

Locally Delivered Antibiotics in Fracture-Related Infection (FRI)

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BACKGROUND

- FRI occurs in ~1% closed fractures and up to 30% of GA III open tibial fractures.¹
- Consequences include non-union, recurrence (9%), amputation (3%).²
- Direct hospital costs may be ~8x higher than in patients without FRI.³

Why local delivery?

Biofilm requires antibiotic concentrations far above the MIC.

Vancomycin-sensitive *S. aureus*
MIC vs. MBEC
2 vs. **>1000**
µg/mL µg/mL

Systemic therapy alone cannot achieve MBEC.⁴

Additional benefits: dead space management, structural support, reliable local delivery.

Considerations



Potential concerns:
Cytotoxicity, resistance, systemic toxicity.



Human evidence:
Adverse events appear uncommon.⁵

Aim

To review the rationale, delivery methods, and evidence for locally delivered antibiotics in the prevention and treatment of FRI.

PREVENTION

Local antibiotics can reduce infection in high-risk fractures.

Vancomycin powder

High-risk tibial plateau/pilon fractures

3.7% ↓

Gram-positive deep SSI
RCT, n=980, p=0.02⁶



Cheap · absorbable · small spaces



Short therapeutic window · no dead-space filling

Aqueous gentamicin

Open fractures

↓ superficial and deep infection

Retrospective, n=168⁷



Absorbable · broad bactericidal activity



Short therapeutic window · limited FRI evidence

Antibiotic cement

GA III open tibial fractures

Deep infection: 14.4%→2.4%

*Predominantly antibiotic-loaded PMMA beads⁸



Adaptable · dead-space management



Non-absorbable · short elution

Hydrogel coating

Closed fractures undergoing internal fixation

SSI: 4.6% → 0%

RCT, n=253, p<0.03⁹



Absorbable · versatile · no thermal damage



Short elution · cost · limited clinical evidence

TREATMENT

Local antibiotics can improve infection control in established FRI.

CLAP system

(continuous local antibiotic perfusion)

Severe/refractory FRI

Near – 100% infection control

9-17 days of treatment^{10,11}



Continuous delivery · implant retention



Invasive · small, non-comparative evidence

Antibiotic cement

Infected non-union / dead space management

95% infection control

ACC nail, tibial non-union, gap <2 cm
n=20¹²



Adaptable · dead-space management



Non-absorbable · short elution

ACC nails: debonding risk

Antibiotic bone graft

Infected tibial non-union, 2–4 cm defect

95.6% vs 82% infection control

vs non-impregnated graft

n=96, p<0.05¹³



Absorbable · osteoconductive · high antibiotic elution



Donor-site morbidity (autograft)

Bioceramics

Established FRI

91% infection eradication

Calcium sulphate + tobramycin
Single-stage treatment, n=110¹⁴



Absorbable · dead-space filling · prolonged elution



Cost · limited high-quality evidence

TAKE-HOME MESSAGE

- Local antibiotics can reduce infection in high-risk fractures and improve infection control in established FRI.
- Delivery method should reflect the clinical situation, including dead space, bone loss and fixation requirements.
- Biodegradable carriers offer promising alternatives to PMMA, but evidence varies considerably by delivery system and further prospective trials are needed.

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