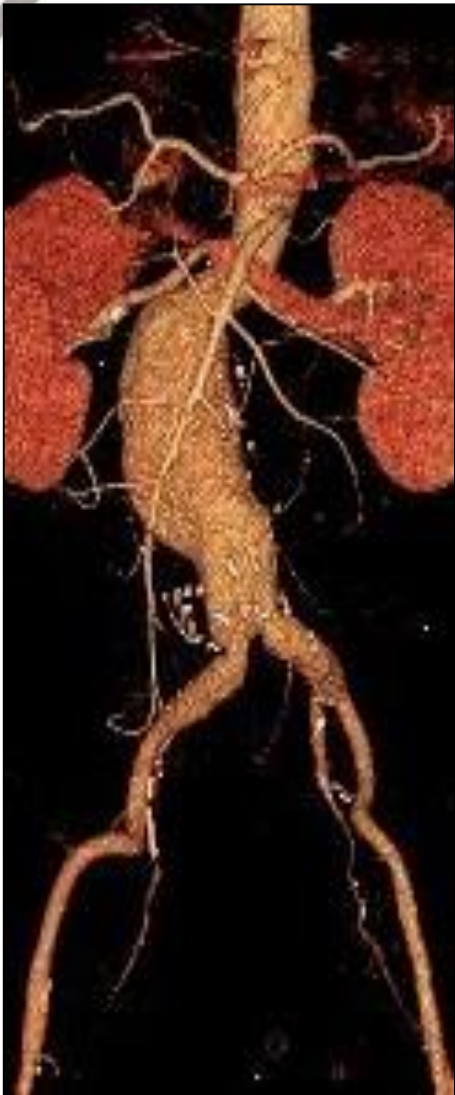
BECS, balloon expanding covered stent  
SECS, self expandable covered stent  
BEBMS, balloon expanding bare metal stent

M/68, EVAR with a chimney stent to the right renal artery

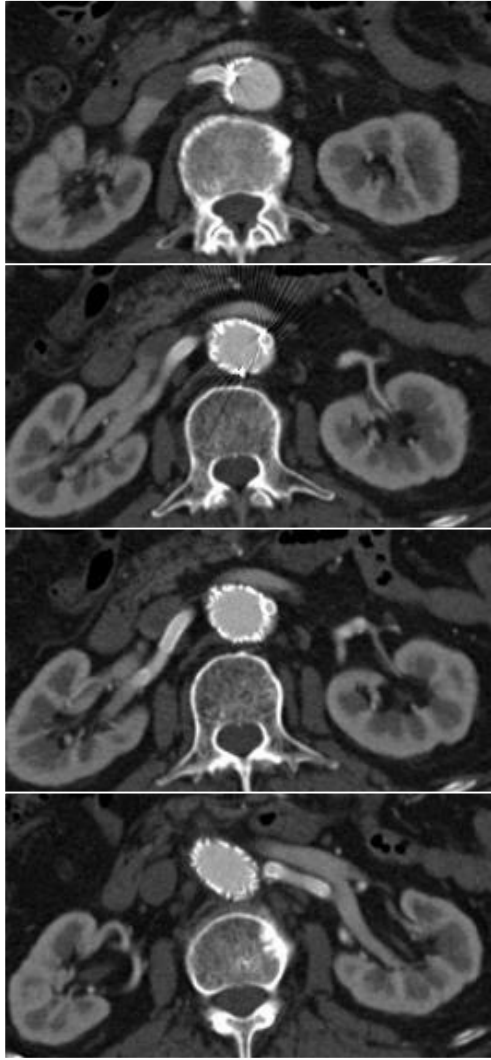


Zenith & BMS

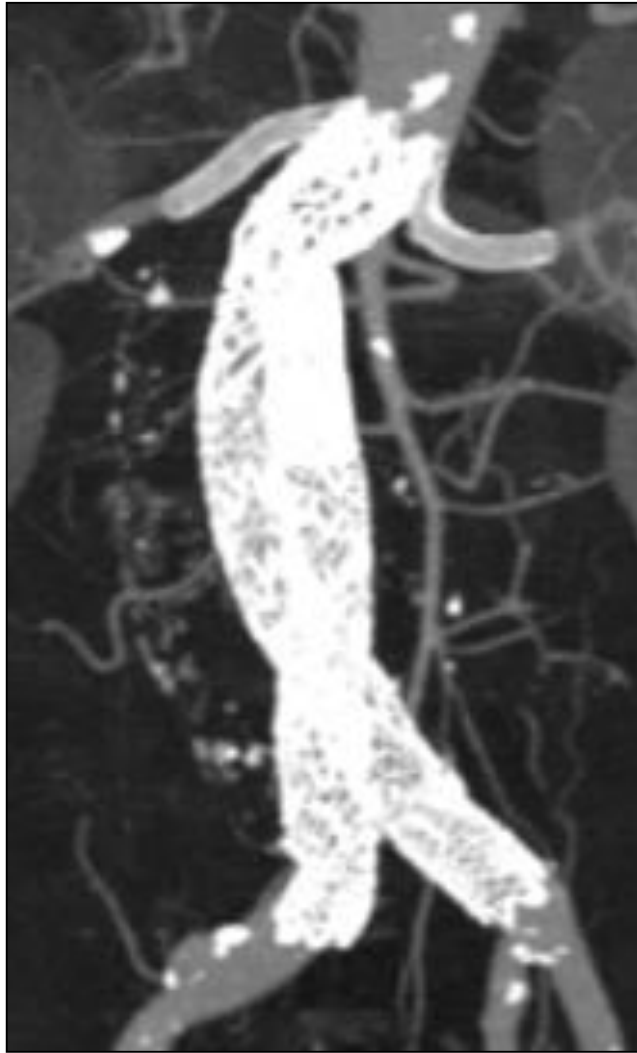
M/72, EVAR with chimney stent grafts to the bilateral renal arteries



Excluder & viabahn



36 mo. F/U



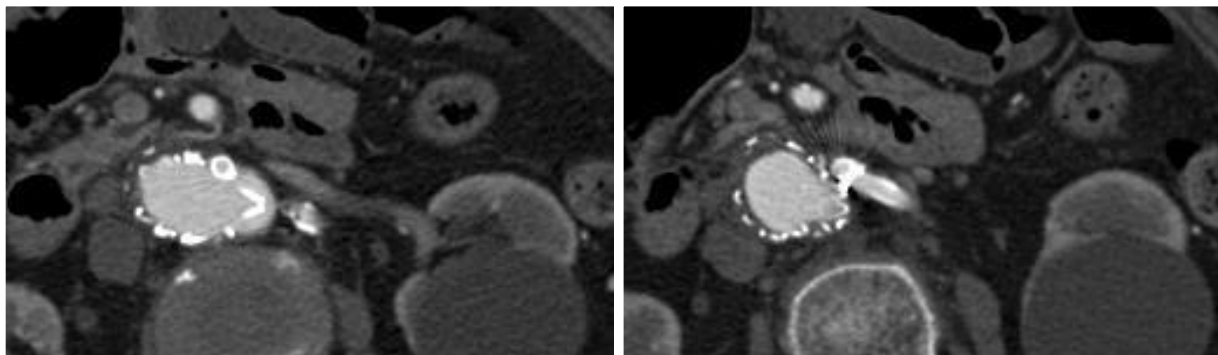
48 mo. F/U  
Cr: 1.09 mg/dL



F/83, EVAR with a chimney stent graft to the left renal artery due to angulated proximal neck



Endurant + Viabahn



36 mo. F/U

# Li Y, et al. Fenestrated & chimney technique for juxtarenal AAA: A systemic review and pooled data analysis. Sci Rep 2016

- 9 F-EVAR cohort (542 patients) & 8 Ch-EVAR cohort (158 patients)
  - ✓ Both techniques are attractive options for juxtarenal AAA treatment with encouraging early and mid-term outcome

**Preoperative patient demographics and main outcomes in F-EVAR and CH-EVAR cohorts.**

	F-EVAR	CH-EVAR	<i>P</i> value
<i>Preoperative</i>			
Age	74 (47–86)	75 (59–88)	
Aneurysm diameter	64 (47–112)	64.5 (33–110)	
Length of aneurysm neck	6.7 ± 3.6(0–14.4)	2.3 ± 4.3 (0–10)	
<i>Outcomes</i>			
Operative time (min)	261 (80–554)	178 (75–810)	
Fluoroscopy time (min)	64 (5–223)	54.6 (15–290)	
Contrast dose (ml)	166 (90–465)	146 (45–465)	
Estimated blood loss (ml)	534 (50–7000)	332 (30–2204)	
Technique success rate	98.8%	97.4%	0.15
30-day mortality	6 (1.1%)	8 (3.8%)	0.02
Over-30-day mortality	29 (5.35%)	15 (9.5%)	0.01
All-cause mortality	35 (6.46%)	21 (13.3%)	0.0002
Patency	95.9%	97%	0.34
Follow-up (month)	12.8 (1–65)	14.7 (0–46)	
Length of stay (day)	7 (1–100)	4.4 (2–50)	
Secondary intervention rate	58 (10.7%)	17 (9.5%)	0.98

## Take home message

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- Ch-EVAR for treating juxtarenal AAA is technically feasible
- Type Ia gutter endoleak following Ch-EVAR is not uncommon, however it can be disappeared spontaneously or treated via endovascular method
- Symptomatic chimney stent occlusion is rare

THANK YOU  
FOR YOUR ATTENTION

