CASE REPORT

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First Reported Case of Prosthetic Joint Infection Caused by an Unusual Bacterium: *Neisseria macacae*

Yeşim Beşli[1], Sinem Öktem-Okullu[2], Yasemin Gündoğdu[3], Orhan Cem Deniz[3], Ayşe Sesin Kocagöz[4]

[1] Department of Microbiology, American Hospital, İstanbul, Türkiye
[2] Department of Medical Microbiology, Acıbadem Mehmet Ali Aydınlar University, School of Medicine, İstanbul, Türkiye
[3] Department of Internal Medicine, Acıbadem Altunizade Hospital, İstanbul, Türkiye
[4] Department of Infectious Diseases and Clinical Microbiology, Acıbadem Altunizade Hospital, İstanbul, Türkiye
* Yeşim Beşli and Sinem Öktem-Okullu contributed equally to this work.

ABSTRACT

Acute non-traumatic joint pain, swelling, and fever require prompt evaluation for a prosthetic joint infection, a serious bacterial complication affecting both large and small joints. *Neisseria gonorrhoeae* and *Staphylococcus aureus* are among the most common causes, typically involving a single joint. To the best of our knowledge, we report the first case of a prosthetic joint infection caused by *Neisseria macacae*, highlighting its relevance for differential diagnosis. Identification was achieved using MALDI-TOF and confirmed with next-generation sequencing. While *N. gonorrhoeae* and *Neisseria meningitidis* are well-recognized pathogens, other *Neisseria* species may cause opportunistic infections, underscoring the importance of comprehensive microbiological evaluation.

Keywords: *Neisseria macacae, Neisseria*, prosthetic joint infection, joint infections

INTRODUCTION

Prosthetic joint infection (PJI) is a serious complication due to its potential for joint destruction, leading to substantial morbidity and mortality. The risk of PJI is higher following knee arthroplasty than hip arthroplasty. Prosthetic joint infections are commonly classified according to time of onset: early (<3 months post-surgery), delayed (3–12 months post-surgery), and late (>12 months post-surgery).

Early-onset PJIs are typically caused by skin flora introduced during the perioperative period, including *Staphylococcus aureus*, aerobic Gram-negative bacilli, beta-hemolytic streptococci, and *Enterococcus* species. Delayed-onset PJIs are frequently associated with organisms such as coagulase-negative staphylococci, *Cutibacterium acnes*, and enterococci. Late-onset PJIs generally arise from hematogenous spread or direct inoculation

Corresponding Author:
Ayşe Sesin Kocagöz

E-mail:
sesin.kocagoz@acibadem.edu.tr

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from adjacent infected tissues. Common pathogens include *S. aureus*, coagulase-negative staphylococci, viridans group streptococci, enterococci, and occasionally Gram-negative bacilli.

In monoarticular presentations, PJIs are most commonly caused by *Neisseria gonorrhoeae* and *S. aureus*, followed by *Streptococcus pneumoniae*, and less frequently by Gram-negative bacilli. Among *Neisseria* species, only *N. gonorrhoeae* and *Neisseria meningitidis* are well-established human pathogens. Other *Neisseria* species, including *Neisseria macacae*, are generally considered commensals of the oropharyngeal flora in humans and non-human primates (1-10).

According to the American Academy of Orthopedic Surgeons (AAOS) and AAOS-endorsed Evidence-Based Clinical Practice Guidelines, established risk factors for PJI after hip or knee arthroplasty include cardiac disease (arrhythmia, coronary artery disease, congestive heart failure, and others), immunocompromised status unrelated to HIV (including transplant and cancer), peripheral vascular disease, inflammatory arthritis, renal disease, liver disease (including hepatitis), tobacco use, malnutrition, and chronic diseases like diabetes (8).

CASE PRESENTATION

A 70-year-old female was admitted as an outpatient to the orthopedics clinic with a painful, warm, and swollen right knee. Her medical history revealed that she had undergone knee replacement surgery 15 months ago due to longstanding osteoarthritis. She had been struck by a ball five months previously, resulting in a cranial cerebrospinal fluid leak requiring minor repair surgery. For her impaired fasting glucose, hypertension, and grade 1 diastolic dysfunction, she was prescribed metformin, losartan/hydrochlorothiazide, and metoprolol. She occasionally took paracetamol for knee pain. She reported no history of alcohol, tobacco, or drug use.

The physical examination was unremarkable except for a unilaterally enlarged right knee joint with signs of inflammation. Radiographic imaging of the right knee showed a well-positioned prosthesis without signs of mechanical failure or loosening. Soft tissue changes were nonspecific, and no overt joint effusion or osteolysis was observed. As fever or other signs of systemic infection were absent, only baseline laboratory tests were performed at admission.

Blood tests revealed mild anemia with elevated acute-phase reactants, while leukocytosis was not noted. A white blood cell count of 8.76 × 10^3/μL (normal 4.06–10.6 × 10^3/μL), a hemoglobin level of 11.3 g/dL (normal 11.9–14.9 g/dL), a C- reactive protein (CRP) level of 1.85 mg/dL (normal < 0.5 mg/dL), and an erythrocyte sedimentation rate (ESR) of 55 mm/h (normal < 30 mm/h) were noted.

A joint fluid aspiration was performed, and the material was sent for microscopic evaluation, cell count with differential, culture, and leukocyte esterase test. The cell counts of the material displayed 12,450 leukocytes/mm^3. Leukocyte esterase, a recently established diagnostic marker for acute bacterial arthritis, tested positive at a high level (+++) in the aspirate. Microscopic examination of the joint fluid revealed 20–30 leukocytes and 40–50 erythrocytes per field, while no microorganism was observed.

After two days of incubation, colonies with a yellowish pigment were observed on a 5% sheep blood agar plate inoculated with the joint fluid sample. The isolated strain was identified as *N. macacae* using matrix-assisted laser desorption ionization-time-of-flight mass spectrometry (MALDI-TOF MS; Bruker, Germany). After bacterial DNA isolation, the sample was sequenced using next-generation sequencing (NGS) on Illumina HiSeq2000/2500 platforms (Illumina, Inc., San Diego, CA, USA). Raw reads were assembled into contigs for annotation using the Basic Local Alignment Search Tool (BLAST) algorithm and the National Center for Biotechnology Information (NCBI) reference database. The bacterial species was identified as *N. macacae* with 100% similarity. All sequence data were deposited in the Science Data Bank.

Since there is no specific recommendation for *N. macacae* in either the Clinical and Laboratory Standards Institute (CLSI) or the European Committee

on Antimicrobial Susceptibility Testing (EUCAST) guidelines, antibiotic susceptibility testing was performed using the Kirby-Bauer disc diffusion method, and results were evaluated according to CLSI breakpoint tables for *N. meningitidis* (11). The isolate was susceptible to ceftriaxone, meropenem, and ciprofloxacin, and she was started on intravenous (IV) ceftriaxone. After her clinical condition had stabilized, she was continued on outpatient therapy with close follow-up.

Our patient was examined for hematogenous infection after starting antibiotic treatment. Gynecological, dental, and cardiological evaluations did not reveal any pathological findings.

The patient has been actively followed by the Department of Orthopedics. They advised removing the instrument via a one-stage exchange procedure. Since she had undergone her initial surgery at a different center, she consulted that center for further evaluation. Among the primary regimens, the patient was treated with a debridement, antibiotics, and implant retention (DAIR) strategy, followed by IV ceftriaxone (2 g/day) for six weeks, and subsequently oral ciprofloxacin (500 mg twice daily) for four months, making the total treatment duration approximately 6–7 months.

Both the PCR and the throat culture were negative. Clinical improvement was achieved, and follow-up laboratory tests were within normal limits. The patient has been monitored jointly with the Department of Orthopedics using the Musculoskeletal Infection Society (MSIS) evidence-based, validated criteria for hip and knee PJI, and no adverse outcomes were observed during a 3-year follow-up (12-13).

DISCUSSION

Neisseria macacae is a rare human pathogen, with only a few documented cases in the literature, including peritonitis, infective endocarditis, and bacteremia in infants. While these reports highlight its potential pathogenicity in diverse clinical settings, our case is, to the best of our knowledge, the first to describe a case of PJI caused by *N. macacae*. This case involves a 70-year-old female patient with a history of knee arthroplasty who presented with localized signs of joint inflammation, including pain, warmth, and edema in the right knee. Laboratory results showed elevated inflammatory markers (CRP and ESR) and a high leukocyte count in synovial fluid, as well as a positive leukocyte esterase test, confirming the diagnosis of PJI. MALDI-TOF mass spectrometry identified the pathogen, which was later confirmed as *N. macacae* using NGS. The isolate was susceptible to ceftriaxone, meropenem, and ciprofloxacin.

The patient underwent a DAIR procedure. She was treated with IV ceftriaxone (2 g/day) for six weeks, followed by oral ciprofloxacin (500 mg twice daily) for four months. Clinical response was favorable, with sustained improvement observed during long-term follow-up. This combined surgical and antimicrobial approach led to the successful management of the infection.

A case of peritonitis in a patient with a peritoneal dialysis catheter has recently been documented in the literature. Ceftriaxone therapy was initiated because the isolate was susceptible according to the first antibiogram; however, clinical improvement occurred only after the catheter was removed (5). In another report, the organism was isolated from a blood culture of a patient with infective endocarditis, who died despite receiving dual ceftriaxone and gentamycin therapy (4). Additionally, it has been detected in the blood culture of a septic five-month-old patient presenting with petechial lesions and fever. The patient was successfully treated with ceftriaxone, achieving clinical recovery (2). Among these three prior cases, only one had an epidemiological link, in which the caregiver of the five-month-old infant was employed at a zoo. Previous antibiotic use, chemotherapy, and mucosal disruption were identified as contributing factors in the colonization of the oral cavity by *Neisseria* species.

In our case, the patient's frequent international travel and recent zoo visit may have facilitated colonization, while her history of trauma with cerebrospinal fluid leakage and subsequent surgical intervention may have contributed to hematogenous seeding. Since prosthetic joints are prone to

hematogenous seeding of microorganisms from distant sites, these factors could explain the development of late-onset PJI due to *N. macacae* (5-14). The total treatment duration was approximately 6–7 months.

Compared with previously reported cases, our patient had several notable risk factors, including zoo exposure, international travel, prior head trauma with cerebrospinal fluid leakage, and surgical intervention—each of which may have facilitated colonization and hematogenous dissemination. Unlike prior reports involving mucosal disruption or immunosuppression, this case illustrates the potential for *N. macacae* to cause late-onset PJI even in the absence of significant immunosuppression. This expands the clinical spectrum of *N. macacae* infections and underscores the importance of recognizing non-human commensal *Neisseria* species as emerging opportunistic pathogens.

CONCLUSION

To our knowledge, this is the first reported case of PJI caused by *N. macacae*. It demonstrates that *N. macacae* can act as an opportunistic pathogen and cause late-onset PJI through hematogenous spread, even in the absence of significant immunosuppression. The patient's successful treatment with a DAIR procedure and prolonged antimicrobial therapy underscores the importance of considering atypical organisms in the differential diagnosis of PJI and performing comprehensive microbiological evaluation when the source of infection is unclear.

Ethical Approval: N.A.

Informed Consent: Informed consent was obtained from the patient.

Peer-review: Externally peer-reviewed

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REFERENCES

1 Nair R, Schweizer ML, Singh N. Septic arthritis and prosthetic joint infections in older adults. Infect Dis Clin North Am. 2017;31(4):715-29. [CrossRef]

2 Yamamoto Y, Terada N, Sugiyama T, Kurai H, Ohkusu K. *Neisseria macacae* bacteremia: report of two cases with a literature review. Emerg Microbes Infect. 2020;9(1):1864-8. [CrossRef]

3 Vecten M, Martel H, Casalta JP, Hubert S, Lepidi H, Habib G, et al. *Neisseria macacae* bacteremia: report of two cases with a literature review. BMC Infect Dis. 2020;20(1):1-4. [CrossRef]

4 Iyama T, Hamada S, Takata T, Hoi S, Fukuda S, Isomoto H. Fatal *Neisseria macacae* infective endocarditis: first report. Infection. 2017;45(3):369-71. [CrossRef]

5 Ai JW, Liu H, Li HX, Ling QX, Ai YQ, Sun SJ, et al. Refractory peritoneal dialysis peritonitis due to *Neisseria macacae*: a case report and review of the literature. Intern Med. 2020;59(18):2287-90. [CrossRef]

6 Hassan AS, Rao A, Manadan AM, Block JA. Peripheral bacterial septic arthritis: review of diagnosis and management. J Clin Rheumatol. 2017;23(8):435-42. [CrossRef]

7 Kaandorp CJ, van Schaardenburg D, Krijnen P, Habbema JD, van de Laar MA. Risk factors for septic arthritis in patients with joint disease: a prospective study. Arthritis Rheum. 1995;38(12):1819-25. [CrossRef]

8 American Academy of Orthopaedic Surgeons. Diagnosis and prevention of periprosthetic joint infections: clinical practice guideline [Internet]. Rosemont (IL): American Academy of Orthopaedic Surgeons (AAOS); Mar 11, 2019. [cited April 15, 2025]. Available from: https://www.aaos.org/globalassets/quality-and-practice-resources/pji/pji-clinical-practice-guideline-final-9-18-19-.pdf

9 Parvizi J, Zmistowski B, Berbari EF, Bauer TW, Springer BD, Della Valle CJ, et al. New definition for periprosthetic joint infection: from the Workgroup of the Musculoskeletal Infection Society. Clin Orthop Relat Res. 2011;469(11):2992-4. [CrossRef]

10 Koh CK, Zeng I, Ravi S, Zhu M, Vince KG, Young SW. Periprosthetic joint infection is the main cause of failure for modern knee arthroplasty: an analysis of 11,134 knees. Clin Orthop Relat Res. 2017;475(9):2194-201. [CrossRef]

11 Clinical and Laboratory Standards Institute (CLSI). Performance standards for antimicrobial susceptibility testing. 28th ed. CLSI supplement M100. Wayne (PA): CLSI; 2018.

12 Parvizi J, Tan TL, Goswami K, Higuera C, Della Valle C, Chen AF, et al. The 2018 definition of periprosthetic hip and knee infection: an evidence-based and validated criteria. J Arthroplasty. 2018;33(5):1309-14.e2. [CrossRef]

13 Osmon DR, Berbari EF, Berendt AR, Lew D, Zimmerli W, Steckelberg JM, et al; Infectious Diseases Society of America. Diagnosis and management of prosthetic joint infection: clinical practice guidelines by the Infectious Diseases Society of America. Clin Infect Dis. 2013;56(1):e1-e25. [CrossRef]

14 Izakovicova P, Borens O, Trampuz A. Periprosthetic joint infection: current concepts and outlook. EFORT Open Rev. 2019;4(7):482-94. [CrossRef]