

# **Fenestrated and Branched Graft for TAAA: report of a case**



Melas N, Perdikides Th.

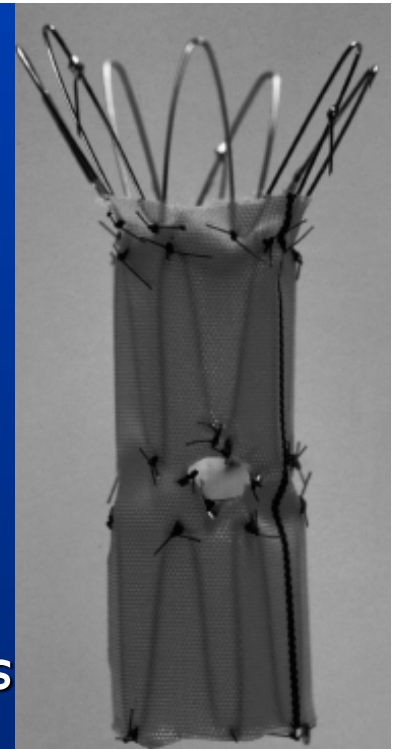
# History

- 1<sup>st</sup> Fenestrated stent-graft, Korea 1996 (1)
- fenestrated stent graft designed by D. Hartley 1997
- 1<sup>st</sup> publication of fenestrated stent graft: 1999 (2)
- Indication: unfavorable neck anatomy of AAA EVAR
- Custom made device
- Commercially available device (Zenith Cook Fenestrated, Brisbane, Australia)
- >1000 cases worldwide
- 13 centers
- 50 authorized users
- CE mark in Europe and Australia, clinical trials in USA

1. Park JH, Chung JW, Choo IW, Kim SJ, Lee JY, Han MC. Fenestrated stent-grafts for preserving renal branches in the treatment of abdominal aortic aneurysms: preliminary experience. J Vasc Interv Radiol. 1999 Dec;7(6):819-23.

Department of Radiology, Seoul National University College of Medicine, Korea.

2. Faruqi RM, Chuter TA, et al. Endovascular repair of AAA using a pararenal fenestrated stent graft. J Vasc Med Biol. 1999; 6:354-8.



# Definition-Goal-advantage

- **Transform** the unfavorable proximal or distal landing zone into favorable  
by incorporating **fenestrations** to revascularize the included vessels (renals, accessory renals, SMA, CA)
- **Translocate** the unfavorable proximal (II, III, IV TAAA) or distal (I,V TAAA) landing zone, more proximally or more distally  
by incorporating **fenestrations and branches** to revascularize the included vessels.

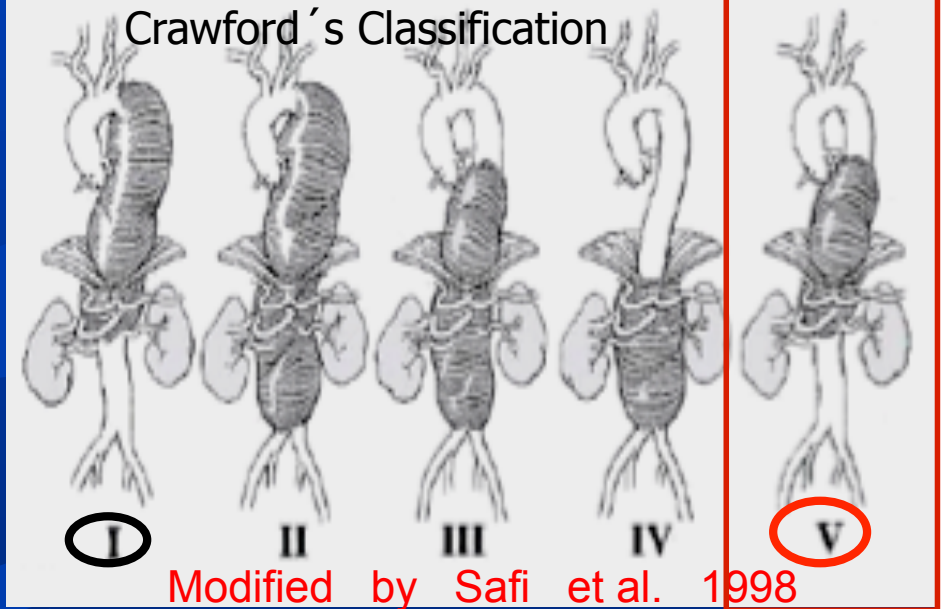
# Indications for F-EVAR

- AAA with unfavorable infrarenal neck  
(short < 10mm, conical)
- Juxtarenal AAA — arise distal to the renal arteries but in very close proximity to them.
- Pararenal AAA — involve the origin of one or both renal arteries
- Suprarenal AAA — encompass the visceral aortic segment containing the superior mesenteric and celiac arteries, and specifically are termed type IV thoraco-abdominal aneurysms if they extend upward to the crus of the diaphragm.
- PAA (Paraanastomotic)  
Juxtarenal  
Pararenal  
Suprarenal — very close to the origin of the renals or involving the renals always after a previous open AAA repair.
- TAAA (I-V)

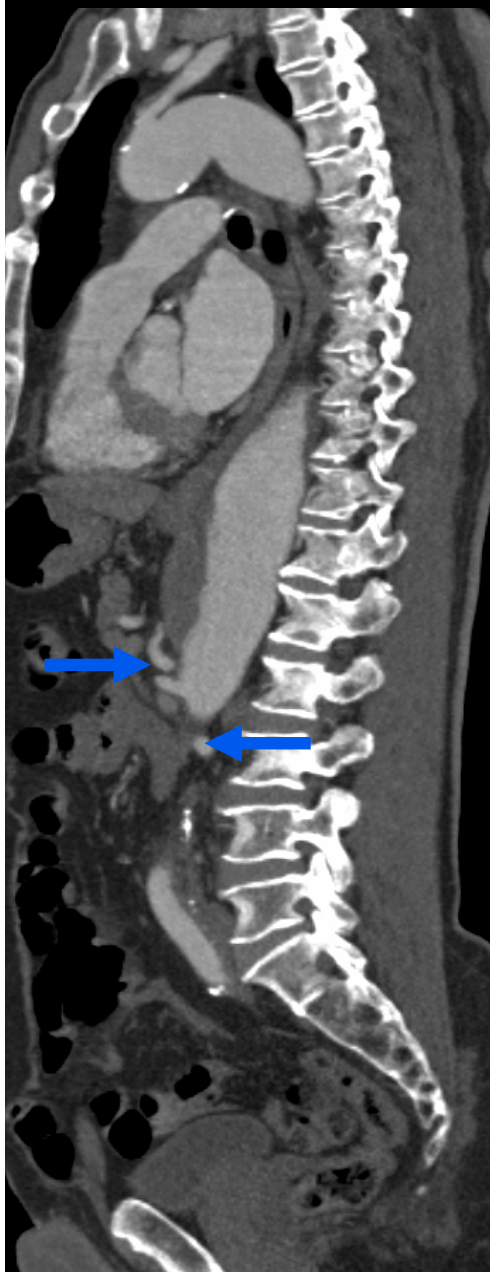


# Case

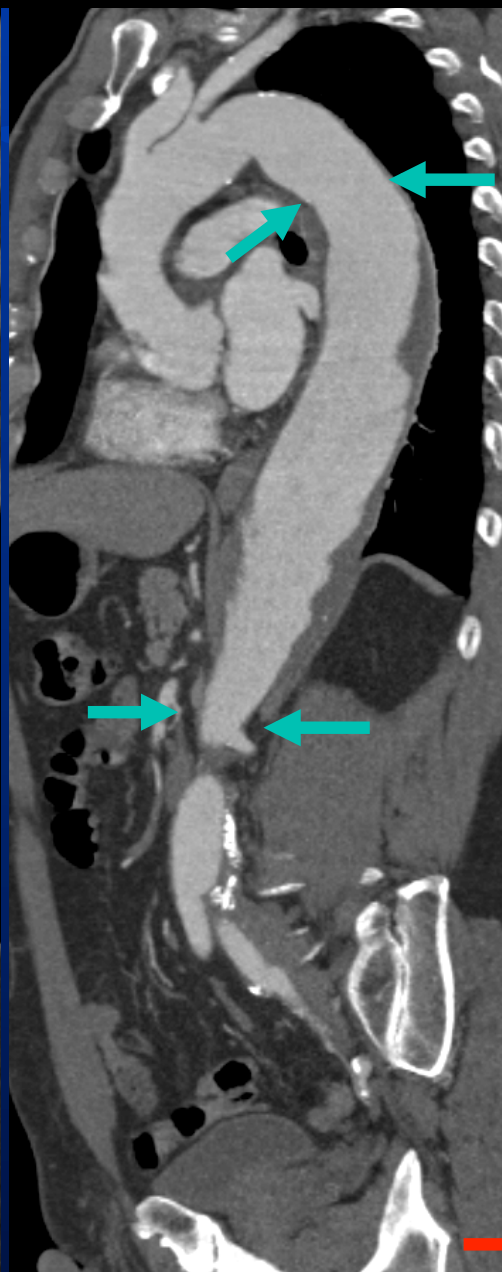
- 71 years old, male, ex smoker
- TAAA 6,7 cm type I (Crawford) or **type V (Safi)**
- Hypertension
- Open repair of a **left common iliac artery rupture** 3 years ago (Y aorto iliac (L) femoral (R) classical Dacron graft)



# Pre-op CTA



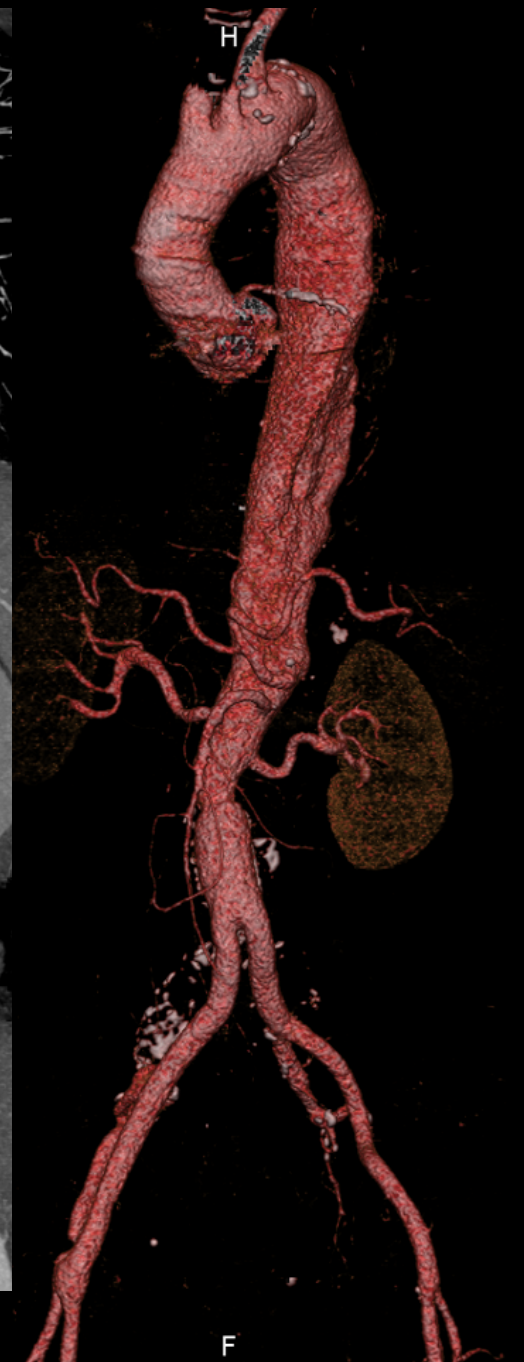
Inclusion of SMA, CA



Extent of TAAA to renals

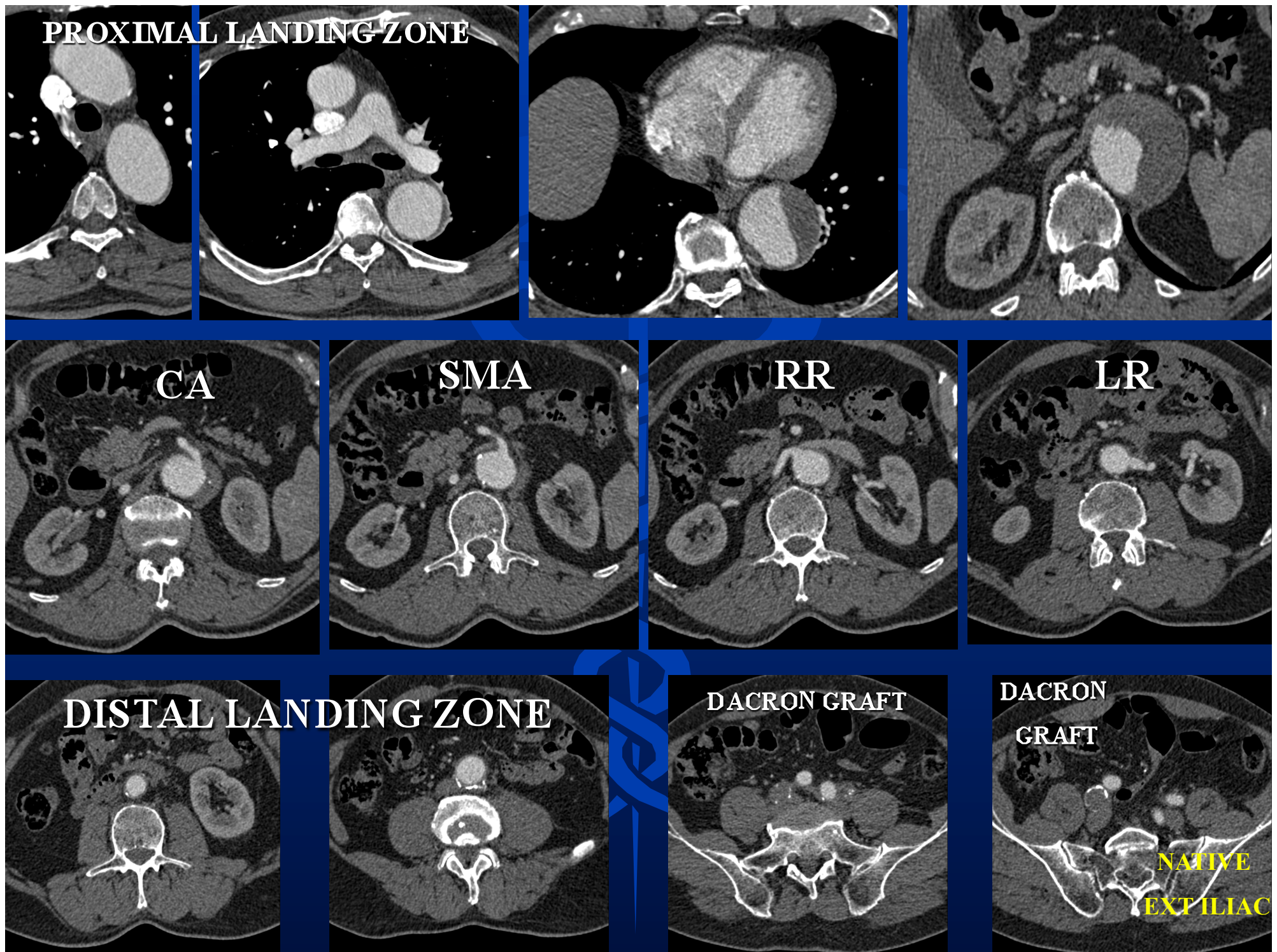


Dacron prosthesis



F



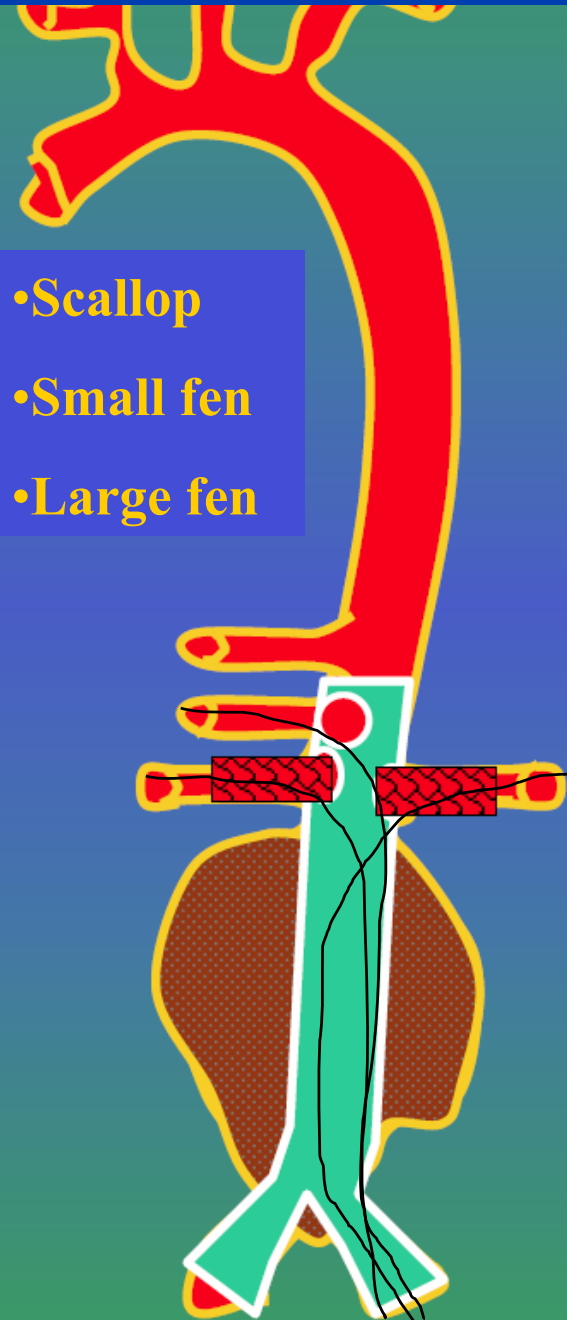


# Pre-op planning

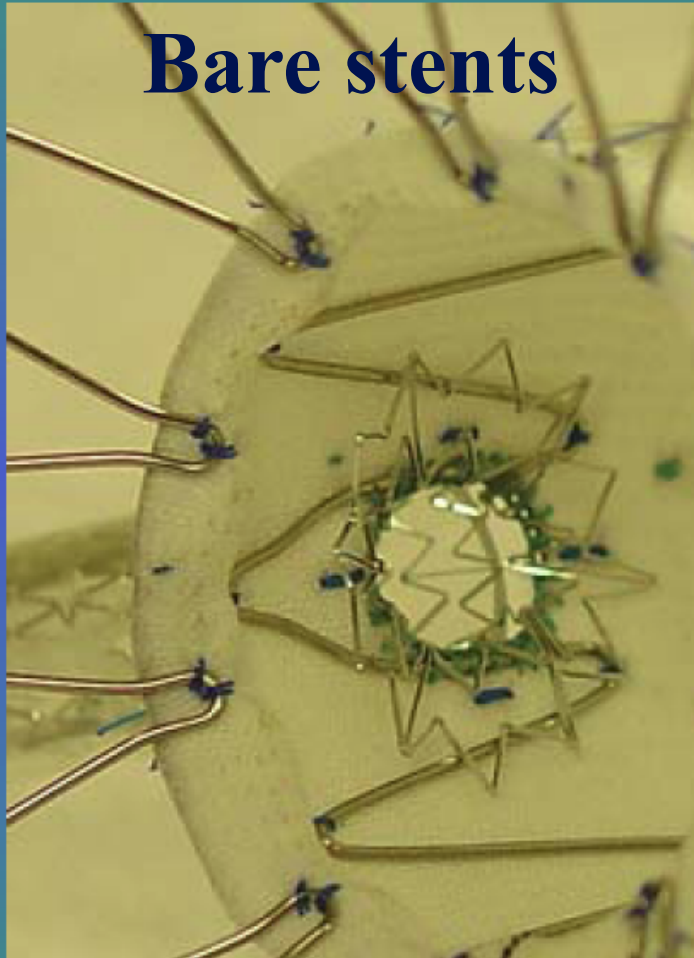
- High resolution multi-slice spiral CTA (1mm slices, VRD, MIP..)
- Measurements from authorized operators - users
- Verification by D. Hartley (Perth, Australia)
- Decision making concerning the type of the fenestrated technique (4 types).....according to Safi type and exact morphology.



# Initial Fenestrated technique



## Bare stents



> 800

## Indications

- AAA with unfavorable infrarenal neck (short < 10mm, conical)
- Juxtarenal AAA
- Pararenal AAA
- Suprarenal AAA
- PAA (Juxtarenal, Pararenal, Suprarenal Paraanastomotic Aneurysm)
- TAAA (I-V)



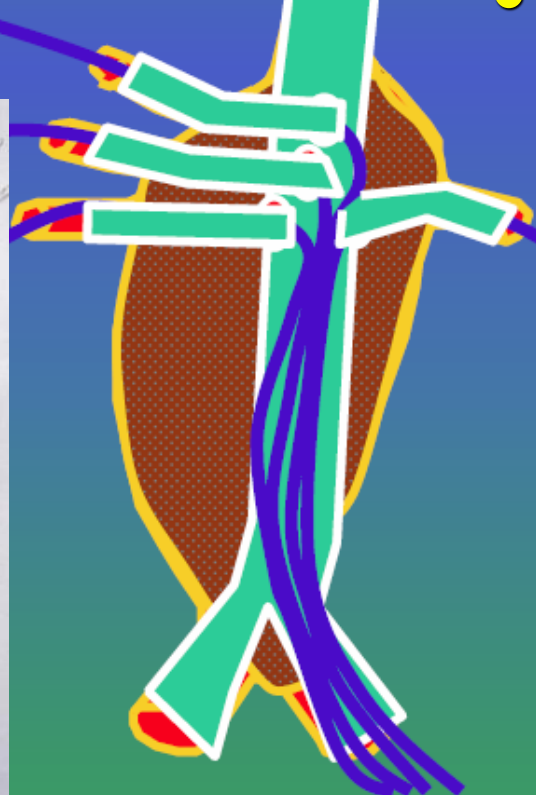
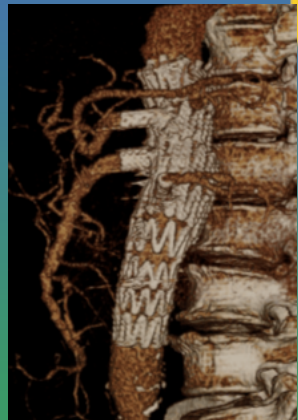
Loosing ground

Almost abandoned

# Basic Fenestrated technique

- Scallop
- Small fen
- Large fen

covered stents



## Indications

- AAA with unfavorable infrarenal neck (short < 10mm, conical)
- Juxtarenal AAA
- Pararenal AAA
- Suprarenal AAA
- PAA (Juxtarenal, Pararenal, Suprarenal Paraanastomotic Aneurysm)
- TAAA (I, II, III, IV, V) with good or intermediate apposition



# Side Branch technique

## Indications

- AAA with unfavorable infrarenal neck (short < 10mm, conical)
- Juxtarenal AAA
- Pararenal AAA
- Suprarenal AAA
- PAA (Juxtarenal, Pararenal, Suprarenal Paraanastomotic Aneurysm)
- **TAAA (I, II, III, IV, V)**  
**poor apposition**



Few cases

covered stents





# Hybrid technique

## Indications

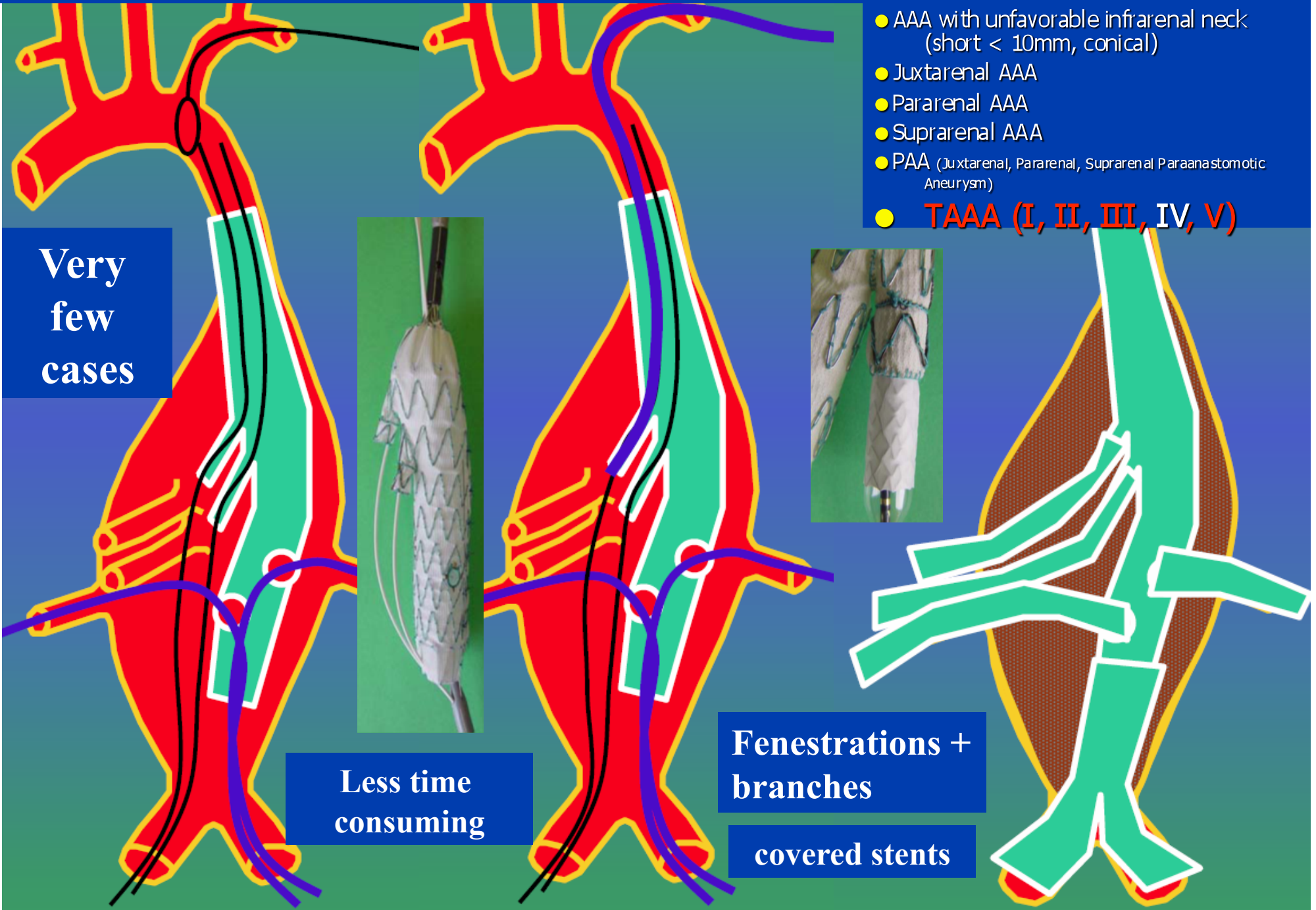
- AAA with unfavorable infrarenal neck (short < 10mm, conical)
- Juxtarenal AAA
- Pararenal AAA
- Suprarenal AAA
- PAA (Juxtarenal, Pararenal, Suprarenal Paraanastomotic Aneurysm)
- **TAAA (I, II, III, IV, V)**

Very few cases

Less time consuming

Fenestrations + branches

covered stents

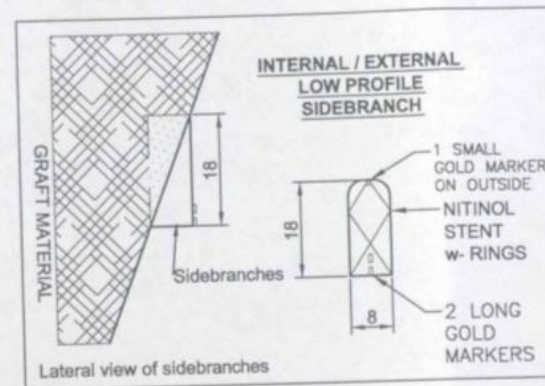


# Our case: Hybrid technique with 2 branches and 2 fen and 1 preloaded catheter

**Cook Australia**

William A Cook Australia Pty Ltd ABN 79 005 526 723

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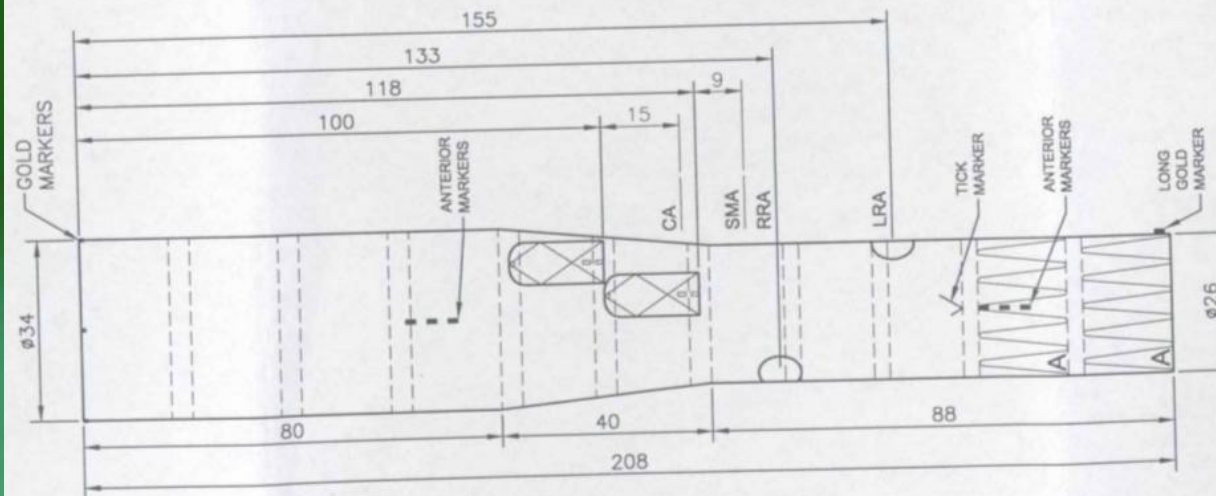


**INT/EXT LOW PROFILE SIDEBRANCH #1**  
DIAMETER: 8mm  
LENGTH: 18mm  
DIST FROM PROX EDGE: 100mm  
CLOCK: 1:15  
PROXIMAL IVD: 33mm  
DISTAL IVD: 29mm

**INT/EXT LOW PROFILE SIDEBRANCH #2**  
DIAMETER: 8mm  
LENGTH: 18mm  
DIST FROM PROX EDGE: 118mm  
CLOCK: 12:30  
PROXIMAL IVD: 29mm  
DISTAL IVD: 25mm  
\*\*PRELOADED CATHETER\*\*

**REINFORCED SMALL FENESTRATION #1**  
WIDTH: 6mm  
HEIGHT: 8mm  
DIST FROM PROX EDGE: 133mm  
CLOCK: 10:00  
IVD: 25mm

**REINFORCED SMALL FENESTRATION #2**  
WIDTH: 6mm  
HEIGHT: 8mm  
DIST FROM PROX EDGE: 155mm  
CLOCK: 3:30  
IVD: 24mm

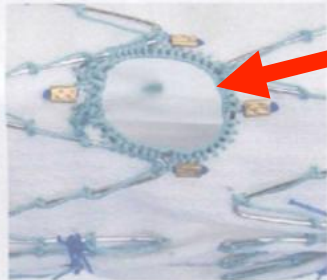




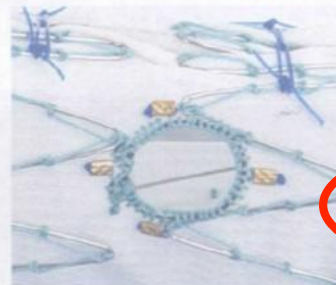
# Thoraco-Abdominal-Side-Branch Endovascular Graft

Patient Name: [REDACTED]

Lot: **AE12653**

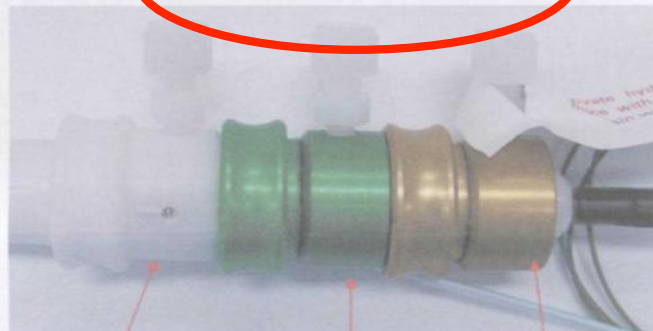


Small Fenestration #1 @ 10:00



Small Fenestration #2 @ 3:30

**CONTROL HANDLE**



3<sup>rd</sup> Release mechanism  
Releases Distal end

2<sup>nd</sup> release mechanism  
Releases Proximal end

1<sup>st</sup> Release mechanism  
Releases reducing ties

## Sheath Information:

**Sheath Type:** Flexor sheath with captor valve  
**Length of Sheath:** 75cm

**ID:** 22FR  
**OD:** 8.5mm

Patient Name: [REDACTED]

Lot: **AE12653**

As Made and Loaded

Anterior Markers

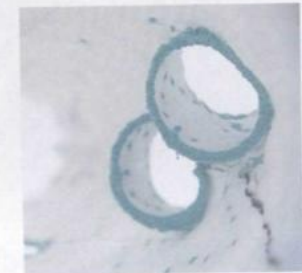
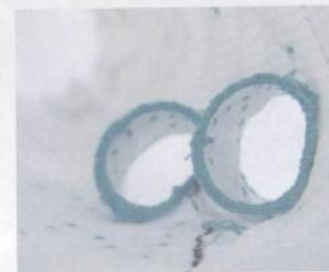
Gold Tick Marker



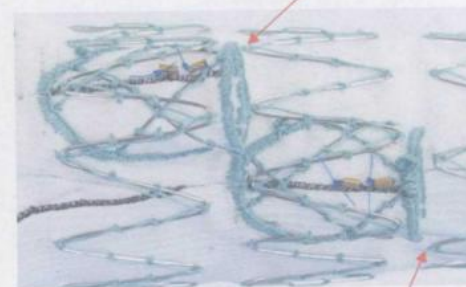
Diameter Reducing Ties



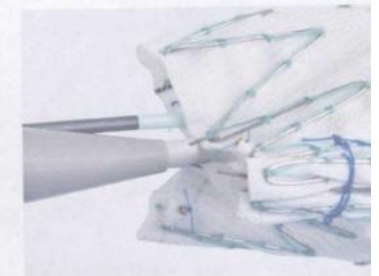
Internal Images of Sidebranches from the Proximal end



Int/Ext Sidebranch #1 @ 1:15



Int/Ext Sidebranch #2 @ 12:30



Proximal Attachment

# Technique

- Heavy duty portable C-arm 12 inch (Philips Pulsera)
- Fully floating radiolucent table with attached side arm (Steris)
- Contrast media injector

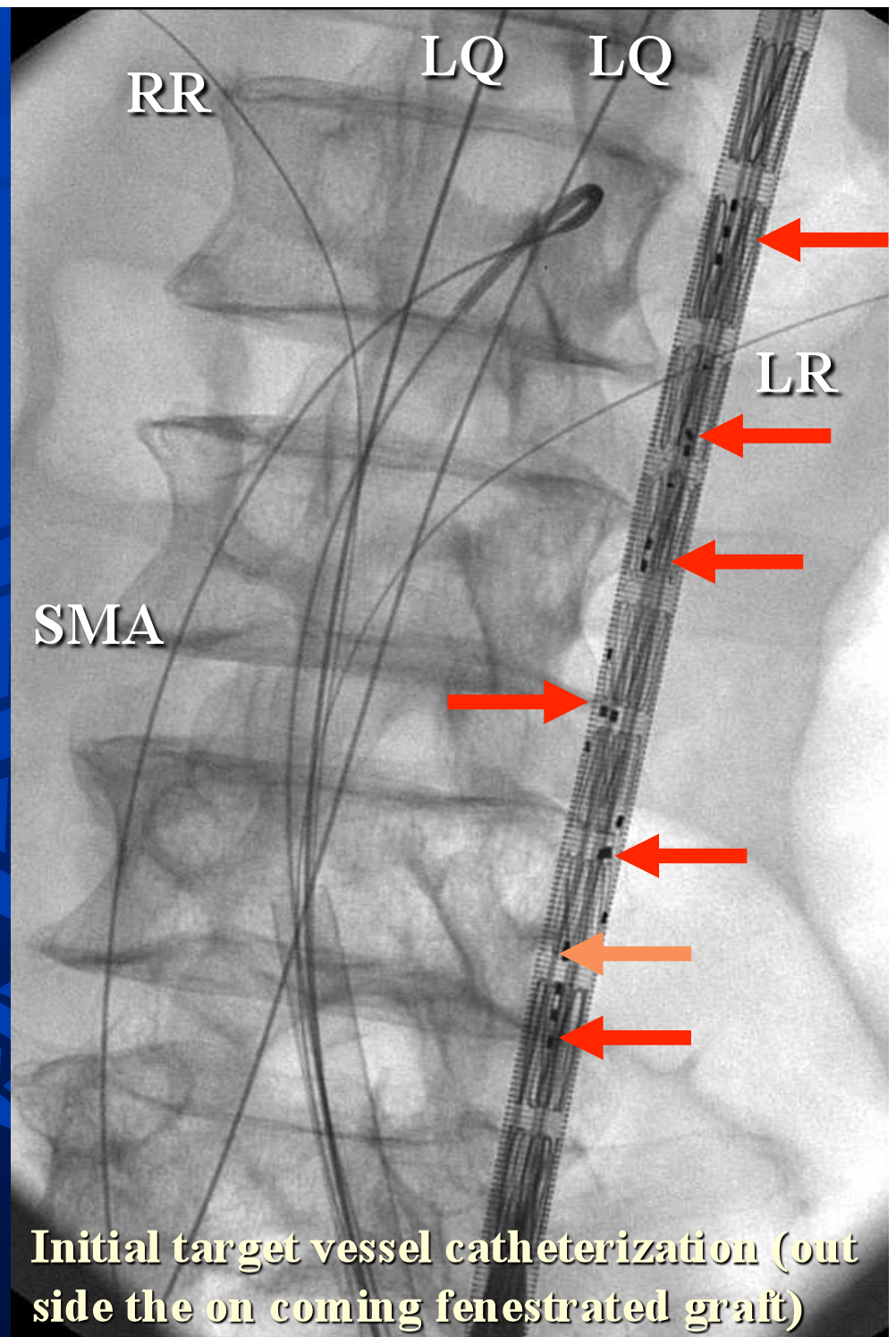
**Both groins and left arm are prepared**







20 Fr Cook sheath  
inserted  
percutaneously



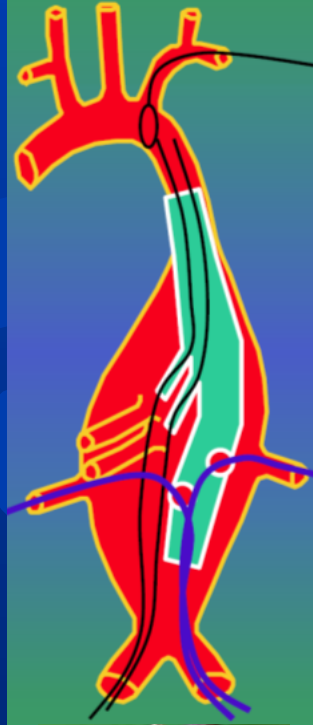
Initial target vessel catheterization (out  
side the on coming fenestrated graft)

**Snared the  
femoral  
wire**

**10 Fr  
KCFW  
SHEATH**



**Graft  
deployment  
  
Diameter  
reducing ties  
still tight**



**8 Fr  
KCFW  
SHEATH  
(RR)**

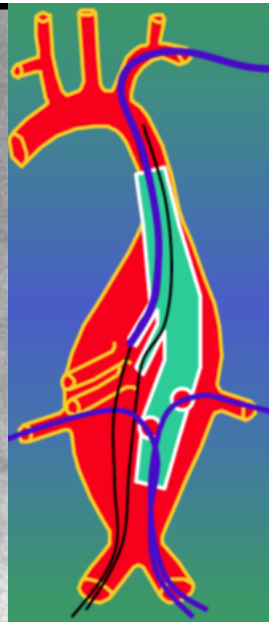
**SMA**

**8 Fr  
KCFW  
SHEATH  
(LR)**

**both renals  
Catheterized  
from inside  
the graft,  
SMA still  
from outside**



10 Fr  
KCFW  
SHEATH  
(SMA)



8 Fr  
KCFW  
SHEATH  
(RR)

8 Fr  
KCFW  
SHEATH  
(LR)

Outside  
SMA  
catheter  
and wire



Outside  
SMA wire

inside SMA  
catheter from 10  
Fr sheath

**Diameter reducing  
ties still tight**



## Release of the diameter reducing ties

inside SMA  
catheter from 10  
Fr sheath

8 Fr  
KCFW  
SHEATH  
(RR)

8 Fr  
KCFW  
SHEATH  
(LR)

## Covered stent deployment through the sheaths

CA Atrium 8x38

RR Atrium 7x28

SMA Atrium  
9x59

LR Atrium  
7x28

# Completion DSA



# Intra-op results

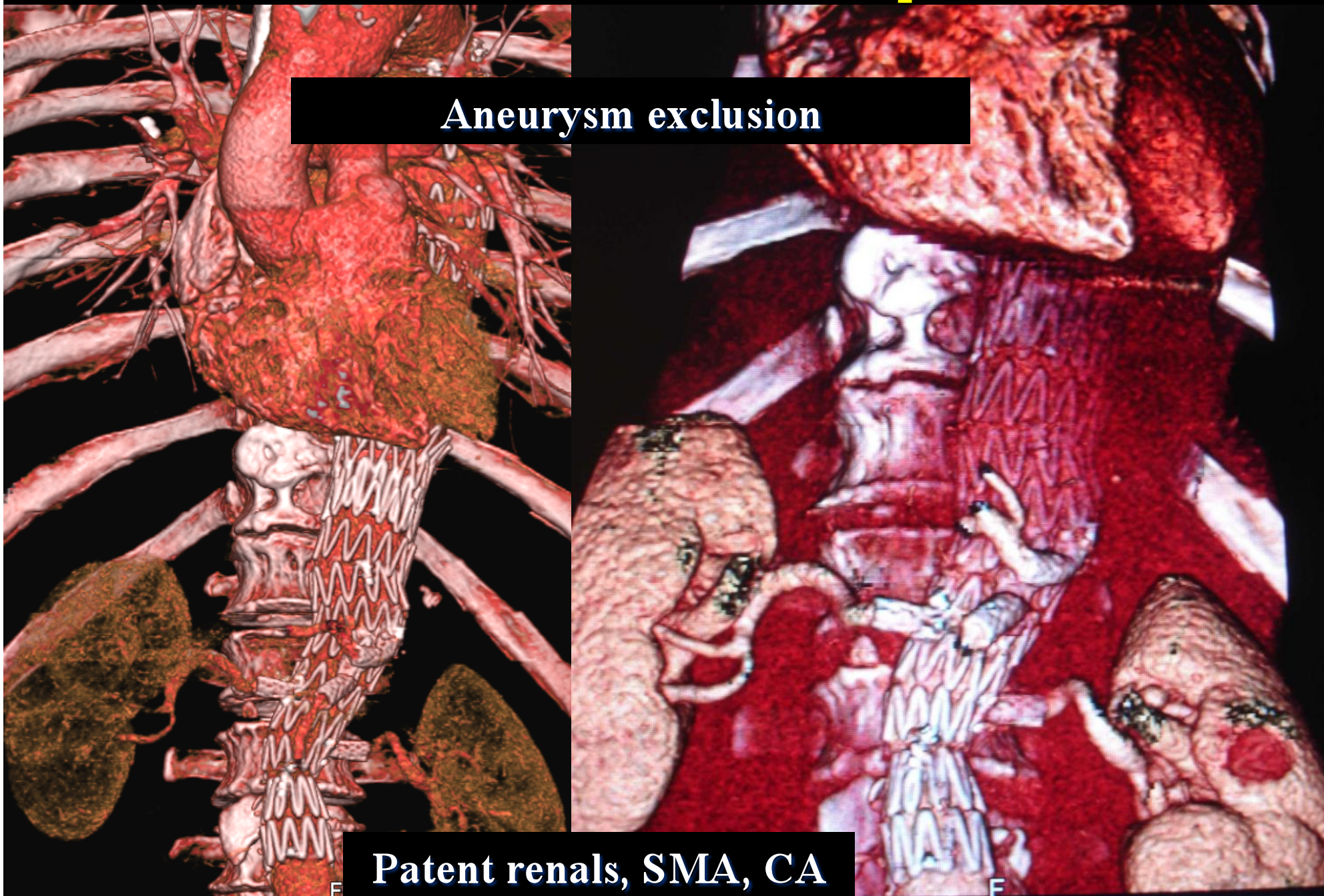
- Operative Duration 4 hours
- Radiation time 80 min
- Contrast media 170cc
- Completion DSA: 4 patent vessels
- No endoleak
- Uncomplicated Recovery
- Discharged 3<sup>rd</sup> po day



# 6<sup>th</sup> month Post-op CTA

Aneurysm exclusion

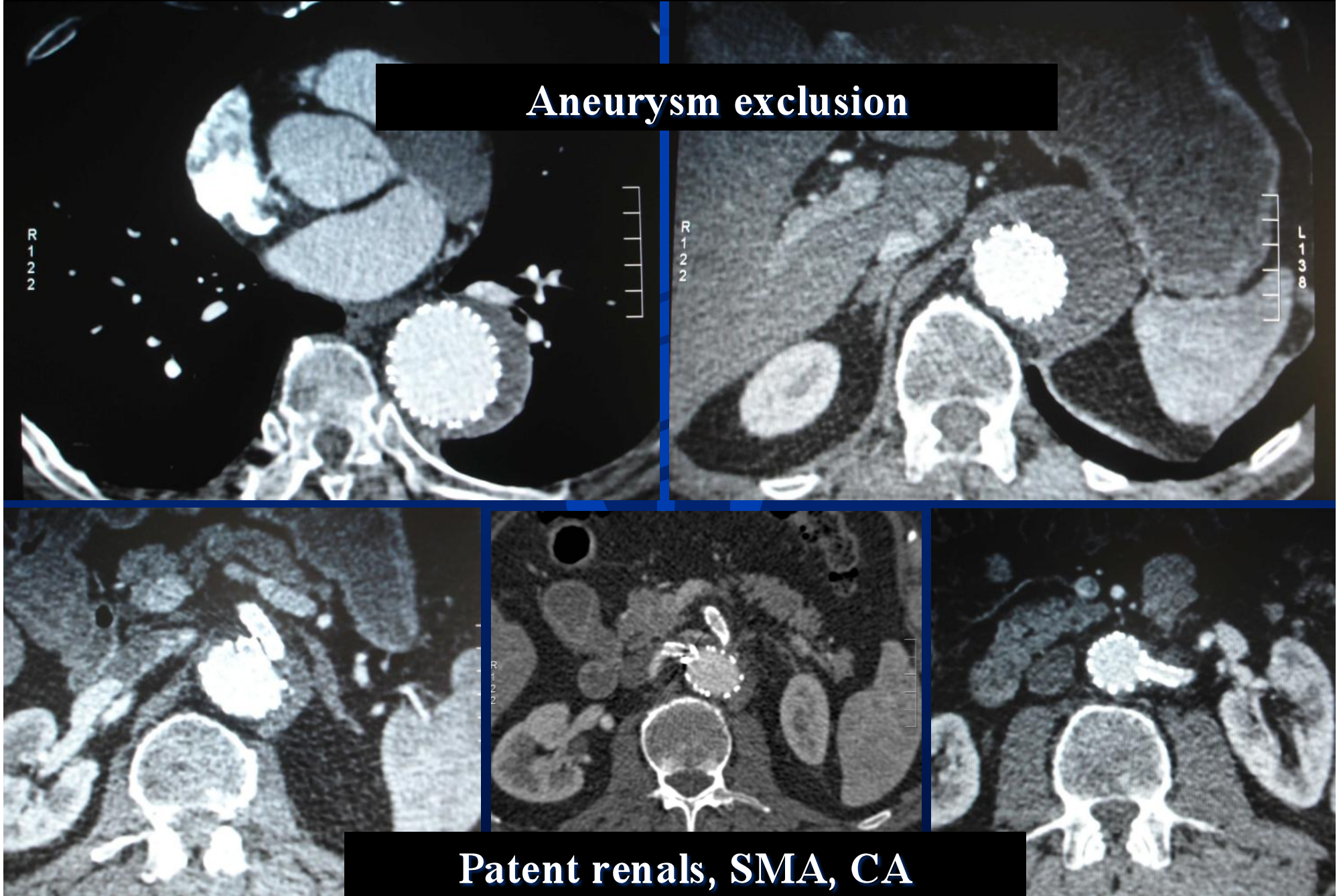
Patent renals, SMA, CA





# 6<sup>th</sup> month Post-op CTA

Aneurysm exclusion



# Results so far

## Results from F-EVAR for TAAA very limited and mixed with unfavorable AAA

Repair of thoracoabdominal aortic aneurysms with fenestrated and branched endovascular stent grafts

John L. Anderson, FACS, FRACS,<sup>a</sup> Donald J. Adam, MD, FRCSEd,<sup>b</sup> Michael Berce, FRACS,<sup>a,c</sup> and David E. Hartley, FIR, FRANZCR (Hon),<sup>d</sup> Ashford and Adelaide, South Australia; Birmingham, United Kingdom; and Perth, Western Australia

s. (J Vasc Surg 2005;42:600-7.)

- 4 patients, asymptomatic TAAA
- 12 month FU : 1 unrelated death, 100% target vessels patency rate

◆ CLINICAL INVESTIGATION

## Fenestrated Endografting for Aortic Aneurysm Repair: A 7-Year Experience

Peter Ziegler, MD<sup>1</sup>; Efthimios D. Avgerinos, MD, PhD<sup>2</sup>; Thomas Umscheid, MD<sup>3</sup>;  
Theodosios Perdikides, MD<sup>2</sup>; and Wolf J. Stelter, MD, PhD<sup>1</sup>

<sup>1</sup>Department of Surgery, Städtische Kliniken, Frankfurt a.M. Höchst, Germany.

<sup>2</sup>Department of Vascular Surgery, Hellenic Airforce Hospital, Athens, Greece.

<sup>3</sup>Department of Vascular Surgery, St Franziskus-Hospital, Münster, Germany.

- RETROSPECTIVE ANALYSIS
- 7 years
- 63 patients (59 AAA, 1 TAAA, 3 DTAA with short distal landing zone)
- 180 fenestrations and branches
- Primary success 97%
- Mean FU 23 +\_ 18 month :
  - Target vessel patency rate 93 % (no obstructions after 1<sup>st</sup> year)
  - 1 conversion
  - 1 rupture
  - Aneurysm related cumulative mortality 4.8 % during 77 months
  - 14 cases with renal impairment (6 permanent 1 dialysis)
  - Endoleak was 8% primary and 11 % secondary.
  - Cumulative Reintervention rate 25 % in 77 months **(all in first 14 months)**



# Mid-term results of endovascular aneurysm repair with branched and fenestrated endografts

Bart E. Muhs, MD,<sup>ab</sup> Eric L. G. Verhoeven, MD, PhD,<sup>a</sup> Clark J. Zeebregts, MD, PhD,<sup>a</sup> Ignace F. J. Tielliu, MD,<sup>a</sup> Ted R. Prins, MD,<sup>a</sup> Hence J. M. Verhagen, MD, PhD,<sup>b</sup> and Jan J. A. M. van den Dungen, MD, PhD,<sup>a</sup> Groningen and Utrecht, The Netherlands

JVS 2006;44:;9-15

- PROSPECTIVE ANALYSIS
- 4 years
- 38 patients (30 AAA, 8 TAAA)
- 87 fenestrations and branches
- 30 DAY MORTALITY 2.6%
- Mean FU 26 +\_ 13 month :
  - Target vessel patency rate 94 % and 92% cumulative in 46 months (no obstructions after 1<sup>st</sup> year)
  - Creatinine level preop-postop (NS)
  - No aneurysm rupture
  - All cause mortality 13 %

**(all relative events  
in first 12 months)**

# Beyond the aortic bifurcation: Branched endovascular grafts for thoracoabdominal and aortoiliac aneurysms

Roy K. Greenberg, MD, Karl West, BS, Kathryn Pfaff, BS, James Foster, BS, Davorin Skender, BS, Stephan Haulon, MD, Jamie Sereika, RN, Leslie Geiger, RN, Sean P. Lyden, MD, Daniel Clair, MD, Lars Svensson, MD, PhD, and Bruce Lytle, MD, *Cleveland, Ohio*

**JVS 2006;43:879-86**

- **PROSPECTIVE ANALYSIS**
- 50 patients (20 unfavorable AAA, 9 TAAA, 21 CIA)
- 87 fenestrations and branches
- **30 DAY MORTALITY 2 %**
- Mean FU 12 months :
  - **Technical success 90%**
  - No aneurysm rupture no conversion
  - 9 secondary interventions
  - **Five late deaths (3 aneurysm related) All cause mortality 13 %**
  - **Paralysis 1 TAAA, none of the rest**

# Final Considerations - Conclusions

Fenestrated endoprotheses using **side branches in TAAA** seems to be a technically efficacious procedure with promising short term results.

However, this procedure should be considered as experimental.

A long term follow up and more cases are needed to establish the outcome of the method and **compare it with Hybrid or open approach.**



" EVAR is no more a failed experiment than the Wright brother's first airplane flight.

Both are stories of successful technological advances over time".

R.J. Hinchliffe

P.W. Wenham

B.R. Hopkinson

Nottingham – UK

12-10-2001

