

# EVAR

## How to overcome hostile anatomy in AAA

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# Hostile Anatomy

Not Consistent with the IFU guidelines of the Grafts

Any Anatomical problem that could cause a failure

Technical

Clinical

Early, Late

# Sites of Hostile Anatomy

Femoral	Pathology and or previous surgery
Iliac	Small diameter and length Stenosis, Occlusion, Tortuosity, Calcified, angulated Aneurysm
Aortic Bifurcation	Size
Aortic Neck	Length, Angulation, Thrombus, Calcification, Shape, Diameter
Renal arteries	Multiple, stenosis
SMA/Coeliac	Occlusive disease
Thoracic Aorta	Shaggy
Subclavian	Stenosis/occlusion

Single or more often in combination

# Problem

30% to 60% of patients unsuitable for conventional EVAR  
63% of women neck length <15 mm

Most **common reasons** for exclusion from EVAR

**1.Short infrarenal neck length**

2.Small iliac access (almost a non issue in 2016)

**3.Angulation of aortic neck**



Femoral artery disease

Surgery

# Femoral and Pevar

## PEVAR trial

Femoral cutdown 5-15% problems

More than 90% are suitable for Pevar

Reduced blood loss

Wound complications

Length of hospital stay even outpatient

Future access Almost virgin territory

Cosmetics and patient satisfaction increased

Proglide

**Assess the common femoral artery image.** Beware anterior wall calcification

Use **ultrasound guidance.** obesity, high femoral bifurcation, small diameter, or calcification

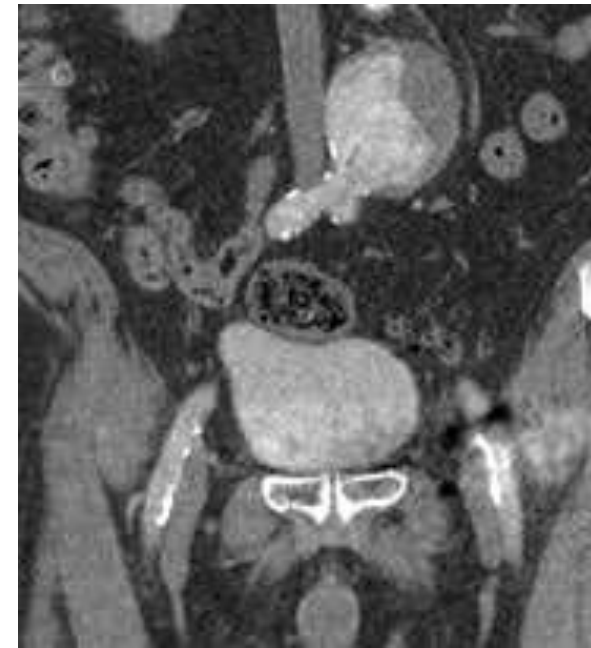
Check the site of puncture with angiography if in doubt (oblique view for side/posterior wall punctures).

Keep access at the moment of closure leave wire until acceptable hemostasis is achieved.

Be patient to achieve good hemostasis

Be prepared for surgical cutdown.

Monitor for occlusion



# Iliac Access

Small caliber iliac arteries

Stenotic or Calcified

Endarterectomies

Direct aortoiliac dissection

Angioplasties with and without stents

Retroperitoneal conduits

Endoconduit

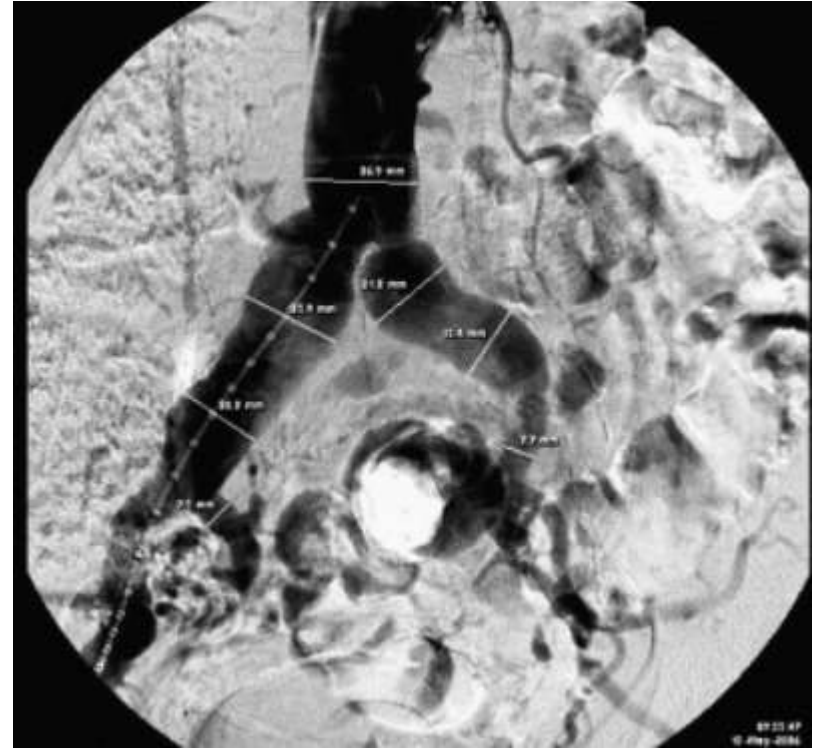
AUI with fem fem and ligate other iliac

**Low profile device eg Ovation, Cook**

**Beware Iliac avulsion**



# Hostile Iliac artery Occluded





Aorto uniliac and fem fem crossover  
Bifurcated graft without recanalization  
Customized modular endograft and covered  
stents  
Bifurcated graft with recanalization : Reentry  
devices



# CIA aneurysm about 20% with AAA

Embolization of IIA one or both: Amplatz plugs, Occluder, Coils, Combination

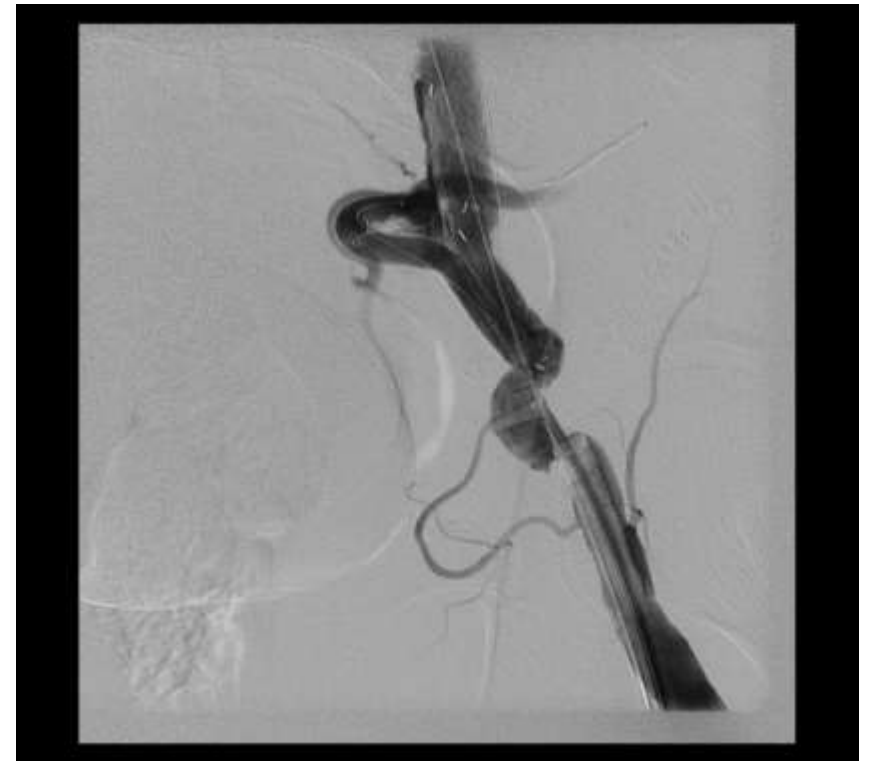
IBD

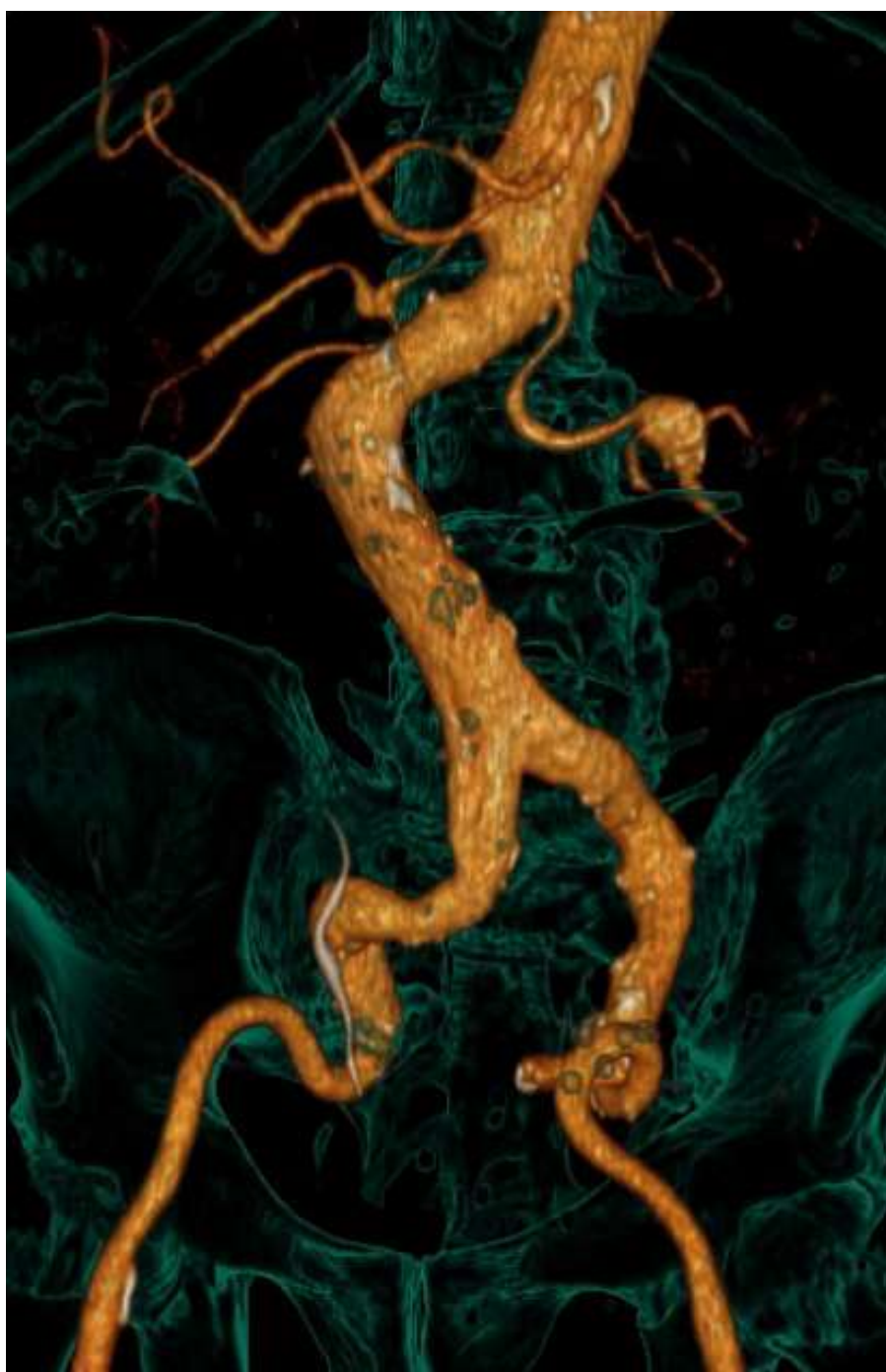
Cook Gore

Reimplantation/bypass EIA IIA

Periscope Technique

Hybrid procedure





# Tortuous Iliac

Difficulty in passing stiff wire and device through the vessel

Balloon-assisted technique

Snare the wire for traction via brachial artery

Through and through wire

Femoral cutdown and straighten the iliac via the groin

Excise a segment and anastomose

Beware dissection when first entering vessel, Advance wire with screening

Beware iliac limb kinking **Liberal use of adjunctive stenting**

Completion angiogram inadequate to assess limbs at risk

IVUS expensive

# Short Common iliac artery

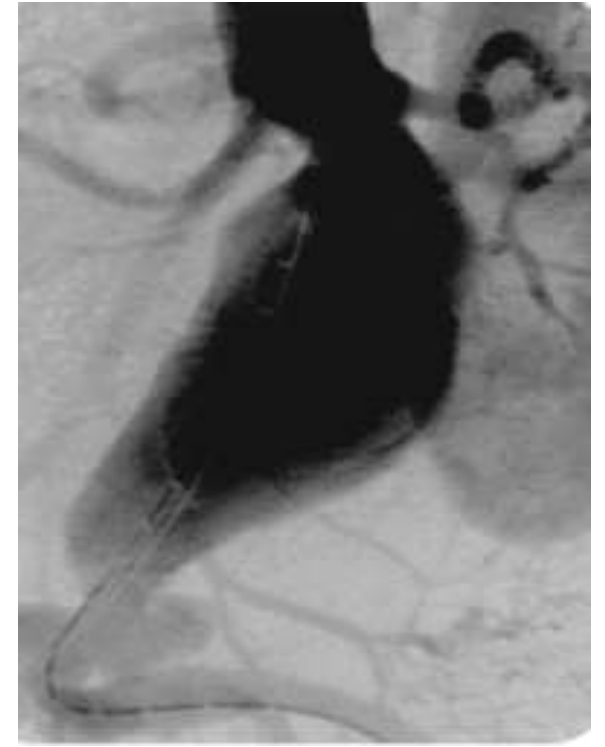
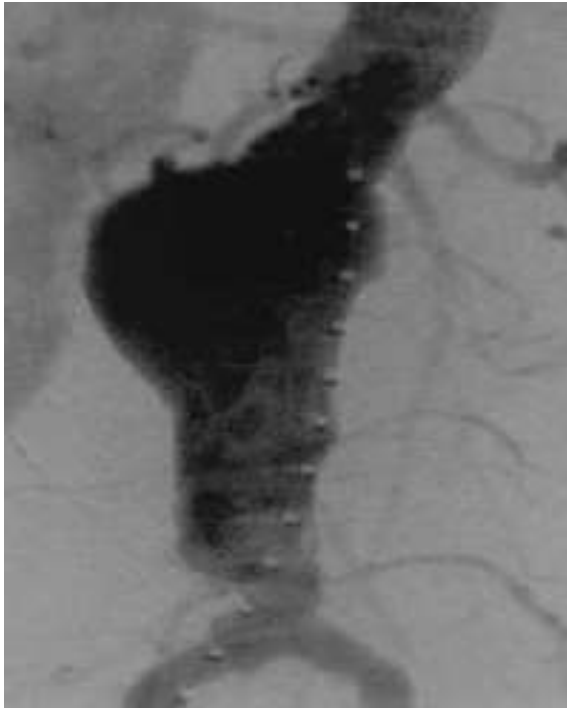
Embolise Internal and extend to external

Balloon expandable stent to anchor limb in common iliac artery

EIA IIA Bypass      Extend the iliac landing zone

Periscope Technique

# Hostile Aortic Neck



# Criteria

Proximal aortic neck of  $\geq 15$  mm ( $\geq 10$  mm for Talent)

neck angulation  $\leq 60$  degrees

neck diameter  $\leq 32$  mm

Reverse Tapered

Calcium

Thrombus

# Hostile Neck Options

**Advances in graft Technology**  
Gore

Ovation, Nellix, Aorfix, Anaconda,

Deployment of conventional infrarenal aortic stent grafts outside IFU

Homemade and physician-modified endografts

Snorkel/chimney approaches with parallel covered stents

Utilization of customized fenestrated endografts Zenith, Anaconda, Jotec

Hybrid abdominal debranching and endograft placement Limited

Branched endografts

Combination



# Options for Short Aortic Neck

Extending the length of the neck

Debranching

VORTEC

Aortic banding

Moving the neck proximally

Chimney or Snorkel

Fenestration and or Branched Zenith,  
Anaconda, Jotec

Surgeon Modified Fenestration

Premade Ventana system

Keeping the short proximal neck

Nellix

Multilayer

Endostapling or endoanchors with device

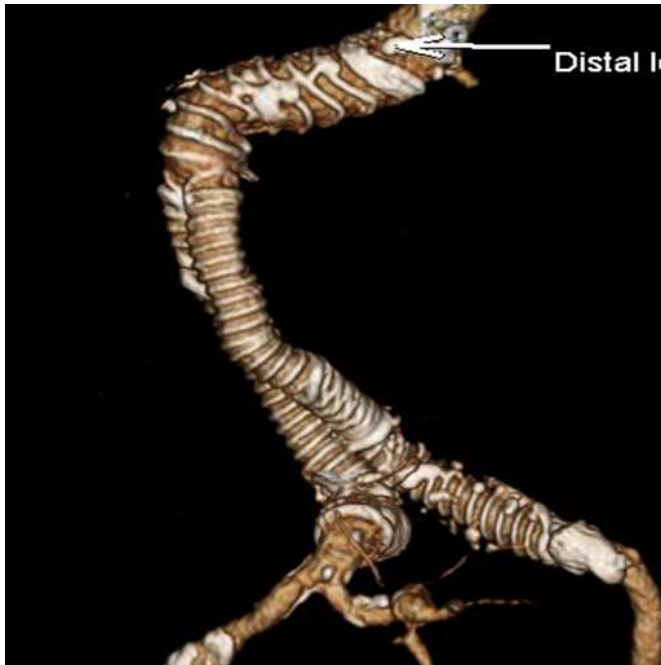
Palmaz reinforcement

Ovation

Thoracic endograft

# Angulated Neck

- Aorfix Pythagoras
- C3 Excluder
- Endurant



# CHIMPS

Cranial extension of the proximal seal zone  
Preservation of branch vessel patency

PERICLES registry 898 grafts, 517 pts, 4.9% mort, Type1a 0.4%, 94% 17m prim pat  
Chevar in elderly.

Fenestrated

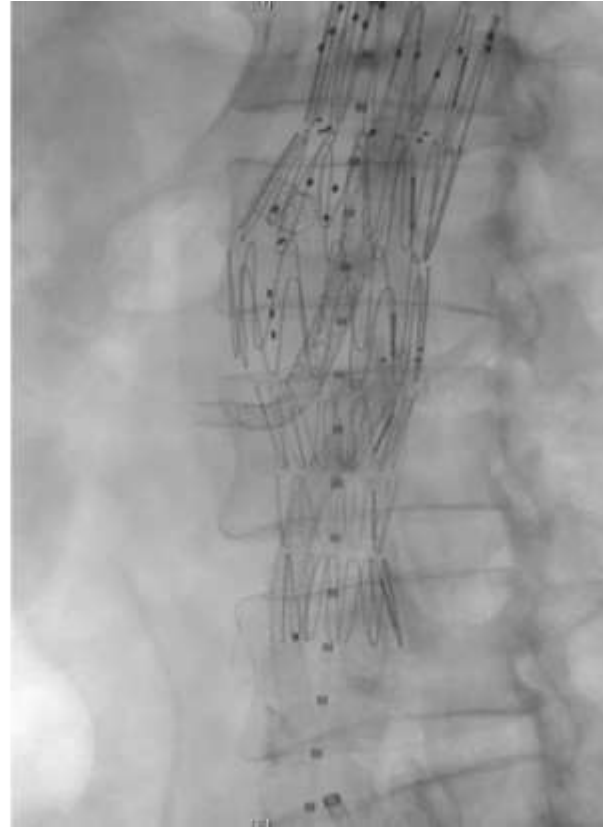
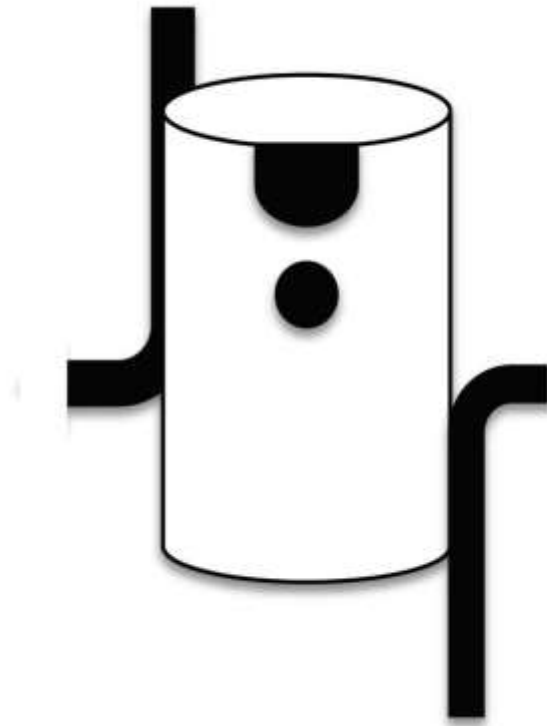
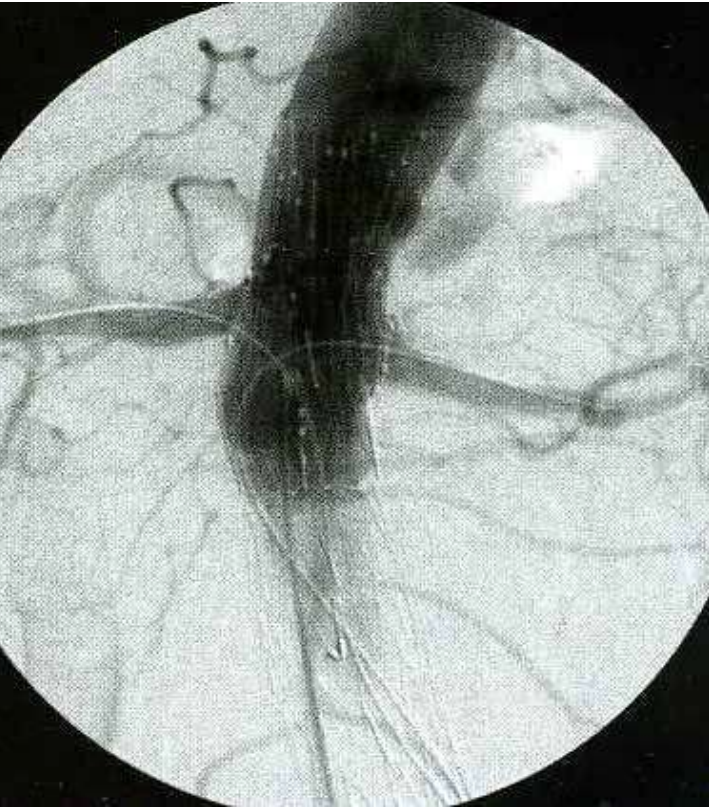
CHIMPS

Elective 6-12 w  
Cranially directed renal  
Proximal renal artery branching  
Upper extremity Occl disease  
Difficult Arch  
Shaggy Aorta  
Cost  
Large Delivery system

Skill, Availability of graft, Time  
Can Be combined

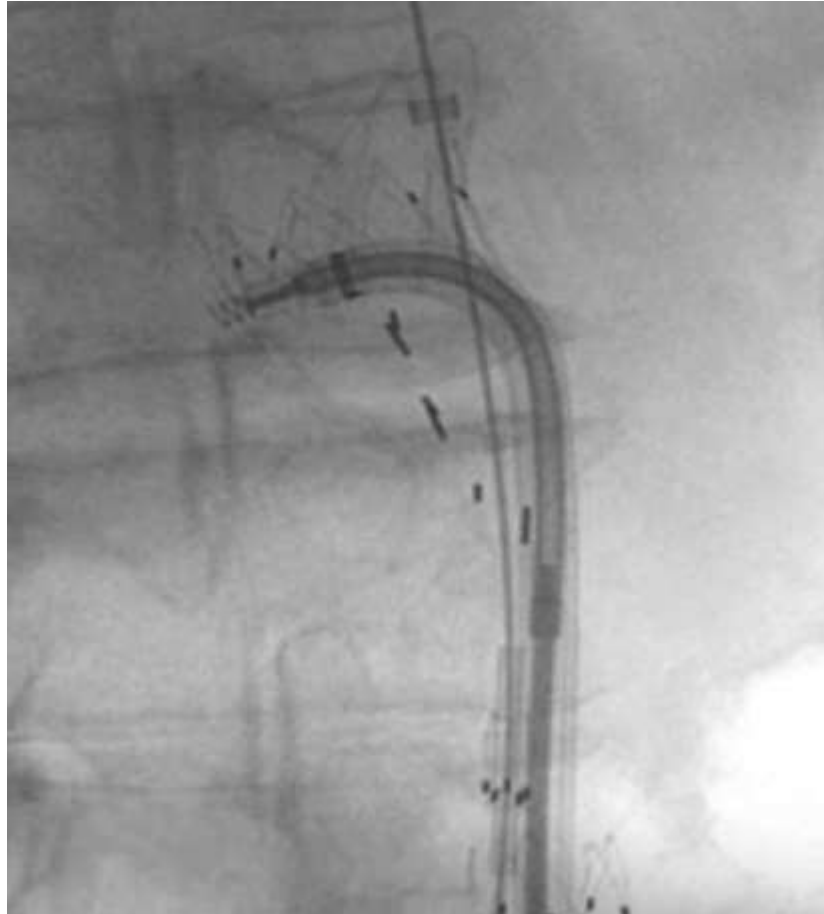
Urgent Cases  
Hostile iliofemoral access  
Caudal Directed Renal artery  
Target Vessel Stenosis  
Proximity of SMA and Renal artery  
Prior Aortic reconstruction  
  
Tortuous Visceral Aortic Segment

# Fenestrated Grafts, Combined Fenestrated and CHIMPS



# Endoanchors

## Staples 1 and 2 trial



# EVAR in hostile and friendly Aortic neck anatomy

Meta-analysis seven studies

Increased difficulty technically

Increased number of adjunctive procedures to achieve proximal seal

Increased risk of proximal endoleaks at short-term and medium-term

Higher incidences of proximal neck dilation

Increased need for secondary interventions

One year            higher risk of type I endoleak

Nine fold increased risk of aneurysm-related mortality

Closer Monitoring

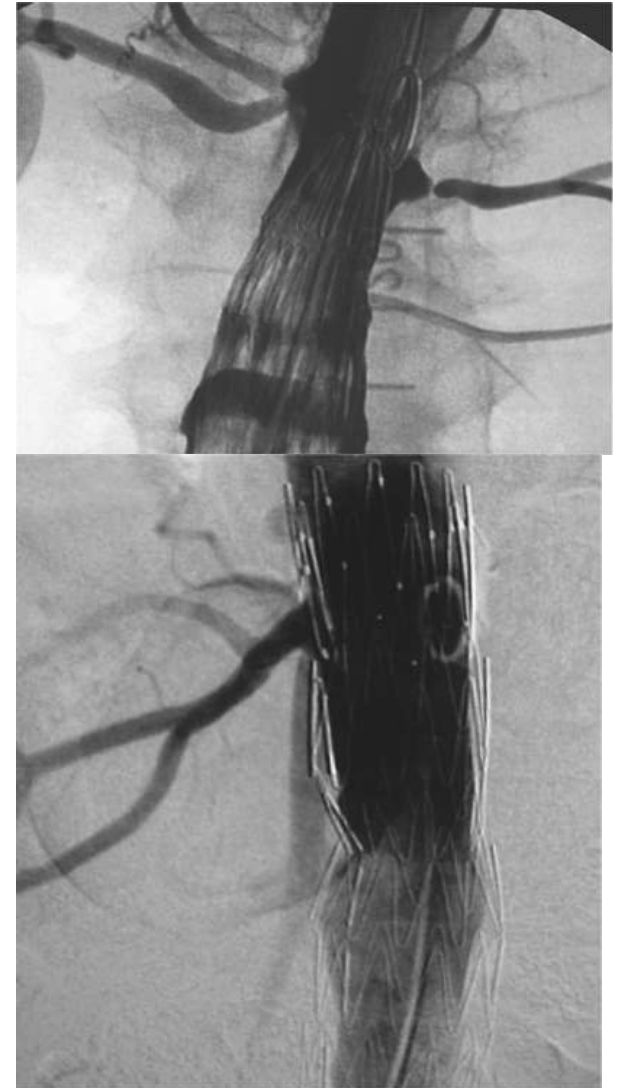
# Renal stenosis

Dilemma of whether or not to stent renal stenosis

Technically much easier before

Choose infrarenal graft

- Discussion vascular surgeon and nephrologist
- Suprarenal fixation safe procedure for renal function



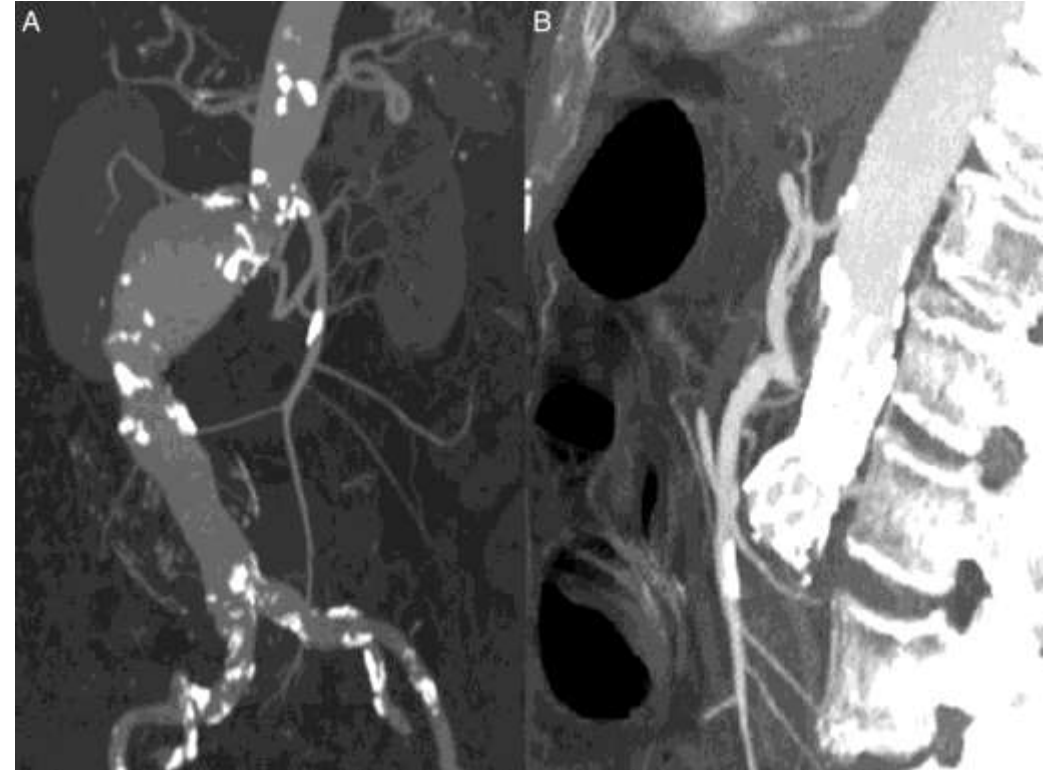
# SMA

Hostile proximal aortic neck, small, angulated and short visceral aorta or **anomalies in SMA/CA origin or occlusive disease**

Occlusion of the SMA recognized contraindication for EVAR  
previous ligation of collaterals between the SMA and the inferior MA are probably as important eg colectomy

Careful preoperative assessment and planning is mandatory  
Beware a large IMA

Correct stenosis or occlusion before  
New Grafts designed for an extremely angulated aortic neck  
Chimney CGT  
Fenestrated branched EVAR endograft should be considered  
Bypass the SMA and or IMA first





# Secondary effects of Hostile Anatomy

Radiation

CT overlay

Mark Arteries with wire or catheter

Contrast Use

Use Co2 below diaphragm

Ischemia of extremities

Compartment syndrome

Shunts

# Ad Hoc Committee for Standardized Reporting Practices in Vascular Surgery of the Society for Vascular Surgery/American Association for Vascular Surgery in 2002

Attribute	Absent: Score of 0	Mild: Score of 1	Moderate: Score of 2	Severe: Score of 3
<b>Aortic neck</b>				
Length (mm)	>25	15–25	10–15	<10
Diameter (mm)	<24	24–26	26–28	>28
Angle (degrees)	>150	150–135	135–120	<120
Calcification or thrombus (%)	0	<25	25–50	>50
<b>Aortic aneurysm</b>				
Aortic tortuosity index	<1.05	1.05–1.15	1.15–1.2	>1.2
Aortic angle (degrees)	160–180	140–159	120–139	<120
Thrombus (%)	0	<25	25–50	>50
Aortic branch vessels	No vessels	1 lumbar or inferior mesenteric artery	2 vessels with <4-mm diameter	2 vessels with inferior mesenteric artery diameter >4 mm
Pelvic perfusion	Patent bilateral internal iliac artery	Single internal iliac artery occlusion	Single internal iliac artery occlusion and contralateral internal iliac artery >50% stenosis	Bilateral internal iliac artery occlusion
<b>Iliac artery</b>				
Calcification	None	<25% vessel length	25%–50% vessel length	>50% vessel length
Diameter and occlusive disease	>10 mm, no occlusive disease	8–10 mm, no stenosis <7 mm in diameter, or >3 cm in length	7–8 mm, focal stenosis <7 mm in diameter and <3 cm in length	<7 mm, stenosis <7 mm in diameter and >3 cm in length, more than one focal stenosis <7 mm in diameter
Iliac artery tortuosity index	<1.25	1.25–1.5	1.5–1.6	>1.6
Iliac artery angle (degrees)	160–180	121–159	90–120	<90
Common iliac artery length (mm)	>30	20–30	10–20	<10
Iliac artery diameter	<12.5 mm	12.5–14.5 mm	14.5–17 mm	>17 mm

# Conclusion

EVAR the “gold standard” for patients with acceptable AAA anatomy that fits within the IFU for each device

Outcomes Improving with time even in Hostile Anatomy

Appropriate Imaging Assessment and Planning

Increasing operator experience and education

Significant advances in endovascular technology Devices lower profile  
conformable, controlled deployment

Rapidly expanding array of complex endovascular strategies and perioperative procedures

Remember the PPPPP rule: Prior planning prevents poor performance!