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UNC Children's Clinical Practice Guideline
Pediatric Musculoskeletal Infection
Page 1: Emergency Department or Direct Admit Phase

UNC HEALTH CARE Children's

Suspicion of MSK Infection

HIGH SUSPICION: Fever PLUS at least one of
- Refusal to bear weight
- Focal pain
- Limited use of extremity
- Immobility of extremity

YES → ****If patient not at UNCH, request transfer****
Initial Diagnostic Management
- If sepsis suspected, proceed to Code Sepsis
- Make patient NPO
- Imaging: Focused radiographs of affected region(s).
- Labs: BMP, CBC/diff, CRP, ESR, Blood culture

NO → **Continue Usual ED Management**

Assess RISK of MSK Infection
Does the patient have ANY of:
- Radiographic evidence of infection
- Temperature >= 38.5º C
- WBC > 12,000
- CRP > 20 mg/L
- ESR > 40 mm/hr
- Unable to bear weight

YES → **HIGH Risk for MSK Infection**

Obtain Orthopedic Surgery Consult

Concern for joint effusion?

YES → Obtain Ultrasound. Effusion confirmed?

YES → Hip?

YES → Consult Radiology for aspiration if amenable

NO → Orthopedic Surgery to perform aspiration. See Box 4 to the right.

Sample obtained

For joint aspirations, please proceed to **Page 4:** Procedural Guidance algorithm

NO

- **ADMIT to Pediatric Hospitalist service**
- **Ortho will follow as consult**
- **Start antibiotics (See Page 2: Antibiotic Selection)**
- **NPO**
- **IV fluids**

NO → **LOW Risk for MSK infection**

Trial NSAIDs

Discharge Criteria
Does patient meet BOTH of following:
1. Clinical improvement (afebrile, ambulating without pain)
2. AND reliable follow-up is available?

YES → Discharge home with PCP follow-up within 48 hours

NO →
- **ADMIT to Pediatric Hospitalist Service**
- **Consult Ortho**
- Scheduled ketorolac
- Observation
- NPO overnight

Improved after 12-24 hours?

YES → Discharge home with PCP follow-up within 48 hours

NO → Repeat CBC and CRP

Rising CRP or WBC?

YES → **Consider managing as HIGH RISK**

NO → Improvement after 24 hours?

YES → Discharge home with PCP follow-up within 48 hours

NO → **Consider managing as HIGH RISK**

Box 1: Inclusion Criteria
- Age: 6 months to 21 years
- Suspicion of acute MSK infection
  - Osteomyelitis, septic arthritis, or pyomyositis
  - Symptoms <2 weeks

Box 2: Exclusion Criteria
- Infants under age 6 months
- Symptoms >2 weeks
- Suspected postoperative infection
- History of penetrating injury (Ex: bite wound, trauma patient)
- Patient with surgical hardware
- Myelomeningocele
- Immunocompromised status
- History of chronic recurrent multifocal osteomyelitis (CRMO)

Box 3: Suspicion of MSK Infection
History
Pain, fever, inability to bear weight, gait disturbance/limp, limited use or immobility of extremity or spine

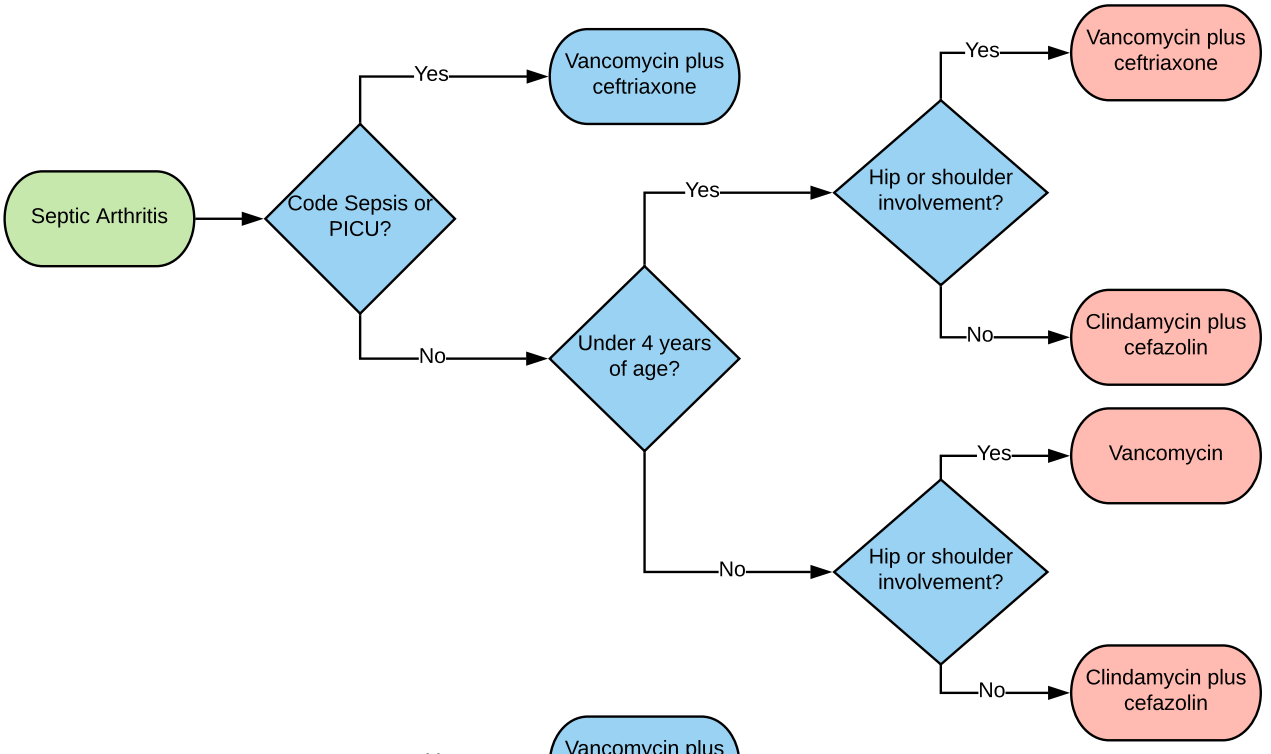
Exam
Localized swelling, tenderness, warmth, erythema; fever; limited joint range of motion; gait (if patient able)

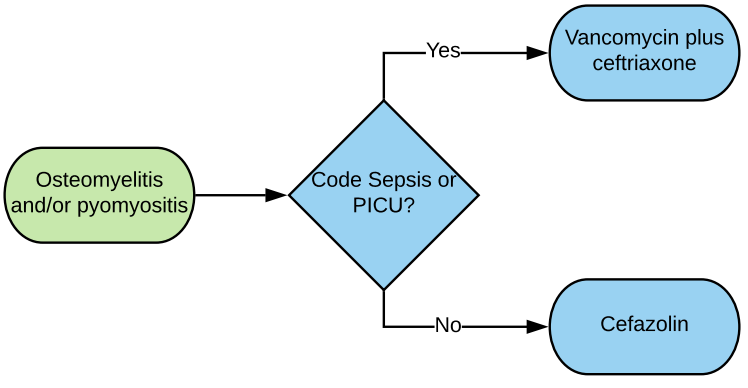
Box 4: Synovial Fluid Specimen Collection
Order in EPIC
1. Joint fluid culture
   - Specimen type: Fluid, joint
   - Specimen Source: Joint, [left knee]
2. Body fluid cell count
   - Specimen type: Fluid, joint
   - Specimen Source: Joint, [left knee]

Obtain
Syringe with at least 4-5 mL
If limited volume, culture is #1 priority

Send
Needleless syringe in bag with order stickers for both CULTURE and CELL COUNT

UNC Children's Clinical Practice Guideline
Pediatric Musculoskeletal Infection
Page 2: Antibiotic Selection





Clinical Sepsis
Children meeting criteria for Code Sepsis should be managed according to Code Sepsis protocols. In most cases, the most appropriate antibiotics are vancomycin plus ceftriaxone.

Cephalosporin Intolerance
Most Penicillin-allergic patients can safely take cephalosporins. If cephalosporins truly contraindicated, **consult ID** for recommendations.

Patient age and risk of *Kingella*
Children under age 4 are at higher risk for *Kingella kingae* infection. *Kingella* is susceptible to cephalosporins, but not clindamycin or vancomycin.

Assess vaccination status
Consider ceftriaxone for children who are not completely vaccinated against pneumococcus and *Haemophilus influenzae* type b. *Haemophilus influenzae* is not susceptible to cefazolin, clindamycin, or vancomycin.

Tailoring Antibiotic Therapy to Results
Ensure Pediatric Infectious Diseases is consulted.

Gram-positive cocci in blood culture: Add vancomycin. Consult ID. Consider oxacillin.

Gram-negative rods in Gram stain or culture of tissue or fluid: Include ceftriaxone. Do not narrow coverage based on Gram stain. Consult ID.

Gram-negative rods in blood culture: Include ceftriaxone in regimen. Consult ID.

Code Sepsis, negative blood cultures. After 36-48 hours, consider de-escalation if patient is improving. Consult ID.

Antibiotic Dosing
Note: individual patient situations may require dose adjustments

Intravenous
Cefazolin: 50 mg/kg IV Q8, max 2000 mg/dose
Clindamycin: 10-13 mg/kg IV Q8, max 600 mg/dose
Oxacillin: 50 mg/kg IV Q6, max 3000 mg/dose
Ceftriaxone: 50 mg/kg IV Q24, max 2000 mg/dose
Vancomycin: Consult vancomycin dosing guide. Goal trough 15-20 for sepsis/bacteremia and severe infections

Oral
Cephalexin: 75-100 mg/kg/DAY div Q6-Q8, max 4000 mg/day
Clindamycin: 10-13 mg/kg/dose PO Q8, max 600 mg/dose
Cefdinir: 7 mg/kg/dose PO Q12, max 600 mg/DAY

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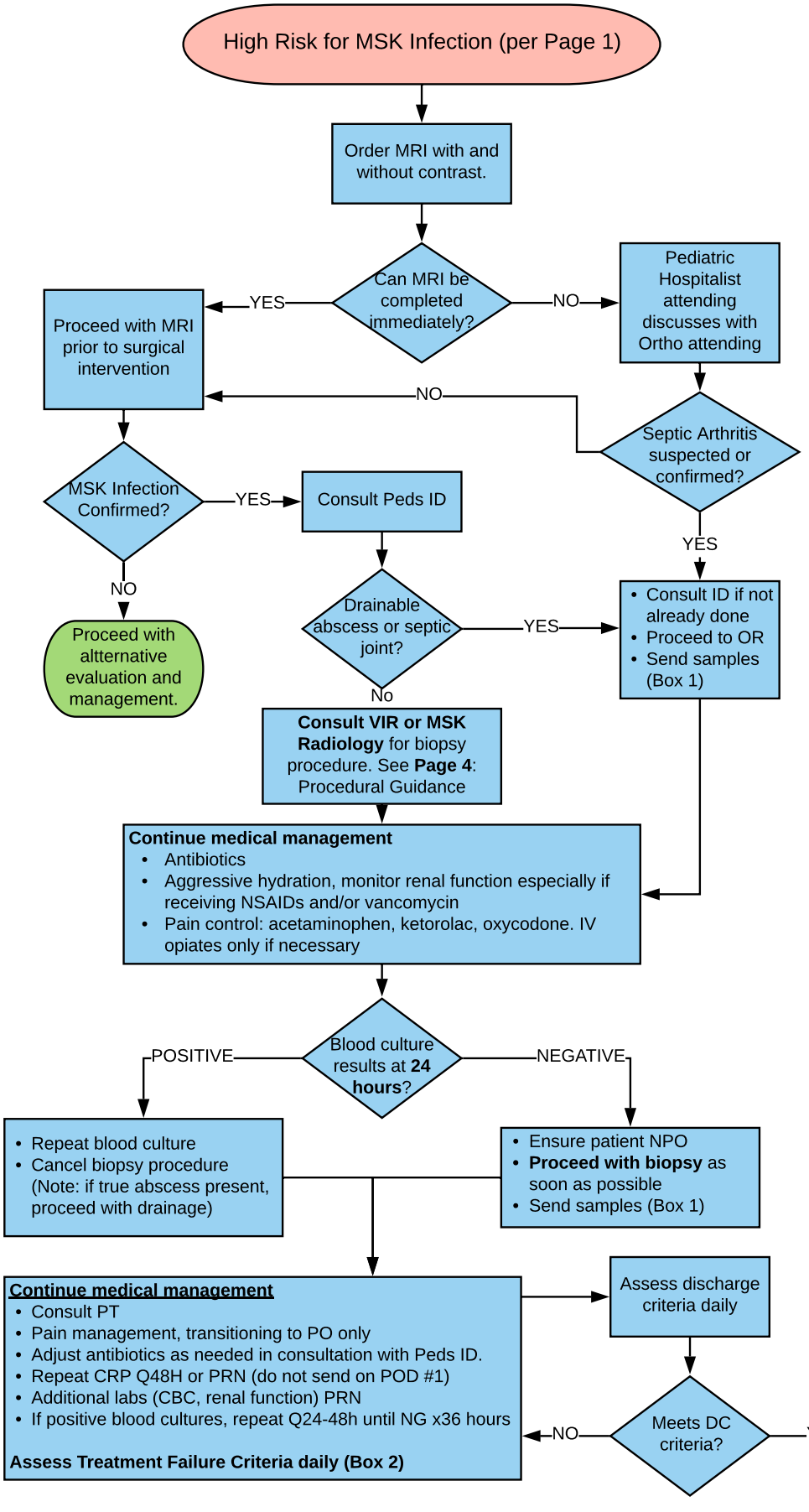
Page 3: Inpatient Management Phase



Box 1: Specimen Collection

Biopsy Specimen Orders

Order:

- Aerobic/anaerobic culture
- AFB culture
- Fungal culture
- If SOLID tissue: surgical pathology exam

Body Fluid (i.e., synovial fluid)

See Box 4 on page 1 ("Synovial Fluid Specimen Collection")

Send

Liquid pus or body fluid: needleless syringe in bag, as much as possible (up to 5 mL)

Solid tissue: place in sterile specimen cup. Do NOT place in formalin

Box 2: Treatment Failure

The following findings may indicate treatment failure:

- Fever > 72 hours after admission or surgery
- Rising CRP >48 hours after admission (or after surgery)
- Worsening pain or failure to progress
- Persistent bacteremia for at least 3 calendar days

Differential Diagnosis of Treatment Failure

- Inadequate source control (consider multifocal infection)
- Antibiotic-resistant pathogen
- Inadequate antibiotic dosing/levels
- Endovascular infection: endocarditis or septic thrombophlebitis

Steps to consider, based on findings

- Repeat imaging, source control
- Antibiotic optimization
- Echocardiogram
- Venous Doppler studies

Box 3: Discharge Criteria

Must meet ALL of the following

- No fever for >24 hours
- Pain manageable (usually without opiates)
- CRP decreased to at least 50% of peak
- Succeeding in PT: able to ambulate 650 feet, go up and down stairs
- Blood cultures negative (minimum 36h)
- If positive cultures, antibiotic susceptibility results available to guide therapy
- Must tolerate at least one dose of home antibiotic regimen (most will be PO)
- Follow-up appointments arranged:
  - Pediatric ID: usually 2-3 weeks
  - Orthopedic Surgery: Individualized
- Prescriptions filled (preferably at UNC)

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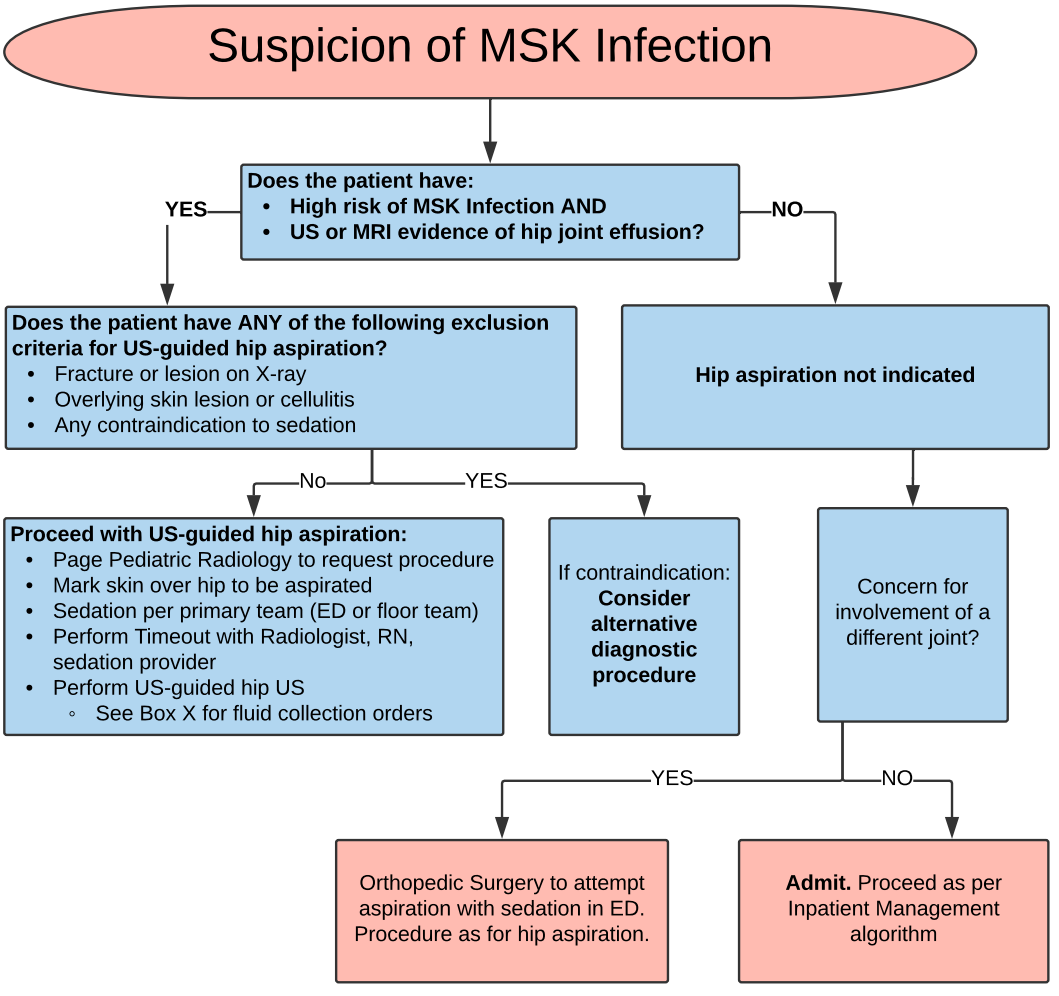
Page 4: Procedural Guidance



Box 1: Indications for Joint Aspiration

- Suspicion of septic arthritis of any extremity joint: hip, knee, ankle, shoulder, elbow, wrist
- In septic arthritis, joint aspiration should occur as **soon as safely possible**

Box 2: Importance of Joint Aspiration

- Delayed management of septic arthritis can result in permanent joint dysfunction
- Cell counts can quickly confirm or refute the diagnosis of septic arthritis
- Culture can establish the microbial cause of septic arthritis, allowing targeted therapy
- Decompression of the joint is therapeutic, pending definitive surgical management

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Obtain

Syringe with at least 4-5 mL
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Send

Needleless syringe in bag with order stickers for both CULTURE and CELL COUNT

Box 4: Which service should perform the biopsy or abscess drainage procedure?

Anatomic Location	Who does the procedure?
Hip Joint Aspiration	Pediatric Radiology
Aspiration of other joint (knee, ankle, shoulder, elbow, wrist)	Orthopedic Surgery **Note:** Consider MSK Radiology for shoulder aspiration, vs early operative management.
Aspirate lesion of appendageal skeleton or musculature	Musculoskeletal (MSK) Radiology
Aspirate lesion of axial skeleton (ex. vertebral involvement, SI joint, etc.) or associated muscles (ex. psoas abscess)	Vascular and Interventional Radiology (VIR)
Complex or multifocal lesion (e.g., osteomyelitis with associated pyomyositis)	Orthopedic Surgery (in OR)
Definitive debridement of septic arthritis	Orthopedic Surgery (in OR)

Box 5: Sedation Providers

Plan	Who does Sedation?
Operating Room (OR)	Pediatric Anesthesia
Bedside Aspiration in ED or PICU	ED or PICU Attending
Bedside Aspiration on floor	Pediatric Sedation Team
MSK Aspiration	Pediatric Sedation Team
VIR Aspiration	Pediatric Anesthesia