New Concepts in Prosthetic Graft Infection in the abdomen and the extermities.

When does the entire graft need to the be excised and when can all or part of the graft be preserved? How to make that judgment?

WACLAW KUCZMIK MD. PHD, FACS
HEAD OF DEPARTMENT OF GENERAL AND VASCULAR SURGERY
MEDICAL UNIVERSITY OF SILESIA, KATOWICE, POLAND

Disclosures

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Prosthetic Grafts Infections

- Infection of prosthetic vascular grafts is a rare but potentially devastating complication in vascular surgery, with a incidence of 0.7% to 2.6%.
- They still represent a major challenge in vascular surgery, with high morbidity and mortality rates (up to 30%) and high major amputation rates (12% to 70%) even after replacement of the infected graft.

Current standards of management of patients with vascular graft infection

- antibiotic therapy
- evacuation of the abscess and tissue debridement
- complete or partial removal of the graft
- in situ or extra-anatomical revascularization with use:
  - prosthesis graft coated with silver or the antibiotic (rafamycin)
  - femoral vein or great saphenous vein
  - bovine pericardium patch/graft
  - cryopreservad homograft
  - the choice of the ideal material for vascular reconstruction is still debated

Nabil Chakfé et al ;European Society for Vascular Surgery (ESVS) 2020 Clinical Practice Guidelines on the Management of Vascular Graft and Endograft Infections Eur J Vasc Endovasc Surg (2020) 59, 339e384

A Promising Alternative to Combat Resistant Infections – Phage Therapy

- **Antibiotic Resistance**
  - Common causative agents: *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Enterococcus*.
  - Biofilm formation on graft material makes treatment difficult.
  - Rising antibiotic resistance: limits conventional treatment options.
- **Need for Alternative Therapies**
  - Antibiotic inefficacy and high recurrence rates.
  - We need alternative or adjunctive therapies like phage therapy and new grafts

What is Phage Therapy?

Introduction to Bacteriophages (Phages)
- Phages are viruses that specifically target bacteria.

History of Phage Therapy
- Origins in the early 20th century; re-emergence due to antibiotic resistance.

Phage Therapy as a Precision Tool
- Highly specific to bacterial species or strains.
- Minimizes impact on beneficial microbiota compared to broad-spectrum antibiotics.

Mechanism of Action of Phages

Phage Life Cycle (Lytic Cycle)

- Attach to bacterial cell → Inject genetic material → Replicate within the cell → Cell lysis and release of progeny phages.

Advantages Over Antibiotics

- Ability to penetrate biofilms.
- Targeted approach reduces risk of side effects.
- Self-replicating as long as target bacteria are present

Application of Phage Therapy in Aortic Graft Infections

Phage therapy influences the biofilm formed in infections on the graft surface

- Phages kill bacteria and destroy biofilm, exposing bacteria to the action of antibiotics, research shows that the effectiveness of antibiotic therapy increases by 100 to 1000 times.

Delivery Methods

- Local application during surgery (direct graft inoculation).
- Systemic administration if bacteremia is present

Prosthetic grafts in future

- Another direction of scientific research is to create a vascular prosthesis that is resistant to infections and biofilm.
- For this purpose, nano-particles of silicon were used and additionally coated with a slowly releasing antibiotic.
- Such a prosthesis has hydrophobic properties, which makes it difficult for bacteria to colonize on its surface. This function is additionally enhanced by the released antibiotic.

Simon Pecha st al: Bionic Nanocoating of Prosthetic Grafts Significantly Reduces Bacterial Growth. ACS Appl. Mater. Interfaces 2024, 16, 13534−13542

Conclsusion

Summary of Key Points

- Phage therapy offers a promising alternative for treating graft infections.
- Effective against biofilms, highly specific, and may reduce resistence on antibiotics.

Future Prospects

- More research with new materials and grafts

When does the entire graft need to the be excised and when can all or part of the graft be preserved?

How to make that Judgment?

Graft Excision: Criteria for Complete Excision vs. Partial Graft Preservation

Decision-Making in Infected Graft Management

Assessment Tools to Guide Decision

- **Imaging Techniques**
  - CT with contrast, PET-CT, WBC scintigraphy, WBC SPECT/CT to assess the extent of infection.
- **Microbiological Analysis**
  - Blood cultures, biopsy of infected tissue for pathogen identification.
  - Sensitivity testing to assess antibiotic response.
- **Clinical Scoring**
  - Using clinical scoring systems to assess severity and guide treatment strategy.

Decision-Making Criteria: Complete vs. Partial Graft Excision

Complete Graft Excision

Factors favoring complete removal:

- Extensive infection involving the entire graft.
- Infected graft with multiple anastomotic sites involved confirm in imaging tools
- Persistent systemic infection unresponsive to antibiotics
- Rapidly worsening symptoms (fever, sepsis).
- Poorly controlled diabetes, history of recurrent infections

Partial Excision or Preservation of Graft

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•Factors supporting partial preservation:

- Localized or early infection.
- Adequate antibiotic response.
- Stable graft with infection limited to part of the graft.
- Patients who may not tolerate extensive surgery

Conclusion

Summary of Key Points

1. Decision for complete vs. partial graft excision depends on infection extent, structural integrity and patient condition.
2. Imaging, microbiology, clinical assessment and patient condition are crucial for guiding management.

Thank you for your attention