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J Case Rep Images Orthop Rheum 2025 Jul-Dec;7(2):1–5.
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CASE REPORT PEER REVIEWED | OPEN ACCESS

Delayed hematogenous right knee prosthetic joint infection following a documented case of epididymo-orchitis

Michael Khnanisho, Carly Horne, Jack M Haglin, Saad Tarabichi, Joshua S Bingham

ABSTRACT

Introduction: Total knee arthroplasty (TKA) is a widely performed elective procedure globally. Periprosthetic joint infection (PJI) remains a serious complication following TKA. Hematogenous seeding from distant infections is a recognized mechanism of PJI. However, to our knowledge, there are no published reports of hematogenous PJI originating from acute epididymo-orchitis.

Case Report: A 74-year-old male presented to the emergency department following a ground-level fall on his right knee. He was diagnosed with a knee effusion and discharged for outpatient follow-up. Approximately one week later, the patient presented to his primary care physician with right scrotal swelling and was diagnosed with epididymitis and started on oral antibiotics. The following day, he underwent right knee arthrocentesis which was positive for an acute PJI. The patient then underwent a double debridement, antibiotics and implant retention (DAIR) procedure and was discharged on a six-month course of oral antibiotics. Eight months after the double DAIR, the patient developed right knee swelling and erythema. Right knee aspiration was positive for a persistent PJI, and the patient underwent resection arthroplasty with insertion of an antibiotic spacer.

Conclusion: Hematogenous spread of epididymo-orchitis resulting in PJI is a rare and underreported complication that has not been fully understood in the literature. In this case, several risk factors—such as the presence of a prosthetic joint, recent trauma, and chronic corticosteroid use—may have increased the patient's susceptibility to infection. Close monitoring of inflammatory markers such as C-reactive protein, erythrocyte sedimentation rate, and white blood cell count can aid in the early detection of septic arthritis and contribute to improved patient outcomes.

Keywords: Epididymo-orchitis, Hematogenous spread, Periprosthetic joint infection, Total knee arthroplasty

How to cite this article

Khnanisho M, Horne C, Haglin JM, Tarabichi S, Bingham JS. Delayed hematogenous right knee prosthetic joint infection following a documented case of epididymo-orchitis. J Case Rep Images Orthop Rheum 2025;7(2):1–5.

Article ID: 100031Z14MK2025

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doi: 10.5348/100031Z14MK2025CR

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Received: 17 March 2025
Accepted: 12 July 2025
Published: 31 July 2025

INTRODUCTION

Total knee arthroplasty (TKA) is among the most commonly performed elective procedures worldwide [1], representing a significant portion of annual Medicare spending. Despite its success, approximately 1.41% of patients require revision TKA for periprosthetic joint infection (PJI) [2]. Periprosthetic joint infection is one of the leading causes of implant failure and is associated with substantial morbidity and mortality. The annual cost of managing PJI was projected to exceed $1.62 billion in the United States by 2020 [3].

Diagnosing PJI remains challenging, as no single test demonstrates definitive accuracy [4]. Common reported symptoms of PJI include pain, warmth, erythema, fever, drainage, and wound dehiscence [5]. In cases of severe infection, systemic symptoms secondary to sepsis may also occur [5]. Acute PJI is often attributed to intraoperative contamination, wound healing issues, or postoperative hematoma formation [5], whereas chronic PJI typically involves biofilm-forming organisms adhering to implant surfaces [6].

Current surgical options for the management of PJI include debridement, antibiotic therapy, implant retention (DAIR), one-stage and two-stage exchange arthroplasty [7]. Accurate identification of the causative organism is critical for guiding targeted antimicrobial therapy and improving outcomes. The most common infecting organisms in PJI include *Staphylococcus aureus* (*S. aureus*), *Enterococcus*, and *Staphylococcus epidermidis* [8]. In cases of acute hematogenous PJI, *S. aureus* is the most commonly isolated pathogen [9]. One study found that patients with urinary tract infections had a significantly higher risk of developing PJI than controls (RR = 3.17; 95% CI, 2.19–4.59) [10]. However, there is limited data regarding hematogenous seeding of prosthetic joints from other genitourinary infections.

Epididymo-orchitis is a bacterial infection of the epididymis and the ipsilateral testis and is a known cause of bacteremia [11]. To date, no study has reported a case of PJI secondary to hematogenous seeding from the site of an ongoing epididymal bacterial infection. As such, the purpose of this report is to present this case and explore the relevant literature examining the potential relationship between epididymo-orchitis and PJI.

CASE REPORT

Patient medical history and surgical course

The patient is a 74-year-old male with a history of degenerative joint disease, polymyalgia rheumatica (corticosteroid dependent), hyperlipidemia (HLD), hypertension (HTN), benign prostatic hyperplasia (BPH), and bilateral TKA.

Seven years after his index procedure, the patient sustained a ground-level fall and presented to the emergency department (ED) with right knee pain and swelling. On examination, he had a right knee effusion but remained stable with varus and valgus stress. Radiographs demonstrated a joint effusion without evidence of periprosthetic fracture or other acute abnormality (Figure 1). He was discharged home with crutches and oxycodone for pain management. The following day, he was evaluated by orthopedics and referred for outpatient physical therapy.

Seven days later, the patient presented to his primary care doctor (PCP) for evaluation of right scrotal swelling. A urine culture grew methicillin-resistant *Staphylococcus aureus* (MRSA). Scrotal ultrasound findings were consistent with right-sided epididymitis (Figures 2 and 3), and prostate specific antigen levels were consistent with concurrent prostatitis. He was prescribed ciprofloxacin 500 mg twice a day for one week, with resolution of his scrotal symptoms.

At that time, inflammatory markers were elevated: C-reactive protein (CRP) was 532 mg/L and erythrocyte sedimentation rate (ESR) was 124 mm/h. The next day, he underwent right knee aspiration by orthopedics. Synovial fluid analysis revealed 87,500 total nucleated cells/μL with 95% neutrophils, consistent with acute PJI. Initial surgical management consisted of irrigation and debridement (I&D) with placement of antibiotic beads, with a plan to monitor response and consider staged revision if infection persisted.

The patient underwent right knee I&D with antibiotic bead placement. Tissue cultures from this procedure were obtained and grew MRSA, and he was started on intravenous vancomycin. Repeat scrotal ultrasound again showed findings consistent with epididymo-orchitis. Although both the scrotal infection and PJI were associated with MRSA, the persistent PJI likely reflects biofilm formation on the implant, which impairs antibiotic penetration and eradication. In contrast, the soft tissue scrotal infection was not biofilm associated and responded to oral antibiotics.

Five days later, the patient underwent a second irrigation and debridement with antibiotic bead removal. Intraoperative tissue cultures again grew MRSA. He was discharged home on postoperative day 2 with a 6-week course of intravenous (IV) vancomycin, followed by a planned 6-month course of oral vancomycin and rifampin.

Figure 1: Lateral radiograph of right TKA. Large knee joint effusion present.

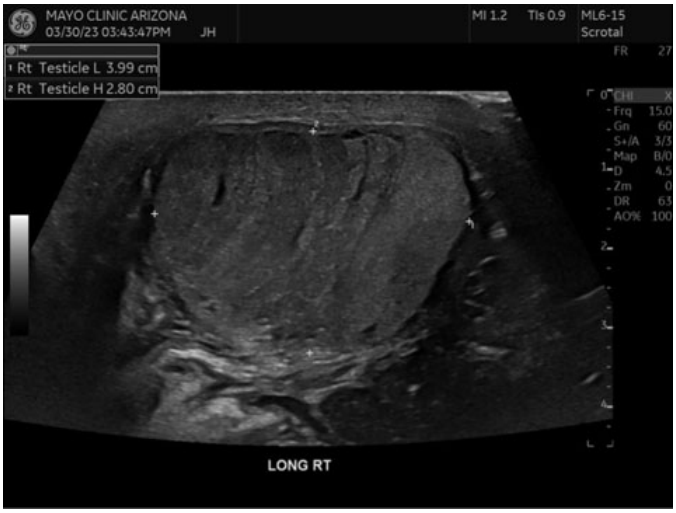

Figure 2: Ultrasound of right testis is heterogenous in appearance.

Figure 3: Ultrasound of right epididymis showing hyperemia and enlargement.

Postoperative and follow-up course

One week after discharge, the patient developed a reaction to intravenous vancomycin and was transitioned to daptomycin per infectious disease recommendations. He was evaluated at 4, 6, and 12 weeks postoperatively, with progressive clinical improvement at each visit. Antibiotics were discontinued after completing the 6-month course, and the patient reported no new knee symptoms at that time. He remained asymptomatic until eight months postoperatively, when he presented to the ED with recurrent swelling and erythema of the right knee. White blood cell count was within normal limits, and his C-reactive protein was mildly elevated. The orthopedic service evaluated the patient, noted low suspicion for infection, and discharged him home.

Two days later, the patient returned to the ED with worsening knee pain and swelling and underwent repeat aspiration of the right knee. He was tachycardic with an elevated lactate, prompting admission for presumed bacteremia and initiation of IV antibiotics. Synovial fluid analysis revealed 12,300 total nucleated cells/μL with 92% neutrophils. Given concern for chronic PJI, the orthopedic team recommended two-stage exchange arthroplasty with removal of the prosthesis and placement of an antibiotic cement spacer. Intraoperative cultures obtained at the time of resection were negative. The patient was discharged on a 6-week course of intravenous daptomycin.

At his most recent follow-up, aspiration of the right knee revealed 682 total nucleated cells/μL with 77% neutrophils. His CRP was 4 mg/L, and ESR was 25 mm/h. Synovasure cultures were negative. Based on these findings, the orthopedic team concluded that laboratory values had normalized, and reimplantation was planned.

DISCUSSION

Patients with PJI after TKA can be treated with multiple different surgical approaches including DAIR, double DAIR, and one or two stage revision. Follow-up at regular intervals and postoperative care are imperative in ensuring that PJI patients undergoing surgical treatment achieve eradication of their infection. As such, it is advisable to continuously monitor white cell count, CRP, ESR, and perform needle aspirations at different time points to monitor PJI patients that have undergone surgical intervention.

There has been one documented case of epididymo-orchitis in a neonate caused by bacteremia [12]. Seeding of the infection in the urinary tract leads us to believe that it is possible for epididymo-orchitis to lead to PJI [12]. While not directly analogous to our case, it does suggest that genitourinary infections can be a source of hematogenous spread. The bacterium isolated from this neonate was *Escherichia coli* and he was treated aggressively with antibiotics. The findings in this case highlight the possibility that localized infection can progress to bacteremia and subsequently disseminate.

In our case, although gram negative organisms such as *E. coli* are the most common cause of epididymo-orchitis, MRSA was isolated from the urine culture and guided subsequent antibiotic selection. The patient was initially prescribed ciprofloxacin but was later transitioned to MRSA-directed therapy once culture results became available. Epididymo-orchitis and PJI occurred in close temporal proximity, and both cultures grew MRSA, which raised concern for possible hematogenous spread. While this supports a potential association, definitive causality cannot be established. Notably, no blood cultures were obtained, which limit our ability to confirm bacteremia or definitively identify the source of joint infection. The trauma to the patient's knee could have exacerbated the infection, though this remains speculative. Although recent trauma may have increased local susceptibility, there were no signs of cellulitis at presentation and no evidence of soft tissue infection on exam or imaging.

Another possible explanation for PJI in our patient could be bacteremia causing hematogenous PJI. In one study, the authors reported on a patient that was diagnosed with *S. pneumoniae* bacteremia causing

epididymitis [13]. This patient presented with pneumonia and bacteremia. After his admission to the hospital, he developed scrotal pain and swelling. Ultrasound of the testes confirmed findings for epididymitis [13]. This case illustrates the possibility that bacteremia may concurrently involve the genitourinary tract and distant sites, such as prosthetic joints.

It is essential to accurately diagnose and appropriately treat PJI, as failure to do so can lead to prolonged hospital stays, poor treatment outcomes, increased disability, reduced quality of life, and a higher risk of mortality [4, 14]. Patients also incur a significant financial burden and substantial utilization of healthcare resources characterize the management of PJI [4, 14]. This is shown by the health-related costs of hip and knee PJI are estimated to be 1.85 billion by 2030, with 735.4 million from total hip arthroplasty PJI and 1.1 billion for TKA PJI [15].

CONCLUSION

Hematogenous spread of epididymo-orchitis resulting in PJI is a rare and underreported complication in the literature. In this case, several risk factors such as the presence of a prosthetic joint, recent trauma, and chronic corticosteroid use may have increased the patient's susceptibility to infection. Close monitoring of inflammatory markers including CRP, ESR, and white blood cell count can aid in the early detection of septic arthritis and improve patient outcomes.

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Acknowledgments

Portions of this manuscript were reviewed using CHATGPT (GPT-4, OpenAI, https://chat.openai.com) to improve grammar and wording. The AI was not used to generate original content, analyze data, or interpret results. The authors have verified the accuracy of all components.

Author Contributions

Michael Khnanisho – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Carly Horne – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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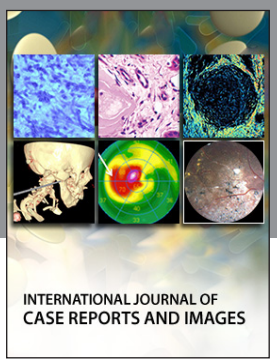
Guarantor of Submission
The corresponding author is the guarantor of submission.

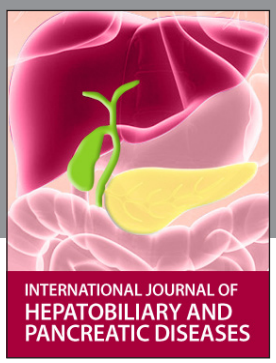
Source of Support
None.

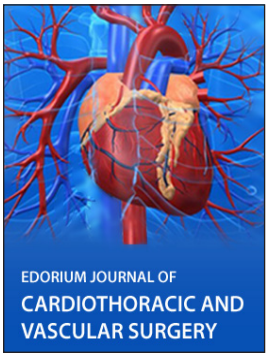
Consent Statement
Written informed consent was obtained from the patient for publication of this article.

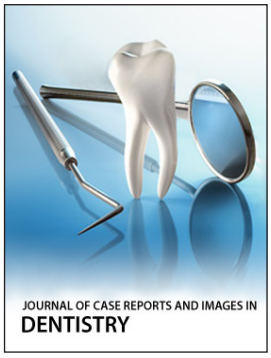
Conflict of Interest
Authors declare no conflict of interest.

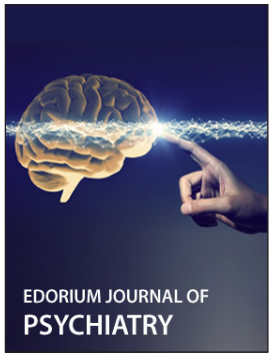
Data Availability
All relevant data are within the paper and its Supporting Information files.

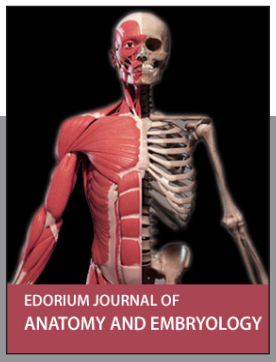


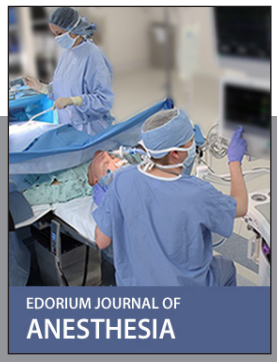












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