



The clinical characteristics and other factors affecting the septic arthritis of the ankle

Minh-Hoang Nguyen¹, Manh-Kien Nguyen², Dinh-Duy Pham³, Phu-Suong Nguyen⁴, Bich-Huy Tran-Thi⁵, Ngoc- Le Nguyen⁶, Hoang-Dung Tran⁷, Quang-Tri Le⁸✉

¹Department of Orthopedics, 7A Military Hospital, 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam; Email: bsnguyenminhhoang@yahoo.com.vn; <https://orcid.org/0000-0002-5021-669X>

²Department of Laboratory and Pathology, 7A Military Hospital, 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam, Email: nguyennk506@gmail.com

³Department of Infectious Disease, 7A Military Hospital; 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam

⁴Laboratory and Pathology Department, 7A Military Hospital, 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam; Email: suongnguyenphu@gmail.com

⁵Faculty of Biotechnology, Nguyen-Tat-Thanh University, 298A-300A Nguyen-Tat-Thanh Street, District 04, Hochiminh City, 72820, Vietnam, Email: ttbhuy@ntt.edu.vn;

⁶Department of Laboratory and Pathology, 7A Military Hospital, 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam; Email: nguyennngocle1977@gmail.com

⁷Faculty of Biotechnology, Nguyen-Tat-Thanh University, 298A-300A Nguyen-Tat-Thanh Street, District 04, Hochiminh City, 72820, Vietnam, Email: thdung@ntt.edu.vn; <https://orcid.org/0000-0003-3563-2887>

⁸Department of Orthopedics and Department of High-Tech Diagnostics, 7A Military Hospital; 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam; Email: lqtri@ntt.edu.vn; <https://orcid.org/0000-0002-2777-0828>

✉Corresponding author

Head of Department of Orthopedics, Head of Department of High-Tech Diagnostics, 7A Military Hospital; 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam;

Email: lqtri@ntt.edu.vn / tsbstri@yahoo.com

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General Note

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ABSTRACT

Purpose: The study was aimed at investigating the clinical and subclinical characteristics, causes, and other factors affecting the septic arthritis of the ankle. *Methods:* The study was conducted on 47 inpatients over 16 years old in the 7A Military Hospital from October 2018 to October 2019. The inpatients were clinically examined, tested for blood compositions, blood cultures, and ankle radiographed. *Results:* The average age of the patients was 46.7 years (from 16 to 81 years old). Most patients had a magnetic resonance image and X-ray diagnostics (n = 47). Bacteria were found in 46 patients, most commonly *Staphylococcus aureus* (57.4%), *Streptococcus pyogenes* (17.0%), *Haemophilus influenzae* (6.4%), *Salmonella B* (4.3%), and *Mycobacterium tuberculosis* (12.8%). *Discussion:* Senior age was one of the risk factors. Inflammatory symptoms are typical and easy to diagnose. The majority of patients showed risk factors, which was similar to other author findings, except that prolonged use of corticoids accounted for a higher percentage of patients. The most prevalent cause was staphylococci, and the most common pathways were via blood, which agreed with previous studies. *Conclusion:* Some risk factors had not been mentioned before, such as prolonged corticoid usage. The study showed that the number of septic arthritis patients after local procedures was high. Preventive measures are needed in medical facilities to manage the risk.

Keywords: septic arthritis, ankle, bacteria, clinical characteristics

1. INTRODUCTION

Septic arthritis is a common disease typically occurring in tropical countries, which possess optimal climates for the growth of the causing bacteria. The rate of acute septic arthritis in the USA and Western Europe was estimated at 2-10 cases per 100,000 people per year (Khan et al., 2013). Living in a tropical developing country, the Vietnamese people have a high risk of septic causing diseases, especially arthritis (Boffeli & Thompson, 2013). An infringement of pyogenic bacteria into the synovial vascular space, septic arthritis can be sourced from the bloodstream, as a secondary result of trauma, from bone infections (especially in children), from an open surgery or direct procedures at the joint such as joint corticosteroids injections or joint aspiration (Shirtliff & Mader, 2002).

Recently, the problems of over use joint procedures (joint injections) as well as the implementation of near-joint procedures such as acupuncture, etc. are becoming common. The incidence of septic ankle arthritis due to infections in Vietnam has been increasing rapidly, becoming a topical problem, especially in the field of orthopaedics. The disease, if diagnosed and treated appropriately and promptly, can be cured entirely. However, if treatment is carried out late or inadequately, it can lead to severe consequences for patients such as disabled or even death from septic shock with a fatality rate as high as 11% and disability rate 25-60% (Gupta et al., 2001; Balabaud et al., 2007; Sharff et al., 2013).

At the 7A Military Hospital, the Department of Orthopaedics recorded cases of septic arthritis patients being detected and treated every year. Notably, among these patients were those who had secondary bacterial infections after joint injection or joint aspiration procedures. Through clinical practice, we realized cases that had not been diagnosed or misdiagnosed in other provincial medical facilities, leading to severe symptoms when hospitalized, such as sepsis or even death. The complicated and various blood composition and bacteriological test results sometimes caused difficulties in treatment decisions, especially when there were negative culturing results or the antibiotic tests were not available. Therefore, it is necessary to determine the clinical and bacteriological characteristics of patients with septic ankle arthritis to help predict and improve the diagnosis and treatment quality.

This study was conducted to describe the clinical and subclinical characteristics of and explore the causes and risk factors for septic ankle arthritis on inpatients in the 7A Military Hospital from October 2018 to October 2019.

2. MATERIALS AND METHODS**The subject of the research**

The study was carried out on 47 patients with septic ankle arthritis diagnosed in the Department of Orthopaedics in the 7A Military Hospital from October 2018 to October 2019 with conditions including over 16 years of age, diagnosed with septic ankle arthritis

and having clinical and subclinical symptoms such as fever, swelling, redness, pain, limited activities of the ankle joints, increase white blood cells, and high rate of blood sedimentation. The excluding criteria were other chronic arthritis (not from infection) such as rheumatoid arthritis, gout, or reactive arthritis.

Research design

A prospective, cross-sectional descriptive study was performed on patients diagnosed with septic ankle arthritis. The patients' history was well exploited including 1-2 week before getting sick, infection pathways (wounds, skin cuts, joint injections, aspiration of synovial fluid, or acupuncture), chronic diseases (diabetes, liver, or kidney), alcoholism, chronic arthritis (rheumatoid arthritis, gout, prolonged use of steroids), previous trauma (closed or open), and surgery.

Subclinical tests were also performed, including blood composition, blood sedimentation, biochemistry, and procalcitonin. The tests were conducted at the Department of Laboratory and Pathology, 7A Military Hospital. Radiographs of ankles and ankle drainage were performed at the Department of High-Tech Diagnostics, 7A Military Hospital, Ultrasound of ankles and aspiration of fluid at the Department of Orthopedics. Microbiological tests included blood culture, joint fluid culture, tuberculosis PCR, and cultures (liquid medium, solid medium) were conducted at Faculty of Biotechnology, Nguyen-Tat-Thanh University (Ho Chi Minh City).

Research ethics

The Medicine Scientific Research Ethics Committee of the 7A Military Hospital approved this study (Number: 253/QĐ-HĐYĐ-BV7A, date: 29.09.2018). The patients and relatives were well-informed about their conditions and equal treatment and were asked to take part in the study. The participation was strictly voluntary, verified by signed documents.

3. RESULTS

The characteristics of the research subjects

A total of 47 patients were diagnosed with septic ankle arthritis for one year of studying. Among them, there are 30 males (63.8%) and 17 females (36.2%). The average age of the study group was 46.7 years (from 16 to 81 years old). The majority of patients were over 40 years of age (74.4%), and the highest proportion belonged to the over-70-year-old group (23.4%). Patients over 60 years old accounted for 38.3%. Only 12 patients were under 40 years old, accounting for 25.6%. There were 26 patients with right ankle arthritis and 21 patients with left ankle arthritis.

Occupational characteristics

The patients mostly live in rural areas in the Northern provinces. The proportion of farmer patients occupied the highest portion (59.6%), followed by workers (17.0%), students (12.8%), officials (6.4%), and other occupations (4.2%). The average duration of illness before admission was 26.7 days, the earliest was ten days, and the latest was 53 days.



Figure 1 A case of septic ankle arthritis with diabetes in a 56-year-old man.

The risk factors

The majority of patients, except one, had prior risk factors. The highest percentage belonged to patients that previously had local procedures (34%), followed by prolonging uses of corticoids (19.2%), diabetes (14.9%) (Figure 1), sepsis (14.9%), and others, such as post-surgery (4.3%) (figure 2) and alcoholism (4.3%). There was one patient with skin infection, one with old trauma and one with drug addiction.



Figure 2 A case of post arthroplasty septic arthritis. Left - Outside appearance. Right - X-ray side images.

The clinical symptoms when hospitalized

There were 14.9% of patients not showing fever symptoms when entering the hospital. In the signs at the joints, 100% of patients showed swollness, pain, and movement limitation; 72.3% had joint effusion; 95.7% had joint warming; 83.0% had redness at the joints (Figure 1).

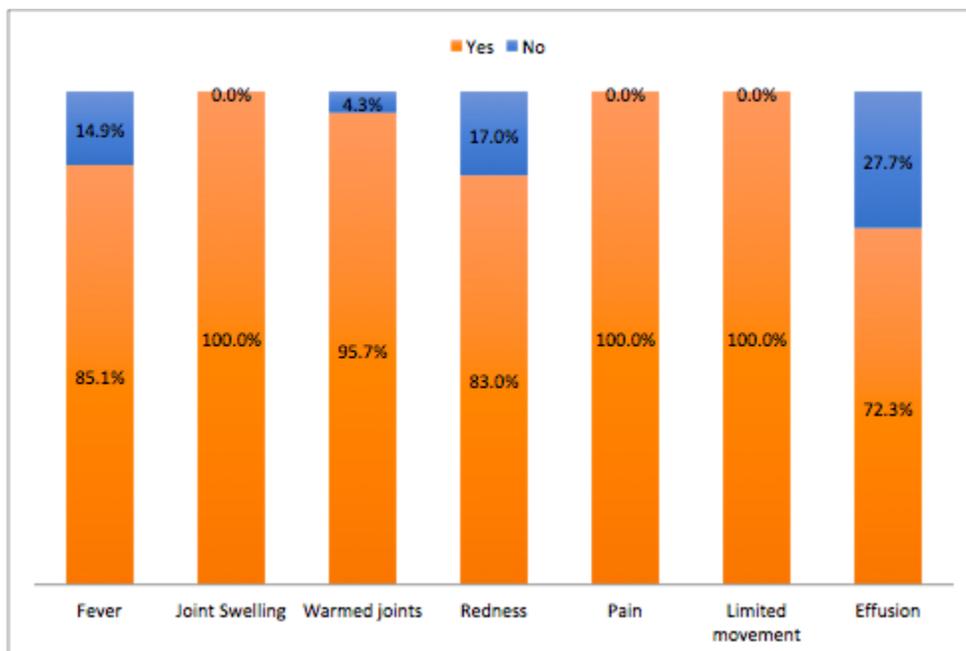


Figure 3 The clinical symptoms when hospitalized

The subclinical symptoms when hospitalized

Testing to evaluate the manifestations of peripheral blood inflammation showed that the average white blood cell (WBC) index was 11.2 ± 5.1 G/l, with 57.4% of patients with WBC increased and 42.6% of patients with normal WBC. However, the sedimentation rate in the first hour, the second hour, and the CRP concentration were much higher than usual. 100% of patients had an increase in the rate of sedimentation, 95.7% had an increase in CRP concentration, and 97.9% had an increase in Procalcitonin (Table 1).

Table 1 The peripheral blood inflammation test (n=47)

Blood test	Average \pm standard deviation	Normal		Increase	
		No. of patients	%	No. of patients	%
White Blood Cell (G/l)	11.2 ± 5.1	20	42.6	27	57.4
Sedimentation rate 1st hour (mm)	88.5 ± 27.2	0	0	47	100
Sedimentation rate 2nd hour (mm)	104.8 ± 22.3	0	0	47	100
C-Reactive Protein (CRP) (mg/dl)	8.4 ± 4.9	2	4.3	45	95.7
Procalcitonin	10.6 ± 2.4	1	2.1	46	97.9

Tests of the ankle fluid showed signs of pus cells on the samples of 27 patients (57.4%). Bacterial cultures were done in 47 patients. Among 46 patients, the most common finding was *Staphylococcus aureus* 57.4%, *Streptococcus pyogenes* 17.0%, *Haemophilus influenzae* 6.4%, and *Salmonella B* 4.3%. *Mycobacterium tuberculosis* was found in 6 patients (12.8%), and one patient had unknown causes. Radiograph of the ankle joints at hospital admission showed lesions on all 47 patient joints; one patient had signs of bone loss, one patient had tissue thickness around the joint, and one patient had bone loss and narrowing of the ankle joint. The ankle joint ultrasound showed to be a highly sensitive method in detecting the ankle effusion, allowing views of fluid in the joint, heterogeneous fluid, thick synovial membrane in 42 patients (accounting for 89.4%).

4. DISCUSSION

The study showed a rather high proportion of patients over 60 years old, accounting for 38.3%. Previous studies also pointed out that senior age was one of the critical risk factors in septic arthritis due to the reduction of blood supply to organs, resistance, and self-healing ability. The body symptoms of the disease were the same as other inflammation. The septic arthritis patients usually had a mild fever, rarely shivering. They might have a high temperature initially and fluctuate when swelling appears, showing clear inflammatory signs such as dry lips, dirty tongue, and foul breath. The elderly or patients using immunosuppressant medication might not have a fever, and patients with joint tuberculosis usually had a mild temperature in the evening (Boffeli & Thompson, 2012). In the case of sepsis, there might be symptoms of primary foci of infection; then, the bacteria spread through the bloodstream to other organs causing high fever with a continuous shiver.

The clinical symptoms showed that all 47 patients had pain and limited ankle joint movement. The patients had severe and continuous pain, especially when moved, causing them the fear of movement and tend to keep the joint immobilized. The presence of intermediates substances dilated, increased vascular permeability resulting in an increase in the amount of fluid in the joint cavity, pinching, and stimulating sensory receptors, causing the pain. Following the synovial membrane, the causative agent, if not localized and eradicated, would quickly spread to articular cartilage. The cartilage is partially destroyed by proteases released by inflammatory cells and by increased intra-joint pressure (Boffeli & Thompson, 2012). If the damage were untreated, the inflammation spread from the synovial membrane to articular cartilage and then to the outside the joints, destroying ligaments and muscle tendons, ingraining into the bones causing osteitis, osteomyelitis, and irreversible loss of joint function. Inflammatory manifestations of the ankles are usually easier to observe and examine, especially when compared to the opposite side. The symptoms are noticeably swollen, skin redness, warm when touched, and the patient is very sore; every movement of the ankles is limited due to pain. The symptoms of primary foci of infection usually appear one to two weeks before manifestations in the ankles such as skin infection, myositis, sepsis, or after the patient is injected into the ankle joint (corticoid), acupuncture, or gout.

In our study, only 2.1% of patients had no risk factors before septic arthritis, while most patients had pre-existing risk factors (97.9%). The result is consistent with various other authors reporting that the majority of patients with arthritis had pre-existing risk factors (Boffeli & Thompson, 2012). Septic ankle arthritis is prevalent in patients with reduced resistance such as patients with

diabetes, prolonged use of corticoids, heavy alcoholism, cirrhosis, gout, had previous joint lesions such as rheumatoid arthritis, and the elderly. In our study, rheumatoid arthritis was seen in 6.4%, and gout was seen in 12.8%. These risk factors could have been the condition that leads to the patient being prescribed joint injection or joint aspiration procedures. However, these procedures, when not ensuring sterilization, could easily result in arthritis infection. The rates of pre-existing risk factors in our study were similar to those of Weston et al. (1982), but the incidence of joint disease was higher. Weston et al. (1999) found that 78% of patients had risk factors, with 35% of patients with arthritis (16% had rheumatoid arthritis, 15% had osteoarthritis and 4% had other arthritis), 10% had prolonged oral corticoids, and 6% of patients with diabetes. Besides, the risk factor for prolonged corticosteroids was found in 19.2% of patients, higher than that of Weston et al. (1999). Physicians need appropriate attention to this risk before prescribing prolonged corticosteroids to patients. Nearly one-third of patients with septic ankle arthritis having long-term corticoids usage were a very high incidence, commonly found in patients with rheumatoid arthritis and gout. Other risk factors included diabetes (14.9%), cirrhosis and alcoholism (4.3%), drug addiction (2.1%), and gout (12.8%). These are conditions that cause the patient's immune response to lower, increasing the risk of arthritis infection. The proportion of this risk group was similar to other authors Weston et al. (1999).

The most common pathways to the ankle joint infection were before local procedures (34.0%), followed by blood sugar (14.9%), skin infections (2.1%), and ankle injury (2.1%) ($p < 0.05$). The result was similar to that of Balabaud et al. (2007). The author pointed out that the most frequent bacterial entry routes had also been after the ankle joint corticoid injection (45.5%), through the blood (35.5%), after open surgery (10%), after acupuncture. (5%), and previously injured (5%). The subclinical test results showed inflammatory signs, as 57.4% of patients had increased WBC, and 42.6% had normal WBC. However, the blood sedimentation rate in the first hour, the second hour, and CRP concentration were much higher than usual. 100% of patients had an increase in blood sedimentation rate, and 95.7% had an increase in CRP. Procalcitonin levels increased in most cases (97.9%).

When testing the ankle joint fluid to determine the cause of the disease, pus cells were found in the joint fluid of 85.1% of patients in our study. The pathogens were *Staphylococcus aureus* (57.4%), *Streptococcus pyogenes* (17.0%), *Haemophilus influenzae* (6.4%), and *Salmonella* (4.3%). *Staphylococcus aureus* is the most common cause of septic arthritis. This type of bacteria is highly virulent for its vigorous ability to attack the organization in the joints and avoid the body resistance to remain inside and causes joint damage (Shirliff & Mader, 2002; Gupta et al., 2001; Mue et al., 2018). Among the causes, *Staphylococcus aureus* is the most common cause because they have proper adhesion to the synovial membrane cells, secreting many enzymes that break down proteins and toxins that damage cells. Weston et al. (1999) reported that 54% of cases of arthritis were caused by *Staphylococcus aureus*, and 18% by *Streptococcus*. Stutz et al. (2000) found that staphylococci were the most common cause of acute septic arthritis (42%), followed by streptococci (15%), pneumococci (6%), and other origins. Some other authors indicated that the most common entry path for bacteria was via blood (Khan et al., 2013). The reason was that the synovial membranes were fed by an excessive vascular system but lacked protective barriers, making it easier for bacteria to enter the synovial membrane when it enters the bloodstream, thereby causing septic arthritis. Joint aspiration or intra-articular corticoid injection are typical procedures used in many joint diseases. Usually, acute septic arthritis of the ankles is very rare after the process, with the rate of 0.0002% of patients. Acute septic arthritis is also a complication of joints, but the incidence is very low, usually less than 0.5%. In the study of Balabaud et al. (2007), 45% of patients were infected with bacteria after surgery, 30% were infected via blood, 17.5% after intra-articular injection or aspiration of joint fluid, and 7.5% following joint wounds.

5. CONCLUSION

Our study shows that some risk factors have not been mentioned previously, such as prolonged use of steroids; nearly one-third of patients with septic ankle arthritis had prolonged corticoid usage. The proportion of patients with septic arthritis after performing joint procedures was high. Failure to comply strictly with aseptic requirements is one of the critical causes of septic ankle arthritis after the procedures. Despite extensive training and technology transfer, many medical facilities and private sector medical institutions are currently providing the joint procedures that do not fully comply with the standard, which needs more controls and management to apply the necessary preventive measures.

Declaration

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article. This study is original and is not published in other scientific journals.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

Contribution

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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