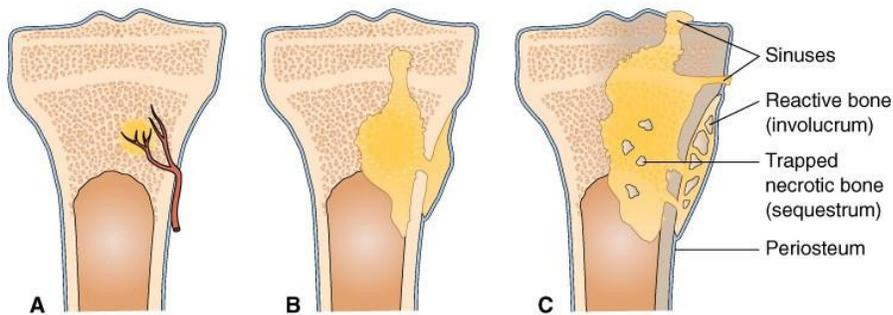


# Musculoskeletal System

## Osteomyelitis

- Infection of bone and/or bone marrow
- Direct or indirect invasion by an organism
- Direct / Exogenous: open fx, foreign body, trauma
- Indirect / Endogenous: from distant site
- Extension / Contiguous: ulcers
- **Classification**
- Acute = the initial infection or an infection **lasting less than one month**  
Inc incidence in children < 12 yrs
- Chronic = infection **lasting longer than one month** or an infection that has failed the initial course of antibiotic therapy for acute osteomyelitis  
Mostly adults  
Recurrences
- **Etiology**
- Staphylococcus aureus - most common
- May have mixed pathogens
- Gram + & - bacteria, fungus, virus



Copyright © 2010 Wolters Kluwer Health | Lippincott Williams & Wilkins

- **Pathophysiology**
- Bacteria enters a bone
- Inflammatory response
- Purulent material collects within the bone
- Increased pressure → pain
- Ischemia & vascular compromise → ↓ O<sub>2</sub>
- Bone dies & sequestra (dead bone separated from living bone) form
- Sequestrum - a haven for bacteria
- Involucrum (new bone sheath) grows around sequestrum
- **Direct Entry (exogenous)**
- Can occur at any age - open wound
- Foreign body
- Microorganisms enter the bone & lodge in an area of bone in which circulation slows, usually the metaphysis.
- Organisms grow → increased pressure

- $\uparrow$  inc pressure = ischemia & vascular compromise (blood vessel thrombosis)
- Infection > bone cortex and marrow = cortical revascularization and necrosis.
- Ischemia  $\rightarrow$  bone dies
- Area of devitalized bone separates from the living bone = sequestra.
- Forms new bone = Involucrum
- Sequestrum is difficult to reach by antibiotics and WBC's.
- Enlarges and serves as a site for microorganisms that spread to other sites
- **The sequestrum can move out of the bone and into the soft tissue.**
- Once outside the bone, the sequestrum may re-vascularize and then undergo removal by normal immune processes.
- The sequestrum can be surgically removed by **debridement**.
- If the necrotic sequestrum is not resolved naturally or surgically, it may develop a sinus tract, resulting in chronic, purulent cutaneous drainage.

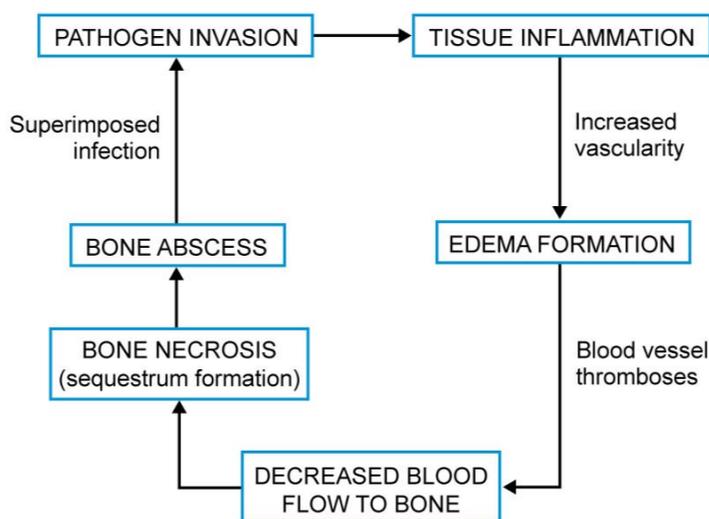


Fig. 53-2. Infection cycle of osteomyelitis.  
Copyright © 2010, 2006, 2002 by Saunders, an imprint of Elsevier Inc.

- **Indirect Entry (endogenous)**
  - Most frequently affects growing bones in young boys (< 12 years)
  - Higher incidence of blunt trauma
  - Most common sites of indirect injury in children
  - Distal femur, proximal tibia, humerus, radius
  - Pelvis and vertebrae - **most common sites of infection in adults**
  - GU & Respiratory infections – vascular insufficiency
- **Complications**
  - Fractures
  - Chronic infection
  - Sepsis
  - Deformities, Leg length discrepancies
  - Brodie's abscess
  - Amputation
- **Acute Osteomyelitis S/Sx:**
  - Both **systemic and local**
  - Fever, Chills, night sweats, restlessness, nausea, malaise

- Bone pain - unrelieved by rest and worsens with activity
- Swelling, tenderness, and warmth
- Restricted movement
- Drainage from sinus tracts (late sign)
- Fracture
- **Chronic Osteomyelitis S/Sx:**
  - Scar tissue
  - Systemic ↓ , local ↑
    - Constant bone pain and swelling, tenderness, and warmth at the site
  - May have a draining sinus tract (late)
- **Diagnosis:**
  - Early diagnosis & treatment is essential
  - H & P
  - Wound & blood cultures – need to ID the organism
  - ↑ WBC, ↑ ESR (chronic), ↑ CrP (acute)
  - Bone scan – 24- 72 hrs of onset
  - X-rays not indicative until 10-21 days after S/Sx appear
  - MRI - acute
  - CT
- **Prevention:**
  - Aseptic technique
  - Prophylactic antibiotics post-op and post-injury
- **Treatment:**
  - #1 = vigorous and prolonged IV antibiotic therapy
  - IV antibiotic therapy is continued in the home for *4 to 6 weeks or as long as 3 to 6 months.*
  - Cultures or bone biopsy
  - Tetanus
- **Antibiotics**
  - penicillin
  - nafcillin (Nafcil)
  - neomycin
  - cephalexin (Keflex)
  - cefoxitin (Mefoxin)
  - gentamycin (Garamycin)
  - tobramycin (Nebcin)
  - cefazolin (Ancef)
- **Treatment:**
  - Ciprofloxacin/Fluoroquinolone for 6 to 8 weeks may be prescribed instead of IV antibiotics.

- Oral abx after IV completed (monitor with ESR & scans)
- Surgical debridement and decompression
- Limit activity to ↓ stress & keep the infection localized
- Immobilize limb
- Cast or splint
  
- **Surgical Treatment**
- Irrigation & Debridement
- Removal of the poorly vascularized tissue and dead bone (sequestrectomy)
- Irrigate with antibiotics
- Removal of implant
- Saucerization = a type of decompression surgery
- Remove a window of bone to ↓ pressure
- Possible bone or skin graft
- Intermittent or constant irrigation with antibiotics
  
- **Wound Packing & Drainage**
- Closed Wound → irrigate with antibiotics > control hematoma & remove debris
- One drain going in and one coming out for continuous or intermittent irrigations
- Open Wound → leave open if 1) open wound or 2) infected with anaerobic organisms
- Debride with dressing changes
  
- **Other treatments**
- Limb protection
- Hyperbaric oxygen therapy
- Removal of orthopedic devices
- Amputation
  
- **Nursing Assessment**
- Subjective Data:
  - PMH
  - Medications
  - PSH
  - IV drug abuse
  - symptoms: malaise, anorexia, wt. loss, chills, weakness, paralysis, spasms, local tenderness, pain with movement, stress/coping tolerance
- Objective Data (signs):
  - Restlessness
  - High, spiking temperature
  - Diaphoresis
  - Erythema, warmth, edema at infected bone
  - Restricted movement
  - Wound drainage
  - Spontaneous fractures
  - Leukocytosis
  - blood and/or wound cultures
  - Elevated ESR & CRP
  - Presence of sequestrum and involucrum

- **Nursing Diagnoses**
  - Acute pain / chronic pain
  - Impaired physical mobility
  - Ineffective therapeutic regimen management
  
- **Acute Nursing Management**
  - Immobilization
  
  - Avoid excessive manipulation
  
  - Pain assessment and intervention
  
  - Dry, sterile dressings
  
  - Dressings saturated in saline or antibiotic solution
  
  - Wet-to-dry
  
  - Bedrest in the early stages
  
  - Good body alignment and frequent position changes
  
  - Avoid - exercise or heat
  
  - Uninvolved joints and muscles should continue to be exercised
  
  - Risk for flexion contractures
  
  - Proper nutrition and hydration
  
- **Health Promotion**
  - Control existing infections
  - Instruct patients on local and systemic manifestations
  - Symptoms of bone pain, fever, swelling, and restricted limb movement
  
- **Ambulatory and Home Care**
  - Venous access device
  - Instruct on antibiotic administration. (Schedule, Labs, Side Effects)
  - Adverse & Toxic Reactions: renal impairment, hearing deficits, neurotoxicity
  - Stress the importance of continuing to take antibiotics after the symptoms have subsided.
  - If there is an open wound, dressing changes are often necessary.
  - Family needs to understand the infection is not contagious.
  - Periodic home nursing/ home health visits