Vascular Graft Sepsis

Nadraj G Naidoo

Vascular & Endovascular Surgery Unit
Department of Surgery
Groote Schuur Hospital
University of Cape Town

Vascular graft sepsis

Definition:

Sepsis involving all or part of a vascular conduit, vascular patch or endovascular prosthesis

- **Prosthetic vascular grafts**

  Polytetraflouroethylene (PTFE)
  Polyester (Dacron)

- **Endovascular prosthesis (aortic or peripheral)**

  Endografts (stentgrafts / covered stents)
  Bare stents

- **Autologous vascular grafts / patches (rare)**

Infection	Incidence (%)
Prosthetic graft implant site	
Axillo-femoral	5 - 8
Femoro-popliteal	0.9 – 4.6
Femoro-distal	2 – 3.4
Femoro-femoral	1.3 – 3.6
Aorto-femoral	0.5 - 3
Descending thoracic / thoraco-abdominal	0.5 – 1.9
Aorto-iliac	0.2 – 1.3
Carotid-subclavian	0.5 – 1.2
Carotid patch	0.2 – 0.8
Endovascular device	
Aortic stentgraft	0.2 – 1.2
Peripheral stent	< 0.1

Clinical classification of prosthetic graft infection

Time of presentation post implantation

- **Early graft sepsis (< 4 months)**
- **Late graft sepsis (> 4 months)**

Relationship to post-operative wound sepsis

(SZILAGYI'S CLASSIFICATION)

Grade 1	Cellulitis involving the wound ***(superficial wound sepsis)***
Grade 2	Infection involving subcutaneous tissues ***(deep wound sepsis)***
Grade 3	Infection involving the vascular prosthesis ***(graft sepsis)***

Extent of graft involvement

(BUNT`s CLASSIFICATION – modified)

- ***Peripheral graft infection***

P0 graft infection	Involving cavitary grafts	e.g. aorto-femoral bypass
P1 graft infection	Involving extra-cavitary grafts	e.g. femoro-popliteal bypass
P2 graft infection	Involving extra-cavitary part of a cavitary graft	e.g. infected groin segment of an aorto-femoral bypass
P3 graft infection	Involving a prosthetic patch	e.g. carotid patch

- ***Graft-enteric erosion***
- ***Graft-enteric fistula***
- ***Aortic stump "blow-out" after excision of an infected aortic graft***

SAMSON CLASSIFICATION

Grade 1	Infection limited to the dermis
Grade 2	Infection involves subcutaneous tissue but not graft
Grade 3	Infection involves graft but not anastomoses
Grade 4	Infection involves exposed anastomosis (bacteraemia / haemorrhage not present)
Grade 5	Infection involves an anastomosis with associated bacteraemia and / or haemorrhage

Clinical sources of infection

- Peri-operative contamination
- Bacteraemia
- Mechanical erosion
- Involvement of a contiguous infectious process

Risk factors predisposing to prosthetic graft sepsis

PERIOPERATVE FACTORS

Prolonged preoperative hospitalization
Remote site sepsis
Recent arterial puncture at operative site e.g. angiogram
“Break” in aseptic technique
Emergent or urgent vascular surgery
Redo vascular procedures
Prolonged operative times
Concomitant GI or urological procedure
Postoperative wound complication (wound sepsis; wound haematoma; lymphatic complications)

Risk factors predisposing to prosthetic graft sepsis

PATIENT-RELATED FACTORS (ALTERED IMMUNE STATUS)

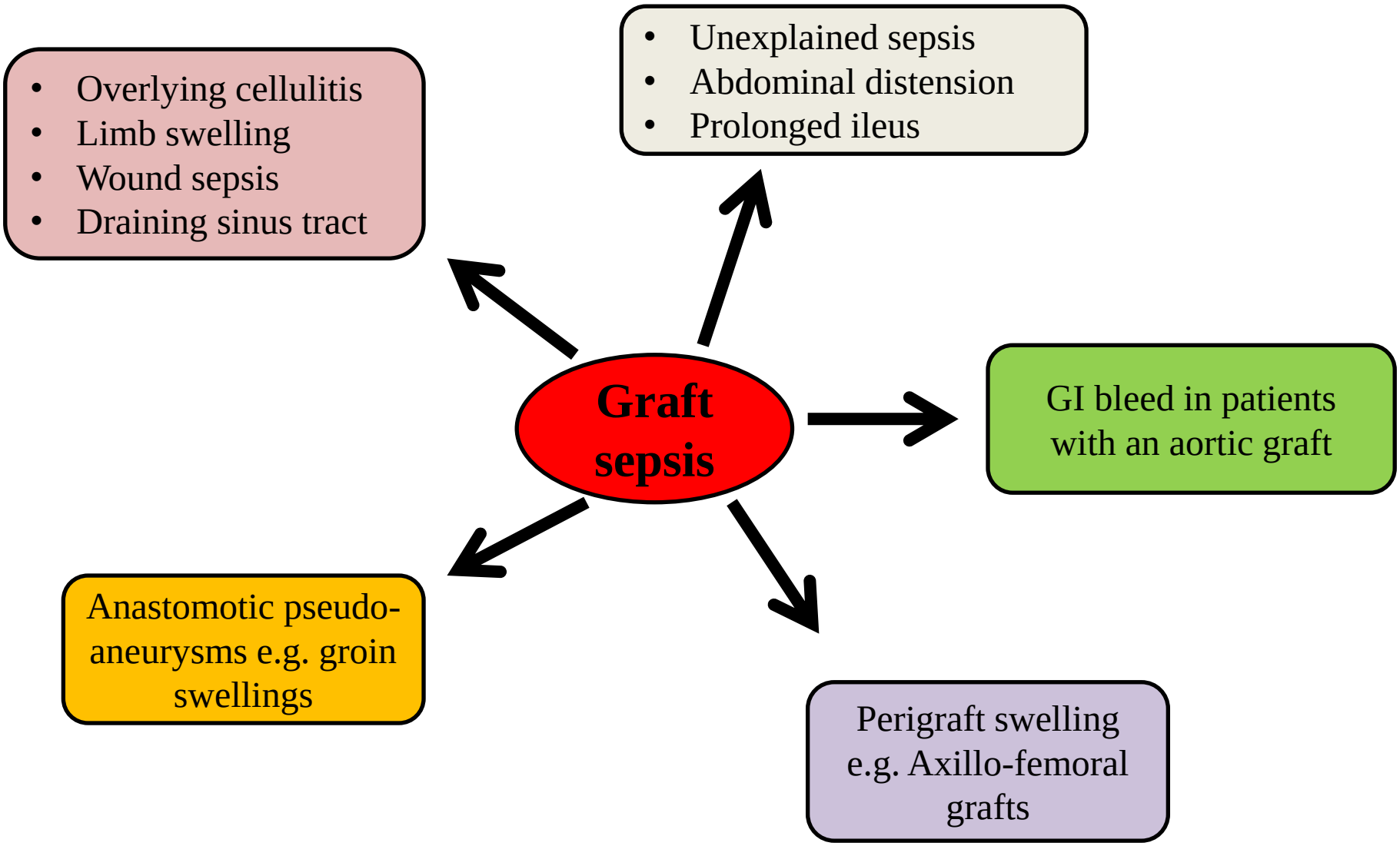
Diabetes Mellitus
Malnutrition
Chronic renal impairment / failure
Liver disease/ failure/cirrhosis
Previous radiotherapy / malignancy/ chemotherapy
RVD positive patients / auto-immune disorders
Long-term corticosteroids

Bacteriology of prosthetic vascular graft infections from collected series

Micro-organism	Incidence (%)				
	Thoracic aorta	GEE/GEF	Aorto-femoral	Femoro-popliteal / distal	Carotid
Staph. aureus	32	4	27	28	50
Staph. epidermidis	20	2	26	11	15
Strep. Spp.	2	9	10	11	3
Pseudomonas Spp.	10	3	6	16	6
Coliforms / other gram negatives	14	49	28	29	9
Candida / Other Spp.	10	15	1	3	5
No growth / Culture negative	12	18	2	2	12

GEE – graft-enteric erosion
GEF – graft-enteric fistula

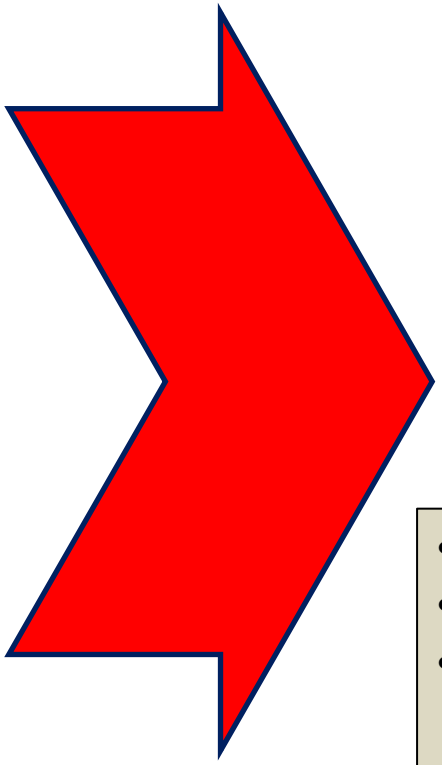
Clinical features



Diagnostic Appraisal

Clinical presentation

White cell count
ESR
C-reactive protein
Procalcitonin
Blood cultures
Pus swab
Aspirates for culture



Duplex Ultrasound

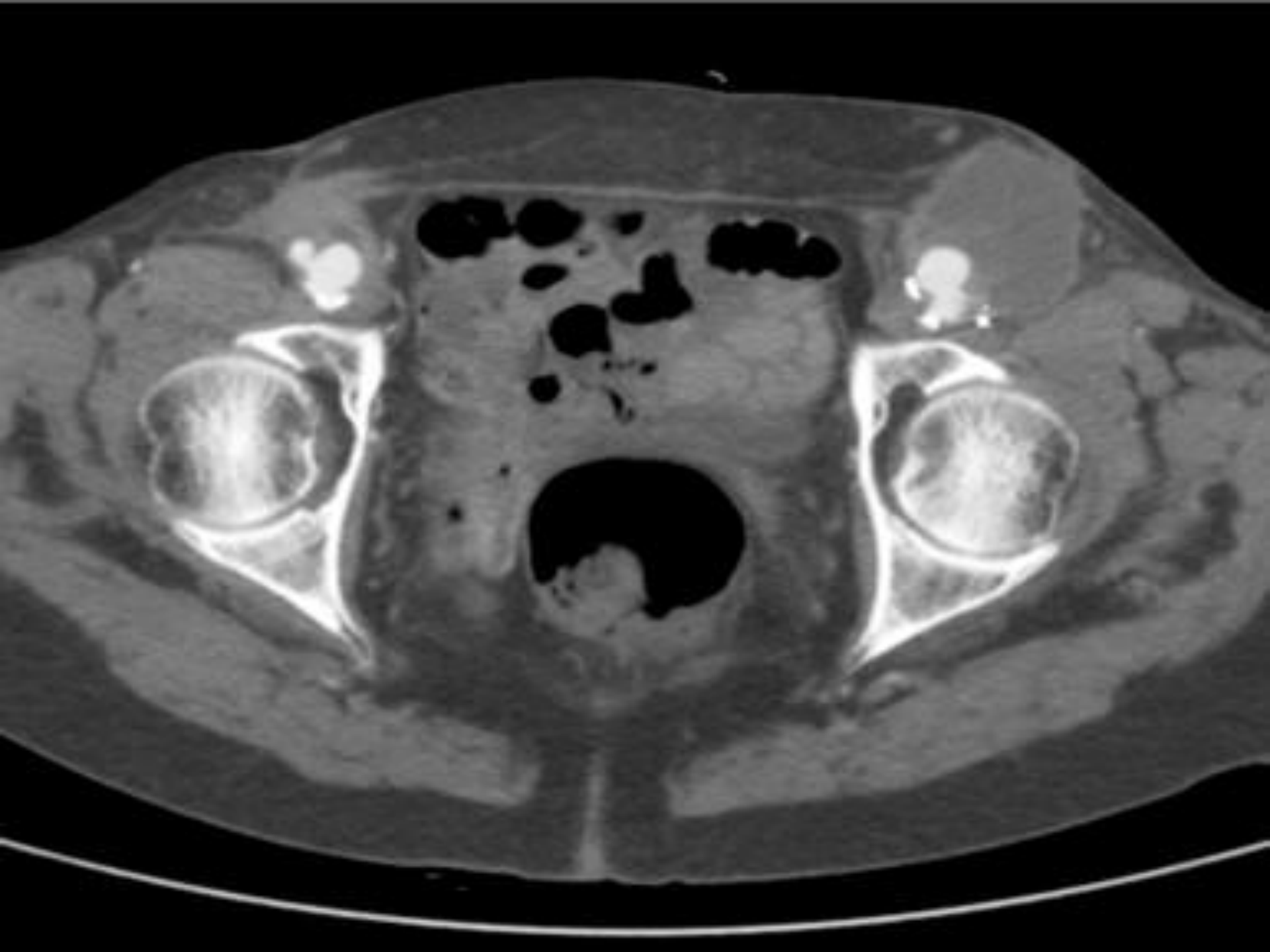
MDCT Angiogram
MRI

Catheter angiography

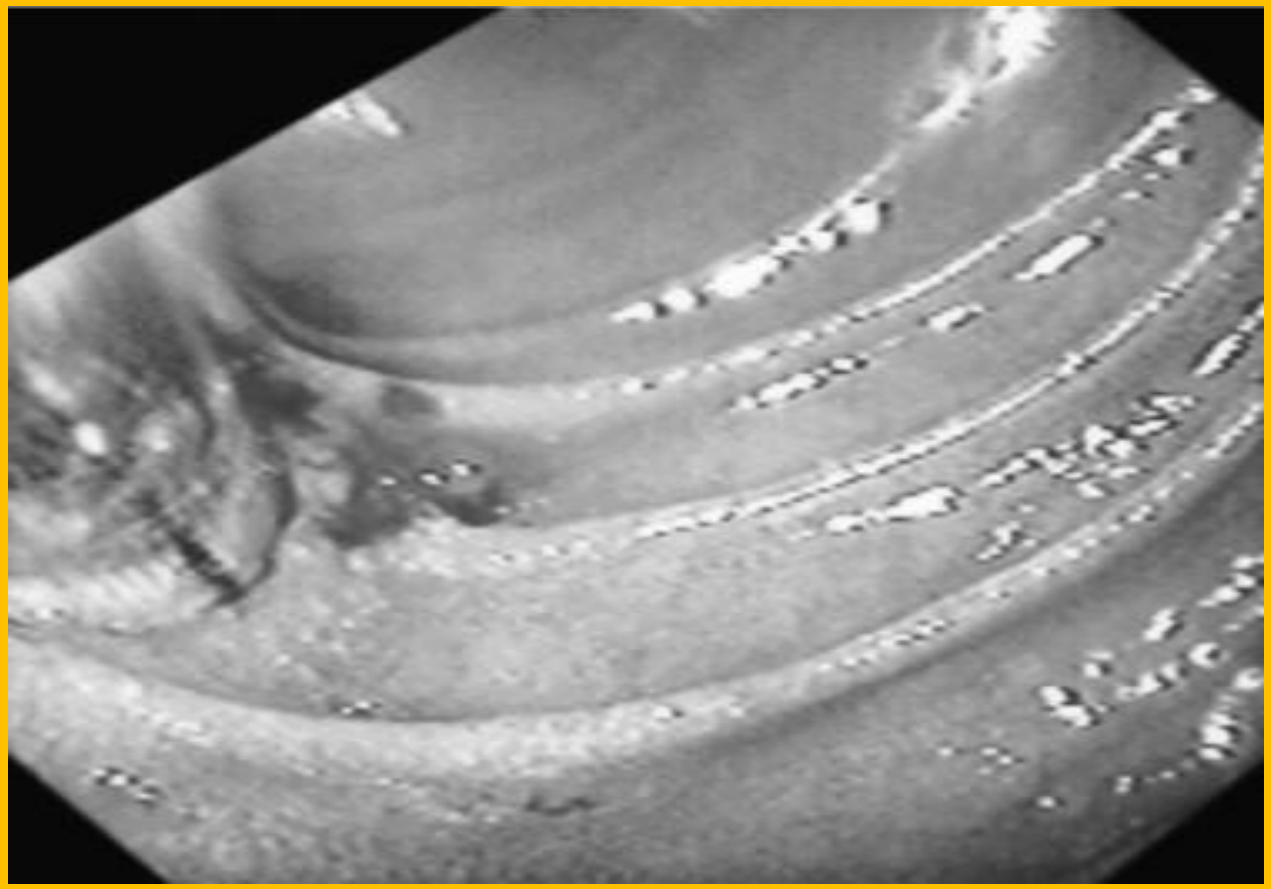
Upper endoscopy

- Gallium 69 citrate scan
- Indium 111-labelled leukocyte scan
- Technetium 99m hexametazime–labelled leukocyte scan
- 18F-FDG PET scan

PET –CT scan




In: 35+C
DFOV 30.3cm
STD+
R
1
3
0
kV 140
mA 70



Pre-operative graft imaging is essential …….

- Confirm perigraft inflammation
- Dilineate the extent of graft sepsis

Perigraft fluid
Peri-graft gas
Anastomotic leak
Partial vs. total graft involvement

- **Angiographic imaging** *is used to develop an operative strategy for revascularization in the presence of distal ischemia, occlusive disease, or graft thrombosis.*
- Combination anatomic and functional imaging is fairly accurate:

Sensitivity 80% - 100%
Specificity 50% - 90%

- Navigational tool to plan operative strategies
- Imaging-guided fluid aspirate

Treatment algorithms need to be patient-specific based on clinical features, extent of graft involvement and bacteriology

Total graft excision
& extra-anatomical / remote bypass grafting

Graft excision (total / partial)
& in-situ graft replacement

Graft preservation techniques

Wound sterilization and closure techniques (in-situ reconstruction or graft preservation)

Serial wound debridement / washouts

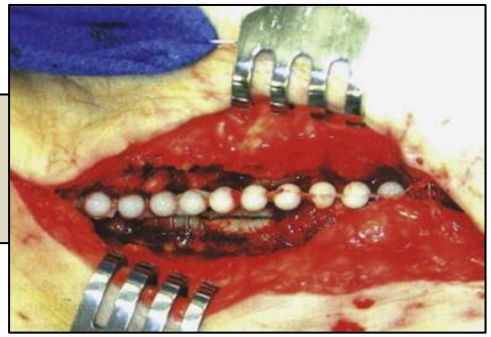
Intra-operative wound irrigation
- dilute Betadine + peroxide
- Pulsed Clorpactin

Aggressive arterial wall / perigraft tissue debridement to normal tissues

Closed suction drains and continuous dilute Betadine irrigation

Culture specific antibiotics

Temporary placement of antibiotic-loaded beads



Wound sterilization and closure techniques (in-situ reconstruction or graft preservation)

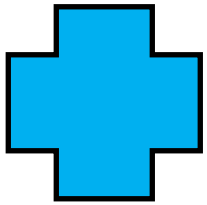
Negative-pressure “sponge” wound therapy

Prosthetic graft coverage

- *Rotational muscle flaps*
- *Free flaps*
- *Omental pedicle*

Graft preservation / local therapy

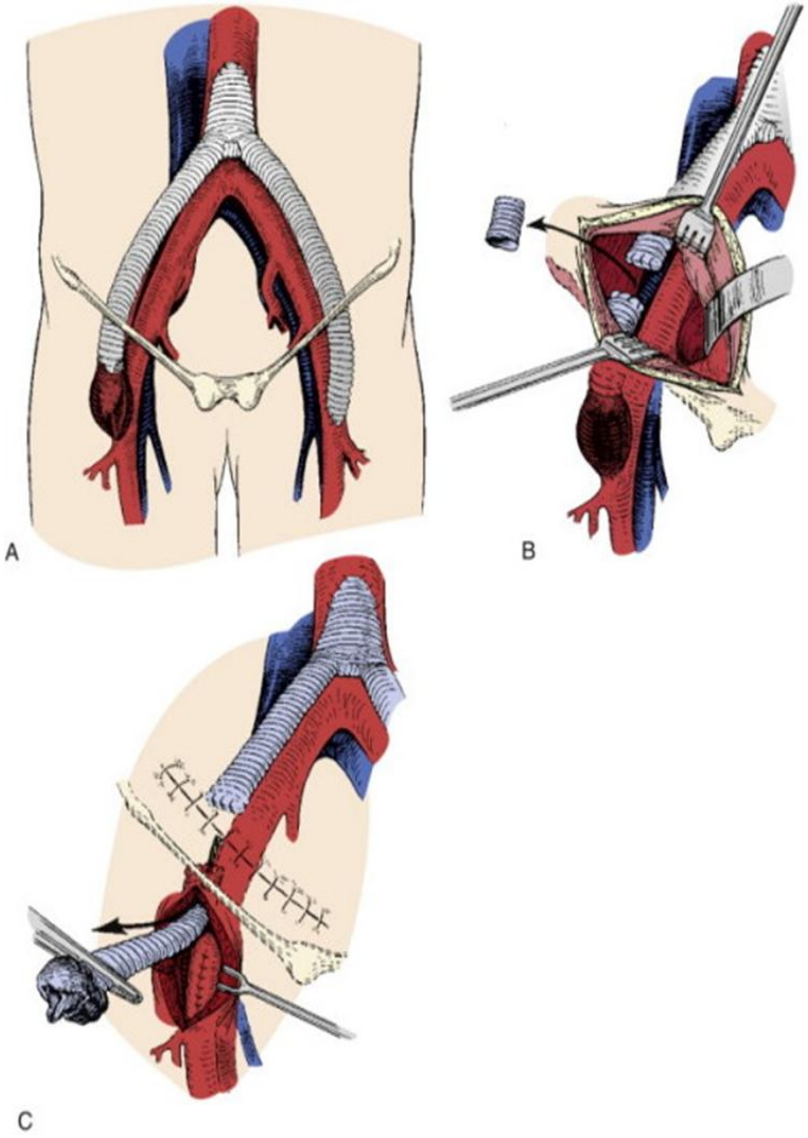
- **Better results with early infection vs. late infection**
- **Better results with PTFE vs. Dacron grafts**
- **Segmental non-anastomotic graft involvement**
- **Any organism (caution with pseudomonas / MRSA)**



Graft sepsis antibiotic protocol: 6 weeks

Graft excision only

- **Occluded septic prosthetic graft**
- **No need for revascularization**
- **Any organism**
- **Culture-directed antibiotics for 7 – 10 days**

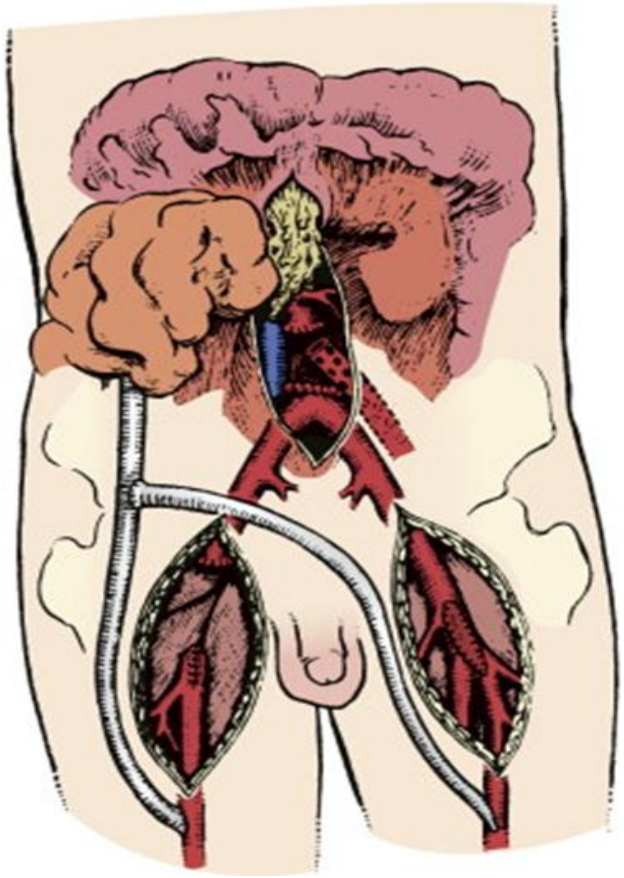


Graft excision & extra-anatomical bypass

Simultaneous

- Unstable patient
- Haemorrhage
- Severe graft sepsis
- GEE / GEF

& a widely patent, functioning graft



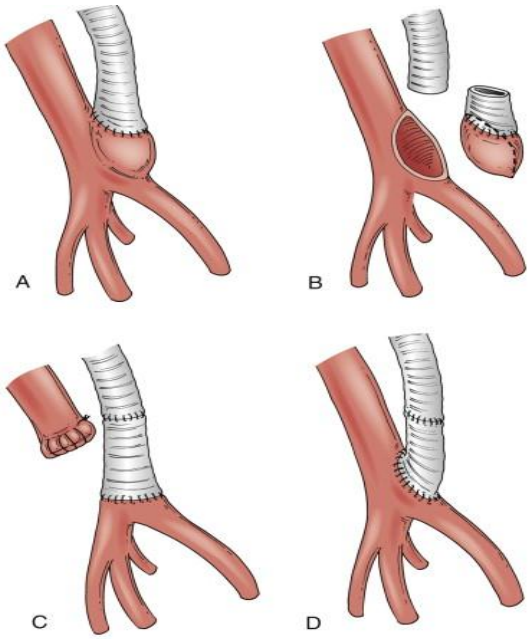
Staged

- Stable patients
- No haemorrhage
- Reasonably collateralized, will tolerate interval ischaemia

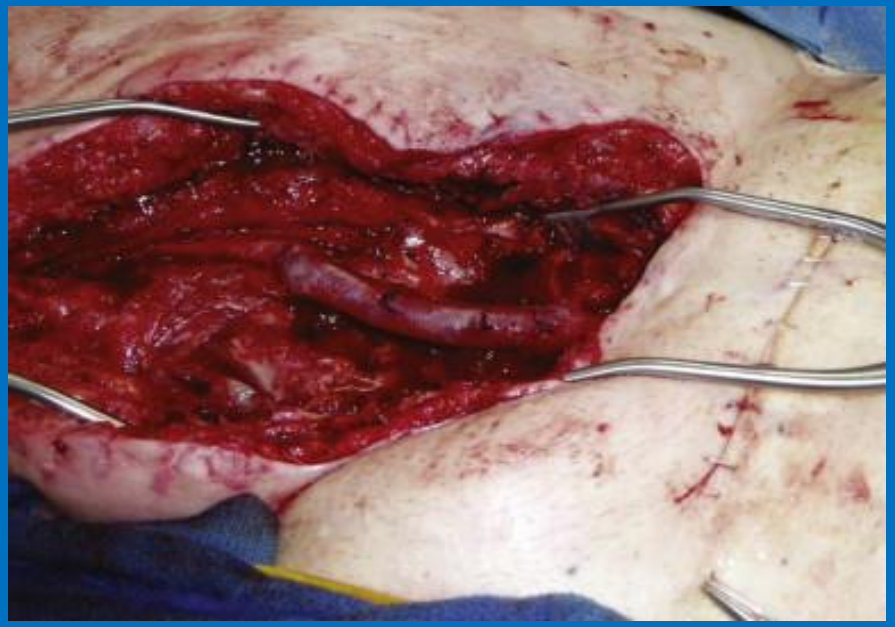
In situ graft replacement (limited or total)

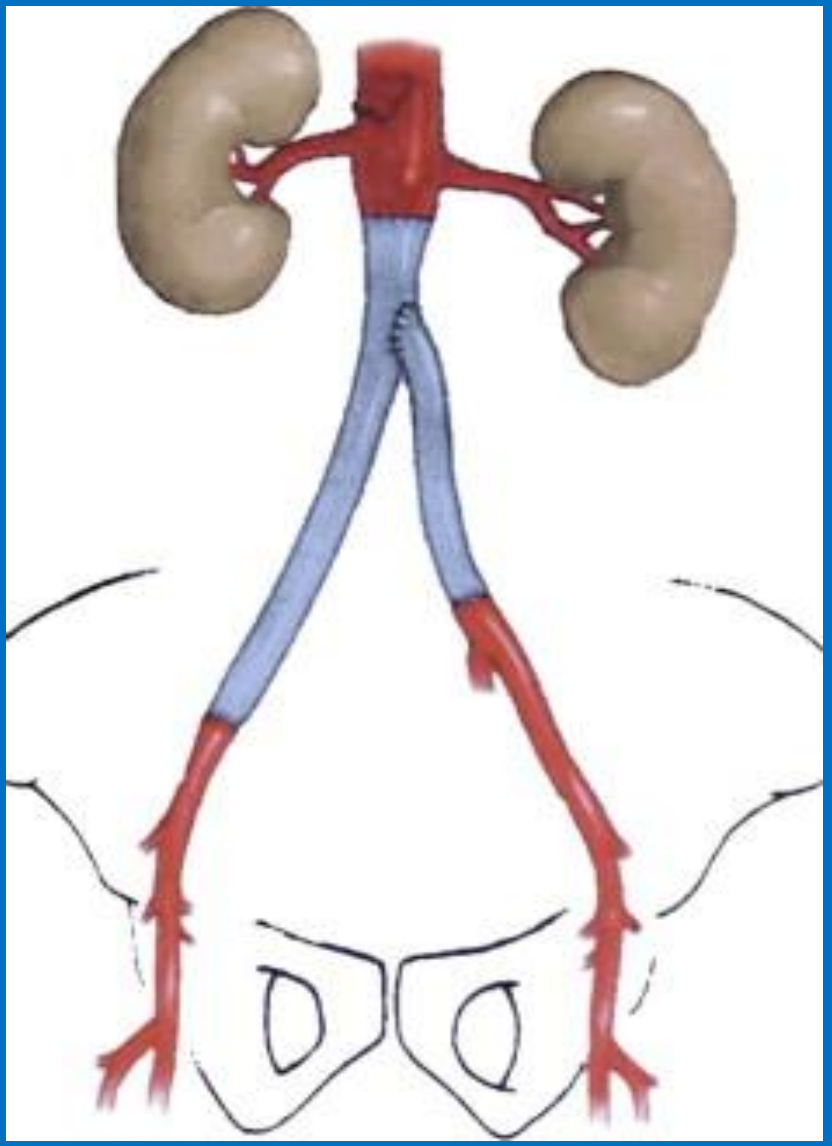
Aortic and / or peripheral grafts

- No GEE / GEF
- Staph epidermidis or culture negative organisms
- No perigraft pus
- Biofilm infection
- Segmental or total graft involvement



Graft sepsis antibiotic protocol for 6 weeks

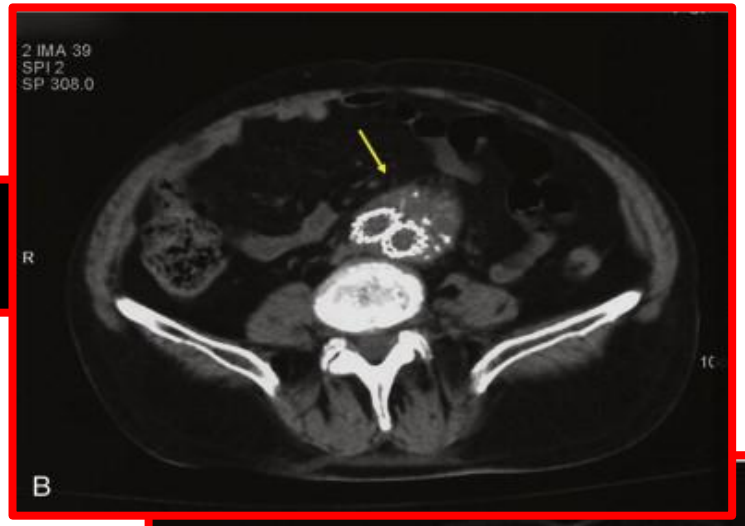




Results: Aorto-iliac / femoral bypass

	Graft excision and ex-situ bypass	Graft excision and in-situ replacement (Vein; prosthetic; allograft)
Operative mortality	**11 – 22%**	**0 – 20%**
Early limb loss	**7% - 27%**	**0 – 6%**
Stump blow-out	**0 – 22%**	
Graft patency > 1 year	**58% - 81%**	**80% - 100%**
Recurrent graft infection	**3% - 25%**	**1% - 12%**

Sepsis of vascular endoprosthesis



Aortic stentgraft sepsis is rare

Generally requires explantation and ex-situ bypass

Operative mortality high: 20%-30%

THANK YOU