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Septic arthritis in children: Literature review

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Abstract

Septic arthritis is a monoarticular infection caused predominantly by bacteria, which produces great morbidity in the child population, for this reason a timely diagnosis and adequate treatment are of utmost importance. In 1999, Kocher published very useful criteria for the clinical diagnosis of septic arthritis of the hip in children, which have been used arbitrarily for the diagnosis of this pathology in other joints.

Keywords: Septic arthritis; Kocher criteria; Diagnosis; Children

1. Definition

Septic arthritis (SA) is characterized as a joint infection caused by microorganisms, with a predominance of bacteria, although it can also be caused by viruses, fungi and parasites. This condition is part of the musculoskeletal infections (MSI), which constitute a significant source of morbidity and mortality in the pediatric population. (1).

2. Epidemiology

Septic arthritis represents the most prevalent musculoskeletal infection in infants and children under 5 years of age. The incidence ranges between 5.5 and 12 cases per 100,000 children, with a higher frequency observed in boys than in girls. In developing nations such as Colombia, this condition constitutes a common cause of consultation in emergency services, although specific local statistics are lacking to support this observation (2). The most commonly affected joints include the hips, knees, shoulders, and elbows individually, however, approximately 20% of patients experience polyarticular involvement (3).

2.1. Risk factors

Although septic arthritis is a pathology that can affect healthy children, there are some risk factors that predispose to its development, which are: (10)

- Young age (< 4 years)
- Male sex
- Bacteremia or recent antibiotic therapy
- Concomitant osteomyelitis
- Immunocompromise (diabetes mellitus, malignancy, corticosteroid therapy, human immunodeficiency virus)
- Hemoglobinopathy
- Low birth weight or prematurity
- Umbilical artery catheterization
- Low socioeconomic status

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3. Etiology

Various microorganisms are involved in the etiology of septic arthritis, however, Staphylococcus Aureus, both in its methicillin-sensitive and resistant variants, continues to be the pathogen most frequently associated with this condition (4). Other pathogenic agents also contribute to the development of this disease, observing a distribution that varies according to the age of the patient or the presence of specific risk factors. (See Table 1).

Table 1 Most frequent microorganisms by age (4).

Age	**Microorganisms**
Newborn – 2 months	*Staphylococcus Aureus*
	Streptococcus agalactiae
	Gram negative bacteria
	Coagulase negative staphylococcus
	Neisseria gonorrhoeae
	Candida
	Streptococcus pneumoniae
2 months – 5 years	*Staphylococcus Aureus*
	Streptococcus pyogenes
	Streptococcus pneumoniae
	Kingella Kingae
	Haemophilus influenzae type b (not vaccinated)
5 years – Adolescence	*Staphylococcus Aureus*
	Streptococcus pyogenes
Teenagers	*Neisseria gonorrhoeae*
Others	*P. Multocida*

4. Pathophysiology

Initially, septic arthritis begins with bacterial colonization of the joint, which triggers an inflammatory and infectious process as a consequence of said colonization (5).

There are 3 main routes through which microorganisms can invade the joint: a) hematogenous; b) direct inoculation or c) continuity, the latter two being less frequent (6).

4.1. Hematogenous

This is the mechanism that represents the most common route, particularly in children under 5 years of age. It consists of the migration of microorganisms present in the blood circulation towards the joint, as a result of an episode of bacteremia. This vascular support comes from the irrigation of the synovium. The importance of this mechanism is reflected in studies that have demonstrated the development of septic arthritis within 24 hours of the introduction of septic material into the circulatory system.

4.2. Direct inoculation

This occurs as a result of trauma, procedures such as infiltrations or arthrocentesis. Depending on the circumstances in which the inoculation occurs, as well as the risk factors, we will find specific microorganisms, or polymicrobial infections.

4.3. By contiguity

In this mechanism, contiguous bone infections end up spreading to the joint space.

The moment a microorganism enters the joint, the innate immune response begins, which is orchestrated mainly by macrophages and neutrophils, with a subsequent adaptive response by lymphocytes induced by cytokines such as IL1 and TNF, which will also induce inflammatory responses such as fever or other constitutional symptoms. This inflammatory response is known as the acute phase. The above occurs in the first hours of the process and its progression is very rapid, explaining the urgency of this type of infection. If there is no control of the inflammatory cascade, joint damage, bone destruction and systemic compromise of the patient will occur, which without timely intervention will cause multisystem complications, septic processes, multiorgan failure and finally the death of the patient (5-6).

The destruction of articular cartilage occurs for 3 reasons:

- Direct damage and toxicity
- Cytokines and proteolytic enzymes
- Increased intra-articular pressure

This entire inflammatory and toxicological cascade will result in the destruction of articular cartilage, beginning with a reduction of proteoglycans and collagen in the extracellular matrix, and culminating with macroscopic articular changes. These changes begin 8 hours after infection.

5. Clinical manifestations

Generally, the clinical picture presents acutely, with an evolution between approximately 2 – 6 days, including symptoms such as pain, edema and functional limitation of the affected joint. Fever may or may not be present. In addition, general engagement may be affected, associated with loss of appetite or irritability in younger children.

Because this condition can have a presentation similar to other pathologies (such as transient synovitis), it is very important to question the parents in order to obtain the patient's history, recent trauma, data related to their birth such as weight and height, vaccination status, medication, travel, among others (7).

6. Physical examination

The clinical presentation of septic arthritis is variable and depends on the affected joint. In the hip, for example, it may not be easy to observe the classic signs of inflammation—redness, heat, pain, and edema—due to the surrounding soft tissue. However, in joints with a smaller amount of surrounding tissue, such as the knee, these signs are more evident and it is even possible to palpate the effusion characteristic of this infectious process. It is common for pain-relieving postures, lameness and inability to bear weight to occur if the involved joint is a lower limb. However, it is crucial to accurately assess joint functional limitation in comparison to the healthy contralateral limb.

7. Diagnosis

The most important thing, once the symptoms are identified, is to suspect this pathology, since delay in diagnosis can cause fatal consequences or leave serious consequences for the patient, in addition to generating high costs for health systems when managing possible complications (7). An early clinical diagnosis and accurate identification of the pathogen constitute the cornerstone of adequate and timely treatment, which requires the participation of various medical specialties such as orthopedics, pediatrics and infectology, among others, due to the need for a multidisciplinary approach. (8)

The images recommended to complement or support the diagnosis include: x-ray of the affected body segment, however, these are usually normal in the acute period. Some findings that we can find are soft tissue edema or widening of the joint space. Ultrasound is also useful to detect increased fluid in the joint cavity, with the limitation of being operator dependent and not distinguishing between the characteristics of different fluids (hemorrhagic, purulent, inflammatory).

The frequently used paraclinical tests are erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), blood count and cultures. Another interesting inflammatory marker is procalcitonin, which can help in taking behavior, although its use is not routine. (8-9)

The criteria described by Kocher in 1999 are a useful tool for the diagnosis of septic arthritis of the hip in children and for its differential diagnosis with transient synovitis; These are based on both clinical and paraclinical parameters:

- Fever > 38.5°C
- Leukocytosis > 12,000/mm3
- Erythrocyte sedimentation rate > 40mm/h
- Limp

Similarly, the predictability percentages of septic arthritis were described according to the number of criteria present in a patient (Table 2).

Table 2 Predictability of the Kocher criteria for septic arthritis

Number of criteria present	Chance of septic arthritis
0	0.2%
1	3%
2	40%
3	93.1%
4	99.6%

Kocher published these predictors, which to this day are a fundamental tool for the clinical diagnosis of patients with suspected septic arthritis of the hip joint. Due to their high sensitivity and easy applicability, they have been arbitrarily extrapolated in clinical practice for the diagnosis of septic arthritis of joints other than the hip; however, there is no clear evidence about their applicability in joints other than the hip.

Taking the above into account, to make a confirmatory diagnosis of septic arthritis, one of these two criteria must be met:

- Isolation of the germ in a quantity greater than or equal to 1 bacteria per mm3 in the culture of synovial fluid obtained intraoperatively or by arthrocentesis or
- Evidence of frank purulent discharge during the arthrotomy.

However, before proceeding to perform an arthrocentesis or arthrotomy, it is essential to maintain a high suspicion of this pathology. This underlines the importance of taking a thorough history, a meticulous physical examination, using clinical diagnostic predictability scales, and rationally using diagnostic aids, without delaying the start of treatment.

Furthermore, it is essential to consider that misinformation on the part of parents, self-medication with antibiotics and possible errors in sample collection can lead to falsely negative results in cultures. Therefore, a negative culture does not exclude the diagnosis of septic arthritis.

8. Treatment

Septic arthritis is considered a surgical emergency in orthopedics because untimely diagnosis and management can cause irreversible damage to the articular cartilage, which means early osteoarthritis, chronic pain, functional disability and a great impact on quality of life.

The two pillars for the management of this pathology are antibiotic therapy and surgery, both urgently in order to avoid irreversible joint compromise.

8.1. Surgery

The surgical treatment of this pathology consists of drainage and lavage of the involved joint, which can be done arthroscopically or by arthrotomy depending on the clinical condition of the patient and the affected joint. The lavage should be carried out with abundant saline solution and a drain can be left to avoid increased intra-articular pressure. Once the procedure has been performed, samples are taken for study of synovial fluid (culture, cytochemistry and gran staining), as well as a sample of synovial tissue for biopsy. (10)

8.2. Antibiotic therapy

It is important to start an empiric antibiotic early, which is capable of covering the most common germs according to the patient's age and risk factors. This is the reason why antibiotics such as oxacillin or first-generation cephalosporins are used primarily for S. Aureus, as well as the addition of gentamicin in neonates for gram-negative microorganisms. Therapy is usually intravenous, however, after a period of time it can be switched to oral administration (4 – 10 days) with an average of 3 – 4 weeks of antibiotic therapy in total. (10)

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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