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The Characteristics of Septic Arthritis Patients at Dr. Kariadi Hospital Semarang

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A B S T R A C T

Background: Septic arthritis is an inflammatory disease caused by microbial infections such as bacteria, fungi, and viruses. Late diagnosis can lead to permanent joint damage, while overdiagnosis may result in unnecessary medical procedures. Although the incidence is relatively low, septic arthritis remains a medical concern due to its impact on joint function and patient quality of life. Determining the characteristics is needed to improve the diagnosis, treatment strategies, and prognosis of septic arthritis.
Methods: This descriptive study utilized a retrospective design and was conducted on adult patients diagnosed with septic arthritis at dr. Kariadi General Hospital, Semarang, from January 2017 to August 2023. The analyzed variables included clinical manifestations, comorbidities, laboratory test results, synovial fluid analysis, synovial fluid culture, and antibiotic resistance.
Results: Among the 49 patients, most were under 60 years old (67.4%) and male (61.2%). The knee joint was the most commonly affected site (87.8%) with the main symptoms such as joint pain, edema, and reduced range of motion (100%), along with inflammatory signs such as joint warmth (89.9%) and redness (83.7%). Synovial fluid analysis revealed that 53.06% of patients had cloudy and foul-smelling synovial fluid, with an average white blood cell count of 93,679.43/mm³ and a predominance of neutrophils (80.37%). Synovial fluid culture identified Staphylococcus aureus as the most common pathogen (34.7%), followed by Klebsiella pneumoniae (4.1%) and Salmonella sp. (2%). Antibiotic sensitivity tests showed Ampicillin/Sulbactam as the most effective treatment, while antibiotic resistance was observed in Gentamicin, Penicillin, and Linezolid.
Conclusion: Staphylococcus aureus is the dominant pathogen, and rising antibiotic resistance remains a concern. Early diagnosis and targeted therapy are crucial for better patient outcomes.

1. Introduction

Septic arthritis is a disease caused by microorganisms such as bacteria, fungi, and viruses, characterized by inflammation.[1] Late detection of septic arthritis can result in permanent damage to the joints, while overdiagnosis can result in patients receiving unnecessary medical and surgical procedures.[2] Etiologically, septic arthritis in children is most commonly caused by Staphylococcus aureus infection, but it can also be caused by bacteria such as group B Streptococcus, Neisseria gonorrhea, and gram-negative bacteria such as Kingella kingae. This disease can also occur due to secondary infections caused by long-term use of antibiotics.1 Age factors, history of arthritis, rheumatoid arthritis, history of joint trauma and skin infections could play a role in septic arthritis infections.[3] In adults, the most common cause of septic arthritis is bacterial infection, with Staphylococcus aureus as the most common pathogen. Other bacteria that can cause septic arthritis are Streptococcus species, Neisseria gonorrhoeae, and Gram-negative bacilli. Fungal infections, such as Candida species, can also cause septic arthritis, but are less common. Septic arthritis is more common in older adults, people with chronic illnesses, and people with immunodefficiency.[4]

According to a retrospective study conducted on emergency department in United States, septic arthritis is the cause for 16,382 emergency department visits which is 0.01% of all emergency department visits.[5] According to research in tertiary hospitals, West Texas United States, there are 4-10 incidences of this disease per 100,000-year-patients, and mortality rates vary between 5 and 20%. Between 10-73% of patients with septic arthritis have decreased mobility and joint function.[6] S aureus is the bacterial pathogen most commonly associated with septic arthritis, with a total of 39% of all bacterial isolates in children with septic arthritis in the Saudi Arabia, S. aureus is also the most common organism in this study.[7] This disease has a prevalence in children less than 5 years, which is 5 cases per 100,000 per year, while for adults there are 6 to 8.4 cases per 100,000 population in Indonesia per year.[8]

Symptoms and clinical manifestations that can be seen in septic arthritis patients on local examination are swelling, redness, stiffness, warm palpable joints, ROM (range of motion) which is very limited, and deformities in infected joints.[9] Painful joints are often maintained in a comfortable position that increases intracapsular volume.[10]

Monoarticular septic arthritis is the most common. The hip (32%-39%) and knee (26%-47%) are the most commonly affected joints. 29.3% of all cases had negative synovial fluid cultures, while the remaining 69.7% were positive. Gram-negative bacilli 7.6%, followed by Staphylococcus aureus is the most commonly identified organism of synovial fluid.[7]

Although the incidence of septic arthritis in Indonesia is small, there is a prognosis that has not improved in Indonesia and there are still no studies on the characteristics and clinical manifestations of septic arthritis in adults in Indonesia. Therefore, this study certainly can provide information on the clinical characteristics, laboratory findings, and microbiological profile of septic arthritis to contribute to improved diagnosis, treatment strategies, and prognosis of septic arthritis..

2. Methods

This study was conducted from June to September 2023, with data collected during the period from January 2017 to August 2023. The research method is descriptive with a retrospective design. The samples used in this study were all adult patients diagnosed with septic arthritis at RSUP dr. Kariadi during the period from January 1, 2017, to August 31, 2023. A total of 49 samples met the inclusion criteria, which included having a medical record of being diagnosed with septic arthritis in adults aged 18 years or older, with sample selection conducted through a total sampling method.

The variables of this study were clinical manifestations, the comorbidities, laboratory test, joint fluid analysis, joint fluid culture, and antibiotic resistance. The data that has been collected will be analyzed and presented in the form of tables and graphs.

The study is carried out after obtaining ethical clearance from the Health Research Ethics Commission (KEPK) Faculty of Medicine, Diponegoro University with the series of No. 229/EC/KEPK/FK-UNDIP/V/2023. The identity of the research subject will be kept confidential and all costs related to the research will be the responsibility of the researcher.

3. Results

The study collected 49 septic arthritis patients are dominated by patients aged <60 years (67.4%), male (61.2%), and most often found in the genu (87.8%). From the aspect of clinical symptoms, all patients experienced joint pain, edema, and decreased of Range of Motion (ROM) (100%), while joint warmth was found in 89.9% of patients, and redness as a sign of inflammation was present in 83.7% of patients. Blood tests showed an increase in inflammatory parameters. The average value of C-Reactive Protein (CRP) was 9.85 ± 9.70, with a leukocyte count of 15.51 ± 5.30. The Erythrocyte Sedimentation Rate (ESR) was recorded at 25.54 ± 6.50, and procalcitonin levels had an average of 1.91 ± 3.16. (Table 1).

The results of synovial fluid analysis revealed that 53.06% of patients had cloudy and unpleasant synovial fluid and low synovial fluid viscosity (85.7%). The average number of white blood cells (WBC) in synovial fluid was 93,679.43 ± 3.16, with a proportion of neutrophils (PMN) of 80.37 ± 7.12%, and glucose levels in synovial fluid were found to be at an average of 61.24 ± 1.75 mg/dL. The most common comorbid diseases experienced by septic arthritis patients in this study were Type 2 Diabetes Mellitus which was found in 28.5% of patients, Rheumatoid arthritis was found in 18.3% of patients, and prosthetic joints were the cause in 16.3% of patients. Some patients also had a history of joint trauma (4%), SLE, leprosy, TB, and gout, each of which was found in 2% of the study population. Meanwhile, 24.5% of patients had no comorbidities. (Table 1).

Table 1. Characteristics of Septic Arthritis Patients at RSUP dr. Kariadi 2017-2023

Characteristics	n (%)
Age	
<60 years	33 (67,4)
≥60 years	16 (32,6)
Gender	
Male	30 (61,2)
Female	19 (38,8)
Location of Arthritis	
Genu	43 (87,8)
Cubiti	1 (2)
Coxae	1 (2)
Ankle	3 (6,1)
Shoulder	1 (2)
Symptoms	
Joint pain	49 (100)
Warmth	44 (89,9)
Edema	49 (100)
Redness	41 (83,7)
Decreased Range of Motion (ROM)	49 (100)
Blood test (mean ± SD)	
CRP	9,85 ± 9,70
Leukocyte	15,51 ± 5,30
ESR	25,54 ± 6,50
Procalcitonin	1,91 ± 3,16
Synovial fluid	
Cloudy, unpleasant	26 (53,06)
Low viscosity	42 (85,7)
WBC (mm^3)	93.679,43 ± 3,16
PMN (%)	80,37 ± 7,12
Glukosa (mg/dL)	61,24 ± 1,75
Comorbid	
DM Tipe 2	14 (28,5)
No comorbid	12 (24,5)
Artritis reumatoid	9 (18,3)
Prosthetic joints	8 (16,3)
Joint trauma	2 (4)
SLE	1 (2)
Leprosy	1 (2)
TB	1 (2)
Gout	1 (2)

The results of joint fluid culture examination showed that Staphylococcus aureus was the most common bacteria found in 34.7% of cases, but there were also gram-negative bacteria, such as Klebsiella pneumoniae found in 4.1% of cases and Salmonella sp. in 2% of cases. In addition to bacteria, fungal infections were also detected in several cases, such as Candida sp. and Aspergillus sp. each found in 2% of patients. Based on the other culture method, MTB was detected in 18.4% of cases, while through the Molecular Rapid Test (TCM) method, MTB was found in 6.1% of cases. (Table 2).

Table 2. Synovial culture test

Synovial culture	n	%
Gram + (Coccus)		
Staphylococcus aureus	17	34,7
Staphylococcus epidermidis	5	10,2
Diplococcus sp	1	2
Staphylococcus capitis	1	2
Streptococcus viridans	1	2
Gram -		
Klebsiella pneumonia	2	4,1
Salmonella sp.	1	2
Fungi		
Candida	1	2
Aspergillus	1	2
MTB		
Kultur		
Mycobacterium tuberculosis	9	18,4
TCM		
Mycobacterium tuberculosis	3	6,1
No data	7	14,29

Antibiotic sensitivity tests showed that several antibiotics still have high effectiveness against the pathogens found. Ampicillin/Sulbactam has the highest sensitivity level, with 126 sensitive cases and no resistant cases. Other antibiotics such as Amoxicillin/Clavulanate, Ciprofloxacin, Nitrofurantoin, Vancomycin, Erythromycin, and Linezolid are also still effective against most pathogens. However, several antibiotics are starting to show quite significant levels of resistance. Gentamicin and Penicillin have the highest levels of resistance, with 15 resistant cases each, while Linezolid showed resistance in 12 cases. In addition, Methicillin experienced 2 cases of resistance, which could indicate the presence of Methicillin-Resistant Staphylococcus aureus (MRSA). (Table 3).

Table 2. Antibiotic resistance result

Antibiotic resistance	Sensitive	Resistance
Amikacin	12	0
Amoxicilin/Clavulanate	24	0
Ampicilin	24	1
Ampicilin/Sulbactam	126	0
Aztreonam	0	1
Cafazolin	0	1
Cefepime	1	0
Cefotaxime	1	0
Ceftazidime	1	0
Chloramphenicol	1	0
Ciprofloxacin	24	0
Gentamicin	1	15
Imipenem	1	0

Moxifloxacin	26	0
Meticillin	25	2
Penicilin	1	15
Piperacillin	0	1
Piperacillin/Tazobactam	1	0
Sulbactam Cefoperazone	1	0
Vancomycin	12	0
Erythromycin	12	0
Linezolid	25	12
Nitrofurantoin	24	0
Rifampicin	3	0
Teicoplanin	1	0
Tetracycline	1	0
Trimethoprim/	1	0
Sulfamethoxazol Levofloxacin	12	0

4. Discussion

Septic arthritis represents a pathological condition that may manifest in pediatric, adult, and geriatric populations. The prevalence of septic arthritis has typically been documented as low, with an incidence rate ranging from 4 to 10 cases per 100,000 individuals annually.[11] Notably, the incidence of septic arthritis exhibits considerable variation across different age demographics, with elevated rates observed among older cohorts. Specifically, the incidence within the demographic exceeding 60 years of age has been reported at 57.7 cases per 100,000 individuals annually.[12] A prior investigation conducted in New Zealand identified an incidence of 58 cases per 100,000 individuals annually among patients aged over 80.[13] Collectively, these investigations provide compelling evidence of a correlation between advancing age and the heightened incidence of septic arthritis. In contrast, this study indicates that septic arthritis may be more prevalent among individuals under 60 years of age or within adult populations.

There is still no research that can proves the cause of the dominance of septic arthritis patients who are male compared to female, but it can occur because of the relation between the occurrence of septic arthritis and risk factors that induced septic arthritis, with the most results being smoking as much as 35%, then osteoarthritis by 29%, diabetes mellitus by 24%, and gout by 15%.[14] This correlates with a study on smoking trends by sex, where the projected smoking rate will be higher in men until 2029.[15] Indonesia has a culture and smoking habits in adulthood and the male sex is higher than that of women. Smoking can reduce body endurance. Exposure to chemicals in cigarette smoke can interfere with the function of immune cells, such as macrophages, neutrophils, and T cells.[16] In addition, the factor that causes arthritis to occur is greater in men is injury factors that are more common in men.[14]

Septic arthritis is more common in large joints due to several factors, which is anatomical factors. Large joints have more space and volume for synovial fluid (the fluid that lubricates the joints) than small joints. This allows for more buildup of synovial fluid that can be a place of attachment for bacteria or infection-causing microorganisms. In addition, to circulatory factors and joint use, large joints, such as the knee and hip joints, are very active and frequently used. Large joints have a greater blood supply than small joints. This can lead to the spread of bacteria or infection through the bloodstream more easily to large joints. Therefore, they are more susceptible to injury or microtrauma that can open pathways for infection-causing microorganisms.[14,17,18]

The occurrence of inflammatory signs is due to the patient's immune mechanism is that, initially, synovial cells release host inflammatory cytokines, such as interleukin 1-β (IL-1β) and interleukin 6 (IL-6), into joint fluid. These cytokines then stimulate the liver to release acute-phase proteins, including C-reactive protein, which bind to bacterial cells and promote opsonization and activation of the complement system.[19]

Patients with septic arthritis are usually found to have white blood cell levels that exceed normal, which is more than 50,000 in joint fluid, and are dominated by PMN cells because it often caused by bacteria, especially gram positive bacteria, in the coccus group.[14] In this study, the results of leukocyte count in joint fluid were all obtained above 50,000 mm^3 which indicates arthritis caused by infection or inoculation of microorganisms in the synovial cavity of the joint. This is fitting with previous research at Sanggala Hospital, Denpasar, and Middlemore Hospital in New Zealand, which obtained the results of joint fluid analysis with leukocyte count or WBC results above 50,000mm^3, some even exceeding 100,000 mm^3.[14, 22]

For PMN cell levels in this study, 73.5% of cases were dominated by PMN cells, where the majority were caused by bacterial infections and indicated the presence of microorganisms in the joint synovial fluid, while there were 26.5% obtained with leukocytes dominated by PMN cells but less than 70% of all leukocytes, which are usually caused by comorbidities of immunocompromised conditions such as type 2 DM, rheumatoid arthritis, SLE, and Leprosy in this case.[3, 23]

In the results of glucose percentage, glucose levels are usually obtained lower than normal in cases of septic arthritis, in this study 73.5% were obtained in cases of septic arthritis with glucose levels less than normal, which is fitting with previous studies. While in 26.5% of cases normal glucose levels were obtained, which is also obtained in MTB infection.[24]

Osteoarthritis, rheumatoid arthritis, and the use of corticosteroid therapy are the most common causative factors. To be more specific, individuals with rheumatoid arthritis face a tenfold greater chance of developing septic arthritis compared to the general population. In addition, patients with conditions such as diabetes mellitus, leukemia, cirrhosis, granulomatous disease, cancer, hypogammaglobulinemia, intravenous substance abuse, kidney disease, and those undergoing cytotoxic chemotherapy also showed an increased incidence of septic arthritis. In immunocompromised cases, there is a decrease in the phagocytosis ability of leukocytes and phagocytes, disruption of T cells and increased levels of proinflammatory cytokines, which weaken the patient's immune system, so that it can be more easily infected with pathogens.[8, 25, 26]

5. Conclusion

Septic arthritis predominantly affects males under 60 years of age, with the knee being the most commonly involved joint. The clinical characteristics, such as joint pain, edema, and decreased range of motion, are universal symptoms. Laboratory investigations revealed elevated inflammatory marker, and synovial fluid analysis showed high leukocyte counts, a predominance of polymorphonuclear cells, and reduced glucose levels, consistent with bacterial infections. Staphylococcus aureus remains the most frequently isolated pathogen, and Ampicillin/Sulbactam remains a sensitive antibiotic.

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