

Infectious Complications in Vascular Patients

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DISCLOSURE

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- **No relevant financial relationship reported**

Objectives

- Overview of types of infections seen in vascular patients
- Epidemiology/Risk Factors
- General management strategies
- Prevention

Types of Infections

- Surgical wound infections
- Vascular graft infections

The Numbers

- SSI in vascular surgery: 4% to 25% - 43% depending on type of study
- Prosthetic graft infection: 0.5% - 6% depending on location
 - <1% for sub renal aortic bypass
 - 0.4% - 3% for open aortic aneurysm repair
 - 1-2% for aortofemoral bypass
 - up to 6% for infra-inguinal bypass
 - 3-8% for arteriovenous dialysis access grafts
 - Endovascular repair risk unclear, but appears to be very low (<1%)
- Death rate for VPGI: 15-75% (amputation rate ~70%)

Surgical Wound Infections

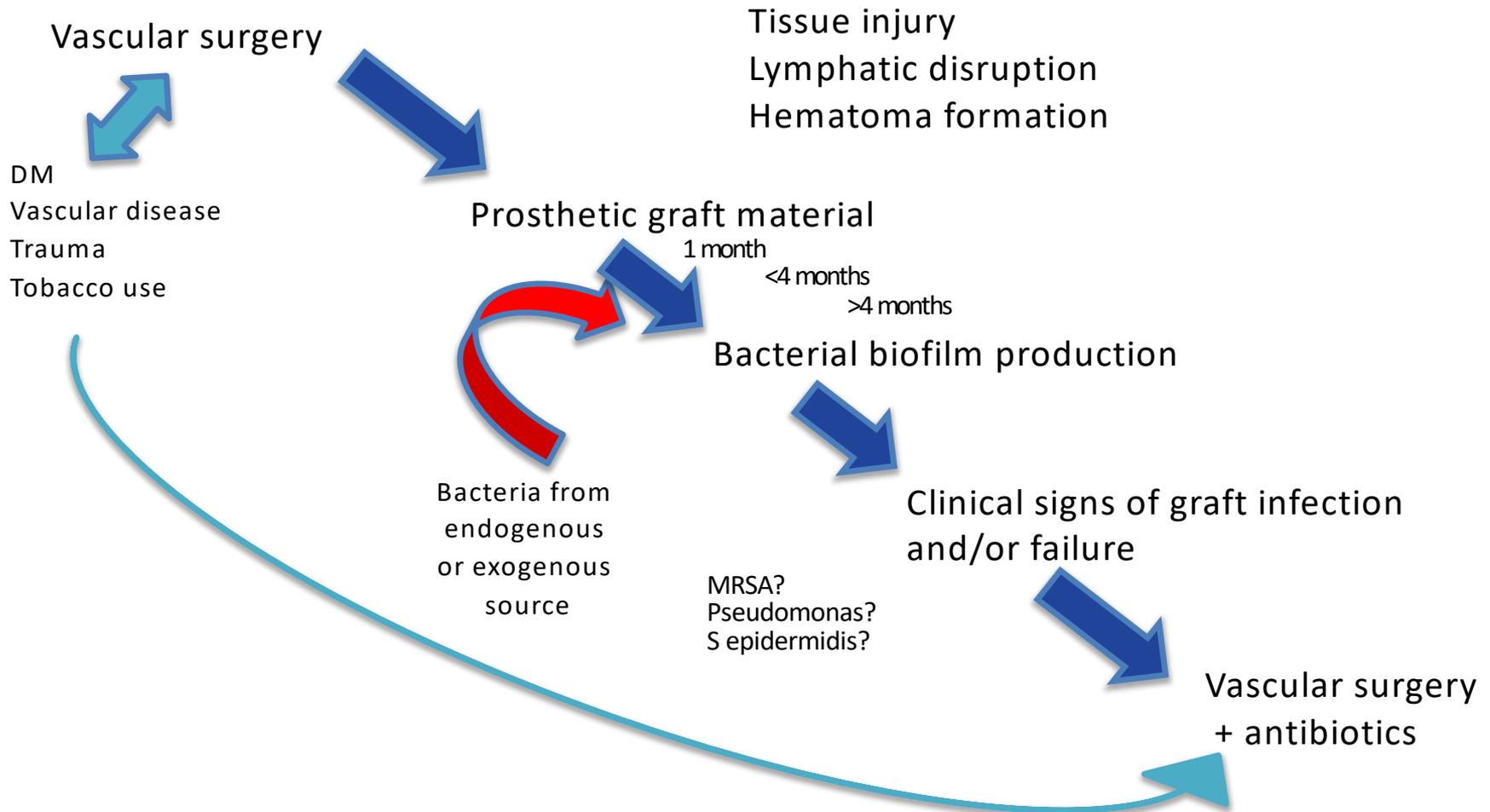
- '07-'08 prospective multi-center Finnish study. Infrarenal aortic or lower limb arterial surgery. Standard pre-op prophylaxis, in OR shaving. 1 m f/u.
 - 64 (35%) included prosthetics or patches
 - 49/184 (27%) with SSI (standard CDC definition)
 - 2 went on to amputation
 - 71% *S aureus*, then coag-negative staph, *E coli*
 - Risk factors for SSI: infrainguinal surgery, obesity, arteriography injection within the injection site.
 - Attributable cost: €3320 (\$4359)

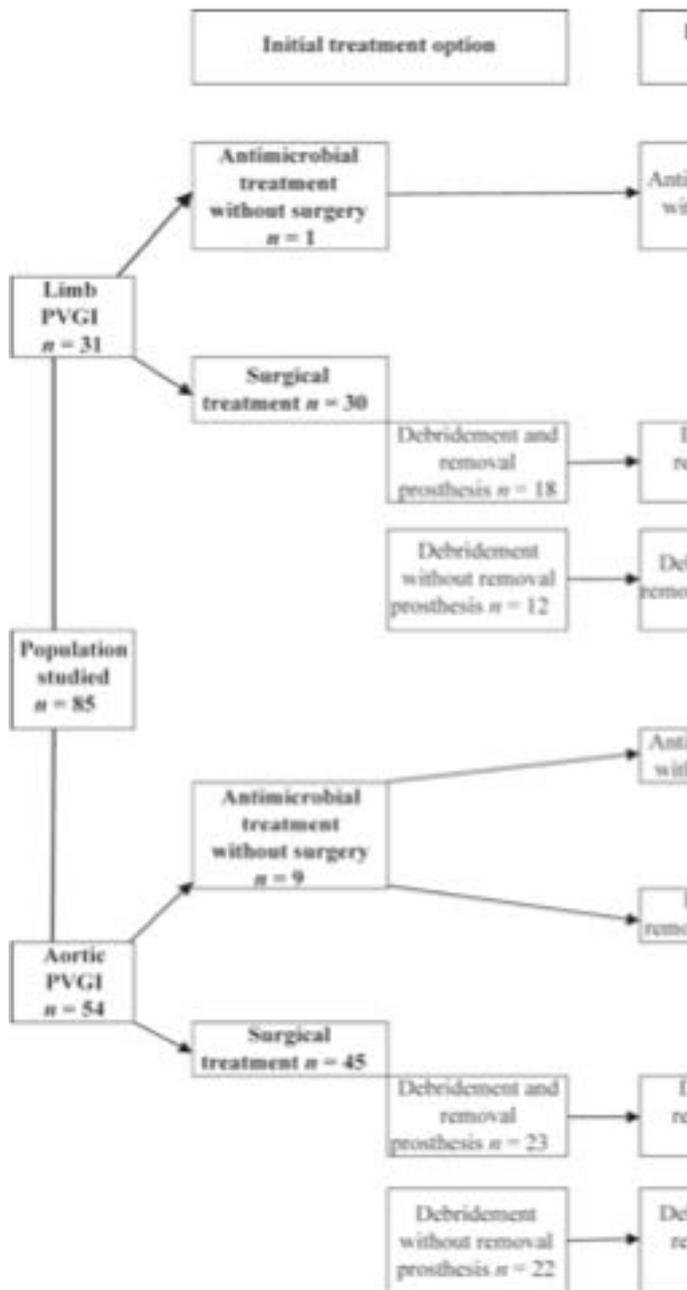
Risk factors for surgical wound infection

- Increased age
- Obesity
- DM
- Infra-inguinal surgery
- Redo surgery
- ? arteriography within operative site

	Total (n = 87)	Early VSSI (n = 50)	Late VSSI (n = 37)
Pure Gram positive	52 (60%)	27 (54%)	25 (68%)
<i>Staphylococcus aureus</i>	10	4	6
MRSA	22	15	7
<i>Staphylococcus epidermis</i>	17	7	10
VRE	2	1	1
<i>Streptococcus</i>	1	0	1
Pure Gram negative	8 (9%)	6 (12%)	2 (5%)
<i>Pseudomonas</i>	4	2	2
<i>Escherichia coli</i>	2	2	0
<i>Serratia</i>	1	1	0
<i>Alcaligenes X</i>	1	1	0
<i>Candida</i>	1 (1%)	1 (2%)	0 (0%)
Mixed	20 (23%)	13 (26%)	7 (19%)
Unknown/No growth	6 (7%)	3 (6%)	3 (8%)

Vascular Graft Infection: A Model of Pathogenesis



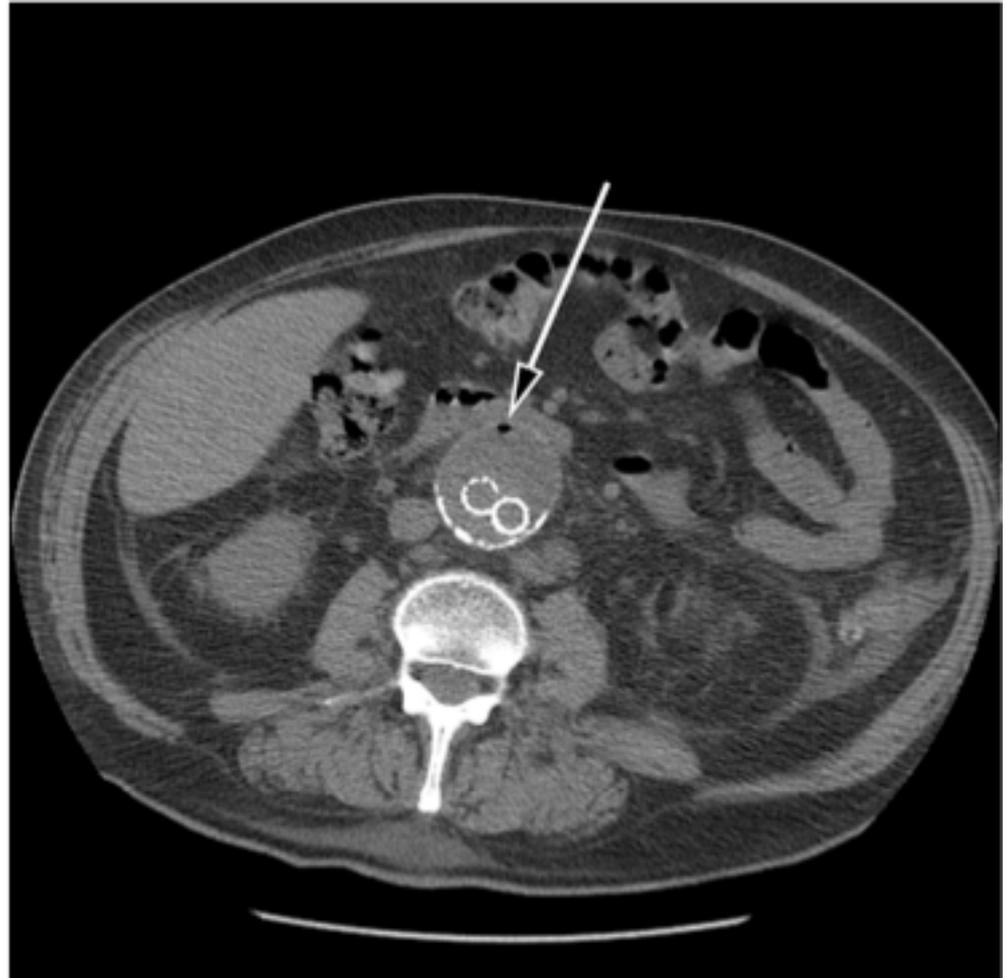


Parameter	Survivors (n = 71)	Non-survivors (n = 14)	p-value
Age (years)	66.8 ± 12	73.3 ± 7.9	0.04
Age ≥70 years	32 (45.1)	12 (85.7)	0.005
Male gender	61 (85.9)	13 (92.8)	0.47
Malnutrition	5 (7)	0 (0)	0.3
Overweight/obesity	42 (59)	8 (57.1)	0.88
Severe renal insufficiency	5 (7)	2 (14.3)	0.36
Diabetes mellitus	20 (28)	4 (28.6)	0.97
Immunosuppression	11 (15.5)	0 (0)	0.11
Chronic pulmonary disease	12 (16.9)	4 (28.6)	0.3
Arterial hypertension	56 (78.8)	10 (71.4)	0.54
Coronary artery disease	34 (47.9)	10 (71.4)	0.1
Aortic graft infection	42 (59)	12 (85.7)	0.06
Early-onset infection	44 (89.8)	5 (10.2)	0.08
Positive blood samples	23 (32.4)	6 (42.8)	0.45
Polymicrobial PVGI	14 (19.7)	6 (42.8)	0.06
PVGI caused by	41 (83.7)	8 (16.3)	0.97
Gram-positive cocci			
PVGI caused by	22 (31.0)	8 (57.1)	0.07
Gram-negative bacilli			
Surgical debridement with excision of infected graft	33 (46.5)	8 (57.1)	0.47
Admission to ICU	28 (39.4)	12 (85.7)	0.001
Septic shock during the surgical procedure	12 (16.9)	5 (35.7)	0.1
Appropriate initial empirical antibiotic treatment	62 (87.3)	13 (92.5)	0.55
Use of aminoglycoside in the initial antibiotic treatment	23 (32.4)	5 (35.7)	0.8

ICU, intensive-care unit; PVGI, prosthetic vascular graft infection. Data are expressed as n (%) or mean ± standard deviation.

Imaging

- Contrast-enhanced CT:
 - quick, image guided sampling
 - ~100% sensitive/specific in early infection
 - Decreases to ~55% in late infection
 - Anastomotic air bubbles? Should be gone after 7 weeks
 - Periprosthetic hematoma? <20% by 45 days, <10% by 100 days



Imaging

- MRI: not better than CT for early VPI, but only limited studies
- Nuclear medicine: maybe better than all above?
 - Scintigraphy (tagged WBCs) appears to be superior for late VPI
 - PET-scanning sens 98.2%, spec 75.6%, PPV 88.5%, NPV 84.4%
 - Lacks anatomic data
 - Hard to access
- Doppler: good for thrombosis, collections



Diagnosis

- Positive intra-operative samples or blood cultures, preferably 2 for commensal bacteria
- Local or general clinical signs of infection: fever, chills, etc
- Lab or imaging: WBC > 10,000, CRP > 10 mg/L, fluid collections, periprosthetic air bubbles >6-8 weeks out, abscess or false aneurysm
- Think VPI when patient presents with a distant site infection in the months following surgery

Antimicrobials I

- Antibiotics should be held until samples are obtained unless patient is severely septic
- No consensus on best drug based on organism(s), timing of presentation, severity of infection, or status of prosthetic material/graft (daptomycin / linezolid / vancomycin?)
- Antibiotic therapy should be narrowed to the most specific, most potent, and least toxic drug possible as soon as culture results are available
- Treatment choices are based on experience, studies and extrapolations from other processes, such as orthopedic prosthetic joint infections and endocarditis

Antimicrobials II

Duration

- Arterial allograft/homograft or prostheses: 6 weeks IV + 6 months PO (at least). 6 week mark based on endothelialization of prosthesis
- Venous graft: 3 weeks
- If infected material remains in place: indefinite suppressive therapy with doxycycline, TMP-SMX, or a fluoroquinolone may be necessary

Surgical Approach

- *Conventional / traditional* approach
- *Conservative / graft preservation* approach
- *Combined* (modern?) approach

Other Therapies

- Antibiotic impregnated PMMA beads- only case series data
- Antibiotic powder- small case series
- Antibiotic-impregnated grafts
 - PTFE
 - Dacron (weaved/knitted, preclot/collagen/gelatin)
 - Rifampin (covers GPCs, no GNRs), lots of animal data, use supported by metanalysis comparing extraanatomic bypass, cryopreserved allografts, autogenous veins and rif-dacron grafts- the latter appeared to be best option.
 - Effect on MRSA less clear

2010 Cochrane Review*

- 10 antibiotic prophylaxis vs placebo (YES)
- 10 different prophylactic abx or dose (NO)
- 3 short duration abx (<24h) vs longer duration (**NO**)
- 3 rifampicin impregnated graft material (prophylaxis) (NO)
- 3 preoperative skin antisepsis (NO beyond standard practices)
- 2 each: suction wound drainage, closed *in situ* bypass techniques (NO, NO)
- 1 each: wound closure technique, single dose abx (NO, NO)

*oldest RCT 1981, newest 2000, most in '80s and '90s

Prevention

- Pre-operative washing with chlorhexidine soap
 - Decreases wound infection rates from 17.5 to 8%
- MRSA swab of nares and open wounds
 - If positive, vancomycin + cefazolin for peri-operative prophylaxis

Thank you