

## General

# Pseudogout After Total Knee Arthroplasty Meeting Minor Criteria for Infection Treated by Polyethylene Exchange

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Keywords: pseudogout, minor, criteria, polyethylene, exchange

<https://doi.org/10.52965/001c.67912>

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## Orthopedic Reviews

Vol. 15, 2023

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### Case

Pseudogout in a total joint arthroplasty is rare and can be difficult to distinguish from a prosthetic joint infection (PJI). In this unique case, we present a patient who developed her first episode of pseudogout 17 years after her primary total knee arthroplasty at age 75.

### Conclusion

With similar clinical and laboratory findings, it is important to distinguish the presence of PJI and inflammatory arthropathy. The use of diagnostic tools available, consideration of patient co-morbidities, and timing of symptoms can help guide surgeons' treatment.

## INTRODUCTION

Calcium pyrophosphate deposition disease (CPPD) is an inflammatory arthropathy characterized by the accumulation of calcium pyrophosphate dihydrate crystals into synovial and periarticular connective tissue.<sup>1</sup> The acute manifestation of this condition is referred to as pseudogout due to a clinical presentation similar to that of an acute episode of urate arthropathy known as a gout attack.<sup>2</sup> Larger joints are frequently affected by CPPD with the knees, hips, and shoulders being the most common locations.<sup>2</sup> CPPD has an estimated prevalence of 4% to 7% of the population with a predisposition towards elderly patients.<sup>3,4</sup>

The clinical presentation of periprosthetic crystalline arthropathy, which includes both gout and pseudogout, is similar to PJI with underlying symptoms consisting of erythema, swelling, and pain in the affected joint.<sup>5</sup> While total knee arthroplasty (TKA) has a high survivorship, infection is a devastating complication.<sup>6,7</sup> Based on Medicare data, the infection rate in the first 2 years following TKA is 1.55% with an additional 0.46% in years 2-10.<sup>8</sup> Although the incidence is unknown, there has been minimal reporting of periprosthetic crystalline arthropathy following TKA in the literature.<sup>5,9</sup>

While pseudogout in a joint after arthroplasty is a rare phenomenon, it is difficult to distinguish from infection

and could also present with a concomitant infection.<sup>5,10,11</sup> In this unique case, we present an elderly patient who developed her first episode of pseudogout at 75 years of age, which was 17 years after her primary TKA leading to an isolated polyethylene exchange. The patient provided informed consent for publication of this article.

## CASE HISTORY

A 75-year-old female with a past medical history of atrial fibrillation, hypothyroidism, hyperlipidemia, hypertension, and breast cancer presented to the emergency department (ED) 17 years after her index primary TKA with 24 hours of acute left knee pain, inability to ambulate, and one objective fever with temperature of 101.4° F prior to arrival. The patient was afebrile on arrival to the ED. Initial x-rays demonstrated a well-placed, well-fixed implant in her left knee ([Figure 1](#)). She reported painful weight bearing, pain with active range of motion of the knee, and pain at rest.

On physical examination, she was alert and oriented. Her left knee was warm to touch and had a moderate effusion with erythema globally to the knee. She had pain when examining passive and active range of motion with flexion limited to 80° due to pain. Of note, she had a contralateral TKA, which was performed 5 years prior that was asymptomatic.

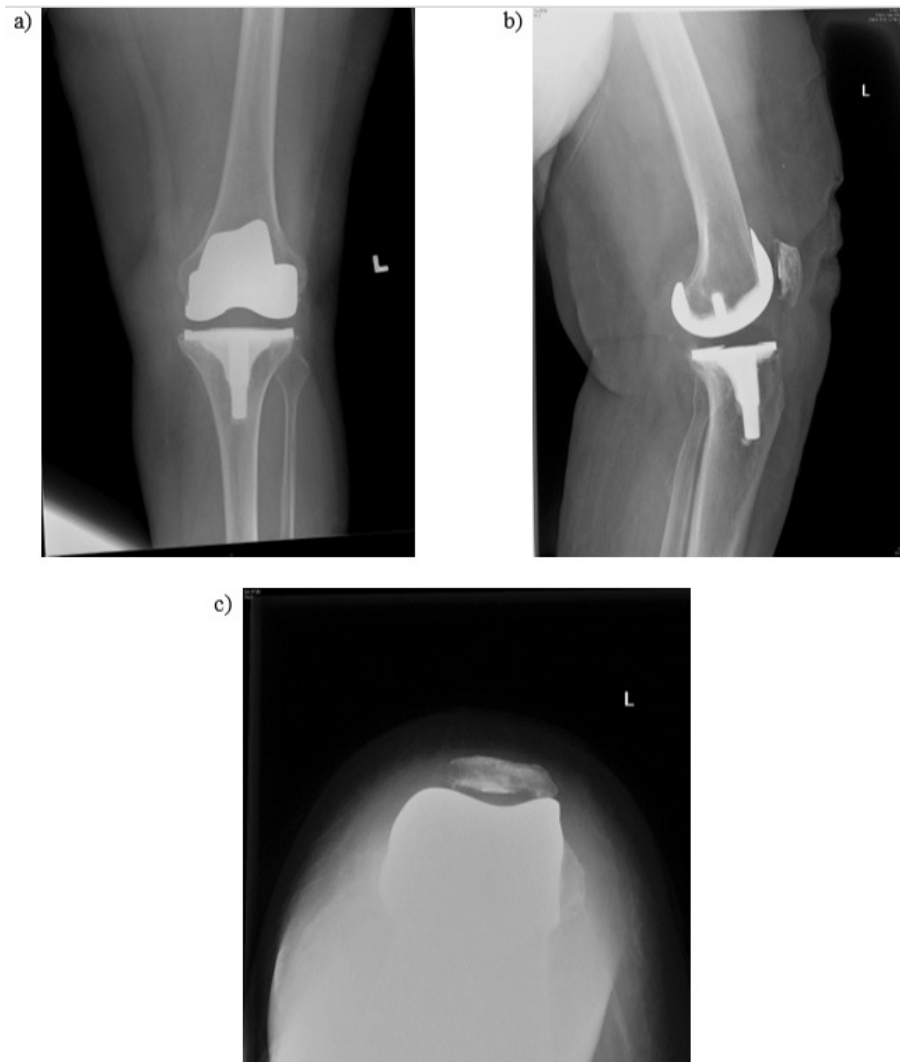
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**Figure 1.** Initial radiographs obtained in the ED include an (a) anterior-posterior (AP), (b) lateral and (c) sunrise view of the left knee.

matic with no evidence of instability and a 0° to 125° range of motion.

The patient's left knee was aspirated obtaining 40 mL of yellow, cloudy fluid. The sample yielded 20,460 cells/uL, of which 94% were neutrophils. The complete cell count and differential is listed in [Table 1](#). Gram stain was negative. A synovial fluid crystal analysis detected the presence of calcium pyrophosphate dihydrate crystals. Initial labs obtained included an erythrocyte sedimentation rate (ESR) of 16, C-reactive protein (CRP) of 142.8, and a WBC count of 13.7. Blood cultures x 2 resulted in no growth at both 24 and 48 hours.

The patient was started on vancomycin and zosyn immediately following aspiration. The synovial fluid analysis demonstrated calcium pyrophosphate crystals, and indomethacin was added to her medication regimen. Although she had a small improvement in her pain over the ensuing 12 hours, she continued to be symptomatic and was unable to bear weight. After a full discussion with the patient regarding the options, it was felt the best course was to proceed with an irrigation and debridement (I&D) and polyethylene exchange as there was concern for a

**Table 1.** Initial joint synovial fluid aspirate cell count and differential.

| Initial joint aspirate |                 |
|------------------------|-----------------|
| Nucleated cell count   | 20,460 cells/uL |
| Red blood cell count   | 880 cells/uL    |
| Neutrophils relative   | 94%             |
| Lymphocytes relative   | 4%              |
| Monocytes relative     | 2%              |

mixed picture of an infection superimposed on a pseudogout attack.

Informed consent with shared decision making was obtained. Prior to skin incision, 2g of intravenous cefazolin was given in addition to vancomycin and zosyn scheduled dosing. The knee was again aspirated and 10 ml of clear yellow fluid were obtained, which resulted in 3,851 cells/uL, of which 71% were neutrophils. The complete differential is included in [Table 2](#). Gram staining and the synovial fluid crystal analysis from this aspirate were negative. Five soft

**Table 2. Intraoperative joint synovial fluid aspirate cell count and differential.**

| Intraoperative joint aspirate |                |
|-------------------------------|----------------|
| Nucleated cell count          | 3,851 cells/uL |
| Neutrophils relative          | 71%            |

tissue samples taken from the synovium and peri-articular tissue demonstrated a range of <5 neutrophils per high power field to 15 neutrophils per high power field.

The implants were well fixed with no signs of wear upon intraoperative inspection. A complete synovectomy and copious irrigation with high pressure lavage was performed, and a povidone-iodine solution was used as a soak for 3 minutes.<sup>12</sup> Following the removal of all contaminated instrumentation from the field, the field was re-draped and new instrumentation was introduced. A new 11 mm polyethylene component was placed without difficulty. The patient was taken through stable and range of motion arc from 0° to 125°. One gram of vancomycin powder was used topically prior to closing and a medium hemovac drain was placed.

All cultures taken including the ED and intra-operatively aspirates were negative and resulted in no growth to date and held for 14 days to detect the presence of microorganisms with prolonged incubation times.<sup>13</sup>

The patient was placed on deep venous prophylaxis and continued intravenous antibiotics for 72 hours, then discharged on doxycycline 100mg PO BID for 30 days per infectious disease recommendations. At the 3-month follow-up period, the patient was pain free, with a range of motion of 0° to 125° degrees in the operative limb.

## DISCUSSION

In 2011, the Musculoskeletal Infection Society (MSIS) convened to establish standard major and minor criteria for defining a PJI. Major criteria for diagnosing a PJI consisted of either two positive cultures isolated from separate specimen sites or the presence of a sinus tract communicating with the prosthesis.<sup>12</sup> To incorporate new diagnostic tests since its conceptualization, a scoring system was developed in 2018 at the International Consensus Meeting (ICM) and minor criteria were updated to include an elevated serum CRP >10mg/L or serum D-dimer >860ng/mL (2 points), an elevated serum ESR >30mm/h (1 point), an elevated synovial WBC >3,000 cells/uL or positive synovial leukocyte esterase (3 points), a positive synovial alpha defensin (3 points), an elevated synovial neutrophil percentage >80% (2 points), and an elevated synovial CRP >6.9mg/L (1 point).<sup>13, 14</sup> Additionally, intraoperative findings were incorporated into scoring and include a positive histology defined as >5 neutrophils per high power field (hpf) in 5 hpf at 400x

magnification (3 points), purulence of the affected joint (3 points), and a single positive culture (2 points). After aggregating preoperative scores from minor criteria, a score of ≥6 indicates infection while a score between 2 to 5 is inconclusive.<sup>15</sup> When the intraoperative and minor criteria values are combined, a score ≥6 indicates the presence of an infection while a score of 4 or 5 is inconclusive.<sup>13</sup> The updated 2018 ICM criteria resulted in a higher specificity than the original 2011 MSIS criteria, 97.7% vs. 79.3%, respectively.<sup>15</sup> In our case, the patient did not meet either of the major criteria. However, the patient had a preoperative score of 8, which indicated an infection according to the minor criteria. Furthermore, the patient had a combined minor and intraoperative score of 10, which was again consistent with infection.

A two-stage revision has been regarded as standard of care for a chronically infected TKA.<sup>16,17</sup> A systematic review by Pangaud et al. demonstrated the eradication rate of a knee PJI ranged from 54% to 100% with an average of 84.8% in the 1,086 patients examined.<sup>18</sup> Complications from a two-stage revision do, however, include degradation of bone stock, soft tissue defects resulting in the need for a constrained prosthesis, and periprosthetic fractures.<sup>19,20</sup>

While two-stage reimplantation procedures are the standard of care for chronic deep PJIs, irrigation and debridement with polyethylene exchange (IDPE) can also be considered as an acute alternative treatment before the development of a biofilm.<sup>21</sup> Potential advantages for IDPE include fewer surgeries, a reduction in potential intraoperative complications, and less direct costs.<sup>19</sup> In a study investigating the use of debridement, antibiotics, and implant retention (DAIR), Ottesen et al. determined DAIR to be viable and safe treatment option for PJI such that 90% of patients who underwent DAIR within 90 days of primary TKA surgery were infection free at a minimum 2-year follow-up.<sup>22</sup> Furthermore, Duque et al. reported I&D with a liner exchange to be suitable option for a PJI such that 85.25% of patients without a methicillin-resistant *Staphylococcus aureus* (MRSA) or *Pseudomonas aeruginosa* infection had successful eradication.<sup>23</sup> Additionally, Brimmo et al. examined the four-year survivorship of a two-stage revision TKA, reporting that patients treated with a prior I&D did not have an increased risk of failure compared to those without a prior I&D.<sup>24</sup> Our patient had a negative gram stain and no growth at 18 hours of an organism such that we felt the odds were favorable for an IDPE. Moreover, with Carson et al. documenting the sensitivity and specificity of MRSA growth on agar at 24 hours being 98.3% and 98.2%, respectively, we felt IDPE was a more favorable option for our patient as no growth was found in this time interval.<sup>25</sup> There is a balance in achieving an expeditious IDPE and also allowing ample time for cultures to finalize, which must take into account all patient factors to determine the best timing of treatment.

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