

PNEUMOCOCCAL SEPTIC ARTHRITIS AT SANGLAH GENERAL HOSPITAL: A CASE REPORT

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ABSTRACT Introduction: Septic arthritis is inflammation of the joints caused by infection with microorganisms. Generally, septic arthritis is caused by *Staphylococcus aureus*. *Streptococcus pneumoniae* is rarely found to be a cause of septic arthritis. However, inadequate treatment can increase morbidity in these cases. This case report aimed to improve the understanding of septic arthritis caused by *Streptococcus pneumoniae*. **Case report:** A 58-year-old woman was being treated at a tertiary referral hospital in Bali for septic arthritis. She had a history of osteoarthritis and underwent prosthesis surgery on her right knee two years ago. The patient had no history of pneumonia. Her knee joint fluid culture was examined before giving empiric antibiotics. The results of synovial culture using VITEK 2 COMPACT (bioMérieux®) were identified as *Streptococcus pneumoniae*. The clinical symptoms experienced were fever accompanied by swelling and pain in both knees with limited mobilization. This patient suffered from osteoarthritis and had a prosthesis in the right knee as a risk factor for septic arthritis. She was given antibiotic ceftriaxone as empiric antibiotic therapy just after synovial fluid collection for culture. After *Streptococcus pneumoniae* was identified from the culture, and the antimicrobial susceptibility testing results were still sensitive to ceftriaxone; therefore, the antibiotic continued as definitive antibiotic therapy. Clinical improvement was found on the sixth day, and she was discharged after 6 days of treatment. **Conclusions:** Cases of septic arthritis in women without a history of pneumococcal pneumonia are rare but remain a problem when associated with the prosthetic joint infection. Special consideration should be given to septic arthritis patients with a history of total knee replacements. It is important to do a synovial fluid culture to identify the cause of infection and select appropriate definitive antibiotics to prevent permanent joint dysfunction.

KEYWORDS knee joint, prosthetic joint, septic arthritis, *Streptococcus pneumoniae*

Introduction

Septic arthritis is a medical emergency that increases a patient's morbidity, disability, and mortality. It accounts for 16,000 emergency department visits annually [1]. Adequate treatment and

eliminating the source of infection will determine the prognosis of the patient. In a septic arthritis case, the body's response to an infection in the joint (bacteria, fungi, mycobacteria, viruses, or other uncommon pathogens). The clinical manifestation is from mild to severe. Its complication due to inadequate treatment can lead to joint damage, ankylosing, avascular necrosis, spreading to the adjacent bone and nerve tissue. The gold standard of treatment is to eliminate the purulent source of infection, either surgically or by arthrocentesis, and select appropriate empiric antibiotics [1].

The mortality rate due to septic arthritis is 11% [2]. The gold standard of diagnosis patients with septic arthritis is culture and antibiotic sensitivity tests from synovial fluid aspiration and antibiotic sensitivity tests. It should be carefully noted about

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the specimen collection to prevent contamination and should be sent immediately to the Clinical Microbiology Laboratory. Delivery time for culture specimen should take less than 15 minutes (maximum less than 24 hours) and can be stored at room temperature [3].

Staphylococcus aureus is the most common organism causing septic arthritis, accounting for 37-65% of the cases. Then, followed by *Streptococcus spp.*, particularly *Streptococcus beta-hemolytic*. *Streptococcus pneumoniae* is uncommon to cause septic arthritis, which is 6% of the cases [4]. The other causal organisms are *Methicillin Resistance Staphylococcus aureus* (MRSA), *Coagulase-negative staphylococcus*, *Salmonella*, *Escherichia coli*, *Klebsiella pneumoniae*, *Enterobacter*, *Serratia*, *Proteus*, *Pseudomonas*, anaerobic organisms, *Neisseria*, *Mycobacteria*, and Fungi [5].

Septic arthritis is usually monoarticular, involving one large joint such as the hip or knee. Polyarticular arthritis is uncommon and generally carries some risk factors. Articular damage is a challenge because irreversible articular damage with loss of joint function occurs in about 25-50% of patients [6]. The high-risk population are children, older patients, prosthetic joints, and people with a history of joint injection drugs [7].

Diagnosis of septic arthritis needs to be enforced as soon as possible because delayed treatment can lead to irreversible joint destruction and increase morbidity. The following case is expected to increase understanding of septic arthritis caused by *Streptococcus pneumoniae*.

Case report

A woman, 58 years old, came to the emergency with a chief complaint of swelling and pain in both knees for seven days before admission. Swelling and pain were more severe in the right knee. The pain was felt with the movement of both knees, palpation of the swelling part, and more severe in the morning. She had a fever and lethargy. The movement of the lower extremities was limited. This patient had a history of chronic osteoarthritis on the right knee and knee arthroplasty right knee in 2018. There was neither history of pneumonia nor allergy.

Physical examination was compos mentis, Glasgow coma scale (GCS 15; Eye 4, Verbal 5, Motor 6), blood pressure 120/70 mmHg, pulse rate 88 beats per minute, respiration rate 24 beats per minute, temperature 37.80C, Visual Analog Scale (VAS) 4/10 (moderate pain), and 2015 ACR/EULAR criteria: 9 (gout criteria). Physical examination of eyes, ears, nose, throat, lymph nodes, heart, lungs, abdomen and upper limbs were within normal limits. The local examination on the knee found a scar on the right knee, swelling and redness on both knees, warmth and tenderness on palpation, with a limitation of range of movement and unable to support the body.

The Complete Blood Count (CBC) showed leukocytosis (leukocytes 14.33x10³/μl), neutrophil 89.82%, Hemoglobin 12.42 g/dl, Platelet 312.10 x10³/μl, and erythrocyte sedimentation rate 101.5 mm/hour. The random blood sugar was 187 mg/dl, increased levels of uric acid 11.4 mg/dl, increased blood urea nitrogen (BUN) 185.30 mg/dl, Serum Creatinine (SCr) 4.02 mg/dl, increased levels of C-reactive protein (CRP) 131 mg/dl, procalcitonin 8.96 ng/ml and decreased levels of albumin 2.70 mg/dl. Bilateral knee X-ray (AP) showed in Figure 1.A and bilateral legs (AP/lateral) showed in Figure 1.B.

The synovial fluid culture showed a growth of *Streptococcus pneumoniae*. Microscopic Gram stain of the synovial fluid showed no epithelial cells, leucocytes >25 per field of view, diplococci gram-positive bacteria >25 per field of view (Fig-

ure 2.A). The culture on blood agar incubated at 5% CO₂ for 18-24 hours showed the growth of colonies in quadrant 4 with a small, smooth, grey, shiny, flat edges with dome-shaped form, and there is an alpha hemolysis colony (Figure 2.B). The identification of the colony using the VITEK 2 Compact (bioMérieux®) machine was *Streptococcus pneumoniae*. The antibiotic sensitivity test showed sensitivity to benzylpenicillin, cefotaxime, ceftriaxone, levofloxacin, moxifloxacin, erythromycin, clindamycin, linezolid, vancomycin, tetracycline, tigecycline, chloramphenicol, rifampicin, and trimethoprim/sulfamethoxazole.

The patient's diagnosis was septic arthritis, acute on chronic gout arthritis, acute kidney injury (AKI) stage II, and acute on chronic kidney disease. This patient had been given 0.9% NaCl fluid 500 ml every 8hour, ceftriaxone intravenous (I.V) 1 gram every 12hour, paracetamol per os (P.O) 750 mg every 6 hour, omeprazole (I.V) drip 8 mg, allopurinol (P.O) 100 mg every 24hour, methylprednisolone (P.O) 8 mg every 8 hours, a right and left knee back slab. The patient was consulted by a rheumatology specialist for further management. From the rheumatology division, the patient was diagnosed with acute on chronic gout arthritis left functional knee class (FC) IV, osteoarthritis bilateral knees FC IV post Total Knee Replacement of right knee, acute on chronic kidney disease et causa suspect renal on chronic kidney disease (CKD) with orthopaedic management and analysis of synovial fluid if VAS > 4/10.

The results of synovial fluid's culture came out on day third from specimen collection, it showed *Streptococcus pneumoniae* and susceptible to ceftriaxone, so the definitive antibiotic was ceftriaxone. The patient showed an improvement clinically. After six days of ceftriaxone (I.V), the patient's condition was stable; physical examination showed an improvement, reduced pain and swelling on both knees, an improvement of CRP levels (11.42 mg/dl) and procalcitonin levels (0.73 ng/ml). Furthermore, the patient was discharged on day seven, and the outpatient therapy was levofloxacin 500 mg once a day, paracetamol 500 mg every 6 hours, lansoprazole 30 mg once a day, and educated for gradual mobilization and low salt diet.

Discussion

Septic arthritis is an inflammatory disease of the joints, which is caused by infection [6]. It usually affects the large joints in the body, knee or hip joints. The high-risk populations are children, the elderly, people with joint prostheses, and people who receive drug injections into the joints[8,2]. The annual incidence of septic arthritis in industrialized countries is 4-10/100.000 patients in the general population and 30-70/100.000 patients with rheumatoid arthritis or a history of prosthetic joint replacement surgery. Its prevalence is increasing in relation to age, the use of immunosuppressant drugs, and orthopaedic procedures [9]. The patient was an old adult, aged 58 years old, with pain and swelling on both knee joints. She had a history of prosthetic joint replacement two years ago. Signs of septic arthritis was positive from clinical examination and laboratories result. It showed a total knee replacement on the right knee from the X-ray knee. This needed to aspirate the synovial fluid for the culture of septic arthritis caused pathogens. According to a study conducted by Horowitz 2011, a history of joint replacement of more than 24 months was a late-onset infection. Clinical manifestations of acute joint pain, fever and a relative increment of leukocytes showed a hematogenous infection [10]. According to this case, the onset of joint pain was 7 days before admission with a fever (37.80C) and a leukocytosis (14.33x10³/μl). The increasing level

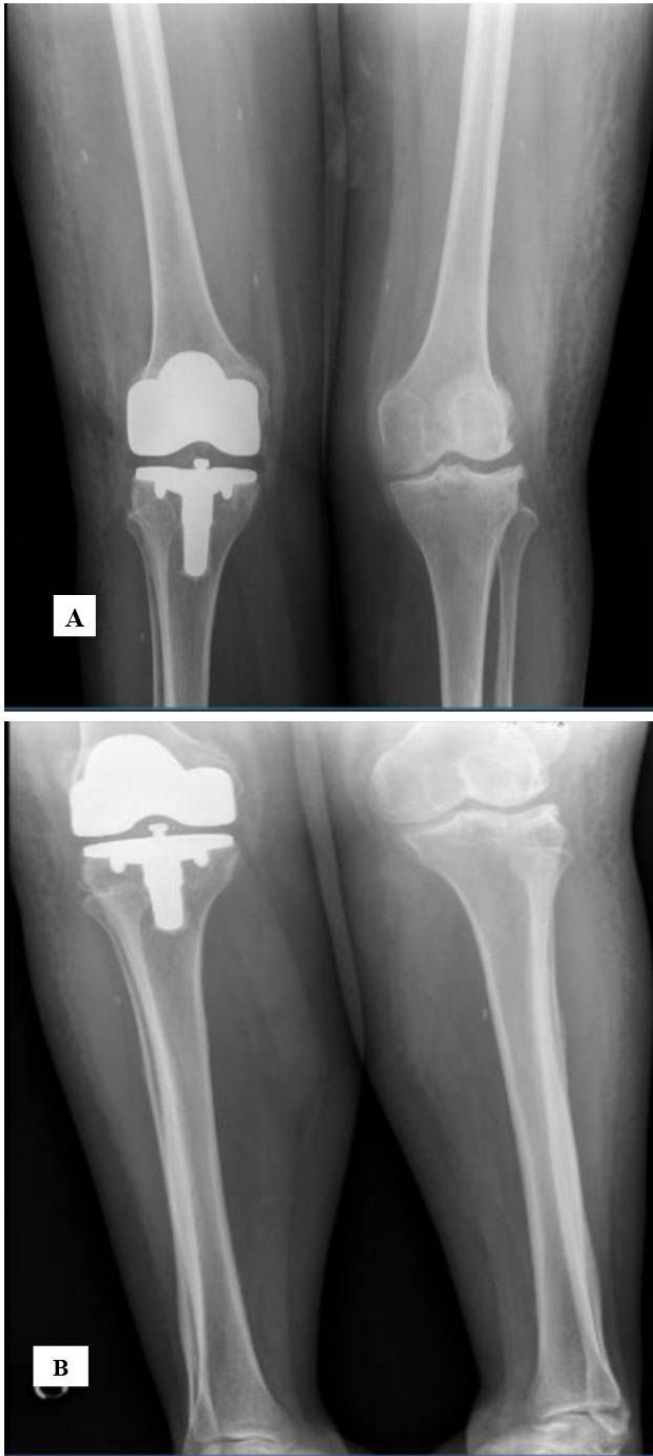


Figure 1: A. Xray of both knees (AP) showed a knee arthroplasty prosthesis on right knee with a good position and apposition with surrounding soft tissue swelling, right femur and tibia osteopenia, left knee osteoarthritis. 1.B. Xray of both lower legs (AP/lateral) showed a both knees osteoarthritis.

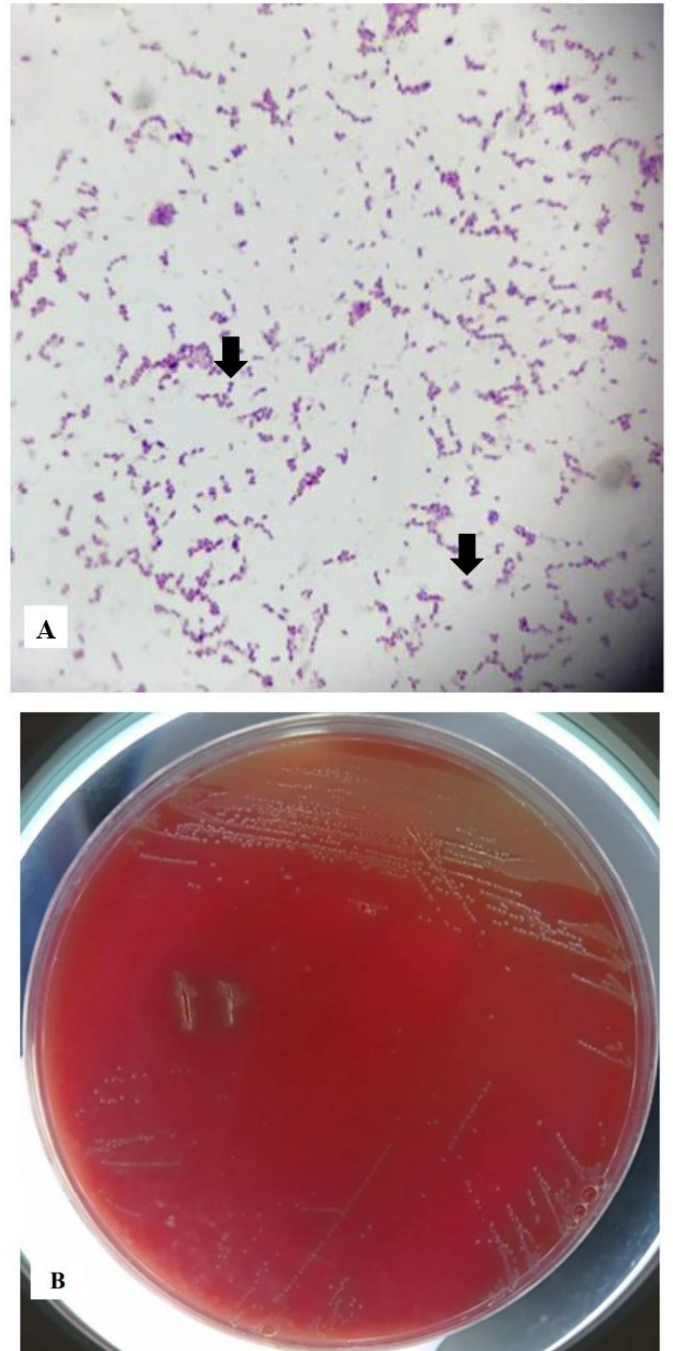


Figure 2: A. Gram stain of synovial fluid sample, no epithelial cells were found, leukocytes >25 per field of view, diplococcal gram-positive bacteria were found (black arrows). 2.B. Bacterial colonies on blood agar from culture of synovial fluid (identified as *Streptococcus pneumoniae*).

of infection indicated a systemic infection, so it was highly recommended to carry out a blood culture before administering an empiric antibiotic.

In this patient, septic arthritis occurred on both knee joints. Polyarticular infections are uncommon and generally due to several risk factors. Articular damage is an important feature and a challenge because around 25% to 50% of patients experience irreversible articular damage with loss of joint function [6].

From a microbiology perspective, organisms of septic arthritis are polymicrobial, a Gram-positive bacteria, such as *Staphylococcus aureus*, *Streptococcus*; a gram-negative bacteria, such as *Salmonella*, *Escherichia coli*, *Klebsiella pneumoniae*, *Enterobacter spp.*, *Serratia spp.*, *Proteus spp.*, *Pseudomonas spp.*; an anaerobe bacteria, such as *Bacteroides spp.*, *Propionibacterium acne*; and fungi. The culture of synovial fluid was *Streptococcus pneumoniae*. Gram-positive bacteria, as a main invasive bacteria on children and the elderly, that caused otitis media, pneumonia, bacteremia, and meningitis [11,2,12]. Around 40% of bacteremia and 35% of meningitis cases due to *Streptococcus pneumoniae* caused death in the elderly and children, respectively. Lipoteichoic acid (LTA) is a cell wall of Gram-positive bacteria similar to lipopolysaccharide (LPS) of Gram-negative bacteria, from the biochemistry and physiological nature. Pneumococcus activates the innate immune system through Toll-like receptor 2 (TLR2). The LTA of pneumococcus induces acute inflammation and causes septic shock or another disease by stimulating the TLR2 [2]. The pathogenesis of *Streptococcus pneumoniae* was through 3 major steps, such as transmission, colonization, and invasion [13]. Invasion of bacteria to synovial space can spread from hematogenous (the most common) or directly [11].

The source of infection in this patient was suspected from the prosthetic joint on the right knee, which spreads hematogenous. According to a study [14], the slow onset of infection in patients with a history of prosthetic joint use was due to the formation of biofilms that adhered to the surface of a foreign body, and the organism could survive intracellularly. The growth of biofilm dynamically, are consisted of several stages, such as starting from the attachment of microbial cells to the surface, the initial growth on the surface, the maturation of the biofilm, and finally, the release. Mature biofilms had a nonhomogeneous multicellular structure where the components of microbial cells could correspond with each other (quorum sensing). It explained that the normal flora could be a pathogen organism when growing on the surface of foreign bodies. Bacteria could pass through the host immune system, and the antimicrobial effect, which made its eradication, is difficult. Surgical removal and replacement of the prostheses are needed to eradicate the biofilms [14].

The knee joint is the most common site of infection reported in 50% of bacterial arthritis' cases[9,15,1]. Contrary to a study done by Kennedy in 2015, which stated that the knee joint (21%) was the second most common site of infection after the shoulder joint [11]. Septic arthritis happens due to the incompetence of the synovium to protect the joint from infection. As a barrier for infection, phagocyte cells, neutrophil and macrophage, migrate to the infected joint, where neutrophil as first-line protection from pathogen and leucocyte as the first cells migrates to the site of infection, which makes inflammation of the joint. Infection due to septic arthritis is fast and destructs another tissue in the joint, namely cartilage [6].

Several risk factors of septic arthritis are the elderly, increased antibiotic resistance, history of orthopaedic procedures, and the use of immunomodulatory drugs. Subsequently, a history of

previous joint diseases, such as rheumatoid arthritis (RA), osteoarthritis, crystalline arthropathy, and other forms of inflammatory arthritis is a predisposing-factors for arthritic infections. Septic arthritis is frequently associated with other comorbidities, such as kidney disease, liver disease, cancer, diabetes, human immunodeficiency virus (HIV) infection, and rheumatology [6]. In this case, it was found that there was an increase in renal function (BUN 185.30 mg/dl, SCr 4.02 mg/dl) which contributed to decreasing the patient's immunity. In addition, the patient had a rheumatological condition (chronic osteoarthritis) which was associated with joint infection.

The primary diagnosis was septic arthritis. According to the results of the study by Singh 2017, that septic arthritis patients with a history of osteoarthritis required a shorter hospitalization with lower treatment costs because the knee joint could be done arthrocentesis immediately, as a diagnostic in the early identification of the causative organism and as a treatment [15]. In addition, a high level of procalcitonin indicated a possible bacterial infection.

The treatment of septic arthritis consists of early antibiotic therapy after an aseptically collected culture material by drainage or needle aspiration. The limiting factors of its success are lack of awareness of the cause of infection at onset and delaying aspiration of synovial fluid or failure of joint drainage [2]. This patient received an empiric broad-spectrum cephalosporin class III, ceftriaxone 1 gram every 12 hours. The synovial fluid culture identified a *Streptococcus pneumoniae* and was sensitive to ceftriaxone, then used as definitive therapy. Ceftriaxone is the first-line therapy for infections caused by *Streptococcus pneumoniae*, the bactericidal, time-dependent beta-lactam group with its mechanism of inhibiting cell walls for gram-positive bacteria and good penetration into the synovial fluid [16].

It is important to collect culture material before being given broad-spectrum antibiotics as an empirical therapy [15]. A delayed treatment causes the local bone and cartilage damage, osteonecrosis, secondary arthritis, and ankylosing [8]. There was a clinical improvement in this patient so that no invasive treatment was carried out apart from synovial fluid aspiration at the admission. There were no indications of surgery after the healing process. The prognosis of this case was good was following the study of Riachy, 2011 which stated that septic arthritis caused by *Streptococcus pneumoniae* had a mild limitation on the range of motion of the extremities with appropriate empirical and definitive antibiotics [17].

Conclusion

A woman, 58 years old, with pain and swelling in both knees, diagnosed with septic arthritis, bilateral genu osteoarthritis, acute on chronic kidney disease without a history of pneumonia, using clinical, laboratory, and radiological examinations. The patient was treated with supportive therapy and antibiotics. The definitive antibiotics used was based on culture results and antibiotic sensitivity tests. The patient's condition improved after day sixth of treatment, then discharged on the seventh day with oral antibiotic therapy, dietary education and gradual mobilization. The risk factors of septic arthritis in this patient were prosthetic joints, and the prosthetic joint should be replaced with a new one if a patient has a recurrent infection. Selection of appropriate empiric antibiotic therapy and given immediately after taking the culture materials for an antibiotic sensitivity test to provide definitive antibiotic therapy in cases of septic arthritis due to *Streptococcus pneumoniae* to improve the quality of life of patients.

List of abbreviations

- ACR: American College of Rheumatology
- EULAR: European League Against Rheumatism
- AP: Anterior Posterior

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Conflict of interest

There are no conflicts of interest to declare by any of the authors of this study.

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