

ORIGINAL ARTICLE

Mortality Rate and Associated Factors Among Patients with Septic Arthritis at Pranangklao Hospital

Annop Bunyod

Department of Internal Medicine, Pranangklao Hospital

KEYWORDS

septic arthritis; mortality; comorbidities; complications

CORRESPONDING AUTHOR

Annop Bunyod

Department of Internal Medicine,
Pranangklao Hospital
91 Nonthaburi Road, Bangkasor Sub-district,
Maung District, Nonthaburi 11000, Thailand
E-mail: mickeylondon2589@gmail.com

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ABSTRACT

Septic arthritis is a medical emergency resulting from infection within a joint. Delayed diagnosis can lead to irreversible joint damage, permanent disability, or dissemination of the infection into the bloodstream, which can ultimately result in death. Despite significant advancements in modern medical care, the mortality rate in patients with septic arthritis remains high. This retrospective cohort study aimed to determine the mortality rate and prognostic factors associated with septic arthritis in hospitalized patients in Pranangklao Hospital between January 1, 2020, and December 31, 2024. Patients aged 15 years and older who were admitted with a diagnosis of septic arthritis were included. Factors associated with mortality were analyzed using univariate analysis and multivariate logistic regression. Mortality was defined as death occurring during hospital admission. A total of 130 patients were enrolled, 124 cases of bacterial arthritis alone, 4 cases of tuberculous arthritis alone, and 2 cases of concurrent bacterial and tuberculous arthritis. No cases of viral, fungal, or parasitic arthritis were identified. The overall in-hospital mortality rate was 12 patients (9.3%). Factors significantly associated with mortality through multivariate logistic regression included chronic kidney disease stage 4–5 ($p=0.002$), oligoarticular or polyarticular involvement ($p=0.015$), hip joint infection ($p=0.03$), and concurrent bloodstream infection ($p=0.012$). While patients who underwent surgical drainage demonstrated a significant association with reduced mortality in the univariate analysis ($p=0.009$), this association was no longer statistically significant after adjustment in the multivariate logistic regression. The findings of this study provide valuable insight into the prognostic factors influencing mortality among patients with septic arthritis. Awareness and early recognition of these risk factors, followed by timely and appropriate treatment, may help reduce mortality rates and improve quality of life in patients affected by this condition.

Introduction

Septic arthritis is a medical emergency characterized by infection within the joint space, most commonly affecting the hip, knee, and ankle joints^{1,2}. The global incidence ranges from 4 to 15 cases per 100,000 person-years, with similar rates reported in the United States, Western Europe, and South Korea³⁻⁶. In Thailand, data from 2018–2020 showed an incidence of 22.6–23.3 cases per 100,000 person-years, highest in the northeastern region and among individuals aged over 70 years (70.2 per 100,000)⁷. Bacterial arthritis, primarily caused by *Staphylococcus aureus*, *Streptococcus spp.*, and *Enterobacteriaceae*, is the most common etiology⁸. In Thailand, *Burkholderia pseudomallei* is more prevalent, particularly in the northeast^{9,10}. Septic arthritis is usually monoarticular (80%), with mortality ranging from 5%–20%, rising to more than 50% in polyarticular cases^{11,12}. Poor prognostic factors include advanced age, comorbidities, such as diabetes, liver or chronic kidney disease, malignancy, prosthetic

joint infection, and polyarticular involvement⁹. Treatment typically involves antibiotics with joint drainage via needle aspiration or surgical debridement; however, evidence on the optimal treatment remains inconclusive¹³⁻¹⁵. Most Thai studies have focused on northeastern populations^{10,14,16-19}, while data from central and other regions is limited. This study aims to investigate mortality and prognostic factors in adult septic arthritis patients in Pranangklao Hospital to inform regional management strategies and guide antibiotic and treatment planning.

Materials and Methods

Study design

A retrospective cohort study conducted on patients diagnosed with septic arthritis who were admitted for inpatient treatment in Pranangklao Hospital between January 1, 2020, and December 31, 2024.

Population

This study included patients aged 15 years and older who were diagnosed with septic arthritis based on medical records. Patients were identified using the International Classification of Diseases (ICD)-10 codes M00 (pyogenic arthritis) or M01 (direct infections of the joint in infectious and parasitic diseases classified elsewhere), recorded as either the principal diagnosis, comorbidity, or complication in inpatient medical records. Diagnostic verification was performed through a comprehensive review of patients' medical records, surgical reports, laboratory data, and both microbiological and histopathological findings. Patients with incomplete, missing medical records, electronic data unavailable or a higher suspicion of alternative diagnoses other than septic arthritis, were excluded from the study.

The demographic data included sex, age, body mass index (BMI), comorbidities, pre-existing joint diseases, and specific details of the septic arthritis, such as the affected joint site, number of joint involvements, and whether the infection occurred in a native or prosthetic joint. Additional data included risk factors for infection, use of immunosuppressive agents or corticosteroids, laboratory results, synovial fluid analysis, identified pathogens, treatment modalities, and clinical outcomes.

Definitions for study eligibility and variables

1. Septic arthritis was defined according to the Newman criteria²⁰ as follows:

A: Isolation of pathogenic organisms from synovial fluid or synovial tissue.

B: Isolation of pathogenic organisms from extra-articular sites, such as blood, sputum, urine, or pus cultures, in the presence of clinical features consistent with septic arthritis.

C: No organism isolated from either synovial fluid or other sites, but with supportive evidence of infection, including:

(i) histological or radiological findings suggestive of joint infection, and/or

(ii) aspiration of turbid synovial fluid.

2. Septic arthritis of bacterial origin was classified as definite or possible/probable. Definite bacterial arthritis was defined by the isolation of bacterial pathogens from cultures or Gram stain obtained from synovial fluid or synovial tissue. Possible/probable bacterial arthritis was defined as cases fulfilling the Newman criteria²⁰ for septic arthritis without microbiological confirmation in synovial fluid or synovial tissue. Given that septic arthritis secondary to bacterial infection is common than other pathogens and associated with substantial morbidity and mortality, cases with negative culture results were classified as septic arthritis of presumed bacterial origin.

3. Mortality was defined as death occurring during hospitalization while the patient was admitted as an inpatient and prior to hospital discharge.

4. Corticosteroid use was defined as a history of receiving prednisolone or an equivalent corticosteroid at a dose of ≥ 5 mg/day for more than 30 consecutive days within the 3 months preceding the onset of septic arthritis.

5. Immunosuppressive therapy was defined as the use of any immunosuppressive agents, including conventional Disease-Modifying Antirheumatic Drugs (DMARDs), biologic DMARDs, targeted DMARDs, or other immunosuppressive agents, within 3 months prior to the onset of septic arthritis.

6. Bloodstream infection was defined as the isolation of any pathogenic organism from blood cultures, including bacteria, viruses, fungi, parasites, or *Mycobacterium spp.*

Sample size

Based on a review of the literature, a study by Andreassen et al.²¹ reported a mortality rate of 9.3% among patients with septic arthritis. The sample size was calculated using an infinite population proportion formula, with a significance level (α) of 0.05, a statistical power of 80%, an expected proportion (p) of 0.093, and a margin of error (d) of 0.05.

$$n = \frac{z_{1-\frac{\alpha}{2}}^2 p(1-p)}{d^2}$$

The required sample size was estimated to be 130 participants.

Statistical analysis

Categorical variables were presented as frequency and percentages, continuous variables were expressed as mean $\pm$ standard deviation (SD) for normal distribution or median with interquartile range (IQR) for nonnormal distribution. Comparisons between inpatient death and survival were performed using the Chi-square test or Fisher's exact test for categorical variables, and the independent t-test or Mann-Whitney U test for continuous variables. A univariate analysis was used to screen for prognostic factors associated with mortality. Variables with a p -value < 0.1 in the univariate analysis were subsequently included in a stepwise multivariate logistic regression. A p -value < 0.05 was considered statistically significant. Statistical analyses were performed using Stata 14.0 (StataCorp, TX, USA).

Results

A total of 130 patients with septic arthritis were included, predominantly female (51.5%) with a median age of 62 years (IQR 48.0–71.0). Most cases were bacterial arthritis alone ($n=124$), followed by tuberculous arthritis alone ($n=4$), and concurrent bacterial and tuberculous infections ($n=2$). In the bacterial arthritis group, two patients were diagnosed with gonococcal arthritis; one male and one female. Neither patient underwent joint aspiration; however, *Neisseria gonorrhoeae* was identified from cervical (female) and urethral (male) swab cultures. Twelve patients (9.3%) died during hospitalization, while 118 (90.7%) survived. Native joint infections accounted for 92.3% and prosthetic joint infections for 7.7%, all of which occurred in the survival group. The knee was the most affected joint (64.5%), followed by the wrist (13.2%), ankle (9.9%), and hip (6.6%). Infection at hip ($p=0.032$) and ankle ($p=0.098$) were more frequent in the death group. Monoarthritis was observed in 83.4% and oligo- or polyarthritis in 16.6% of patients, multiple joint involvement was significantly higher in the death group (50.0% vs. 13.0%, $p=0.004$). No viral, fungal, or parasitic arthritis was detected (Table 1).

Comorbidities

Diabetes mellitus (DM) was the most common comorbidity (30%), followed by hyperlipidemia, cardiovascular disease (CVD), and chronic kidney disease (CKD) stage 4–5. The prevalence of DM ($p=0.042$), hyperlipidemia ($p=0.038$), and CKD stage 4–5 ($p<0.001$) was significantly higher in the death group. Thirty-one patients

(23.8%) had pre-existing joint disease, of whom two were in the death group had systemic lupus erythematosus (SLE) and psoriatic arthritis (PsA), respectively. The duration of fever (median 2.0 days; IQR 2.0-7.0) and joint pain (median 3.5 days; IQR 2.0-7.0) before admission was comparable between groups. Concurrent infections at hospital admission were

identified in 56.1% of patients. Bloodstream infection was the most frequent (21.5%), followed by skin and soft tissue (16.1%) and urinary tract infections (13.1%). Bloodstream infection ($p=0.004$) and urinary tract infection ($p=0.052$) occurred more often in the death group (Table 1).

Table 1 Baseline characteristics of patients with septic arthritis in this study

Characteristics	Total (n=130)	Death (n=12)	Survival (n=118)	p-value
Type of arthritis, n (%)				1.000
Bacterial arteritis alone	124 (95.4)	12 (100.0)	112 (94.9)	
Tuberculous arthritis alone	4 (3.1)	-	4 (3.4)	
Bacterial and tuberculous arthritis	2 (1.5)	-	2 (1.7)	
Native joint, n (%)	120 (92.3)	12 (100.0)	108 (91.5)	0.597
Prosthetic joint, n (%)	10 (7.7)	-	10 (8.5)	1.000
Gender, n (%)				0.367
Female	67 (51.5)	8 (66.7)	59 (50.0)	
Male	63 (48.5)	4 (33.3)	59 (50.0)	
Age (years), median (IQR)	62.0 (48.0 - 71.0)	71.0 (58.5 - 75)	60.5 (47.0 - 70.0)	0.141
Body mass index (BMI) (kg/m ²), median (IQR)	23.0 (20.4 - 26.3)	22.8 (20.4 - 26.0)	23.0 (20.5 - 26.6)	0.875
Joint (native joint) (n=120), n (%)				
Knee	78 (64.5)	7 (58.3)	71 (60.2)	0.753
Ankle	12 (9.9)	3 (25)	9 (7.6)	0.098
Hip	8 (6.6)	3 (25)	5 (4.2)	0.032
Wrist	16 (13.2)	1 (8.3)	15 (12.7)	1.000
Elbow	4 (3.3)	1 (8.3)	3 (2.54)	0.345
Sacroiliac	1 (0.8)	-	1 (0.8)	1.000
Number of joint involvements (n=120)	120 (100.0)	12 (100.0)	108 (100.0)	0.004
Monoarthritis	100 (83.4)	6 (50.0)	94 (87.0)	
Oligoarthritis	19 (15.8)	6 (50.0)	13 (12.0)	
Polyarthritis	1 (0.8)	-	1 (1.0)	
Corticosteroids used, n (%)	4 (3.1)	-	4 (3.4)	1.000
Immunosuppressive agents used, n (%)	6 (4.6)	1 (8.3)	5 (4.2)	0.447
Comorbidities, n (%)				
Diabetes mellitus (DM)	39 (30.0)	7 (58.3)	32 (27.1)	0.042
Hyperlipidemia	37 (28.5)	7 (58.3)	30 (25.4)	0.038
Cardiovascular disease (CVD)	9 (6.9)	2 (16.7)	7 (5.9)	0.195
Chronic kidney disease (CKD) stage 4-5	8 (6.2)	5 (41.7)	3 (2.5)	<0.001
HIV	5 (3.8)	-	5 (4.2)	1.000
Liver cirrhosis	7 (5.4)	-	7 (5.9)	1.000
Malignancies	7 (5.4)	2 (16.7)	5 (4.2)	0.127
Pre-existing joint disease, n (%)	31 (23.8)	2 (16.7)	29 (24.6)	0.730
Rheumatoid arthritis (RA)	3 (2.3)	-	3 (2.5)	1.000
Systemic lupus erythematosus (SLE)	4 (3.1)	1 (8.3)	3 (2.5)	0.324
Psoriatic arthritis (PsA)	2 (1.5)	1 (8.3)	1 (0.8)	0.177
Other	22 (16.9)	-	22 (18.6)	1.000

Table 1 Continued

Characteristics	Total (n=130)	Death (n=12)	Survival (n=118)	p-value
Duration of fever before hospital visit (days), median (IQR)	2.0 (2.0 - 7.0)	2.0 (1.0 - 8.0)	2.5 (2.0 - 7.0)	0.134
Duration of joint pain and swelling before hospital visit (days), median (IQR)	3.5 (2.0 - 7.0)	2.5 (2.0 - 6.5)	4.0 (2.0 - 7.0)	0.264
Concomitant infection at other sites at initial admission, n (%)				
Pneumonia	3 (2.3)	1 (8.3)	2 (1.7)	0.254
Urinary tract infection	17 (13.1)	4 (33.3)	13 (11.0)	0.052
Skin and soft tissue infection	21 (16.1)	4 (33.3)	17 (14.4)	0.104
Infective spondylodiscitis	3 (2.3)	-	3 (2.5)	1.000
Cervicitis	1 (0.8)	-	1 (0.8)	1.000
Bloodstream infection	28 (21.5)	7 (58.3)	21 (17.8)	0.004

IQR: interquartile range

Laboratory and microbiology

In the death group, both white blood cell (WBC) count ($p=0.002$) and serum creatinine level ($p=0.006$) were significantly higher than in the survival group. Joint aspiration or surgical drainage was performed in 126 patients, while four did not undergo aspiration. Among the four patients who did not undergo arthrocentesis, two patients (one male and one female) were diagnosed with gonococcal arthritis based on the identification of *Neisseria gonorrhoeae* from urethral and cervical swab specimens, respectively. Both patients presented with septic arthritis involving the wrist joint. The remaining two patients were diagnosed with septic arthritis of the sacroiliac joint ($n=1$) and the hip joint ($n=1$) based on magnetic resonance imaging (MRI) findings. All four patients were categorized in the survival group. The synovial fluid WBC count tended to be higher in the death group ($p=0.083$). Gram staining identified organisms in 27.8% of cases, including gram-positive bacteria in 15.9% and gram-negative in 11.9%. Synovial fluid cultures were positive in 38.9% of cases, with *Streptococcus agalactiae* (12.7%) and *Staphylococcus aureus* (9.5%) as the predominant pathogens. Among 6 cases of tuberculous arthritis, 1 was

culture-confirmed, and five were diagnosed via polymerase chain reaction (PCR). Blood cultures were positive in 27.7% of patients, most commonly isolating *S. agalactiae* (12.3%) and *S. aureus* (9.2%). No significant differences in microbiological profiles were observed between death and survival groups. Among patients diagnosed with septic arthritis according to the Newman criteria²⁰, 58 patients were classified as category A, 18 as category B, and 54 as category C. Within category A, pathogenic organisms were identified in synovial fluid or synovial tissue. Of these, 49 had bacterial pathogens identified from synovial fluid culture, and one patient had *Mycobacterium tuberculosis* identified by culture. Three patients had organisms detected by Gram stain despite negative synovial fluid cultures. Additionally, five patients were diagnosed with tuberculous arthritis based on positive PCR for *Mycobacterium tuberculosis* from synovial tissue biopsy specimens. Two patients had evidence of both bacterial infection identified by culture and concomitant tuberculous arthritis confirmed by PCR for *Mycobacterium tuberculosis*. However, no statistically significant difference was observed between the survival and death groups (Table 2).

Table 2 Baseline laboratory at admission and microbiology results

Characteristics	Total (n=130)	Death (n=12)	Survival (n=118)	p-value
WBC in serum ($\times 10^3$ cells/uL), median (IQR)	12.0 (8.9 - 16.2)	19.5 (13.8 - 28.1)	11.5 (8.4 - 15.6)	0.002
Serum creatinine (mg/dl), median (IQR)	0.9 (0.6 - 1.3)	1.5 (1.0 - 4.4)	0.9 (0.6 - 1.2)	0.006
Hemoglobin (g/dl), mean (SD)	10.8 (2.3)	10.0 (2.2)	10.9 (2.5)	0.200
ESR (mm/hr) (n=119), median (IQR)	102.0 (85.0 - 117.0)	102.0 (99.0 - 106.5)	101.0 (84.0 - 117.0)	0.624
CRP (mg/dl) (n=117), median (IQR)	147.0 (69.9 - 234.0)	212.9 (148.1 - 298.2)	139.9 (56.7 - 226.0)	0.062
Arthrocentesis, n (%)	126 (96.9)	12 (100)	114 (96.6)	1.000
WBC in synovial fluid ($\times 10^3$ cells/uL) (n=113), median (IQR)	69.6 (34.7 - 131.5)	109.9 (58.8 - 186.9)	67.9 (33.5 - 126.1)	0.083

Table 2 Continued

Characteristics	Total (n=130)	Death (n=12)	Survival (n=118)	p-value
Organisms detected on synovial fluid Gram stain (n=126), n (%)	35 / 126 (27.8)	3 / 12 (25.0)	32 / 114 (28.1)	1.000
Gram-positive bacteria	20 (15.9)	2 (16.7)	18 (15.8)	
Gram-negative bacteria	15 (11.9)	1 (8.3)	14 (12.3)	
Pathogen identified in synovial fluid (n=126), n (%)	49 / 126 (38.9)	5 / 12 (41.6)	44 / 114 (38.7)	1.000
<i>Streptococcus agalactiae</i>	16 (12.7)	1 (8.3)	15 (13.2)	1.000
<i>Staphylococcus aureus</i>	12 (9.5)	2 (16.7)	10 (8.8)	0.320
<i>Klebsiella pneumoniae</i>	2 (1.6)	1 (8.3)	1 (0.9)	0.182
<i>Pseudomonas aeruginosa</i>	2 (1.6)	1 (8.3)	1 (0.9)	0.182
<i>Mycobacterium tuberculosis</i>	1 (0.8)	-	1 (0.9)	1.000
Others	16 (12.7)	-	16 (14.0)	
Pathogen identified in hemoculture, n (%)	36 (27.7)	5 (41.6)	31 (26.3)	0.311
<i>Streptococcus agalactiae</i>	16 (12.3)	1 (8.3)	15 (12.7)	
<i>Staphylococcus aureus</i>	12 (9.2)	4 (33.3)	10 (8.5)	
Others	8 (6.2)	-	6 (5.1)	
Newman criteria, n (%)				0.456
A	58 (44.7)	5 (41.7)	53 (44.9)	
B	18 (13.8)	3 (25.0)	15 (12.7)	
C	54 (41.5)	4 (33.3)	50 (42.4)	

IQR: interquartile range, SD: standard deviation

Treatment and complications

Of 130 patients, 4 patients did not undergo joint aspiration, 38 patients underwent needle aspiration alone, and 88 patients underwent surgical drainage, either by open arthrotomy or arthroscopy, with or without concurrent needle aspiration. Surgical drainage was more common in the survival group (70.3%) than in the death group, where conservative treatment predominated (58.3%; $p=0.055$). Among those who underwent surgery, the procedure was performed earlier in survival group (median 27.0 hours vs.

72.0 hours, $p=0.052$). All 35 patients (39.8%) who underwent surgical drainage within 24 hours survived. Among 126 bacterial arthritis cases, the median intravenous antibiotic duration was longer in the survival group (median 14.0 days; IQR 12.0-17.0) than in the death group (median 11.0 days; IQR 5.5-21.5). Complications such as acute kidney injury ($p<0.001$), septic shock ($p<0.001$), hospital- or ventilator-acquired pneumonia ($p=0.037$), and pressure sores ($p=0.018$) were significantly more frequent in the death group (Table 3).

Table 3 Treatment and complications of patients with septic arthritis in this study

Characteristics	Total (n=130)	Death (n=12)	Survival (n=118)	p-value
Arthrocentesis, n (%)				1.000
None	4 (3.1)	-	4 (3.4)	
Needle aspiration alone	38 (29.2)	7 (58.3)	31 (26.3)	
Open arthrotomy / arthroscopy with or without needle aspiration	88 (67.7)	5 (41.7)	83 (70.3)	
Number of needle aspiration, median (IQR)	1.0 (0.0-1.0)	1.0 (1.0-1.0)	1.0 (0.0-1.0)	0.115
Treatment, n (%)				0.055
Conservative treatment	42 (32.3)	7 (58.3)	35 (29.7)	
Surgical drainage	88 (67.7)	5 (41.7)	83 (70.3)	
Duration from admission to surgical drainage (hours) (n=88), median (IQR)	31.0 (18.0 - 76.0)	72.0 (48.0 - 216.0)	27.0 (18.0 - 72.0)	0.052

Table 3 Continued

Characteristics	Total (n=130)	Death (n=12)	Survival (n=118)	p-value
Surgical drainage within 24 hours after admission (n=88), n (%)	35 (39.8)	-	35 (39.8)	0.152
Duration of intravenous antibiotic therapy (days) (n=126), median (IQR)	14.0 (11.0 - 27.0)	11.0 (5.5 - 21.5)	14.0 (12.0 - 27.0)	0.146
Complications, n (%)				
Acute kidney injury	33 (25.4)	11 (91.7)	22 (17.2)	<0.001
Septic shock	18 (13.9)	11 (91.7)	7 (5.9)	<0.001
Hospital/ventilator acquired pneumonia	9 (6.9)	3 (25.0)	6 (5.1)	0.037
Congestive heart failure	7 (5.4)	2 (16.7)	5 (4.2)	0.127
Pressure sore	7 (5.4)	3 (25.0)	4 (3.4)	0.018
Gastrointestinal bleeding	19 (14.6)	3 (25.0)	16 (13.6)	0.382
Osteomyelitis	9 (6.9)	2 (16.7)	7 (5.9)	0.195

IQR: interquartile range

Prognostic factors associated with the mortality

In the univariate analysis, several factors were found to be significantly associated with in-hospital mortality among patients with septic arthritis. Patients with CKD stage 4-5 had a markedly increased risk of death (HR 9.13, 95% CI: 2.74-30.45), as did those with malignancies (HR 4.08, 95% CI: 0.86-19.25). The presence of pre-existing joint disease, particularly psoriatic arthritis, was also associated with higher mortality (HR 8.83, 95% CI: 1.10-70.93). Patients with oligo- or polyarthritis had an increased risk of death compared with those with monoarthritis (HR 3.39, 95% CI: 1.05-10.93). In terms of joint involvement, infection of the ankle joint (HR 3.51, 95% CI: 0.93-13.25) and hip joint (HR 4.17, 95% CI: 1.08-16.13) were both associated with higher mortality. The presence of concurrent infections at hospital admission, such as urinary tract infection (HR 3.14, 95% CI: 0.91-10.83) and bloodstream infection (HR 3.68, 95% CI: 1.15-11.83), particularly *S. aureus* bacteremia (HR 5.38, 95% CI: 1.51-19.18), was also significantly correlated with mortality. Regarding in-hospital complications, the occurrence of acute kidney injury (HR 25.28, 95% CI: 3.21-198.83), septic shock (HR 59.66, 95% CI: 7.59-469.25),

hospital- or ventilator-acquired pneumonia (HR 4.12, 95% CI: 1.08-15.70), and congestive heart failure (HR 3.82, 95% CI: 0.81-18.02) were associated with increased mortality risk. Elevated serum WBC count (HR 1.04, 95% CI: 1.02-1.05) and serum creatinine level (HR 1.26, 95% CI: 1.08-1.46) at admission were also significant predictors of death. Conversely, receiving surgical drainage (HR 0.16, 95% CI: 0.04-0.63) and a longer duration of intravenous antibiotic therapy (HR 0.87, 95% CI: 0.78-0.96) were identified as protective factors against in-hospital mortality.

When using a multivariate logistic regression, several independent predictors of in-hospital mortality were identified. The presence of CKD stage 4-5 (HR 15.19, 95% CI: 2.76-83.43, $p=0.002$), oligo- or polyarthritis (HR 6.32, 95% CI: 1.42-28.13, $p=0.015$), hip joint infection (HR 15.31, 95% CI: 2.56-91.50, $p=0.003$), and concurrent bloodstream infection (HR 7.95, 95% CI: 1.59-39.85, $p=0.012$) were all significantly associated with increased in-hospital mortality. In contrast, a longer duration of intravenous antibiotic therapy (HR 0.80, 95% CI: 0.71-0.90, $p<0.001$) was found to be significantly associated with decreased mortality (Table 4).

Table 4 Logistic regression analysis of the mortality in septic arthritis patients

Variables	Univariate logistic regression		Multivariable logistic regression	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Age	1.02 (0.98 - 1.05)	0.369		
Diabetes	2.66 (0.80 - 8.70)	0.107		
Chronic kidney disease stage 4-5	9.13 (2.74 - 30.45)	<0.001	15.19 (2.76 - 83.43)	0.002
Malignancies	4.08 (0.86 - 19.25)	0.076		
Pre-existing joint disease	0.66 (0.14 - 3.05)	0.594		
Psoriatic arthritis	8.83 (1.10 - 70.93)	0.040		
Oligoarthritis or polyarthritis	3.39 (1.05 - 10.93)	0.041	6.32 (1.42 - 28.13)	0.015
Knee septic arthritis	0.51 (0.15 - 1.69)	0.272		
Ankle septic arthritis	3.51 (0.93 - 13.25)	0.064		
Hip septic arthritis	4.17 (1.08 - 16.13)	0.039	15.31 (2.56 - 91.50)	0.003

Table 4 Continued

Variables	Univariate logistic regression		Multivariable logistic regression	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Pneumonia	4.51 (0.56 - 36.17)	0.156		
Urinary tract infection	3.14 (0.91 - 10.83)	0.070		
Skin and soft tissue infection	1.59 (0.41 - 6.12)	0.499		
Bloodstream infection	3.68 (1.15 - 11.83)	0.029	7.95 (1.59 - 39.85)	0.012
Staphylococcus aureus bacteraemia	5.38 (1.51 - 19.18)	0.009		
Surgical drainage	0.16 (0.04 - 0.63)	0.009		
Duration of intravenous antibiotic therapy	0.87 (0.78 - 0.96)	0.008	0.80 (0.71 - 0.90)	<0.001
Acute kidney injury	25.28 (3.21 - 198.83)	0.002		
Septic shock	59.66 (7.59 - 469.25)	<0.001		
Hospital/ventilator acquired pneumonia	4.12 (1.08 - 15.70)	0.038		
Congestive heart failure	3.82 (0.81 - 18.02)	0.091		
WBC in serum	1.04 (1.02 - 1.05)	<0.001		
Serum creatinine	1.26 (1.08 - 1.46)	0.002		
WBC in synovial fluid	1.00 (1.00 - 1.00)	0.186		
CRP	1.00 (1.00 - 1.01)	0.129		

HR: hazard ratio, CI: confidence interval

Discussion

In our study, the in-hospital mortality rate in patients with septic arthritis was 9.3%, consistent with previous reports ranging from 7% to 15%^{13,15,21-23}. Most infections involved native joints (92.3%), while prosthetic joint infections (7.7%) occurred more frequently than in other studies (1-2%)^{24,25}. The majority were bacterial arthritis alone (95.4%), with 3.1% tuberculous arthritis alone, and 1.5% concurrent bacterial and tuberculous infections. No viral, fungal, or parasitic cases were identified. The median age was 62 years, align with prior international^{12,22,26-28} and Thai studies^{14,16,18} showing predominance among older adults. Monoarthritis was most common (83.4%), followed by oligoarthritis (15.8%) and polyarthritis (0.8%), consistent with previous findings²⁹. The knee was the most frequently affected joint, followed by the wrist, ankle, and hip.

Streptococcus agalactiae (12.7%) was the predominant pathogen, followed by *Staphylococcus aureus* (9.5%), differing from international studies where *S. aureus* predominates^{8,13,22,28,30} but consistent with Thai data reporting *S. agalactiae* as the leading cause¹⁵⁻¹⁸. Interestingly, *Burkholderia pseudomallei* was not identified in our cohort, contrasting with several studies conducted in northeastern Thailand, where *B. pseudomallei* has been reported as one of the leading causative pathogens of septic arthritis^{10,14,16,18}. However, in this study, among the 126 patients diagnosed with septic arthritis due to bacterial infection, four patients did not undergo arthrocentesis. Among those who underwent arthrocentesis, bacterial pathogens were identified in synovial fluid cultures in only 49 patients, while three additional patients had organisms detected by Gram stain despite negative synovial fluid cultures. We postulated that patients with negative results from both synovial fluid culture and Gram stain were also likely to have septic

arthritis of bacterial origin, given that bacterial infections are more common than other etiologies, are associated with substantial morbidity and mortality, and typically respond to antibiotic therapy. Nevertheless, findings in the mortality group should be interpreted with caution. These patients may have had true bacterial arthritis but failed to respond to antibiotic treatment or developed severe complications. Alternatively, their condition may have been attributable to non-bacterial infections.

Based on clinical data derived from the literature review and the data collected in this study, univariate analysis identified several factors that were significantly associated with mortality. Variables with a *p*-value <0.1 were subsequently included in a multivariate logistic regression analysis, which demonstrated that CKD stage 4-5 (HR 15.19, *p*=0.002), oligo- or polyarthritis (HR 6.32, *p*=0.015), hip joint infection (HR 15.31, *p*=0.003), and concurrent bloodstream infection (HR 7.95, *p*=0.012) as independent prognostic factors associated with the mortality. These findings are consistent with previous studies identifying CKD and bacteremia as major mortality risk factors^{22,26,31}. Hip joint infections, often difficult to drain, were also associated with poorer outcomes. However, a longer duration of antibiotic therapy (HR 0.80, *p*<0.001) was found to be associated with reduced mortality. This finding should be interpreted with caution. After reviewing the medical records, it was revealed that all 12 patients who died were receiving antibiotic therapy at the time of death, but subsequently developed complications that ultimately led to death.

Surgical drainage was associated with improved survival in univariate analysis (HR 0.16, *p*=0.009), but not in multivariate analysis, consistent with prior conflicting evidence on this treatment approach^{13,15}. In our study, earlier surgical drainage—particularly within 24 hours—

was observed only among survival group, suggesting that timely intervention may improve outcomes, especially in hip infections.

Finally, the survival group had longer intravenous antibiotic courses (median 14.0 days) than the death group (median 11.0 days). As previously mentioned, all 12 patients in the death group died while receiving antibiotic therapy and subsequently developed complications that led to death; therefore, these findings should be interpreted with caution. Nevertheless, according to standard treatment guidelines, the recommended duration of antibiotic therapy is 2-6 weeks depending on pathogen, joint involved, and presence of osteomyelitis². These findings reinforce that prolonged intravenous antibiotics and early surgical intervention may improve survival in septic arthritis, particularly among patients with high-risk factors such as CKD, oligo- or polyarticular disease, hip involvement, or concurrent bloodstream infection.

This study possesses several strengths: (1) Broad inclusion criteria: this study enrolled patients with septic arthritis caused by bacteria, *Mycobacterium species*, viruses, fungi, and parasites, providing a wider epidemiological scope than previous studies that often excluded non-bacterial causes. Although only bacterial and tuberculous arthritis were identified. (2) Inclusion of both native and prosthetic joints: patients with infections of both native and prosthetic joints were analyzed, enhancing the generalizability of findings, as prior studies frequently excluded prosthetic joint infections. (3) Regional contribution: conducted in central region of Thailand, this study adds valuable epidemiological data, complementing previous reports mainly from the northeastern region. (4) Comprehensive dataset: the study incorporated detailed demographic, laboratory, microbiological, and treatment data, providing an integrated view of patient outcomes.

However, several limitations should be considered: (1) Single-center retrospective design: limits generalizability and the retrospective nature of this study limit the ability to establish causal relationships between potential risk factors and mortality in septic arthritis. (2) Incomplete medical records: some clinical data were missing or inaccessible due to incomplete documentation or unavailable historical results. (3) Uncaptured confounding variables: factors such as smoking history, prior intra-articular injections, or unrecorded medications were unavailable. (4) Assessment limited to in-hospital mortality: dysfunction or delayed post-discharge mortality were not assessed. (5) Limited microbiological confirmation: only 76 patients had microbiological evidence of infection with bacteria or *Mycobacterium tuberculosis* based on culture, Gram stain, or PCR from synovial fluid, synovial tissue, or other relevant sites, the remaining 54 patients had no identifiable pathogens and were classified as having bacterial arthritis, although alternative infectious etiologies cannot be excluded.

Conclusions

Septic arthritis remains a significant clinical problem associated with mortality. Our study identified several prognostic factors associated with death, including chronic kidney disease stage 4-5, oligo- or polyarthritis, hip joint infection, and concurrent bloodstream infection. Moreover, patients who underwent surgical drainage also demonstrated a trend toward better survival outcomes. Therefore, in patients presenting with these risk factors,

early surgical drainage combined with adequate duration intravenous antibiotic therapy may help reduce mortality from septic arthritis. However, as this study was a retrospective analysis, further studies are needed to establish causal relationships between these factors and mortality in patients with septic arthritis.

Ethical statement

The study was approved by the Institutional Human Research Ethics Committee of Pranangklaao Hospital (EC 50/2568; approval date: 28 August 2025). Informed consent was obtained from all participants or their legal representatives.

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