



## Fracture-related Infection

Fracture-related infection is an increasing problem, following open injuries and internal fixation of fractures. It can occur in up to 40% of some open fractures and has serious consequences for patients and healthcare systems. It is important to put in place, effective protocols for prevention, detection and management of infection in a multidisciplinary service.

This short guide gives general advice on the principles which underpin safe care of adult patients with infection arising at any time after treatment of a fracture of the limb bones.

### Prevention

- All hospitals should have an agreed and accessible protocol for the prevention of infection in patients presenting with open and closed fractures<sup>1</sup>. This will include, as a minimum, theatre protocols, preoperative and intraoperative patient preparation, prophylactic antibiotic protocols and colonisation screening (where appropriate).
- For open fractures also refer to BOAST 4<sup>2</sup> and the NICE complex fracture guideline<sup>3</sup>

### Suspected infection

Patients should receive clear written advice on how to spot the signs and symptoms of fracture-related infection. This should be provided at initial fracture treatment and copied to primary carers.

Suspected early fracture-related infection:

- Systemic sepsis must be recognised early by an immediate medical assessment<sup>4</sup>. Early management includes urgent blood culture followed by administration of parenteral antibiotic therapy.
- A patient who is not systemically unwell should be seen in a clinic within 24 hours. Antibiotic treatment can be safely withheld until discussed with the treating fracture surgeon.

Suspected late fracture-related infection (e.g. infected non-unions, infected healed fractures):

- Late infection can occasionally present with acute symptoms. Systemic sepsis must be recognised early by an immediate medical assessment<sup>4</sup>. Early management includes urgent blood culture followed by administration of parenteral antibiotic therapy.
- A well patient should be seen at a specialist bone infection combined clinic (Appendix 2)

### Diagnosis of suspected fracture-related infection

Treatment should not be started before a diagnostic workup. Clinical assessment and diagnostic investigations should be focussed on the elements of the Consensus Definition of Fracture-related Infection<sup>5</sup>.

This should include:

- Blood cultures in all febrile and/or systemically septic patients
- Plain radiology for implant loosening, periosteal reaction and progressive bone loss.
- Imaging-guided aspiration of possible fluid collections or joint effusions for microbiological culture. This is essential in patients not undergoing surgery.
- Intra-operative sampling remains the diagnostic test of choice. This should include 4-6 samples of bone and soft-tissue, taken from around the fracture or implant site, using separate sterile instruments for each sample and processed in an accredited laboratory.
- For stable patients, antibiotic therapy should be stopped prior to sampling. Generally, this will be for a minimum of 2 weeks.

## Management

Initial medical assessment will guide the urgency of care. Sepsis must be treated promptly. In well patients, co-morbidities should be sought and addressed before definitive treatment of the infection. This should not produce indefinite delays. Review of existing medications is essential to avoid drug interactions with antibiotic therapy.

In a few patients, the risks of definitive surgery may be unacceptable to the patient, compared to the disease symptoms. These patients should be considered for diagnostic workup and either no therapy or antibiotic suppressive therapy.

- There is no place for empiric antibiotics without a diagnostic work up.
- Early infections can be managed in an acute trauma unit with microbiological and plastic surgery support. Management must be delivered by an experienced senior surgeon and must include:
  - diagnostic sampling
  - debridement and excision of dead tissue
  - assurance of fracture stability (with possible retention or exchange of fixation)
  - provision of definitive soft tissue cover
- An MDT\*\* focused on infection management should manage all;
  - late or recurrent infections.
  - infected non-unions
  - infected fractures with major bone and soft tissue defects.
- Broad-spectrum antibiotics should be started systemically after sampling. Local antibiotics may be implanted in dead spaces created at surgery. Hospitals must have a relevant antibiotic policy. Antibiotics must be reviewed after 48 hours with preliminary culture results.
- Antimicrobial therapy should be narrowed and be culture specific as soon as possible. Hospitals should provide 24 hour telephone or bedside antimicrobial therapy advice for drug choice, monitoring and duration.
- In complex infections (pelvic bones, multi-resistant organisms, multiply operated infected non-unions, FRI with septic arthritis), referral to a specialist septic unit should be considered early.

## Monitoring and follow up

- A senior clinician should see the patient at each clinic visit.
- Any concern about progress should prompt a return to the MDT for a reassessment of the treatment options. Antibiotics should not be simply prolonged.
- Significant adverse effects from antimicrobial therapy are common and expert advice should be sought.

## Evaluation of Outcomes

- Hospitals should have a robust surgical site infection surveillance system<sup>6</sup>.
- Outcomes should be reviewed regularly to identify both success and failure. Teams should review;
  - primary outcome measures (re-operation rates, non-union, infection recurrence, amputation and death)
  - access to care (turnaround times)

\*\* **MDT** = multidisciplinary team which should include orthopaedic and plastic surgeons experienced in infection management, infection specialists and musculoskeletal radiologists. The MDT should meet regularly and engage in outcome evaluation.

## References

1. <https://www.nice.org.uk/guidance/qs61/resources/infection-prevention-and-control-pdf-2098782603205>
2. <https://www.boa.ac.uk/wp-content/uploads/2017/12/BOAST-Open-Fractures.pdf>
3. <https://www.nice.org.uk/guidance/ng37>

4. NICE guideline: Sepsis; recognition, diagnosis and early management.  
<https://www.nice.org.uk/guidance/ng51>
5. W.J. Metsemakers, et al., Fracture-related infection: A consensus on definition from an international expert group, Injury (2017), <http://dx.doi.org/10.1016/j.injury.2017.08.040>
6. <https://www.gov.uk/government/collections/surgical-site-infection-ssi-guidance-data-and-analysis>

## **Review Process**

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