Vascular Graft Infections
Infected Prosthetic Graft

Mr P Somaiya
Specialist Registrar, General Surgery, London Deanery
Part One

Vascular Graft Infections
History

• the history of vascular grafts is closely linked to popliteal aneurysms and was influenced by Alexis Carrel’s published work in 1902

• the first vascular grafts were done as follows:

  Goyanes – 1906 – popliteal vein was used in situ to replace a popliteal aneurysm

  Enderlen – 1907 – end to end anastomosis

  Pringle – 1913 – reversed saphenous vein
History

• the Korean War influenced emergence of reconstructive surgery for arterial injuries initiated by Schumaker and reported by Hughes and Bowers – 1952

• Voorhees also in 1952 reported his initial work in dogs using Vinyon-N cloths to bridge arterial defects.

• work done by DeBakey in the 1950 ‘s and 1960’s firmly established the use of Dacron grafts for arterial reconstruction

• 1970’s saw the introduction of ePTFE
Uses

- for bridging of arterial defects open vascular surgery in the following forms:
  - tube grafts
  - trouser grafts
  - patch repair of arteries
- as internal by-pass systems in endovascular surgery in the following forms:
  - covered stents for peripheral arteries
  - EVAR stents for aorta
Types

• natural materials:
  - autologous:
    in-situ
    reversed
  - homologous – human umbilical vein (HUV)
  - heterologous – bovine or porcine patches
  - genetically engineered tissue grafts
Types

- prosthetic:
  - Dacron woven knitted
  - ePTFE or Teflon (both can come with and without external support)
- hybrid
when to choose what?

• prosthetic:
  - medium to large vessel reconstruction
  - extra-anatomic reconstruction
  - absence of natural materials
  - suprageniculate bypasses
  - patch repair of

• natural:
  - small vessel reconstruction
  - anatomic reconstruction
  - presence of infection
  - infrageniculate bypasses
  - cuffs in hybrid grafts
what can go wrong?

- re-stenosis
- thrombosis
- graft infections

the general rule is try and use autologous materials if possible, especially when doing reconstruction after infection and for infra-geniculate by passes.
graft infections - a few facts

- size of the problem:
  varies from 1-5% dependant on graft size and patient population
  it is highest for infra-inguinal bypasses with rates of upto 12% reported in some studies
  aorto-femoral and aortic repairs are associated with lower graft infection rates of approx. 1-2%
graft infections-a few facts

• causes:
  most of the graft infections occur at the time of surgery. Breakdown of sterility is the commonest cause of graft infection. Other causes include presence of pre-existing aneurysms (mycotic aneurysms), extension from superficial wound infections and a haematogenous spread
graft infections-a few facts

- causes:
  Operative factors include:
  - Reoperation during same hospital admission
  - Preoperative shaving
  - Open surgical drainage for more than 3 days
  - Operations > 2 hours
  - Emergency surgery
graft infections-a few facts

• causes:
Patient factors include:
- age,
- obesity,
- diabetes,
- steroid treatment and
- wound hematoma
microbes involved

• Staphylococci are the commonest organisms isolated from graft wound infections; *S. aureus* is most common in early graft infections while coagulase negative Staphylococci are prevalent in late infections.

• Gram negative organisms and anaerobes are the next in line of organisms being isolated.
graft infections—a few facts

• many suspected graft infections are treated without knowing identity or antimicrobial susceptibilities of the causative organisms

• this is due to suitable specimens not being obtained or because antibiotic treatment was instituted before collection of appropriate samples for culture.
graft infections-a few facts

• once infected a prosthesis acts as a foreign body

• renders bacteria inaccessible to Abx

• vein grafts are more resistant to bacterial erosion especially if exposed in an open wound
diagnosis of graft infection

- clinical findings
- radiology
- microbiological tests

Clinical manifestations of graft infection vary according to length of time that has elapsed since procedure.
clinical findings for diagnosis

early onset:

- occur within 4 months of surgery
- systemically toxic with fever and leucocytosis
- bloodstream infection
- wound infection
- graft dysfunction from thrombosis or anastomotic bleeding may occur
clinical findings for diagnosis

late onset:

- occur more than 4 months after surgery
- tend to be more subtle – non-specific signs and symptoms
- fever usually absent often presenting with complications
- false aneurysm
- osteomyelitis or nonhealing ulcers in distal tissues
imaging modalities used for diagnosis

- CT scanning: preferred imaging modality for diagnosis of graft infections
- MRI: yet to be evaluated
- Technetium -99m-hexametazime-labelled leucocyte scanning (sensitivity up to 100%)
- Sinography – determines whether a draining sinus extends to the graft - diagnostic of graft infection
microbiological aids to diagnosis

- explanted graft tissue
- aspirated material from peri-graft collection
- blood cultures often negative – especially late onset infections
- contamination – organisms from overlying wounds/ sinuses – eg MRSA
- postpone ABx in non-critically ill patient until cultures taken
Treatment options are usually divided into the following:

- Medical Therapy and Irrigation
- Surgical Treatment

Surgical treatment is considered the gold standard for management of vascular graft infections.
Treatment options

Surgical treatment options:

- 1 stage extra anatomic bypass (axillo-bifem by-pass)
- 2 stage extra anatomic bypass (axillo-bifem by-pass)
- Autogenous native vessel in-situ bypass (aorto-iliac reconstruction)
- Homograft vessel in-situ bypass (aorto-iliac reconstruction)
- Prosthetic drug impregnated in-situ bypass (aorto-iliac reconstruction)
Treatment options

Extra Anatomic by-pass (Axillo-bifem by-pass)
Treatment options

Autogenous native vessel in-situ bypass (aorto-iliac reconstruction)
Treatment options

Homogenous vessel in-situ bypass (aorto-iliac reconstruction)

In Jan.’05 the VSGBI in collaboration with the National Blood Service drew up a plan to develop the National Arterial Tissue bank (NATB).
Part Two

Infected Prosthetic Graft
Patient History

- 69yrs of age investigated for severe left hip pain
- Ex-smoker – 40 pack year history
- Security guard
- Past History: HT, IHD, CABG, Hypercholesterolemia
- Investigation done: X-ray pelvis (AAA found)

USS abdomen-12cm aneurysm diagnosed
Imaging

Abdominal Aortic Aneurysm Images in Cross Section

Ultrasound
- Aortic diameter
- Lumen
- Thrombus

Computed Tomogram
- Thrombus
- Lumen
- Aortic diameter
Operation

Infrarenal Abdominal Aortic Aneurysm

Abdominal Aortic Aneurysm (AAA) Open Surgical Repair

- Aorta
- Left Kidney
- Right Kidney
- Left Renal Artery
- Right Renal Artery
- Infrarenal Aneurysm
- Bladder
- Abdominal Aneurysm
- Graft
Post operation

- Unremarkable recovery, discharged on day 5
- 6/52 follow up normal.
- Re-presentation to GP with pyrexia (39.5°C), rigors, night sweats. Rx: Amoxicillin (PO) followed by Ciprofloxacin (PO)
- Presented to A&E with peri-umblical pain, pyrexia (37.7°C), WCC: 15.5 (Neutrophils: 12.13), CRP: 182
CT Scan results

- Gas inside existing sac which surrounds graft, perisaccular inflammation,

- Features are consistent with perigraft infection.

- ??Aorto-enteric fistula
What are the commonest causes of graft infections?

A) Breakdown of sterility

B) Patient factors

C) Operative factors
Microbes involved

Which is the commonest organism involved?

A) Gram negative organisms + Anaerobes

B) Staphylococci

A) Polymicrobial (including fungi)
Our patient’s microbial profile

• Gram +ve rods and cocci from aortic tissue and pus.

• *Streptococcus milleri* sensitive to penicillin and vancomycin.
Treatment options

What is the best treatment option for this patient?

A) Medical Therapy and Irrigation

A) Surgical
Treatment options

Surgical treatment:
A) 1 stage extra anatomic bypass (axillo-bifem by-pass)
B) 2 stage extra anatomic bypass (axillo-bifem by-pass)
C) Autogenous native vessel in-situ bypass (aorto-iliac reconstruction)
D) Homograft vessel in-situ bypass (aorto-iliac reconstruction)
E) Prosthetic drug impregnated in-situ bypass (aorto-iliac reconstruction)
Treatment given to our patient

• Autogenous native vessel in-situ bypass (aorto-iliac reconstruction)

• Autogenous vein used for reconstruction was the superficial femoral vein.

• An graft-enteric connection was also repaired.
Graft enteric connection
Thank You!

Acknowledgements to the three women who have influenced me in my life:

My Mum
Prof. Homer-Vanniasinkam
Prof. Val Edwards-Jones