Texas Children's Hospital

TEXAS CHILDREN'S HOSPITAL
EVIDENCE-BASED OUTCOMES CENTER
Acute Hematogenous Osteomyelitis (AHO) and/or Septic Arthritis
Evidence-Based Guideline

Definition: Acute hematogenous osteomyelitis (AHO) is inflammation of the bone and bone marrow caused by an infectious organism that reaches the bone through the bloodstream; it is considered acute if a diagnosis is made within 2-4 weeks of symptom onset. [1]
Septic arthritis is the infection of the joint, which can be caused by bacteria, fungi, mycobacteria, or viruses.

Pathophysiology: AHO is the most common form of osteomyelitis found in children; it occurs as the result of an infection that spread through the bloodstream. The pathophysiology and epidemiology of osteomyelitis are greatly influenced by the anatomy of the bone in pediatric patients. [2-4]
The blood supply to the bone (nutrient artery) divides into a tortuous capillary bed that joins sinusoidal veins before entering the bone marrow of the metaphysis. The slow movement of blood and lack of a reticuloendothelial lining make it easy for bacteria to seed the bone and grow rapidly. [2,4] The bacterial growth leads to cellulitis in the bone marrow which then causes an inflammatory response. [4] The inflammatory response leads to the accumulation of leukocytes which produces an exudate that causes pressure and necrosis of the bone. The most common causative organisms *Staphylococcus aureus* and *Kingella kingae*. [1]
Septic arthritis may occur in isolation or concurrently with AHO. Microorganisms can enter the joint space by hematogenous spread, direct inoculation, or extension of a contiguous focus of infection (e.g., osteomyelitis). [5]

Epidemiology: Acute hematogenous osteomyelitis occurs more commonly in children than in adults. Although any bone can be affected, AHO occurs primarily in the long bones, most commonly the femur or tibia. [3]
Bacterial arthritis occurs more commonly in childhood than during other periods of life. [5] The hip and knee are the joints most frequently involved.

Inclusion Criteria
- Age ≥6 months
- Healthy children without underlying conditions (e.g., spina bifida, sickle cell disease, immunodeficiency)

Exclusion Criteria
- Age <6 months
- Ill/Toxic appearance
- Contiguous osteomyelitis (next to a decubitus ulcer)
- Penetrating trauma
- Chronic osteomyelitis
- Immunocompromised patients
- Known rheumatologic disease
- History of a recent orthopedic procedure
- Prosthesis of the affected joint
- Bleeding disorder

Differential Diagnosis
Fracture
Myositis
Discitis
Cellulitis
Slipped capital femoral epiphysis (SCFE)
Legg calve perthes (LCP)
Juvenile idiopathic arthritis (JIA)
Reactive arthritis
Post-infectious arthritis
Bone tumor (e.g., Ewing's sarcoma, osteosarcoma)
Leukemia (e.g., acute lymphoblastic, acute myeloid)
Hemearthrosis (e.g., bleeding disorder)
Spondylolisthesis
Spondylolysis
Deep pelvic infections
Serum sickness like reactions

Diagnostic Evaluation
Clinicians should immediately refer to the Septic Shock guideline and intervene rapidly if patient has toxic appearance, ill appearance, altered mental status, and/or compromised perfusion with abnormal vital signs.

Table 1. Vital Sign Changes of Sepsis [6]

Age	Heart Rate	Resp Rate	Systolic BP	Temp (°C)
0d - 1m	>205	>60	<60	<36 or >38
>1m - 3m	>205	>60	<70	<36 or >38
>3m - 1y	>190	>60	<70	<36 or >38.5
>1y - 2y	>190	>40	<70 + (age in yr x 2)	<36 or >38.5
>2y - 4y	>140	>40	<70 + (age in yr x 2)	<36 or >38.5
>4y - 6y	>140	>34	<70 + (age in yr x 2)	<36 or >38.5
>6y - 10y	>140	>30	<70 + (age in yr x 2)	<36 or >38.5
>10y - 13y	>100	>30	<90	<36 or >38.5
>13y	>100	>20	<90	<36 or >38.5

Table 2. Signs and Symptoms of Shock [6]

	Sign and/or Symptom
Peripheral Pulses	Decreased or weak Bounding
Capillary refill	≥ 3 sec Flash (< 1 sec)
Skin	Mottled, cool Flushed, ruddy, erythroderma (other than face) Petechiae below the nipple, any purpura
Mental status	Decreased, irritability, confusion inappropriate crying or drowsiness, poor interaction with parents, lethargy, diminished arousability, obtunded

History: Assess for
- Favoring an extremity/Limp
- Limp deformity
- Patient/Family skin and soft tissue infection (SSTI)
- Fever
- Trauma
- Bone Pain
- Cellulitis
- Duration of symptoms
- Pain with diaper changes (non-toilet trained children)
- Recent antibiotics/medications

- Recent/preceding infection
- Immunization status
- Travel
- Animal/insect exposures
- Sexual activity

Physical Examination
Erythema
- Warmth
- Swelling
- Point tenderness
- Gait refusal
- Restricted movement
- Failure to bear weight
- Metaphyseal pain
- Fever

Laboratory Tests
Obtain a blood culture, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and complete blood cell count (CBC).
Obtain a BUN/Creatinine for antibiotic monitoring parameters.

Diagnostic Imaging Studies
Obtain a radiograph to rule out fracture or malignancy.
Obtain an ultrasound to rule out joint effusion of the hip.
Consider obtaining magnetic resonance imaging (MRI) for diagnostic and surgical interventions.

Critical Points of Evidence*

TCH Evidence-Based Recommendations

Evidence Supports
- Obtain a blood culture in patients with suspected AHO and/or septic arthritis. [7-16] – Strong recommendation, low quality evidence
  Remarks: According to a sample of TCH patients [12], the median time to positivity of a blood culture was 16.3 hours (IQR 12.5-19.5 hours).
- Initiate IV antibiotics after drawing a blood culture if suspicion of AHO and/or septic arthritis. [8,12,14,16,17] – Strong recommendation, low quality evidence
- For suspected AHO not requiring surgery, if blood and body fluid cultures remain negative at 24 hours, obtain an IR-performed bone biopsy with culture as soon as possible to maximize yield. [7,12,14,16,18] – Strong recommendation, low quality evidence
- Utilize MRI for diagnostic imaging and surgical interventions for patients with suspected AHO and/or suspected septic arthritis of the hip with a Kocher score of 2-4 or suspected septic arthritis of a non-hip joint. [13,19-31] – Strong recommendation, low quality evidence
- Administer short-term parenteral antibiotics followed by oral therapy for uncomplicated, confirmed AHO and/or septic arthritis. Criteria for transition to oral therapy include: afebrile, clinical improvement (e.g., weight-bearing, ambulating), source control (e.g., adequate surgical drainage), clearance of bacteremia (≥2 negative blood cultures), ability to take oral antibiotics, improving CRP, no evidence of endovascular disease (if evaluation is warranted), organism sensitive to age-appropriate oral antibiotics. [18,32-45] – Strong recommendation, low quality evidence
- Use scheduled acetaminophen or ibuprofen for patients with AHO and/or septic arthritis and mild pain (pain scores ≤4). [46-49] – Strong recommendation, low quality evidence
  Remarks: Scheduled acetaminophen and ibuprofen are equally effective for pain control. Ketorolac and ibuprofen *should not* be given concurrently. In a patient with AHO and/or septic arthritis, strongly consider administering an anti-inflammatory agent.
- Use ibuprofen, acetaminophen, or oxycodone for patients with AHO and/or septic arthritis and moderate pain (pain scores >4). [46-49] – Strong recommendation, low quality evidence
  Remarks: Scheduled acetaminophen and ibuprofen are equally effective for pain control. Ibuprofen alone or acetaminophen alone may not result in adequate analgesia for patients with moderate pain. Ketorolac and ibuprofen *should not* be given concurrently. In a patient with AHO and/or septic arthritis, strongly consider administering an anti-inflammatory agent.
- Use IV ketorolac perioperatively (≤5 days duration) in patients with AHO and/or septic arthritis and moderate pain (pain scores >4). [50-56] – Strong recommendation, low quality evidence
  Remarks: Ketorolac and ibuprofen *should not* be given concurrently.
- Children with clinical features concerning for septic hip arthritis should have a diagnostic evaluation (i.e., needle aspiration, arthroscopy, or arthrotomy of the hip joint) if the patient has an elevated laboratory marker (WBC >12X10^3/μL, ESR >40 mm/h, or CRP >2 mg/dL [20 mg/L]), an effusion, and a Kocher score of 2-4 (1 point for each of the following: non weight bearing, ESR >40 mm/h, fever, WBC >12X10^3/μL). [13,57-70] – Strong recommendation, low quality evidence
- Children with clinical features concerning for septic hip or shoulder arthritis should undergo a diagnostic and/or therapeutic evaluation as soon as possible given the known sequelae of delayed treatmentingella. [71-74] – Strong recommendation, very low quality evidence
- Consult Orthopedics if the joint aspiration is purulent, turbid, or positive for any of the following findings: WBC >50X10^3 μL, neutrophil >90%, positive gram stain. [75] – Strong recommendation, very low quality evidence
  Remarks: The absence of purulent/turbid fluid does not rule out an infection.

Evidence Against
- Do not *routinely* obtain a post-surgical MRI. Consider a post-surgical MRI if persistent, worsening, or new clinical findings. [22,76] – Strong recommendation, very low quality evidence

Evidence Lacking/Inconclusive
- Utilize ESR, CRP, and CBC w/diff, in conjunction with other diagnostic studies, to establish a diagnosis of AHO and/or septic arthritis. [13,57-70] – Strong recommendation, very low quality evidence

Remarks: Patients without an elevated ESR, CRP, or CBC are not likely to have AHO and/or septic arthritis; the value of these laboratory tests lies in their negative predictive value. In patients with an elevated ESR, CRP, or CBC, further tests to diagnose AHO and/or septic arthritis are warranted.

- Consider additional analgesia for patients with AHO and/or septic arthritis and moderate pain (pain scores >4) who are receiving ibuprofen, acetaminophen, or oxycodone. [46-49] – Weak recommendation, very low quality evidence
  Remarks: Ibuprofen alone or acetaminophen alone may not result in adequate analgesia for patients with moderate pain. Ketorolac and ibuprofen *should not* be given concurrently. In a patient with AHO and septic arthritis, strongly consider administering an anti-inflammatory agent.
- Use IV morphine in conjunction with acetaminophen or ibuprofen for patients with AHO and/or septic arthritis and severe pain (pain scores >7). [77,78] – Strong recommendation, very low quality evidence
  Remarks: Ibuprofen alone or acetaminophen alone may not result in adequate analgesia for patients with severe pain. IV morphine provides faster pain relief than oral morphine or oxycodone.
- No evidence found regarding the use of procalcitonin as a diagnostic adjunct for children with suspected AHO and/or septic arthritis. – Unable to make a recommendation
- Currently, there is not enough evidence to support an evidence-based recommendation for the use of percutaneous aspiration as a first-line treatment option for septic arthritis. The team recommends continued research in this area to further understand the significance of utilization in pediatric septic arthritis. [65,71,79-82] – Unable to make a recommendation

Recommendations adopted from the Clinical Practice Guideline by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America: 2021 Guideline on Diagnosis and Management of Acute Hematogenous Osteomyelitis in Pediatrics and the 2023 Guideline on Diagnosis and Management of Acute Bacterial Arthritis in Pediatrics.

Non-Invasive Diagnostic Laboratory Tests

- "In children with suspected acute bacterial arthritis (ABA), we suggest against measuring serum procalcitonin." [84] -This recommendation was adopted.
- "In children with suspected AHO, we suggest against using serum procalcitonin (PCT)." [83] -This recommendation was adopted.

Imaging Studies

- "In children with suspected ABA, we recommend obtaining plain radiography of the affected joint and adjacent bones rather than not performing plain radiographs." [84] -This recommendation was adopted.
- "In children with suspected ABA in whom further imaging studies are required to detect the presence of joint effusion, particularly of the hip or the shoulder, we recommend performing ultrasonography of the affected joint before performing more complex and less widely available imaging tests." [84] -This recommendation was adopted.

Surgical-Site Antimicrobial Agents

- "In children with AHO requiring a surgical procedure, we recommend against routine use of surgical-site (ie, instilled or implanted) antimicrobial agents." [83] -This recommendation was adopted.

*NOTE: The references cited represent the entire body of evidence reviewed to make each recommendation.

Condition-Specific Elements of Clinical Management

Treatment Recommendations

For ("well-appearing") patients start single coverage with Cefazolin (50 mg/kg IV q8 hours [max: 2,000 mg/dose]).
For ("ill-appearing") patients we recommend the addition of Vancomycin (15 mg/kg/dose, q6 to q8 hours).

Antibiotic Recommendations

In Houston, children with suspected musculoskeletal infections should be empirically treated to cover *S. aureus*. *S. aureus* is responsible for the overwhelming majority of skin and soft tissue infections seen at TCH. About 30% of *S. aureus* osteomyelitis infections at TCH are MRSA. Local surveillance data from the Infectious Disease laboratory reports that for community *S. aureus* isolates at TCH, 16% are clindamycin-resistant.

Bone Biopsy/Initiation of Antibiotics

Antibiotics should be initiated immediately if Kocher score is >/=2 or if there is high suspicion of AHO and/or septic arthritis. For suspected AHO not requiring surgery, if blood and body fluid cultures remain negative at 24 hours, obtain a bone biopsy as soon as possible to maximize yield.

Duration of Antibiotic Therapy

The duration of treatment for osteomyelitis can range from 3 to 12 weeks, with most patients requiring treatment for 4 to 6 weeks. Typically, the duration of treatment for septic arthritis is 3 weeks. Treatment duration is dependent on the extent of the disease, causative organism, and inflammatory markers.

Admission Criteria

- Suspected AHO
- Suspected Septic Arthritis of the hip or shoulder

Discharge Criteria

- Clinical improvement (e.g., improved range of movement, pain controlled, weight-bearing, ambulating)
- Source control (e.g., adequate surgical drainage)
- Appropriate mental status for age
- Tolerating PO and able to take oral antibiotics
- Appropriate support system (e.g., PMD, caregivers)
- Afebrile
- Improving CRP
- Home care/transfer arranged
- Home Health orders for PICC placed, if needed
- Clearance of bacteremia (≥2 negative blood cultures) Baseline "monitoring labs" obtained
- Follow-up visits scheduled (e.g., PMR, Infectious Disease, PT, Ortho)

- Plan of care for antibiotics
- No evidence of endovascular disease, if evaluation is warranted
- Organism sensitive to age-appropriate oral antibiotics

Consults/Referrals

Consult Orthopedic Surgery for patients with complicated osteomyelitis requiring drainage or debridement.
Consult Orthopedic Surgery for patients with suspected septic arthritis of the hip and a Kocher score of 2-4.
Consult Interventional Radiology for bone biopsy, PICC line Placement, or joint aspiration of the hip.
Consult Infectious Disease as soon as there is concern for AHO and/or septic arthritis of the hip.
Consult Physical Therapy for concern regarding range of motion and gait training, following surgical intervention.
Request to see Child Life for coping techniques, procedural teaching, and psychosocial support

Follow-Up Care

Follow-up care is recommended for all children hospitalized with AHO and septic arthritis.
For a child who is not following the expected clinical course, consider complications, such as an alternative or ineffective antibiotic treatment due to lack of antibiotic coverage or resistance patterns.

Measures

Process

- Time to obtain MRI from order entry
- Time to hip joint aspiration from IR consult order
- Time to first dose of antibiotics

Outcome

- Length of stay (e.g., inpatient, observation)

TCH Evidence-Based Outcomes Center
Clinical Algorithm for Suspected Acute Hematogenous Osteomyelitis (AHO) and/or Septic Arthritis of the HIP

If the patient becomes "ill-/toxic-appearing" or develops s/sx of septic shock at any time:
- **OFF algorithm**
- Refer to the Septic Shock guideline.
- Administer IV antibiotics.
- STAT Consult to ICU, Ortho, IR, ID.

Begin

Clinical findings suggestive of musculoskeletal infection:
Pain/Tenderness OR limp OR limited ROM
± Non weight bearing*
± Fever (≥100.4°F/38°C)*

Signs/Symptoms of septic shock — Yes → **OFF algorithm**
- Refer to the Septic Shock guideline.
- Administer IV antibiotics.
- STAT Consult to ICU, Ortho, IR, ID.

No

Ultrasound, X-ray, CBC w/diff, CRP, ESR, BUN, creatinine, blood culture

Non-infection findings (e.g., fracture, mass) — Yes → **OFF algorithm**

No

Any of the below elevated lab markers?
- WBC >12X10^3/µL*
- ESR >40 mm/h*
- CRP >2 mg/dL (20 mg/L)

No → **OFF algorithm** Consider transient/toxic synovitis or other inflammatory condition.

Yes

Effusion — No → Concern for AHO — No → **OFF algorithm** Consider transient/toxic synovitis or other inflammatory condition.

Effusion — Yes → Kocher score 2-4 — No → Kocher score 0-1

Kocher score 2-4 — Yes

Concern for AHO — Yes

Exclusion Criteria
- Ill-appearing/Toxic-appearing
- Immunocompromised
- Known rheumatologic disease
- History of recent orthopedic procedure of the affected joint
- Prosthesis of the affected joint
- Penetrating injuries
- Age <6 months
- Bleeding disorder

Kocher Criteria
Used to differentiate septic arthritis from transient synovitis. 1 point is given for each of the criteria below.
- * Non weight bearing
- * ESR >40 mm/h
- * Fever
- * WBC >12X10^3/µL

1: 3% probability of septic arthritis of the hip
2: 40% probability of septic arthritis of the hip; send patient for MRI to r/o concurrent osteomyelitis
3: 93% probability of septic arthritis of the hip; send patient for MRI to r/o concurrent osteomyelitis
4: 99% probability of septic arthritis of the hip; send patient for MRI to r/o concurrent osteomyelitis

*If symptom duration >3 days, strongly recommend obtaining an MRI w/ contrast to rule out concurrent osteomyelitis.

Concern for Septic Arthritis and/or AHO:
- Initiate IV antibiotics immediately:
  - For ("well-appearing") patients start single coverage with Cefazolin (50 mg/kg IV q8 hours [max: 2,000 mg/dose]).
  - For ("ill-appearing") patients we recommend the addition of Vancomycin (15 mg/kg/dose, q6 to q8 hours [max: 2,000 mg/dose]).
- Admit to PHM or IP unit.
- Obtain nasal S. aureus surveillance PCR.

Concern for Septic Arthritis:
- If symptoms **greater than 3 days*** order **MRI w/ contrast,** ideally completed within **12 hours** of order entry (call Radiology front desk to confirm order).
- Consult Ortho emergently
- Alert lab of potential upcoming labs.
- Ortho to aspirate joint, ideally completed within **8 hours** of diagnostic finding of effusion (coordinate sedation with MRI if applicable).
- Consult ID as appropriate.

Concern for AHO:
Order **MRI w/ contrast,** ideally completed within **24 hours** of order entry (call Radiology front desk to confirm order).

AHO or concurrent osteomyelitis confirmed or highly likely — No → **OFF algorithm** Manage as appropriate to clinical findings.

AHO or concurrent osteomyelitis confirmed or highly likely — Yes

Based on the fluid amount, send for:
1. Gram stain and culture in sterile container to Microbiology.
2. Cell count and diff in a **GREEN TOP** sodium heparin tube (minimum 0.5 mL; 1 mL preferred).
3. Bacterial Body Fluid PCR (includes Kingella PCR, can be performed from fluid sent to Microbiology in sterile container).

Subperiosteal abscess, contiguous arthritis present (with drainable fluid collection) — No → -Consult Ortho and ID -Obtain bone biopsy if pathogen not available from blood/body fluid culture after **24 hours.**

Subperiosteal abscess, contiguous arthritis present (with drainable fluid collection) — Yes → -Consult Ortho and ID. -Obtain bone biopsy and aspiration.

AHO or concurrent osteomyelitis confirmed or highly likely — Yes → Subperiosteal abscess, contiguous arthritis present (with drainable fluid collection)

AHO or concurrent osteomyelitis confirmed or highly likely — No

Any of the following findings from the aspiration:
- WBC >50X10^3/µL
- Neutrophil >90%
- Positive Gram stain

No → **OFF algorithm** Manage as appropriate to clinical findings.

Yes → OR with Ortho for I&D within **12 hours** of positive findings from aspiration (OR add on class D).

-Send specimen for histopathology of the bone, routine bacterial Gram stain, culture, and aspirate in blood culture bottle.
-Send Bacterial Body Fluid PCR to lab (includes Kingella PCR, can be performed from fluid sent to Microbiology in sterile container).

-Initiate discharge planning
-Transition the patient to oral antibiotics as soon as clinically appropriate. Criteria include:
- -Afebrile
- -Clinical improvement (e.g., weight-bearing, ambulating)
- -Source control (e.g., adequate surgical drainage)
- -Clearance of bacteremia (≥2 negative blood cultures)
- -Ability to take oral antibiotics
- -Improving CRP
- -No evidence of endovascular disease, if evaluation is warranted
- -Organism sensitive to age-appropriate oral antibiotics

Meets discharge criteria~ — No → Manage as appropriate to clinical findings.

Meets discharge criteria~ — Yes → Discharge home.

Clinical improvement — No → **OFF algorithm** Manage as appropriate to clinical findings.

Clinical improvement — Yes

Kocher score 0-1 — Yes

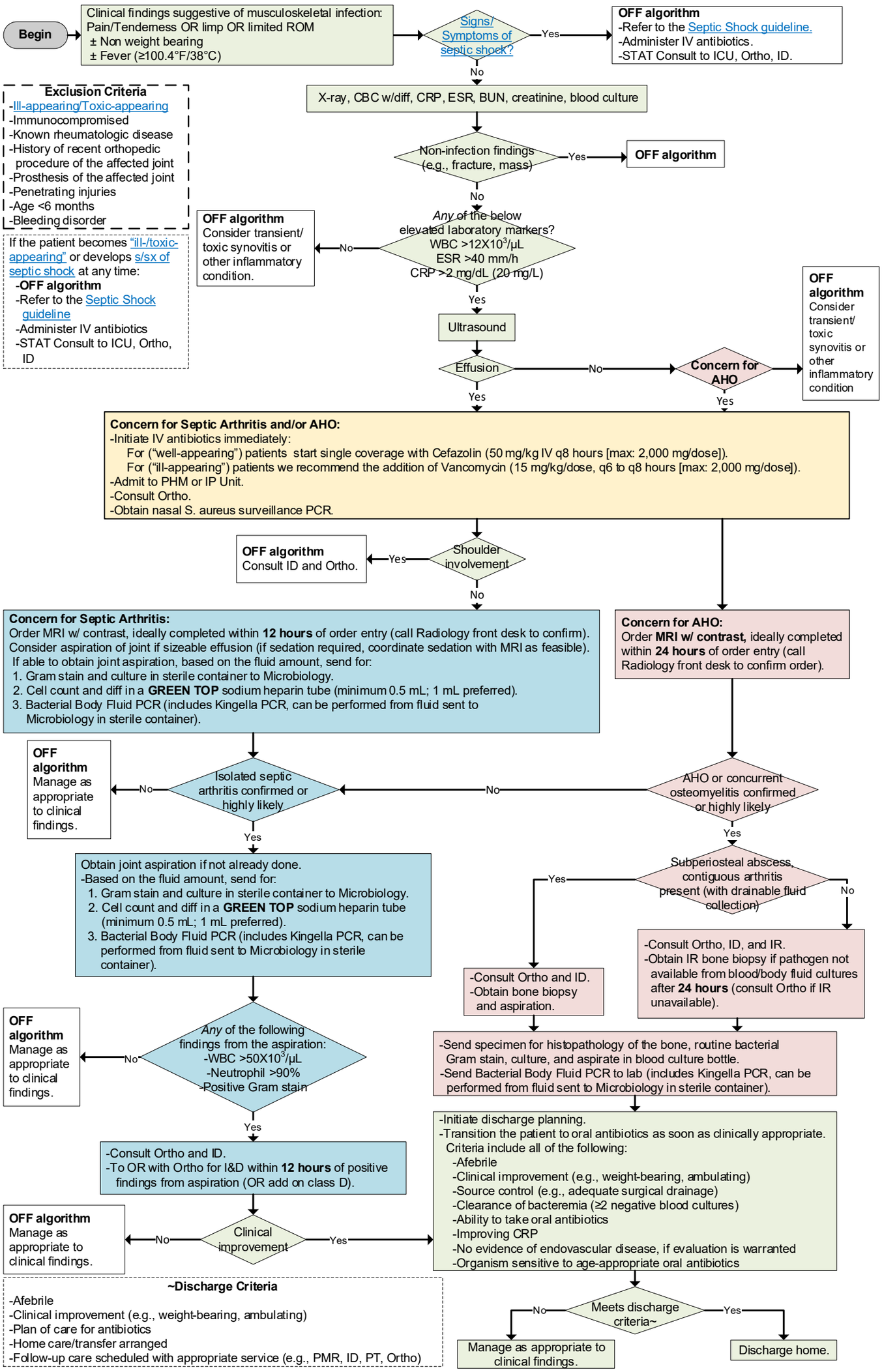
-Provide symptomatic care (NSAIDs if transient/toxic synovitis suspected).
-Reassess.

Improvement — No → **OFF algorithm** Consider MRI.

Improvement — Yes → **OFF algorithm** Discharge home when appropriate.

~Discharge Criteria
- -Afebrile
- -Clinical improvement (e.g., weight-bearing, ambulating)
- -Plan of care for antibiotics
- -Home care/transfer arranged
- -Follow-up care scheduled with appropriate service (e.g., PMR, ID, PT, Ortho)

TCH Evidence-Based Outcomes Center
Clinical Algorithm for Suspected Acute Hematogenous Osteomyelitis (AHO) and/or Septic Arthritis of the NON-HIP (See separate algorithm for hips)



Clinical standards are developed for 80% of the patient population with a particular disease. Each practitioner must use his/her clinical judgment in the management of any specific patient.

References

1. Le Saux, N. (2018). Diagnosis and management of acute osteoarticular infections in children. *Paediatric Child Health, 23*(5), 336-343.
2. Feigin, R. D., Cherry, J., Kaplan, S. L., & Demmler-Harrison, G. J. (2009). Feigin and Cherry's textbook of pediatric infectious diseases (6th ed.). Philadelphia, PA: Saunders.
3. McMillan, J. A., Feigin, R. D., DeAngelis, C. D., & Jones, M. D., Jr. (Eds.). (2006). Oski's pediatrics: Principles and practice (4th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.
4. Perkin, R. M., Swift, J. D., Newton, D. A., & Anas, N. (Eds.). (2008). Pediatric hospital medicine: Textbook of inpatient management (2nd ed.). Philadelphia, PA: Lippincott Williams & Wilkins.
5. Krogstad P. Septic arthritis. In: Feigin and Cherry's Textbook of Pediatric Infectious Diseases, 8th ed, Cherry JD, Harrison G, Kaplan SL, et al (Eds), Elsevier, Philadelphia 2018.
6. American Heart Association & American Academy of Pediatrics. (2016). Pediatric Advanced Life Support: Provider Manual. Dallas, TX: American Heart Association.
7. Bonhoeffer, J., Haeberle, B., Schaad, U. B., & Heininger, U. (2001). Diagnosis of acute haematogenous osteomyelitis and septic arthritis: 20 years experience at the University Children's Hospital Basel. *Swiss Medical Weekly, 131*(39-40), 575-581.
8. Chen, W. L., Chang, W. N., Chen, Y. S., Hsieh, K. S., Chen, C. K., Peng, N. J., et al. (2010). Acute community-acquired osteoarticular infections in children: High incidence of concomitant bone and joint involvement. *Journal of Microbiology, Immunology and Infection, 43*(4), 332-338.
9. Goergens, E. D., McEvoy, A., Watson, M., & Barrett, I. R. (2005). Acute osteomyelitis and septic arthritis in children. *Journal of Paediatrics and Child Health, 41*(1-2), 59-62.
10. Kung, J. W., Yablon, C., Huang, E. S., Hennessey, H., & Wu, J. S. (2012). Clinical and radiologic predictive factors of septic hip arthritis. *AJR. American Journal of Roentgenology*, *199*(4), 868-872.
11. MacLean, S. B., Timmis, C., Evans, S., Lawniczak, D., Nijran, A., & Bache, E. (2015). Preoperative antibiotics for septic arthritis in children: Delay in diagnosis. *Journal of Orthopaedic Surgery (Hong Kong), 23*(1), 80-83.
12. McNeil, J., Forbes, A., Vallejo, J., Flores, A., Hulten, K., Mason, E., & Kaplan, S. (2016). Role of operative or interventional radiology-guided cultures for osteomyelitis. *Pediatrics, 137*(5).
13. Riise, O. R., Kirkhus, E., Handeland, K. S., Flato, B., Reiseter, T., Cvancarova, M., et al. (2008). Childhood osteomyelitis-incidence and differentiation from other acute onset musculoskeletal features in a population-based study. *BMC Pediatrics, 8*, 45.
14. Saavedra-Lozano, J., Mejías, A., Ahmad, N., Peromingo, E., Ardura, M. I., Guillen, S., et al. (2008). Changing trends in acute osteomyelitis in children: Impact of methicillin-resistant Staphylococcus aureus infections. *Journal of Pediatric Orthopaedics, 28*(5), 569-575.
15. Section, J., Gibbons, S. D., Barton, T., Greenberg, D. E., Jo, C. H., & Copley, L. A. (2015). Microbiological culture methods for pediatric musculoskeletal infection: A guideline for optimal use. *The Journal of Bone and Joint Surgery. American Volume, 97*(6), 441-449.
16. Zhorne, D. J., Altobelli, M. E., & Cruz, A. T. (2015). Impact of antibiotic pretreatment on bone biopsy yield for children with acute hematogenous osteomyelitis. *Hospital Pediatrics, 5*(6), 337-341.
17. Hindle, P., Davidson, E., & Biant, L. C. (2012). Septic arthritis of the knee: The use and effect of antibiotics prior to diagnostic aspiration. *Annals of the Royal College of Surgeons of England, 94*(5), 351-355.
18. Wheeler, A. M., Heizer, H. R., & Todd, J. K. (2012). Influence of culture results on management and outcome of pediatric osteomyelitis and/or septic arthritis. *Journal of the Pediatric Infectious Diseases Society, 1*(2), 152-156.
19. Browne, L. P., Mason, E. O., Kaplan, S. L., Cassady, C. I., Krishnamurthy, R., & Guillerman, R. P. (2008). Optimal imaging strategy for community-acquired Staphylococcus aureus musculoskeletal infections in children. *Pediatric Radiology, 38*(8), 841-847.
20. Connolly, L. P., Connolly, S. A., Drubach, L. A., Jaramillo, D., & Treves, S. T. (2002). Acute hematogenous osteomyelitis of children: Assessment of skeletal scintigraphy-based diagnosis in the era of MRI. *Journal of Nuclear Medicine, 43*(10), 1310-1316.
21. Connolly, S. A., Connolly, L. P., Drubach, L. A., Zurakowski, D., & Jaramillo, D. (2007). MRI for detection of abscess in acute osteomyelitis of the pelvis in children. *American Journal of Roentgenology, 189*(4), 867-872.
22. Kan, J. H., Hilmes, M. A., Martus, J. E., Yu, C., & Hernanz-Schulman, M. (2008). Value of MRI after recent diagnostic or surgical intervention in children with suspected osteomyelitis. *American Journal of Roentgenology, 191*(5), 1595-1600.
23. Malcius, D., Jonkus, M., Kuprionis, G., Maleckas, A., Monastyreckiene, E., Uktveris, R., et al. (2009). The accuracy of different imaging techniques in diagnosis of acute hematogenous osteomyelitis. *Medicina (Kaunas, Lithuania), 45*(8), 624-631.
24. Metwalli, Z. A., Kan, J. H., Munjal, K. A., Orth, R. C., Zhang, W., & Guillerman, R. P. (2013). MRI of suspected lower extremity musculoskeletal infection in the pediatric patient: How useful is bilateral imaging? *American Journal of Roentgenology, 201*(2), 427-432.
25. Monsalve, J., Kan, J. H., Schallert, E. K., Bisset, G. S., Zhang, W., & Rosenfeld, S. B. (2015). Septic arthritis in children: Frequency of coexisting unsuspected osteomyelitis and implications on imaging work-up and management. *American Journal of Roentgenology, 204*(6), 1289-1295.
26. Montgomery, C. O., Siegel, E., Blasier, R. D., & Suva, L. J. (2013). Concurrent septic arthritis and osteomyelitis in children. *Journal of Pediatric Orthopaedics*, *33*(4), 464-467.
27. Nguyen, A., Kan, J. H., Bisset, G., & Rosenfeld, S. (2015). Kocher criteria revisited in the era of MRI: How often does the Kocher criteria identify underlying osteomyelitis? *Journal of Pediatric Orthopaedics,* prepublication status.
28. Refakis, C. A., Arkader, A., Baldwin, K. D., Spiegel, D. A., & Sankar, W. N. (2017). Predicting periarticular infection in children with septic arthritis of the hip: Regionally derived criteria may not apply to all populations. *Journal of Pediatric Orthopaedics, 39*(5), 268-274.
29. Rosenfeld, S. (2015). Predicting the presence of adjacent infections in septic arthritis in children. *Journal of Pediatric Orthopaedics*. [epub ahead of print]
30. Schallert, E. K., Kan, J. H., Monsalve, J., Zhang, W., Bisset III, G. S., & Rosenfeld, S. (2015). Metaphyseal osteomyelitis in children: How often does MRI-documented joint effusion or epiphyseal extension of edema indicate coexisting septic arthritis? *Pediatric Radiology, 45*(8), 1174-1181.
31. Welling, B. D., Haruno, L. S., & Rosenfeld, S. (2015). Validating an algorithm to predict adjacent musculoskeletal infections in septic arthritis. *Clinical Orthopaedics and Related Research, 476*(1), 153-159.
32. Bachur, R., & Pagon, Z. (2007). Success of short-course parenteral antibiotic therapy for acute osteomyelitis of childhood. *Clinical Pediatrics, 46*(1), 30-35.
33. Ceroni, D., Regusci, M., Pazos, J. M., Saunders, C. T., & Kaelin, A. (2003). Risks and complications of prolonged parenteral antibiotic treatment in children with acute osteoarticular infections. *Acta Orthopaedica Belgica, 69*(5), 400-404.
34. Faden, D., & Faden, H. S. (2009). The high rate of adverse drug events in children receiving prolonged outpatient parenteral antibiotic therapy for osteomyelitis. *Pediatric Infectious Disease Journal, 28*(6), 539-541.
35. Jaberi, F. M., Shahcheraghi, G. H., & Ahadzadeh, M. (2002). Short-term intravenous antibiotic treatment of acute hematogenous bone and joint infection in children: A prospective randomized trial. *Journal of Pediatric Orthopaedics, 22*(3), 317-320.
36. Jagodzinski, N. A., Kanwar, R., Graham, K., & Bache, C. E. (2009). Prospective evaluation of a shortened regimen of treatment for acute osteomyelitis and septic arthritis in children. *Journal of Pediatric Orthopaedics, 29*(5), 518-525.
37. Keren, R., Shah, S. S., Srivastava, R., Rangel, S., Bendel-Stenzel, M., Harik, N., et al. (2015). Comparative effectiveness of intravenous vs oral antibiotics for postdischarge treatment of acute osteomyelitis in children. *JAMA Pediatrics, 169*(2), 120-128.
38. Le, J., San Agustin, M., Hernandez, E. A., Tran, T. T., & Adler-Shohet, F. C. (2010). Complications associated with outpatient parenteral antibiotic therapy in children. *Clinical Pediatrics, 49*(11), 1038-1043.
39. Le Saux, N., Howard, A., Barrowman, N. J., Gaboury, I., Sampson, M., & Moher, D. (2002). Shorter courses of parenteral antibiotic therapy do not appear to influence response rates for children with acute hematogenous osteomyelitis: A systematic review. *BMC Infectious Diseases, 2*, 16.
40. Maraqa, N. F., Gomez, M. M., & Rathore, M. H. (2002). Outpatient parenteral antimicrobial therapy in osteoarticular infections in children. *Journal of Pediatric Orthopaedics, 22*(4), 506-510.
41. Peltola, H., Paakkonen, M., Kallio, P., & Kallio, M. J. (2010). Short- versus long-term antimicrobial treatment for acute hematogenous osteomyelitis of childhood: Prospective, randomized trial on 131 culture-positive cases. *Pediatric Infectious Disease Journal, 29*(12), 1123-1128.
42. Ruebner, R., Keren, R., Coffin, S., Chu, J., Horn, D., & Zaoutis, T. E. (2006). Complications of central venous catheters used for the treatment of acute hematogenous osteomyelitis. *Pediatrics, 117*(4), 1210-1215.
43. Vinod, M. B., Matussek, J., Curtis, N., Graham, H. K., & Carapetis, J. R. (2002). Duration of antibiotics in children with osteomyelitis and septic arthritis. *Journal of Paediatrics and Child Health, 38*(4), 363-367.
44. Zaoutis, T., Localio, A. R., Leckerman, K., Saddlemire, S., Bertoch, D., & Keren, R. (2009). Prolonged intravenous therapy versus early transition to oral antimicrobial therapy for acute osteomyelitis in children. *Pediatrics, 123*(2), 636-642.

45. Cincinnati Children's Hospital. (2011). BESt (Best Evidence Statement): Treatment of acute hematogenous osteomyelitis.
46. Koller, D. M., Myers, A. B., Lorenz, D., & Godambe, S. A. (2007). Effectiveness of oxycodone, ibuprofen, or the combination in the initial management of orthopedic injury-related pain in children. *Pediatric Emergency Care, 23*(9), 627-633.
47. Poonai, N., Bhullar, G., Lin, K., Papini, A., Mainprize, D., Howard, J., et al. (2014). Oral administration of morphine versus ibuprofen to manage postfracture pain in children: A randomized trial. *CMAJ, 186*(18), 1358-1363.
48. Shepherd, M., & Aickin, R. (2009). Paracetamol versus ibuprofen: A randomized controlled trial of outpatient analgesia efficacy for paediatric acute limb fractures. *Emergency Medicine Australasia, 21*(6), 484-490.
49. Swanson, C. E., Chang, K., Schleyer, E. Pizzutillo, P. D., & Herman, M. J. (2012). Postoperative pain control after supracondylar humerus fracture fixation. *Journal of Pediatric Orthopaedics, 32*(5), 452-455.
50. Eberson, C. P., Pacicca, D. M., & Ehrlich, M. G. (1999). The role of ketorolac in decreasing length of stay and narcotic complications in the postoperative pediatric orthopaedic patient. *Journal of Pediatric Orthopaedics, 19*(5), 688-692.
51. Kay, R. M., Directo, M. P., Leathers, M., Myung, K., & Skaggs, D. L. (2010). Complications of ketorolac use in children undergoing operative fracture care. *Journal of Pediatric Orthopaedics, 30*(7), 655-658.
52. Neri, E., Maestro, A., Minen, F., Montico, M., Ronfani, L., Zanon, D., et al. (2013). Sublingual ketorolac versus sublingual tramadol for moderate to severe post-traumatic bone pain in children: A double-blind, randomised, controlled trial. *Archives of Disease in Childhood, 98*(9), 721-724.
53. Pierce, M. C., & Fuchs, S. (1997). Evaluation of ketorolac in children with forearm fractures. *Academic Emergency Medicine, 4*(1), 22-26.
54. Sucato, D. J., Lovejoy, J. F., Agrawal, S., Elerson, E., Nelson, T., & McClung, A. (2008). Postoperative ketorolac does not predispose to pseudoarthrosis following posterior spinal fusion and instrumentation for adolescent idiopathic scoliosis. *Spine, 33*(10), 1119-1124.
55. Vetter, T. R., & Heiner, E. J. (1994). Intravenous ketorolac as an adjuvant to pediatric patient-controlled analgesia with morphine. *Journal of Clinical Anesthesia, 6*(2), 110-113.
56. Vitale, M. G., Choe, J. C., Hwang, M. W., Bauer, R. M., Hyman, J. E., Lee, F. Y., & Roye, D. P., Jr. (2003). Use of ketorolac tromethamine in children undergoing scoliosis surgery: An analysis of complications. *Spine Journal, 3*(1), 55-62.
57. Akinkugbe, O., Stewart, C., & McKenna, C. (2018). Presentation and investigation of pediatric bone and joint infections in the pediatric emergency department. *Pediatric Emergency Care*, epub ahead of print.
58. Benvenuti, M. A., An, T. J., Mignemi, M. E., Martus, J. E., Mencio, G., A., Lovejoy, S. A., et al. (2019). A clinical prediction algorithm to stratify pediatric musculoskeletal infection by severity. *Journal of Pediatric Orthopaedics, 39*(3), 153-157.
59. Caird, M. S., Flynn, J. M., Leung, Y. L., Millman, J. E., D'Italia, J. G., & Dormans, J. P. (2006). Factors distinguishing septic arthritis from transient synovitis of the hip in children: A prospective study. *Journal of Bone and Joint Surgery (American), 88*(6), 1251-1257.
60. Delaney, R. A., Lenehan, B., O'Sullivan, L., McGuinness, A. J., & Street, J. T. (2007). The limping child: An algorithm to outrule musculoskeletal sepsis. *Irish Journal of Medical Science, 176*(3), 181-187.
61. Gafur, O. A., Copley, L. A., Hollmig, S. T., Browne, R. H., Thornton, L. A., & Crawford, S. E. (2008). The impact of the current epidemiology of pediatric musculoskeletal infection on evaluation and treatment guidelines. *Journal of Pediatric Orthopaedics, 28*(7), 777-785.
62. Kocher, M. S., Zurakowski, D., & Kasser, J. R. (1999). Differentiating between septic arthritis and transient synovitis of the hip in children: An evidence-based clinical prediction algorithm. *Journal of Bone and Joint Surgery (American), 81*(12), 1662-1670.
63. Kocher, M. S., Mandiga, R., Zurakowski, B., Barnewolt, C., & Kasser, J. R. (2004). Validation of a clinical prediction rule for the differentiation between septic arthritis and transient synovitis of the hip in children. *Journal of Bone and Joint Surgery (American*), *86-A*(8), 1629-1635.
64. Luhmann, S. J., Jones, A., Schootman, M., Gordon, J. E., Schoenecker, P. L., & Luhmann, J. D. (2004). Differentiation between septic arthritis and transient synovitis of the hip in children with clinical prediction algorithms. *Journal of Bone and Joint Surgery (American), 86-A*(5), 956-962.
65. Paakkonen, M., Kallio, M. J., Kallio, P. E., & Peltola, H. (2010). Sensitivity of erythrocyte sedimentation rate and C-reactive protein in childhood bone and joint infections. *Clinical Orthopaedics and Related Research, 468*(3), 861-866.
66. Patel, L., Michael, J., Schroeder, L., Sherman, A. K., Berglund, L., & Newland, J. G. (2019). Can a septic hip decision rule aid in the evaluation of suspected pediatric musculoskeletal infections? *Journal of Emergency Medicine, 56*(3), 241-247.
67. Reed, L., Baskett, A., & Watkins, N. (2009). Managing children with acute non-traumatic limp: The utility of clinical findings, laboratory inflammatory markers and X-rays. *Emergency Medicine Australasia, 21*(2), 136-142.
68. Reitzenstein, J. E., Yamamoto, L. G., & Mavoori, H. (2010). Similar erythrocyte sedimentation rate and C-reactive protein sensitivities at the onset of septic arthritis, osteomyelitis, acute rheumatic fever. *Pediatric Reports, 2*(1), e10.
69. Singhal, R., Perry, D. C., Khan, F. N., Cohen, D., Stevenson H. L., James L. A., et al. (2011). The use of CRP within a clinical prediction algorithm for the differentiation of septic arthritis and transient synovitis in children. *Journal of Bone and Joint Surgery (Britain)*, *93*(11), 1556-1561.
70. Sultan, J., & Hughes, P. J. (2010). Septic arthritis or transient synovitis of the hip in children: The value of clinical prediction algorithms. *Journal of Bone and Joint Surgery (Britain), 92*(9), 1289-1293.
71. Journeau, P., Wein, F., Popkov, D., Philippe, R., Haumont, T., & Lascombes, P. (2011). Hip septic arthritis in children: Assessment of treatment using needle aspiration/irrigation. *Orthopaedics & Traumatology, Surgery & Research: OTSR, 97*(3), 308-313.
72. Kodumuri, P., Geutjens, G., & Kerr, H. L. (2012). Time delay between diagnosis and arthroscopic lavage in septic arthritis. Does it matter? *International Orthopaedics*, *36*(8), 1727-1731.
73. Li, Y., Zhou, Q., Liu, Y., Chen, W., Li, J., Yuan, Z., Yong, B., et al. (2016). Delayed treatment of septic arthritis in the neonate: A review of 52 cases. *Medicine, 95*(51), e5682.
74. Nunn, T. R., Cheung, W. Y., & Rollinson, P. D. (2007). A prospective study of pyogenic sepsis of the hip in childhood. *Journal of Bone and Joint Surgery (Britain)*, *89*(1), 100-106.
75. Kung, J. W., Yablon, C., Huang, E. S., Hennessey, H., & Wu, J. S. (2012). Clinical and radiologic predictive factors of septic hip arthritis. *AJR. American Journal of Roentgenology*, *199*(4), 868-872.
76. Courtney, P. M., Flynn, J. M., Jaramillo, D., Horn, B. D., Calabro, K., & Spiegel, D. A. (2010). Clinical indications for repeat MRI in children with acute hematogenous osteomyelitis. *Journal of Pediatric Orthopaedics, 30*(8), 883-887.
77. Beale, J. P., Oglesby, A. J., Jones, A., Clancy, J., & Beattie, T. F. (2001). Comparison of oral and intravenous morphine following acute injury in children. *European Journal of Emergency Medicine, 8*(4), 271-274.
78. Miner, J. R., Moore, J., Gray, R. O., Skinner, L., & Biros, M. H. (2008). Oral versus intravenous opioid dosing for the initial treatment of acute musculoskeletal pain in the emergency department. *Academic Emergency Medicine, 15*(12), 1234-1240.
79. Calvo, C., Nunez, E., Camacho, M., Clemente, D., Fernandez-Cooke, E., Alcobendas, R., et al. (2016). Epidemiology and management of acute, uncomplicated septic arthritis and osteomyelitis: Spanish multicenter study. *Pediatric Infectious Disease Journal*, *35*(12), 1288-1293.
80. Paakkonen, M., Kallio, M. J., Peltola, H., & Kallio, P. E. (2010). Pediatric septic hip with or without arthrotomy: Retrospective analysis of 62 consecutive nonneonatal culture-positive cases. *Journal of Pediatric Orthopedics. Part B, 19*(3), 264-269.
81. Ravindran, V., Logan, I., & Bourke, B. E. (2009). Medical vs surgical treatment for the native joint in septic arthritis: A 6-year, single UK academic centre experience. *Rheumatology (Oxford, England), 48*(10), 1320-1322.
82. Weigl, D. M., Becker, T., Mercado, E., & Bar-On, E. (2016). Percutaneous aspiration and irrigation technique for the treatment of pediatric septic hip: Effectiveness and predictive parameters. *Journal of Pediatric Orthopedics. Part B, 25*(6), 514-519.
83. Woods CR, Bradley JS, Chatterjee A, Copley LA, Robinson J, Kronman MP, Arrieta A, Fowler SL, Harrison C, Carrillo-Marquez MA, Arnold SR, Eppes SC, Stadler LP, Allen CH, Mazur LJ, Creech CB, Shah SS, Zaoutis T, Feldman DS, Lavergne V. Clinical Practice Guideline by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America: 2021 Guideline on Diagnosis and Management of Acute Hematogenous Osteomyelitis in Pediatrics. J Pediatric Infect Dis Soc. 2021 Sep 23;10(8):801-844. doi: 10.1093/jpids/piab027. PMID: 34350458.
84. Woods CR, Bradley JS, Chatterjee A, Kronman MP, Arnold SR, Robinson J, Copley LA, Arrieta AC, Fowler SL, Harrison C, Eppes SC, Creech CB, Stadler LP, Shah SS, Mazur LJ, Carrillo-Marquez MA, Allen CH, Lavergne V. Clinical Practice Guideline by the Pediatric Infectious Diseases Society (PIDS) and the Infectious Diseases Society of America (IDSA): 2023 Guideline on Diagnosis and Management of Acute Bacterial Arthritis in Pediatrics. J Pediatric Infect Dis Soc. 2024 Jan 29;13(1):1-59. doi: 10.1093/jpids/piad089. Erratum in: J Pediatric Infect Dis Soc. 2024 Aug 24;13(8):443. doi: 10.1093/jpids/piae065. PMID: 37941444.

Clinical Standards Preparation

This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children's Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

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No relevant financial or intellectual conflicts to report.

Development Process

This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
   - PICO questions established
   - Evidence search confirmed with content experts
2. Review of Existing External Guidelines
   - Cincinnati Children's Hospital Treatment of Acute Hematogenous Osteomyelitis Best Evidence Statement (BESt; 2011)
3. Literature Review of Relevant Evidence
   - Searched: PubMed, Cochrane, Google
4. Critically Analyze the Evidence
   - 9 randomized controlled trials and 64 nonrandomized studies
5. Summarize the Evidence
   - Materials used in the development of the clinical standard, literature appraisal, and any order sets are maintained in a Musculoskeletal Infections evidence-based review manual within EBOC.

Evaluating the Quality of the Evidence

Published clinical guidelines were evaluated for this review using the **AGREE II** criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.
This clinical standard specifically summarizes the evidence *in support of* or *against* specific interventions and identifies where evidence is *lacking/inconclusive*. The following categories describe how research findings provide support for treatment interventions.
"Evidence Supports" provides evidence to support an intervention
"Evidence Against" provides evidence against an intervention.
"Evidence Lacking/Inconclusive" indicates there is insufficient evidence to support or refute an intervention and no conclusion can be drawn *from the evidence.*
The **GRADE** criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

Recommendation	
STRONG	Desirable effects clearly outweigh undesirable effects or vice versa
WEAK	Desirable effects closely balanced with undesirable effects
Quality	**Type of Evidence**
High	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
Moderate	Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
Low	Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence
Very Low	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

Recommendations

Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the diagnosis/management of musculoskeletal infections in children. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

Approval Process

Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children's Hospital. Content Expert Teams are involved with every review and update.

Disclaimer

Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care and are not intended to be used to dictate a course of care. Each physician/practitioner must use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient's family, to make the ultimate judgment regarding care.

Permission of Use

Version History

Date	Comments
Mar 2012	AHO guideline originally completed
Nov 2015	SA evidence summary originally completed
Jul 2016	AHO guideline updated
Sep 2018	SA evidence summary updated
Nov 2019	Merged the AHO guideline and the SA evidence summary. Reaffirmed/Updated practice recommendations and updated the algorithms.
Nov 2020	Updated Cefazolin dosing recommendations for infants and children.
Jan 2021	Updated Hip Algorithm- Care coordination
Sept 2021	Signs and Symptoms of Shock Table Revised
Feb 2024	Removed EC Joint Aspiration Care Coordination algorithm from Hip Algorithm.
Dec 2025	Updated. IDSA/PIDS guidelines reviewed.