

CLINICAL AND MICROBIOLOGICAL INSIGHTS INTO SEPTIC ARTHRITIS: REVALENCE, RISK FACTORS, AND JOINT INVOLVEMENT PATTERNS

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Abstract

Background: Although septic arthritis is a rare condition, it is very significant since inadequate treatment can have catastrophic consequences. There is still insufficient data on the epidemiology of septic arthritis.

Objective: To determine the various microorganisms in septic arthritis in children under age of 12years.

Material and Methods: This Cross-Sectional Study was conducted in the Akbar Medical Center and Hospital, Peshawar, Pakistan from May2023 to March 2024 on 165 consecutive patients. Sample size was calculated by sample size calculator for cross-sectional study. Patients with congenital joint deformity and traumatic joint injury were excluded from the study, however patients between the ages of 1 year and 12 years who presented with septic arthritis. For culture sensitivity, synovial fluid was aspirated. The microorganisms' growth pattern in the culture was observed. SPSS version 26.0 was used for data entry and analysis.

Results: The study group consisted of 165 individuals the diagnosis of septic arthritis was confirmed in 76 (46%) patients. Mean age was 7.47 ± 1.96 , the frequency of septic arthritis was high among the men ($n=47:62\%$). Swelling (57%; $P=.01$), pain (59; $P=.001$) and movement limitation (53%; $P=.002$) were the signs found statistically significant. Fever was not found statistically significant (18%; $P=.47$.) The frequently isolated microorganism was *Staphylococcus aureus* ($n=29:38.1\%$). large joints were involved in 52(68.4%) of patients and small joints were affected in 24(31.6) of patients. Single joint was affected in 49(64.4%) while multiple joints were affected in 27(35.6%) of patients.

Conclusion: *S. aureus* is still the most common pathogen in acute joint infections in our environment in children under the age of 12years.

Key words: Children; Infection, Microorganisms, Septic arthritis.

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Introduction:

Inflammation of the joints resulting from an infectious cause, such as a bacterial, fungal, mycobacterium, viral, or other infection, is known as septic arthritis. Commonly, it is monoarticular; however, several or smaller joints may be affected by polyarticular septic arthritis¹. In the United States and Western Europe, the incidence ranges from 2 to 10 per 100,000 patient years². Septic arthritis is characterized by fever, redness, edema, and soreness in the joints, along with a reduced range of motion for both passive and dynamic movements. Septic arthritis is a genuine orthopedics crisis². Delays in diagnosis and treatment

can result in severe consequences such as joint dislocation, physical injury, and articular cartilage degradation. Even with the availability of improved

antibiotics, which have significantly improved medicine, septic arthritis remains a leading cause of morbidity. The epidemiology and microbiological spectrum are changing due to the emergence of antibiotic resistance, which makes the etiology complex. This also varies rather noticeably in terms of location³.

The hip and knee joints are the most commonly

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affected by septic arthritis. Any synovial joint in the body can get infected; however the shoulder and ankle are two more joints that are frequently affected. *Staphylococcus aureus* is the most prevalent microorganism. *Enterobacter* species and group A *Streptococcus* are two more causal microbes. Children who have not received the vaccination may also get septic arthritis due to *Hemophilus influenza*⁴. The microorganisms responsible for septic arthritis exhibit regional variations. *Staphylococci* and *streptococci* have been reported to occur more frequently in most of the countries in Europe and North America. Up to 20% of septic arthritis cases may be linked to gram-negative bacteria, primarily in situations where cirrhosis, malignancy, diabetes, or immunosuppressant are present.¹⁰ The clinical picture (joint pain, functional impairment, and body temperature >38.5 °C) raises the possibility of septic arthritis diagnosis, which is then confirmed by a positive joint fluid culture⁵.

According to a study by Moro-Lago and colleagues, the most often isolated pathogen in patients with septic arthritis was *Staphylococcus aureus*, which was found in 23% of cases. Other common isolates were *Streptococcus pneumonia* (15%), *Streptococcus pyogenes* (13%), and *E. coli* (8%)⁶.

Debilitating orthopedic disorders such as septic arthritis can have a number of short- and long-term consequences, particularly if treatment is put off⁷. The range of different pathogens identified from the diseased joint in our local community is still not well understood. The geographical variety in the pathogen pattern makes it impossible to generalize the findings of international studies. Therefore, our goal was to find out how frequently different microorganisms were present in septic arthritis patients⁸. The study's findings will be useful in determining the prevalence of different microorganisms in our community that have been isolated from septic joints. It will benefit future researchers studying this subject as well

Material and Method:

Study Design and Setting:

This cross-sectional study was conducted at Akbar Medical Center and Hospital, Peshawar, Pakistan, from May 2023 to March 2024.

Sampling Technique and Sample Size:

Sampling Technique was non-probability consecutive sampling. Sample size was 165 patients. Sample size was determined using the WHO sample size algorithm.

Inclusion Criteria:

Patients aged 1 to 12 years, of both genders, who presented with septic arthritis, were included. Septic arthritis was defined based on the following

criteria: Clinical presentation: Fever, joint pain, swelling, and tenderness. Ultrasound findings: collection in the joint cavity.

Exclusion Criteria:

Patients with the following conditions were excluded: Congenital joint deformity, immunocompromised status, rheumatologic joint disease, traumatic joint injury.

Ethical Considerations:

Approval was obtained from the hospital's ethical board. Written informed consent was secured from all participants after explaining the purpose of the study.

Data Collection:

Demographic and clinical data recorded included: age (years), gender, length of illness (days), type of joint involved (large/small), number of affected joints. Large joints included hip, knee, and shoulder; small joints included wrist, ankle and elbow.

Clinical Examination and Joint Aspiration:

A detailed medical history was obtained for all participants. A thorough physical examination of the affected joint was performed following standard protocols. Ultrasound-guided joint aspiration was carried out under sterile conditions in a designated treatment room. Joint fluid turbidity was noted during aspiration. A synovial fluid white blood cell count >50,000 cells/ μ L was considered confirmatory. A 2cc aspirate sample was sent to the medical laboratory for Gram staining and culture within 30 minutes of collection.

Microbiological Analysis

Aspirates were cultured in both aerobic and anaerobic conditions. Agar Types Used were Blood agar, Chocolate agar, and Mac Conkey agar. Incubation Period was 48 hours. Microbial identification was performed using standard biochemical tests. Bacterial identification used standard biochemical tests and the API® system (bioMérieux). Antimicrobial susceptibility testing was performed by the Kirby–Bauer disk diffusion method according to CLSI 2022. Data entry and analysis were conducted using SPSS version 26.0.

Results:

The study group consisted of 165 individuals. The diagnosis of septic arthritis was confirmed in 76 (46%) patients. In the current study, age of the patients ranged from 1 year to 12 years. Mean age was 7.47 ± 1.96 . The frequency of septic arthritis was high among the male ($n=47, 62\%$), in the female patients, the incidence observed was low ($n=29, 38\%$). Swelling (57%; $P = .01$), pain (59; $P = .001$) and movement limitation (53%; $P = .002$) were the signs found

statistically significant. Fever was not found statistically significant (18%; P=.47.)

The frequency of microorganism is shown in table1. The frequently isolated microorganism was *Staphylococcus aureus* (n=29;38.1%). Analysis of the type of joint affected revealed that large joints were involved in 52(68.4%) of patients and small joints were affected in 24(31.6) of patients. Single joint was affected in 49(64.4%) while multiple joints were affected in 27(35.6%) of patients. Microorganisms with respect to gender, type of joint and number of joints is shown in Table 2-4, respectively.

Table1: Frequency of microorganisms n=76	
Microorganisms	Frequency n (%)
<i>Staphylococcus aureus</i>	29 (38.2)
<i>Streptococcus pyogenes</i>	16 (21.0)
<i>Streptococcus pneumoniae</i>	12 (15.9)
<i>Pseudomonas aeruginosa</i>	10 (13.1)
<i>E. coli</i>	7 (9.2)
<i>Staphylococcus epidermidis</i>	2 (2.6)
Total	76(100)

Table2: Gender and Microorganisms			
Microorganisms	Male	Female	P.value
<i>Staphylococcus aureus</i>	13 17.1%	16 21.0%	0.385
<i>Streptococcus pyogenes</i>	9 11.8%	7 9.2%	
<i>Streptococcus pneumoniae</i>	6 8%	4 5.1%	
<i>Pseudomonas aeruginosa</i>	4 5.1%	3 4.1%	
<i>E. coli</i>	1 1.3%	1 1.3%	
<i>Staphylococcus epidermidis</i>			
Total	47(62%)	29(38%)	

Table3: Type of joints and microorganisms			
Microorganisms	Type of joint		Pvalue
	Large	Small	
<i>Staphylococcus aureus</i>	20 26.3%	9 11.8%	0.041
<i>Streptococcus pyogenes</i>	13 17.1%	3 3.9%	
<i>Streptococcus pneumonia</i>	7 9.2%	5 6.6%	
<i>Pseudomonas aeruginosa</i>	4 5.2%	6 7.8%	
<i>E. coli</i>	2 2.6%	5 6.6%	
<i>Staphylococcus epidermidis</i>	2 2.6%	0 0%	
Total	52(68.4%)	24(31.6)	

Table4: Number of joints and Microorganisms			
Microorganisms	Numbers of joints		Pvalue
	Single	Multiple	
<i>Staphylococcus aureus</i>	18 26.3%	11 11.8%	0.037
<i>Streptococcus pyogenes</i>	10 13.2%	6 7.8%	
<i>Streptococcus pneumonia</i>	8 10.6%	4 5.3%	
<i>Pseudomonas aeruginosa</i>	7 9.2%	3 3.9%	
<i>E. coli</i>	5 6.6%	2 2.6%	
<i>Staphylococcus epidermidis</i>	2 2.6%	0 %	
Total	49(64.4%)	27(35.6%)	

Discussion:

Septic arthritis in children is an orthopedic emergency that has serious consequences if not diagnosed promptly and treated effectively¹¹. Considering the samples studied, the mean age demonstrated that septic arthritis is a disease with great predominance among children (patients were younger than 10 years of age) and has gained significant representation among children between 7 to 12 years of age¹². Although most patients with this condition have not presented unfavorable outcomes, infection among elderly patients may result in more serious consequences¹³. Although gender has been reported to be a factor of higher risk for certain specific types of septic arthritis, this aspect cannot be generalized¹⁴. The majority of the individuals with septic arthritis in this study were men, a finding similar to those reported in previous studies^{15,16}. A detailed clinical history and well performed physical examination are sufficient to awaken the suspicion of septic arthritis within the first 3 days of onset of symptoms in the majority of cases¹⁷. Similar to cases of other infections of the musculoskeletal system, systemic symptoms such as fever were of little help for the diagnosis, since less than 50% of the patients presented with high temperature initially. Absence of fever should not be relied upon to exclude the diagnosis¹⁸. In this respect, swelling, the presence of pain and functional disability were the most prevalent clinical signs in our population. Eder et al. and Margaret ten et al. reported pain to be a consistent symptom in up to 85% of the patients with septic arthritis. However, the individual differences in pain threshold can influence the final diagnosis^{19,20}.

Of the 76(46%) isolates, Gram positive cocci were 59(77.6%) while Gram negative rods were 17(22.4%). *Staphylococcus aureus* was found to be frequent among the isolated microorganisms followed by *streptococcus* species, which is in agreement to other studies²¹. The

results of George et al. are in contrast to our findings as they observed *E. coli* and *Pseudomonas* as the second prevalent species²².

This study showed single joint involvement more than multiple joints and large joints were found to be affected more than small joints, which is in consistent with other studies²³. Septic arthritis results from bacteremia in 70% of cases due to the absence of a protective basement membrane within the joint lining. This provides easy passage of bacteria into the synovial fluid. Other causes include direct inoculation from trauma or a medical procedure and contiguous spread from osteomyelitis, an abscess, cellulitis, or septic bursitis²⁴.

The current investigation did not reveal a rise in the quantity of surgical operations performed or the emergence of joint or systemic problems as a result of postponing the need for surgery. There was only one patient who experienced symptoms for more than a week who required multiple surgical drainage procedures. However, the literature supports the notion that delaying treatment for more than three days after symptoms first appeared can result in a worse prognosis.²⁵

In this study, 21 cases (27.6%) did not show positive Gram staining and required to wait for a culture to establish the diagnosis. In addition to Gram staining, the diagnostic strategy should take into account the systemic and local clinical conditions, inflammatory tests like CRP and ESR, and the differential cell count in the synovial fluid.

Conclusion:

It is important to characterize each population epidemiologically, so that empirical treatment based on local evidence can be implemented. From the data analysis, it was possible to conclude that *S. aureus* is still the most common pathogen in joint infections in our environment.

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