Pediatrics

Prevention

P-1 (Former P-1) Are pediatric patients on oral or intravenous steroids at an increased risk of developing septic arthritis?

RESEARCHED BY:

Muhammad Amin Chinoy MD, Pakistan

Literature:

- **Meta-analysis 1, Prospective/Randomized 2, Retrospective 6**

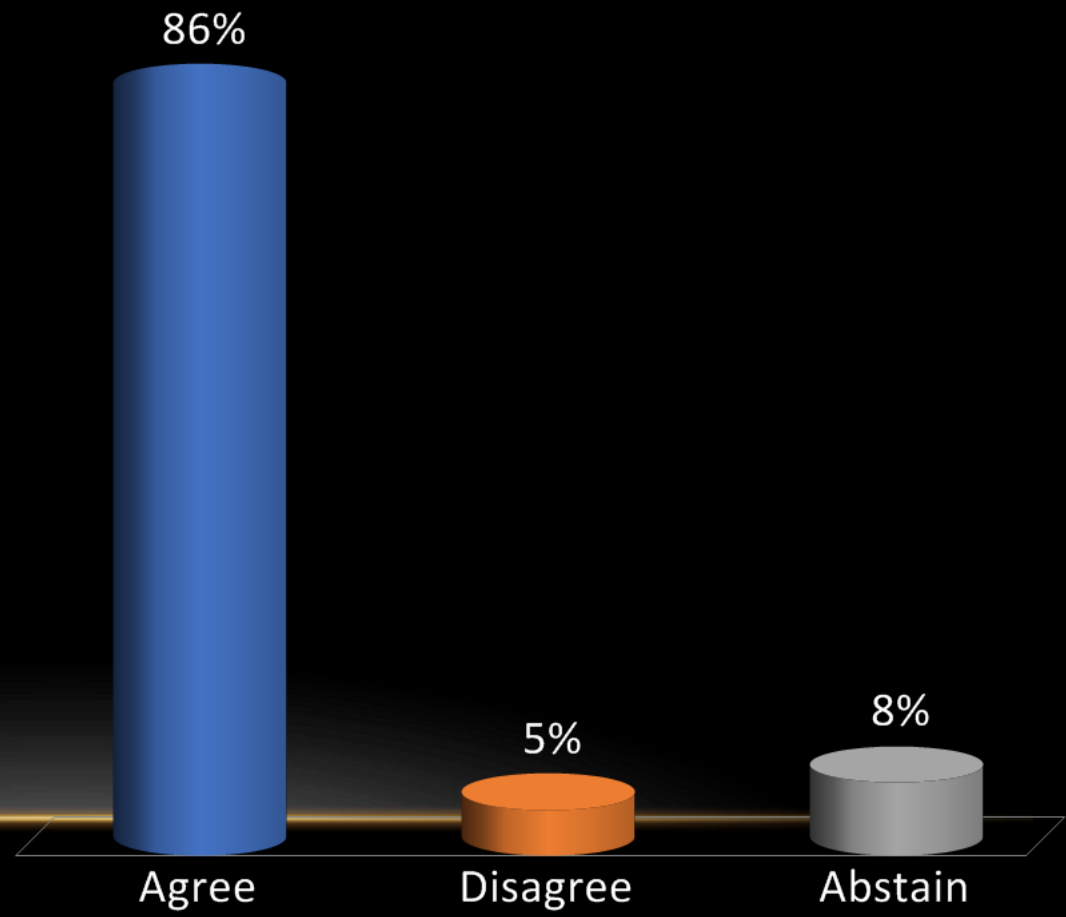
- RCTs were found in favor of the prolonged use of IV and oral corticosteroids to avoid complications in pediatric patients suffering from septic arthritis, with no further complications were observed that lead to the worsening of this disease [1–3].

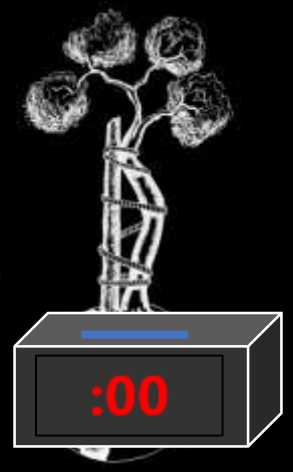
- However is still a debate whether immunosuppressive drugs, such as corticosteroids and cytotoxic agents increase the risk for septic arthritis [4].

Recommendation: Unknown. There is no definitive link between the use of oral or intravenous steroids and development of septic arthritis in pediatric patients.

Level of Evidence: Limited

A. Agree
B. Disagree
C. Abstain





Diagnostic

P-2 (Former P-16) What are the essential tests that need to be done in pediatric patients with joint infection?

RESEARCHED BY:

Ali Parsa MD, Iran

Mahzad Javid MD, Iran

Literature:

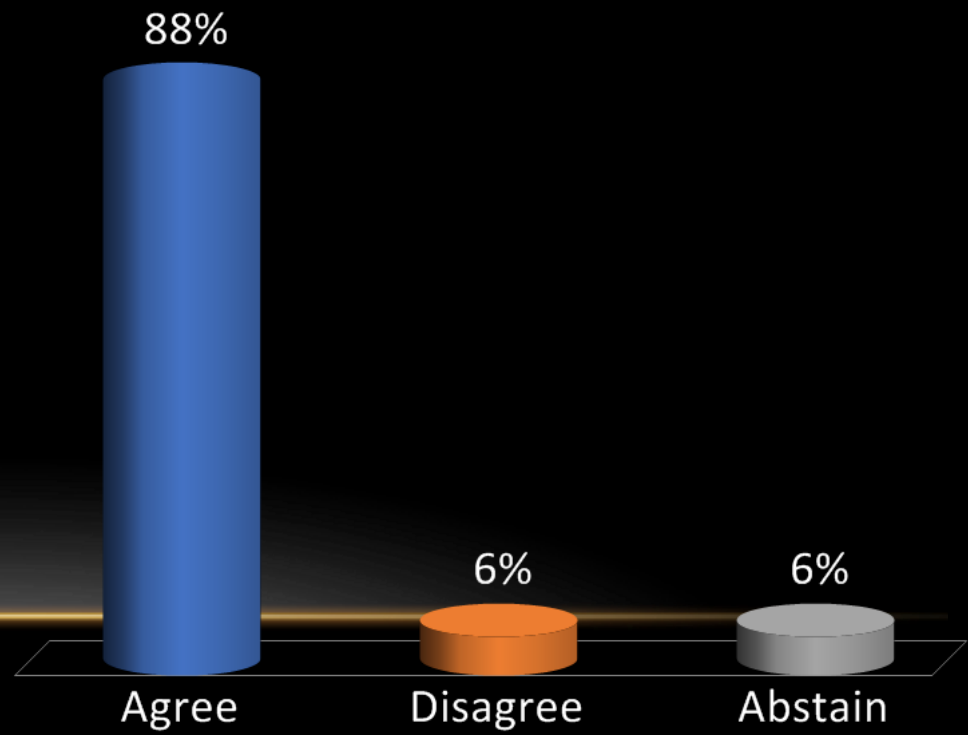
- **Meta-analysis 0, Prospective/Randomized 1, Retrospective 22**

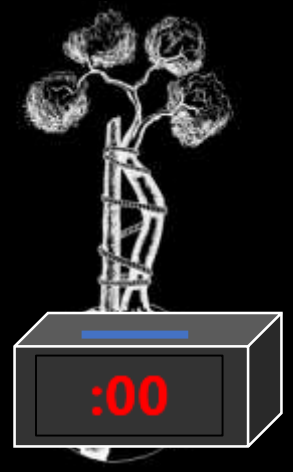
- **Conventional serum tests, namely CRP and ESR, plain radiographs and synovial fluid analysis are the most important tests in work-up of a pediatric patient with suspected septic arthritis and/or osteomyelitis.**
- **Molecular biomarkers or techniques involving DNA sequencing may play a role in facilitating diagnosis, as they have demonstrated superior sensitivity than conventional cultures.**

Recommendation: Essential laboratory tests include CRP, ESR, WBC count, blood cultures, synovial fluid analysis and culture of tissue and/or synovial fluid. Further molecular testing and leucocyte esterase testing may have a role and warrant further research. Imaging studies including ultrasound in the hip joint. Symptoms lasting over a week warrant investigation with plain radiography. MRI and bone scanning may have a value in confirmation of the diagnosis in some patients.

Level of Evidence: Moderate

A. Agree
B. Disagree
C. Abstain





P-3 (Former P-2) Are there conditions where the ESR and other blood tests are unreliable for diagnosis of pediatric musculoskeletal infections?

RESEARCHED BY:

Ali Parsa MD, Iran

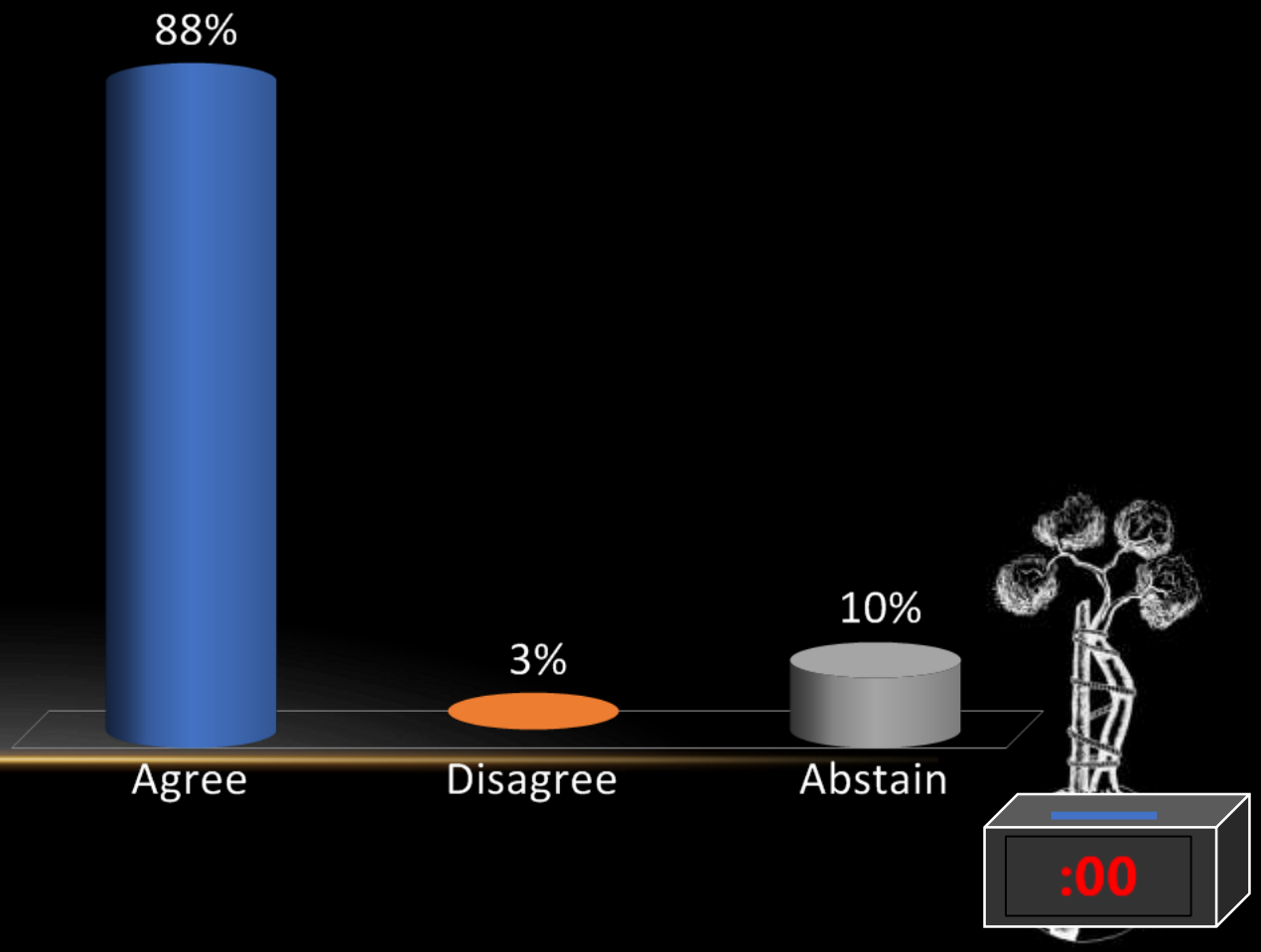
Literature:

- **Meta-analysis 0, Prospective/Randomized 0, Retrospective 15**
- **Levine et al. reported that ESR and CRP are better as negative predictors for septic arthritis, particularly when the CRP level is less than 1mg/dL with an accuracy of <85%.**
- **Aupias et al showed that while CRP and WBC counts of synovial samples are believed to be useful tests for diagnosis of septic arthritis and distinguishing it from Juvenile inflammatory arthritis, a recent report demonstrates that these tests might not be sufficiently specific.**
- **Kallio et al demonstrated that levels of CRP and ESR may be elevated following trauma and after surgical procedures, and confound a diagnosis of musculoskeletal infection in pediatric patients.**

Recommendation: Yes. Serum tests including ESR, CRP and absolute WBC count might be unreliable for diagnosis of pediatric musculoskeletal infections in neonates, patients with rheumatological disease, post-trauma, post-surgery, patients with Lyme arthritis and those receiving IVIG administration.

Level of Evidence: Moderate

A. Agree
B. Disagree
C. Abstain



P-4 (Former P-3) For pediatric patients with suspected septic arthritis, does the clinical criteria override inconclusive laboratory tests?

RESEARCHED BY:

Muhammad Amin Chinoy MD, Pakistan

Literature:

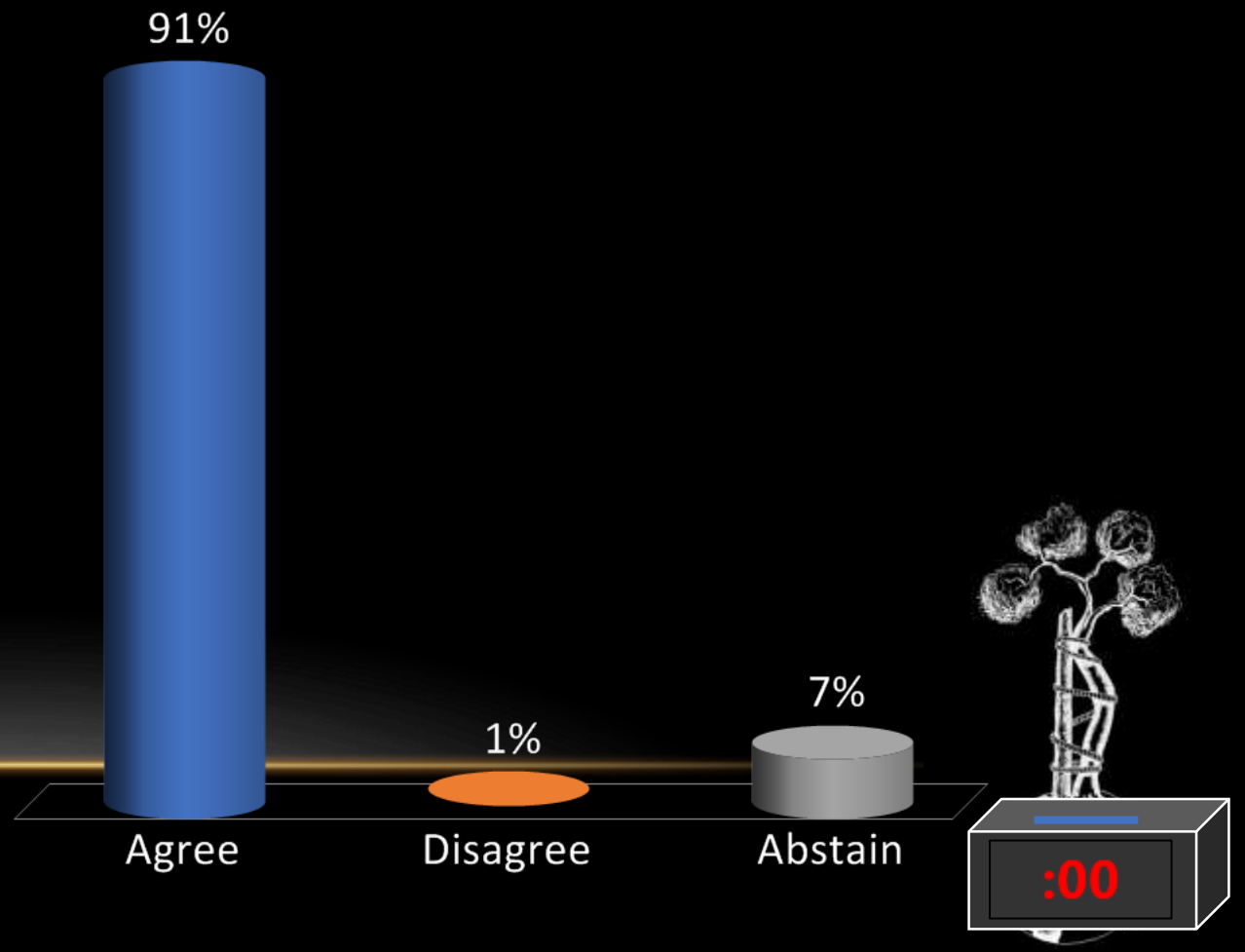
- **Systematic review 1, Prospective/Randomized 0, Retrospective 8**

- **A systematic review revealed that, despite the use of laboratory investigations, the ‘gold standard’ for the diagnosis of septic arthritis should be made the level of clinical suspicion of a physician experienced in the management of pediatric patients with musculoskeletal infections. (Matthews CJ et al; Li S et al; Kang SN et al).**

Recommendation: For pediatric patients with suspected septic arthritis, the clinical criteria override inconclusive laboratory tests.

Level of Evidence: Moderate

A. Agree
B. Disagree
C. Abstain



P-5 (Former P-9) Is there a role for arthrocentesis (joint puncture) of an infected joint in a pediatric patient?

RESEARCHED BY:

Ali Parsa MD, Iran

Literature:

- **0 Meta-analysis, 1 Prospective/Randomized, 16 Retrospective**

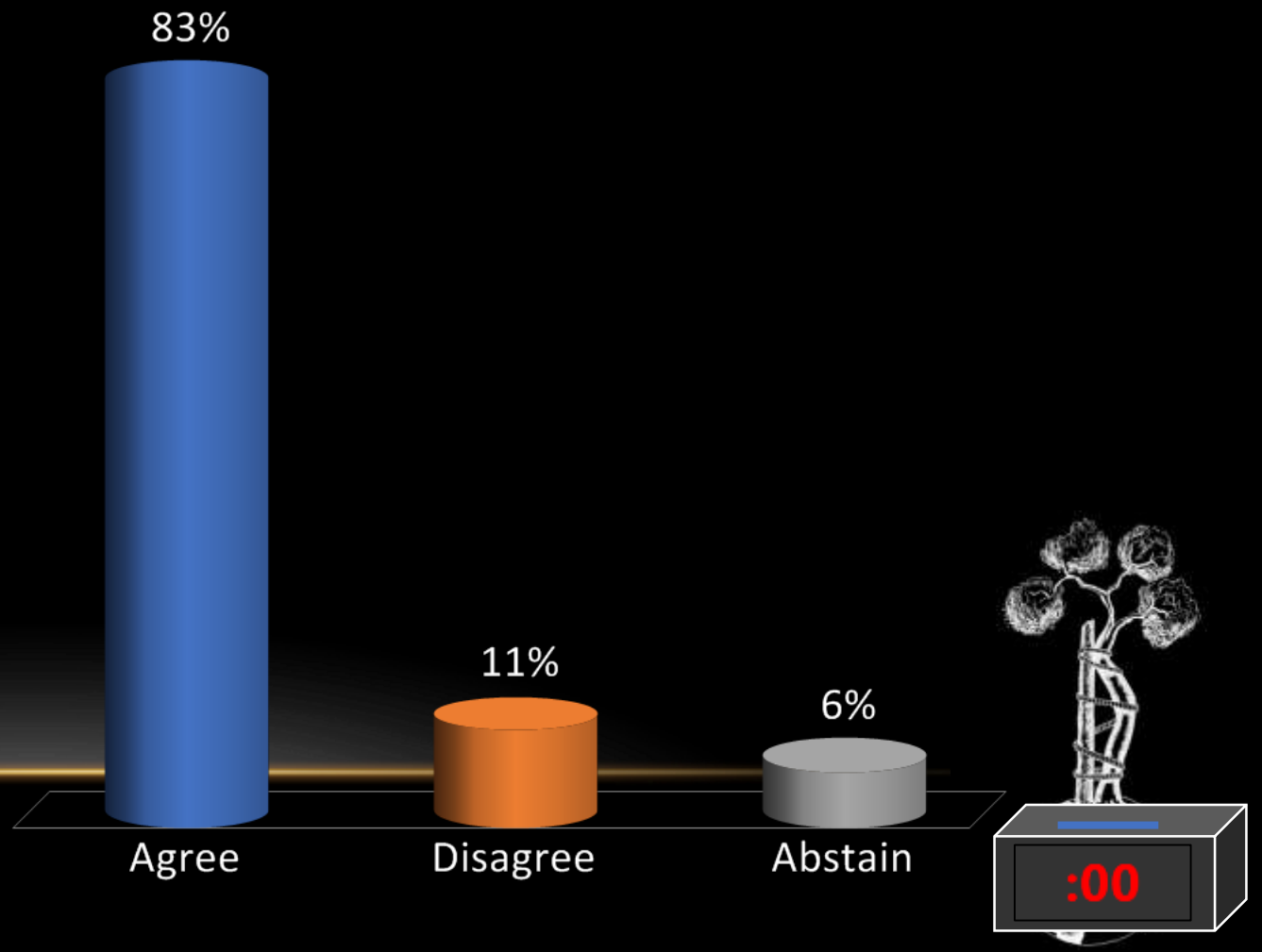
- In a prospective randomized trial of 201 consecutive children with the diagnosis of SA, arthrocentesis and arthrotomy were compared with minimum 1-year follow up. There was no difference in clinical outcomes between groups; but hospital stay was shorter in arthrocentesis group (Lavy CB et al).

- Smith et al. in an RCT reported similar results for outcome of arthrotomy vs. arthrocentesis in 61 children with SA of shoulder.

Recommendation: Yes. Arthrocentesis of an infected joint is effective for decompression of the joint. However, some children need arthrotomy.

Level of Evidence: Limited

A. Agree
B. Disagree
C. Abstain



P-6 (Former P-12) Is there a role for percutaneous bone sampling (biopsy) for microbiological diagnosis of septic arthritis/osteomyelitis? If so, when should this be performed?

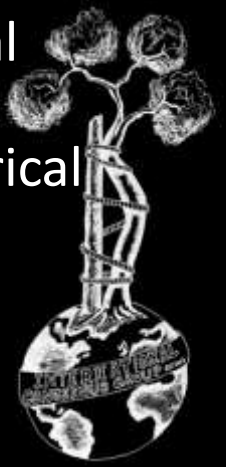
RESEARCHED BY:

Muhammad Amin Chinoy MD, Pakistan

Literature:

- **2 Meta-analysis, 0 Prospective/Randomized, 11 Retrospective**

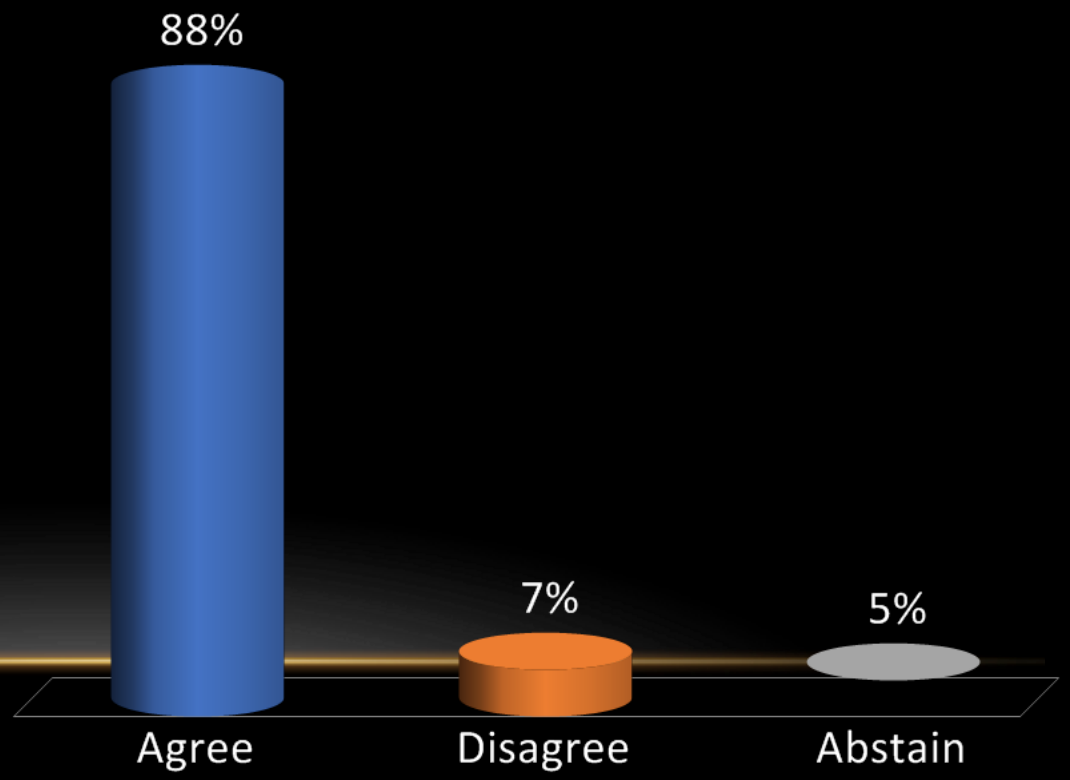
- Literature search has revealed one study evaluating the role of bone biopsy in children with the remainder of the studies being performed in adult population.
- Based on the available evidence, it appears that percutaneous bone biopsy under fluoroscopic or CT guidance is a reasonable, fast, and cost-effective modality for diagnosis of osteomyelitis and differentiating infection from neoplasm.
- Percutaneous bone biopsy carries low complication rate but the ability of this test to isolate the infective organism in osteomyelitis continues to remain low. The above studies suggest that this method shows high specificity but low sensitivity in microbiological diagnosis of osteomyelitis but the combining results of microbiological examination with histological evaluation of the samples enhanced the sensitivity.
- Literature also suggests that bone biopsy should be performed before initiating empirical antibiotic therapy in order to increase its yield for isolation of the infective organism.

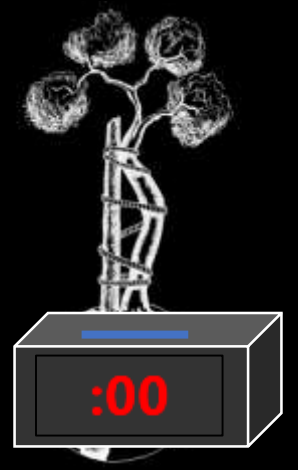


Recommendation: Yes. Percutaneous bone sampling (biopsy) is very safe and cost-effective and can be obtained from any site under the guidance of fluoroscopy or computed tomography. It has a low sensitivity for microbiological diagnosis of osteomyelitis that can be enhanced by the addition of histopathological examination. Literature suggests that bone sampling should be performed before initiating empirical antibiotic therapy.

Level of Evidence: Limited

A. Agree
B. Disagree
C. Abstain





P-7 (Former P-13) Is there any role for PCR or molecular testing in pediatric musculoskeletal infection (PMSI)?

RESEARCHED BY:

Ali Parsa MD, Iran

Irene Kalbian MD, USA

Karan Goswami MD, UK

Literature:

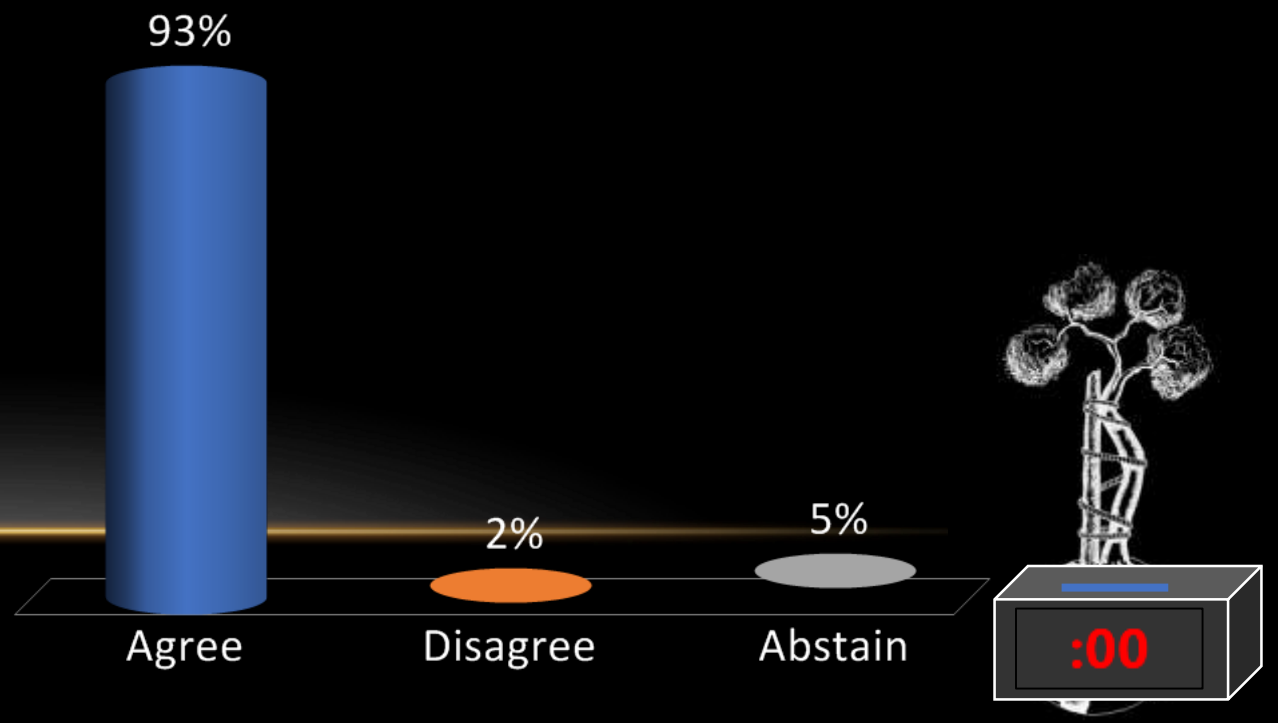
- **Meta-analysis 0, Prospective/Randomized 1, Retrospective 16**

- **Limited evidence demonstrating that molecular techniques can be a valuable tool for isolation of infective organisms in pediatric patient population especially when the infection is caused by fastidious or slow growing organisms.**

Recommendation: PCR may be a useful diagnostic adjunct with the potential to expedite a preliminary diagnosis of pediatric musculoskeletal infection (PMSI) in comparison to the use of microbiological culture alone. Furthermore, PCR can enable pathogen identification in cases where the organism is indolent, fastidious or difficult to culture. However, data remains sparse and further research is needed to standardize molecular techniques, minimize contamination, and explore emerging molecular methods that are primer-independent.

Level of Evidence: Limited

A. Agree
B. Disagree
C. Abstain



P-8 (Former P-7) How can we differentiate between a sickle cell crisis and septic arthritis/osteomyelitis?

RESEARCHED BY:

Mahzad Javid MD, Iran

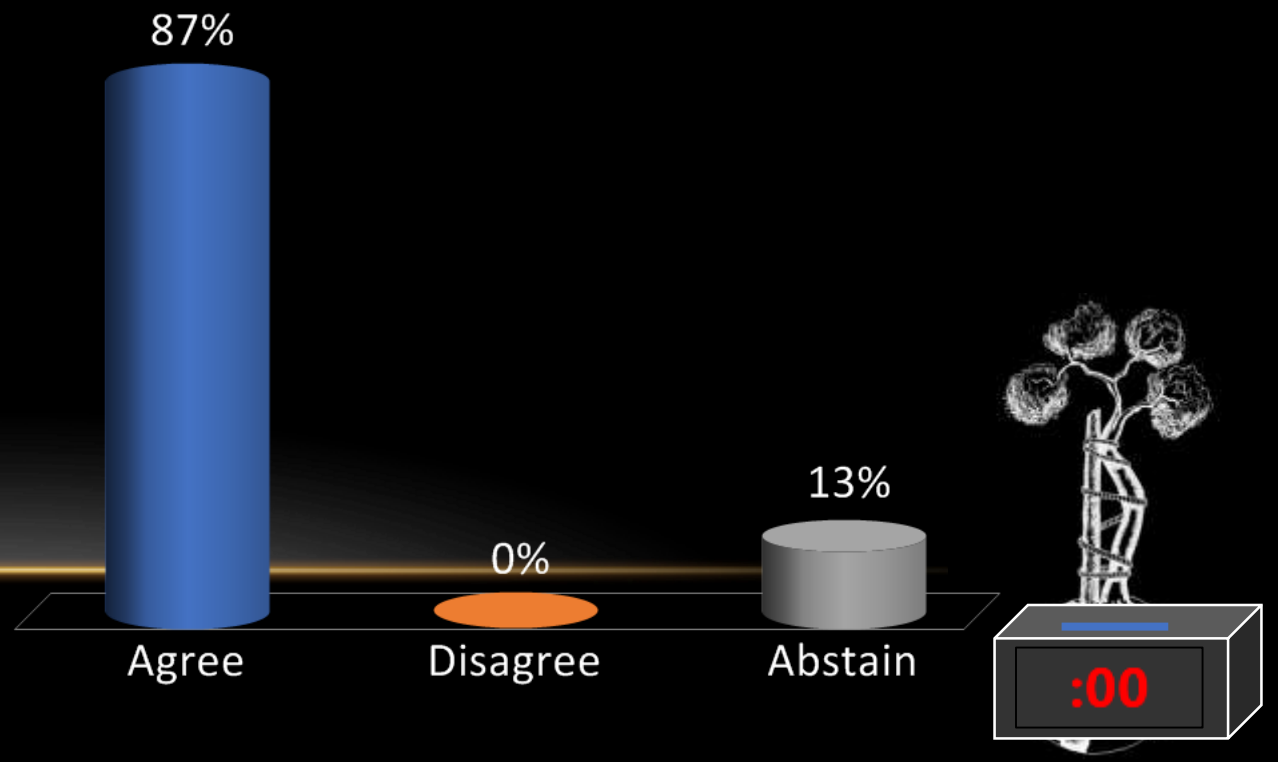
Literature:

- **Meta-analysis 0, Prospective/Randomized 0, Retrospective 20**
- **Clinical presentation is an important tool in distinguishing osteomyelitis from vaso-occlusive crisis (VOC) in SCD - namely sudden, often severe pain, no or low-grade fever of less than 100° F (<38°C), inflammatory markers only mildly elevated, elevated HB/HCT ratio are all indicative of crisis and osteonecrosis (ON). Also, pain in more than one site is more likely to be a VOC.**
- **Insua et al. in a retrospective study demonstrated that mean initial WBC was 14.9 in vaso-occlusive crisis versus 17.8 in osteomyelitis. They reported mean CRP as the more informative test in differentiating osteomyelitis from VOC - 86.4 versus 39.8. Thus CRP should be included in the work up for infection in an SCD patient with fever**
- **. Tri-phasic bone scan in the first 24 hours can differentiate vaso-occlusive crisis (VOC) from acute infection.**

Recommendation: A combination of clinical, laboratory and imaging studies are all needed for differentiating between sickle cell crisis and infection. A positive aspiration for infection from the joint or periosteum confirms the presence of infection while sequential ultrasounds in the absence of sub-periosteal fluid collection favor sickle cell crisis. Tri-phasic bone scan in the first 24 hours can differentiate vaso-occlusive crisis (VOC) from acute infection. Contrast-enhanced MRI is fairly accurate in differentiating infection from infarction.

Level of Evidence: Moderate

A. Agree
B. Disagree
C. Abstain



Treatment

P-9 (Former P-17) What are the indications for surgical intervention in cases of osteomyelitis / septic arthritis? How should treatment progress and resolution be monitored?

RESEARCHED BY:

Alexander J Shope MD, USA

Ali Parsa MD, Iran

Literature:

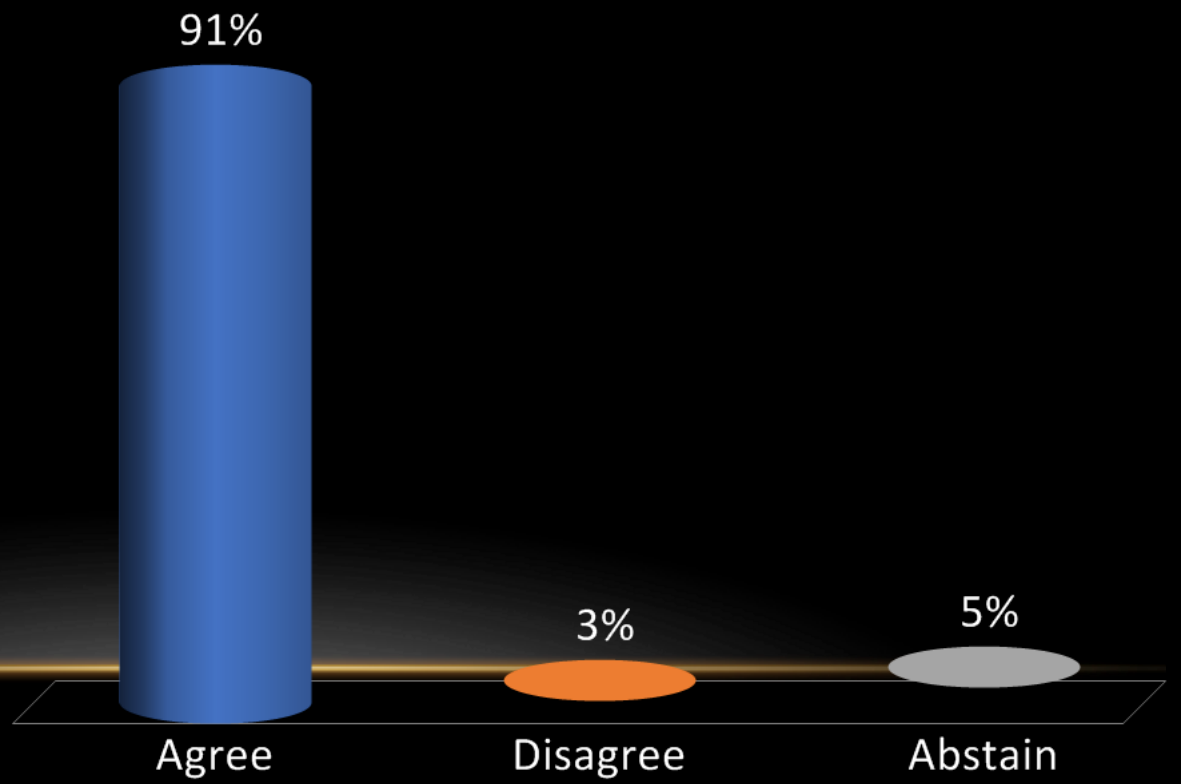
- Meta-analysis 0, Prospective/Randomized 1, Retrospective 22
- In a systematic review by Dartnell et al. very little evidence was found to support surgical intervention in pediatric patients with osteomyelitis and/or septic arthritis, mainly due to a lack of RCTs.
- At best, current recommendations for surgery include (Funk et al, Castellazi et al, Street M et al., Dartnell et al., Baker et al):
  - 1) Failure to improve in 48-72 hours despite antibiotic treatment;
  - 2) Presence of frank pus on aspiration of the joint;
  - 3) Identification of sequestered abscess
- Kocher et al. established a clinical algorithm in order to aid in early diagnosis of pediatric septic hips , However, this clinical algorithm has not been fully validated across all populations and further studies must be carried out before it can be applied universally (Uzoigwe et al.; Sultan et al.)
- The literature supports the use of CRP and ESR for aiding the diagnosis and monitoring of treatment response in the setting of osteomyelitis and septic arthritis

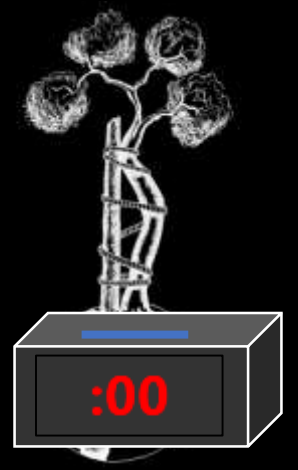
Recommendation:

Septic arthritis is an orthopaedic emergency and needs prompt surgical treatment. Based on current evidence there are no clear indications for the timing of surgical intervention in cases of osteomyelitis. The current literature does suggest monitoring disease progression, treatment efficacy, and resolution by trending C-reactive protein (CRP) levels.

Level of Evidence: Limited

A. Agree
B. Disagree
C. Abstain





P-10 (Former P-8) How radical should surgery be for osteomyelitis/septic arthritis?

RESEARCED BY:

Mahzad Javid MD, Iran

Literature:

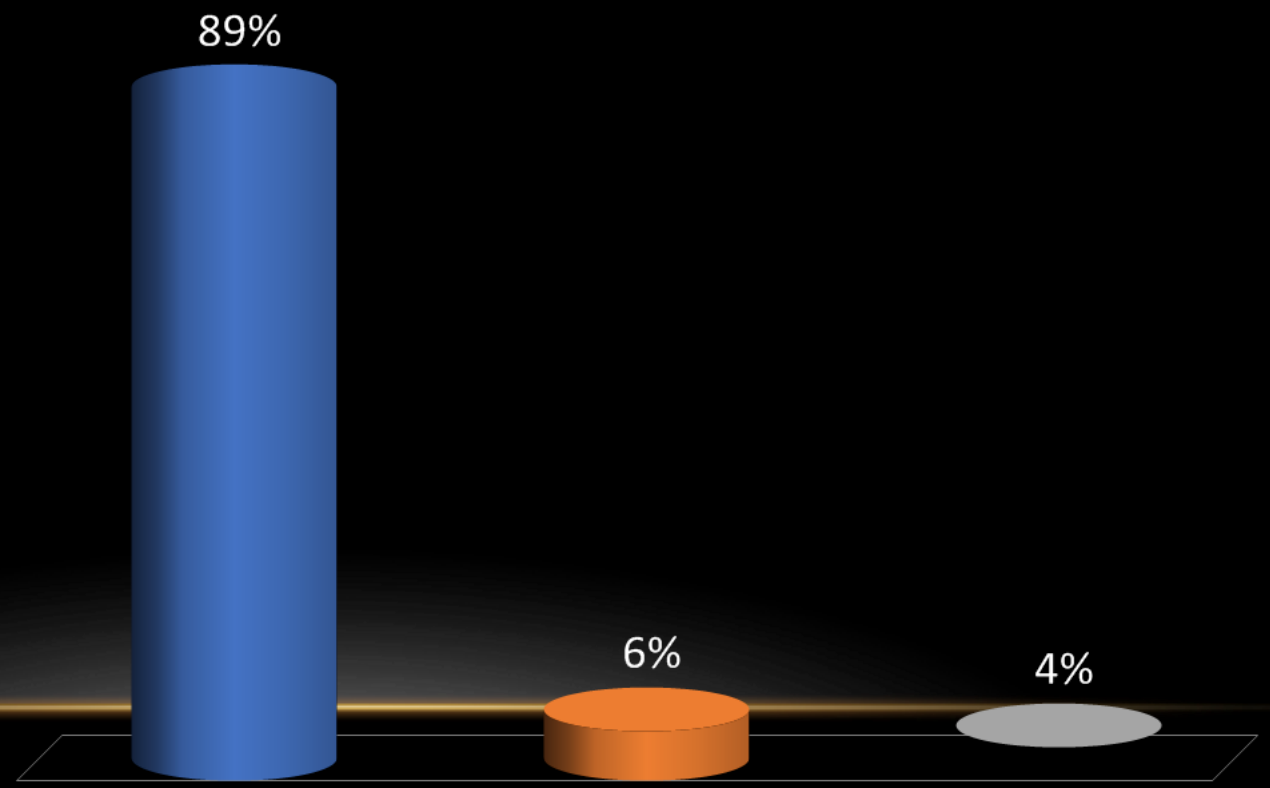
- **1 Meta-analysis, 0 Prospective/Randomized, 23 Retrospective**

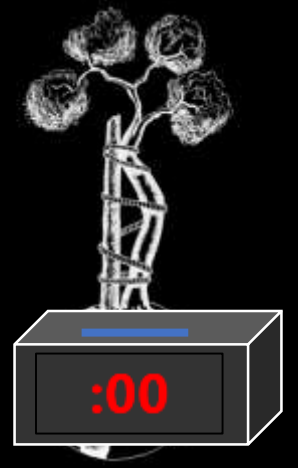
- **There is no consensus for the time, type, and extent of surgical procedures in patients with osteomyelitis.**
- **Surgery is recommended in the presence of subperiosteal abscess, bone necrosis, or direct invasion of the growth plate that may be seen in MRI images, also if the patient does not respond to antibiotic therapy in clinical examination or in laboratory indices and imaging studies (particularly MRI) (Copley LA et al).**

Recommendation: In pediatric patients with osteomyelitis/septic arthritis who require surgical intervention, aggressive debridement and copious irrigation of the infected joint is required.

Level of Evidence: Moderate

A. Agree
B. Disagree
C. Abstain





P-11 (Former P-10) Is there a role for arthroscopic washout in children with septic arthritis?

RESEARCHED BY:

Ali Parsa MD, Iran

Literature:

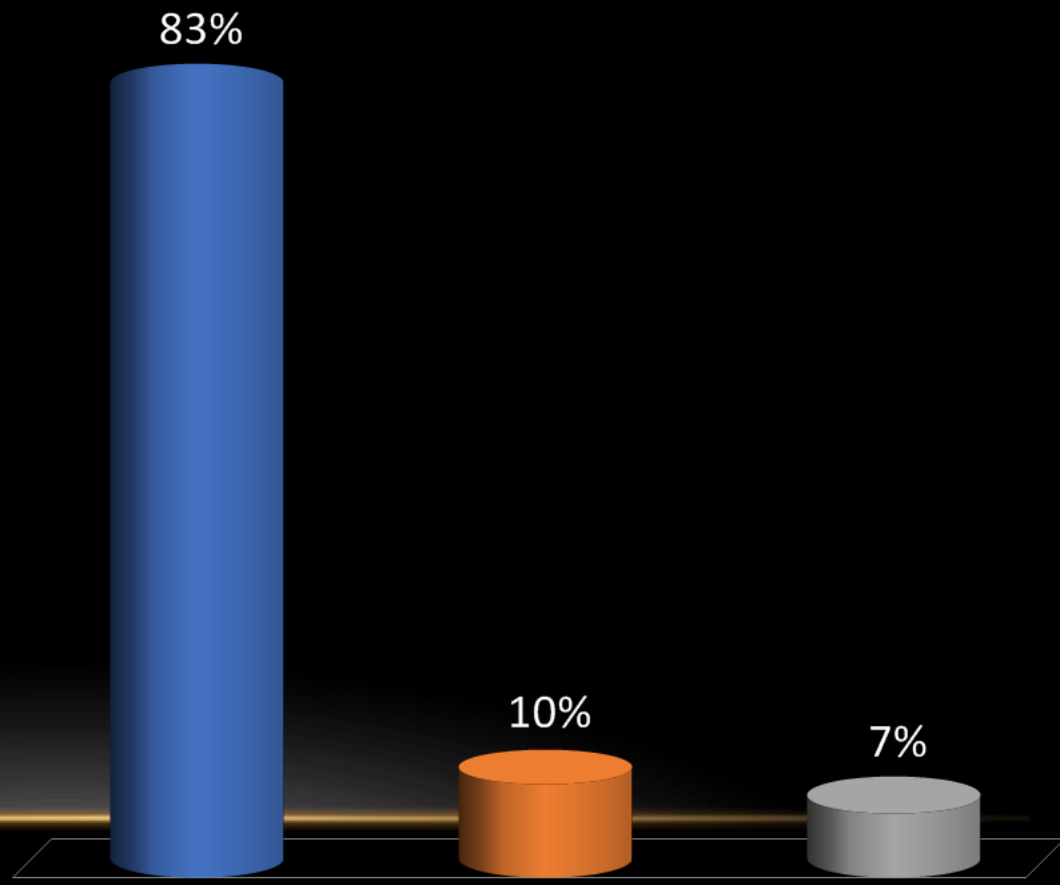
- **0 Meta-analysis, 0 Prospective/Randomized , 20 Retrospective**

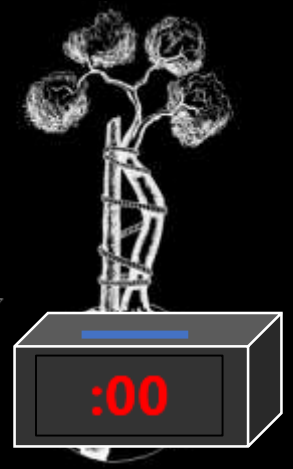
- Arthroscopic washout is a useful procedure for the treatment of pediatric septic arthritis, but the evidence is weaker that in the adult literature due to limited sample size and the absence of randomized clinical trials are evident in both knee and hip SA in pediatric setting.
- Thus, there is no definitive to support arthroscopic washout over open arthrotomy in children.

Recommendation: Yes. Arthroscopy is a useful tool in the treatment of SA in children.

Level of Evidence: Limited

A. Agree
B. Disagree
C. Abstain





P-12 (Former P-15) Should the length of antibiotic usage be different for a primary septic arthritis versus osteomyelitis?

RESEARCHED BY:

Craig A Aboltins MD, Australia

Parham Sendi MD, Switzerland

Ali Parsa MD, Iran

Literature:

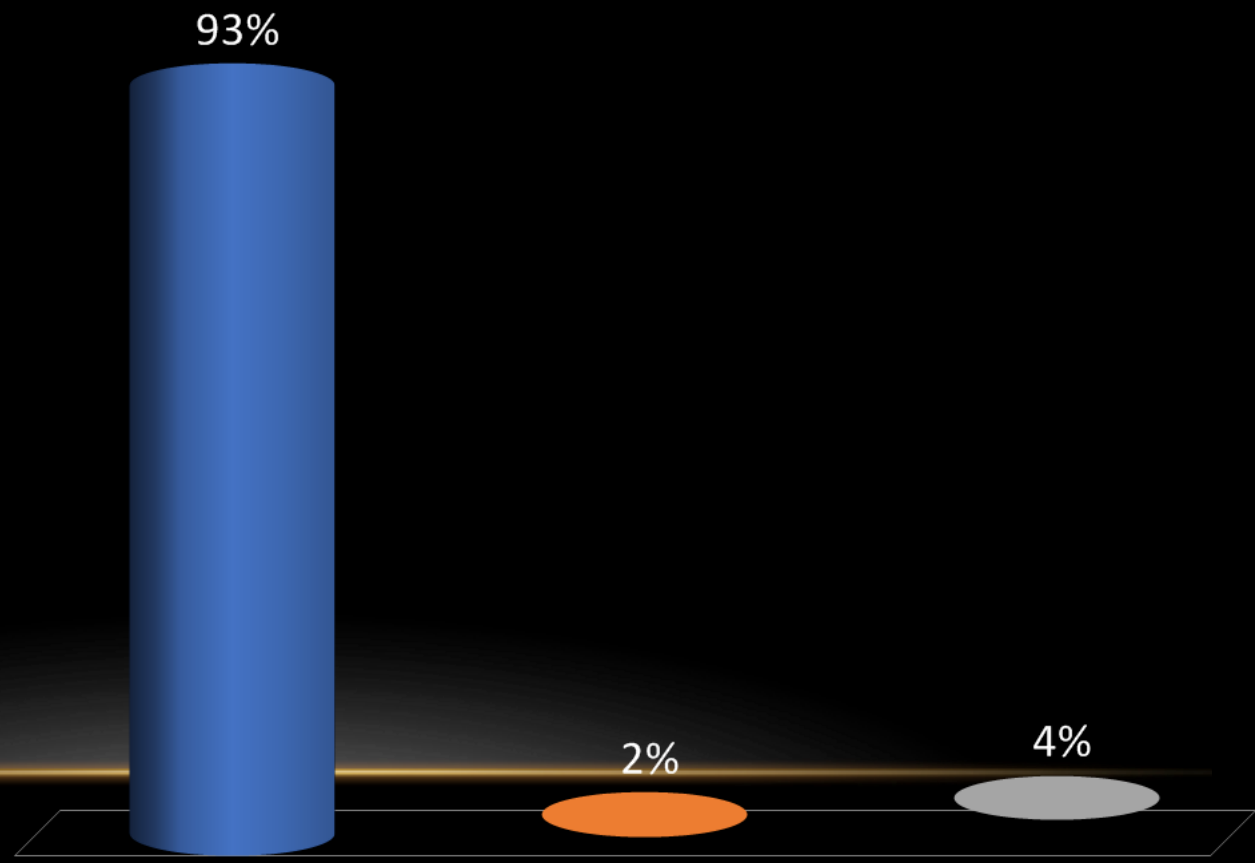
- **Meta-analysis 1, Prospective/Randomized 1, Retrospective 19**

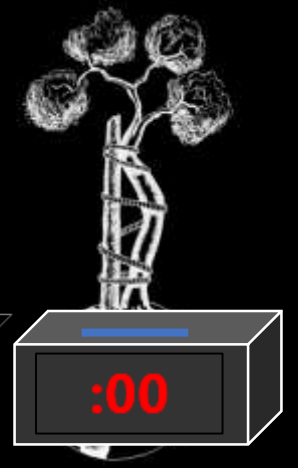
- **Limited evidence - There have been no high level studies examining the appropriate length of antibiotic treatment for pediatric patients with SA versus OM which is why it remains unclear if the length of antibiotic usage should be different.**

Recommendation: Although there is a tendency towards prescribing a longer course of antibiotics in pediatric patients with osteomyelitis (OM) compared to primary septic arthritis (SA), this practice is not based on conclusive evidence.

Level of Evidence: Limited

A. Agree
B. Disagree
C. Abstain





P-13 (Former P-14) Do steroids have a chondroprotective effect in children with septic arthritis?

RESEARCHED BY:

Ali Parsa MD, Iran

Ashok Johari MD, India

Literature:

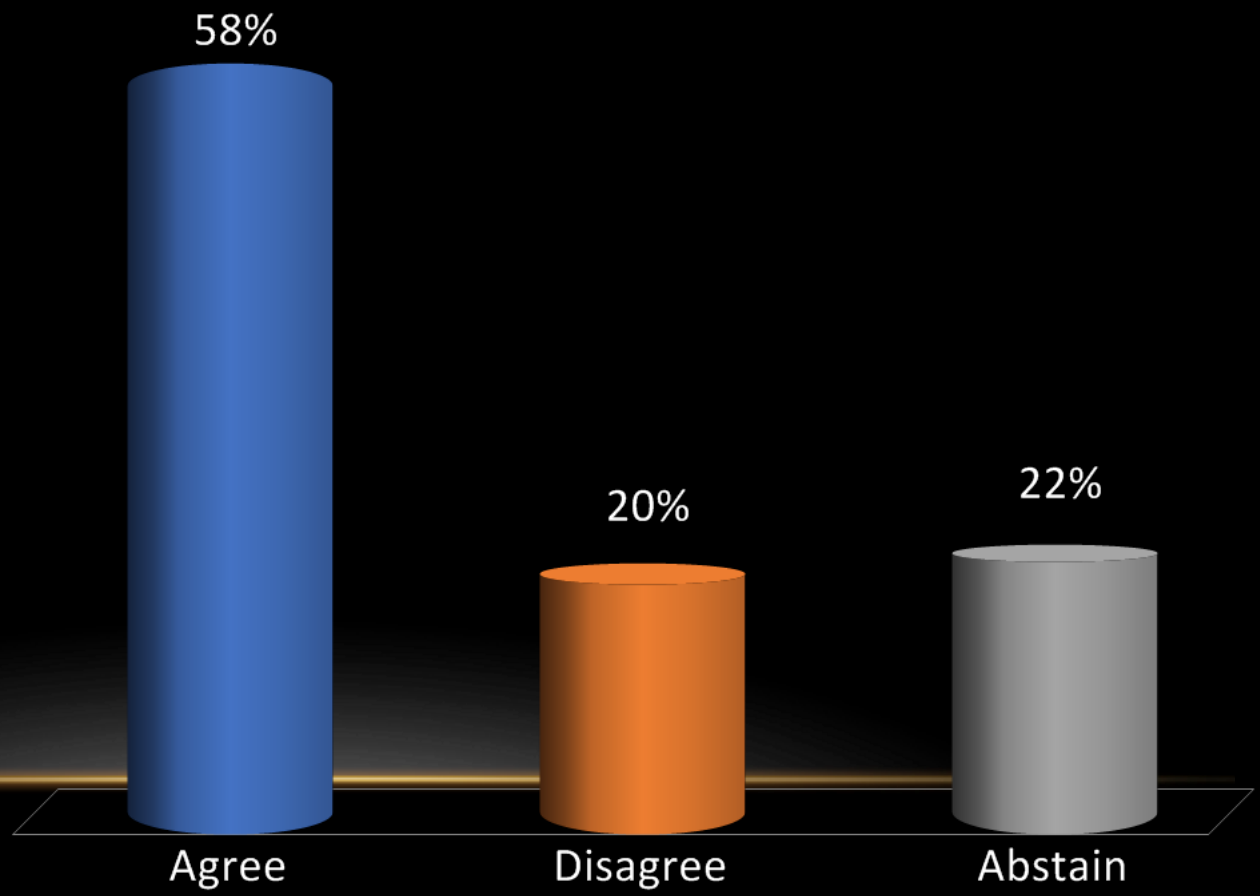
- **Meta-analysis 2, Prospective/Randomized 2, Retrospective 15**

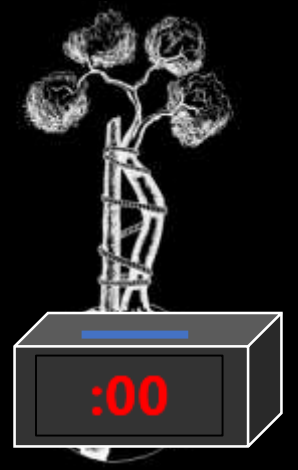
- **There is moderate evidence demonstrating improvements in clinical symptoms, length of hospital stay, reduced use of antibiotics, faster return to normal values of serum inflammatory markers such as C-reactive protein.**

Recommendation: Based on available pre-clinical and clinical studies it appears that the concurrent use of corticosteroids and antibiotics may have a protective role in the management of septic arthritis in pediatric patient population.

Level of Evidence: Limited

A. Agree
B. Disagree
C. Abstain





P-14 (Former P-19) What is the optimal management of septic arthritis/osteomyelitis caused by methicillin resistant *Staphylococcus aureus*?

RESEARCHED BY:

Mahzad Javid MD, Iran

Literature:

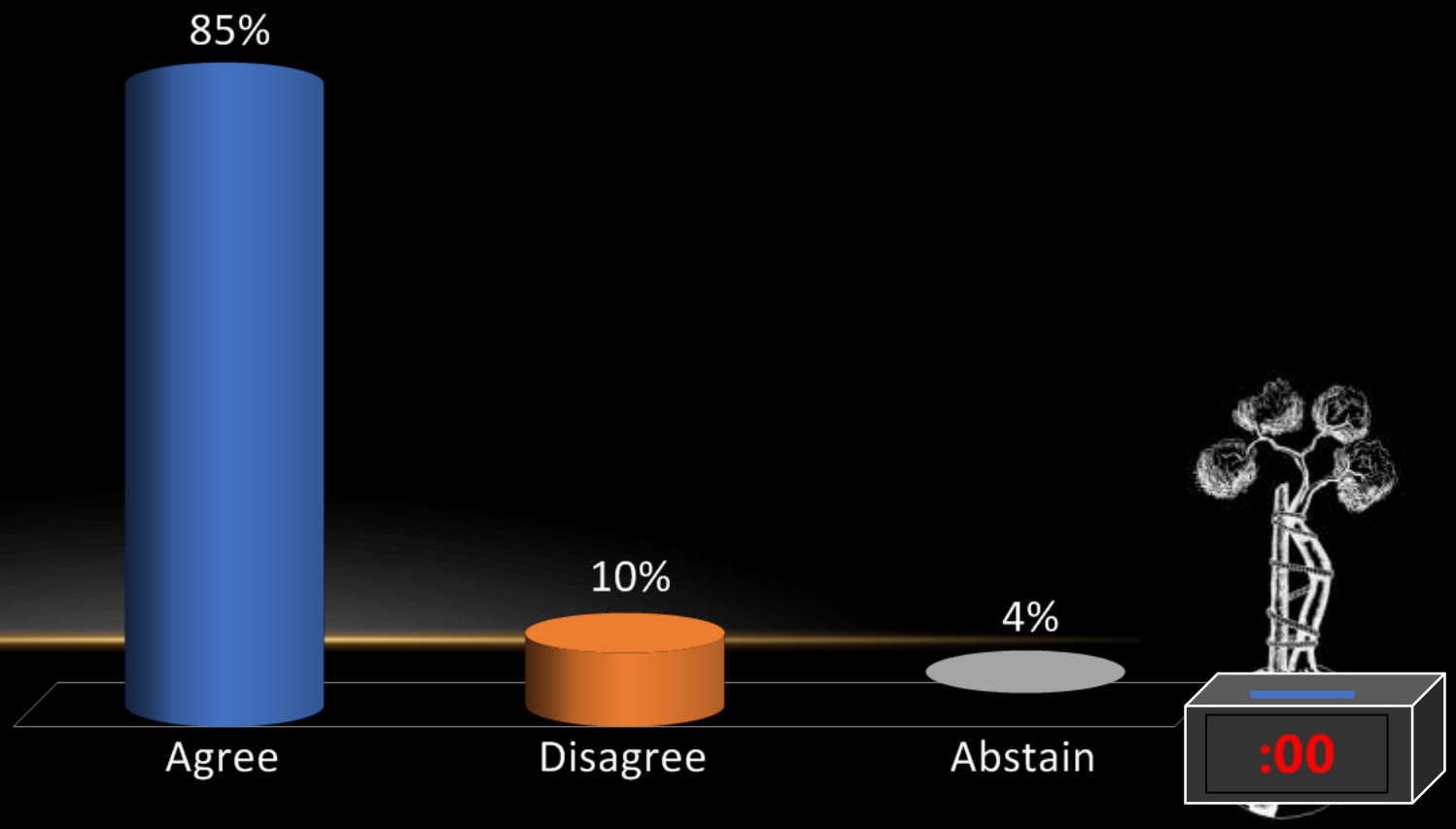
- Meta-analysis 0,Prospective/Randomized 0,Retrospective 15

- MRSA infections of the musculoskeletal system in children may have serious complications. They require early administration of antibiotics and possible multiple surgical intervention. These patients often have a protracted hospital course and require vigilant monitoring to minimize the risk of complications.

Recommendation: Patients with MRSA infection should be started on an antibiotic regimen, such as vancomycin intravenously followed by oral linezolid, which is effective against this organism. Early consideration for surgical treatment and close monitoring is essential in pediatric patients with musculoskeletal MRSA infection to reduce the high prevalence of complications and late sequelae that are often seen.

Level of Evidence: Moderate

A. Agree
B. Disagree
C. Abstain



P-15 (Former P-18) What is the best management for tuberculosis of the musculoskeletal system in children?

RESEARCHED BY:

Parham Sendi MD, Switzerland

Ali Parsa MD, Iran

Ashok Johari MD, India

Ed McPherson MD, USA

Literature:

- **Meta- analysis 0, Prospective/Randomized 0,Retrospective 14**

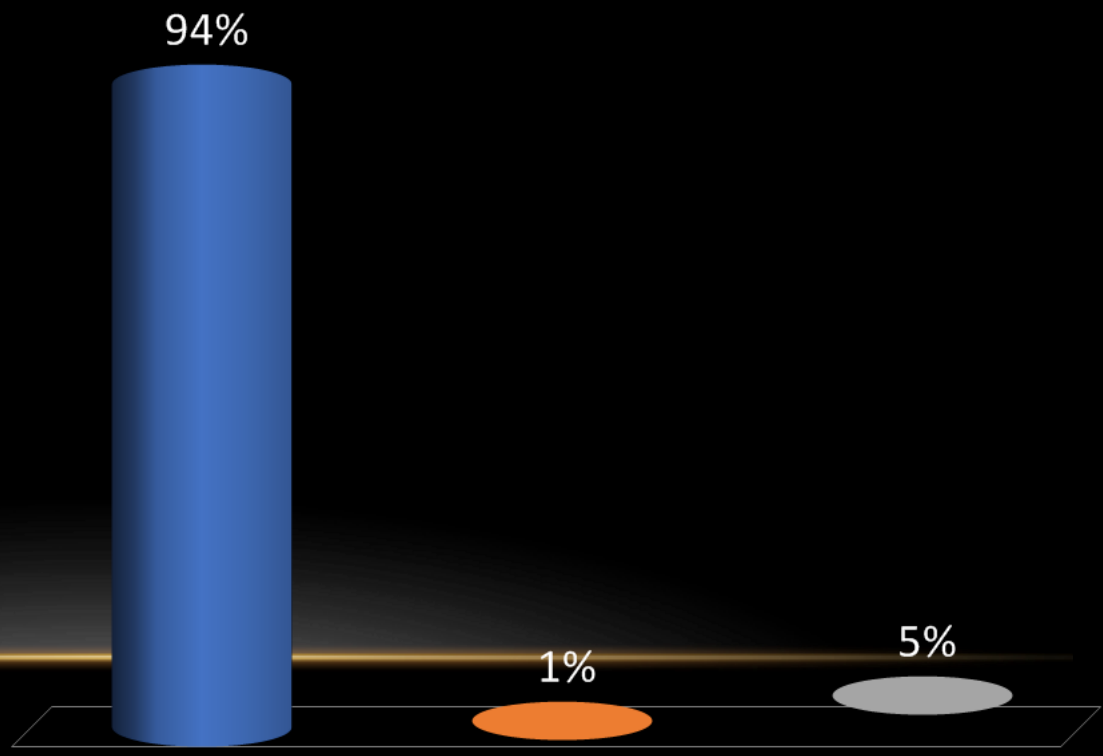
There is limited evidences in the literature to recommend the best management for tuberculosis of musculoskeletal system in children.

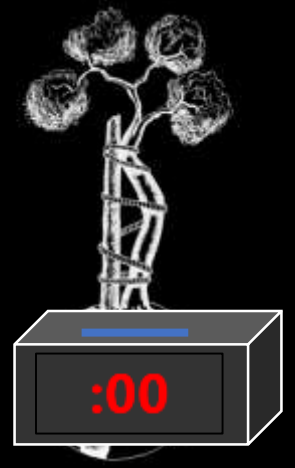
However, a regimen of multiple antibiotics in different stages is recommended, in addition to surgical intervention for debridement and stabilization specially in spinal tuberculosis.

Recommendation: Mycobacterium tuberculosis (TB) Periprosthetic joint infection (PJI) must be treated in collaboration with an infectious diseases specialist noting that the duration of treatment (minimum six months and up to two years) and the type of antimicrobials (usually a combination of four drugs) is determined based on the resistance profile of the pathogen. Selected orthopedic intervention especially in spine is needed to prevent deformities and accelerate the treatment process.

Level of Evidence: Moderate

A. Agree
B. Disagree
C. Abstain





P-16 (Former P-20) What is the role of host gene expression and severity of acute osteoarticular infection in children; especially MRSA infection?

RESEARCHED BY:

Ali Parsa MD, Iran

Irene Kalbian MD, USA

Literature:

- **0 Meta-analysis, 0 Prospective/Randomized , 12 Retrospective**

- **There is limited literature that suggests altered host gene expression may increase susceptibility to Osteomyelitis in children, especially in MRSA infections.**

Recommendation: Unknown. The limited literature available suggests altered host gene transcription related to the balance of the body's adaptive and innate immune responses may increase pediatric patients' susceptibility to severe osteoarticular infection, particularly in cases of MRSA. However, much more investigation is needed to determine which genes are most useful and how they can be utilized to help physicians anticipate the course of infection in a given patient.

Level of Evidence: Consensus

A. Agree
B. Disagree
C. Abstain