

## *Salmonella* prosthetic joint septic arthritis

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We describe a case of *Salmonella enteritidis* infection of a prosthetic knee joint that was cured with ceftriaxone therapy for 6 weeks and replacement of the tibial component of the prosthesis. Eleven other cases of salmonella prosthetic joint infection have been reported in the English-language literature. Five infections occurred within 20 days of prosthesis placement, and seven occurred several months to years later; ten of 12 infections involved hip prostheses. Nine of 12 patients who had prosthesis removal were cured of the infection. Two of the three patients with retention of the prosthesis required long-term suppressive antibiotic therapy.

**Keywords** Septic arthritis, prosthetic knee infection, *Salmonella*

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Septic arthritis is a rare consequence of salmonella bacteremia, usually occurring in patients with underlying medical conditions, such as sickle cell disease and systemic lupus erythematosus (SLE) [1]. Less commonly, *Salmonella* species have been reported to cause prosthetic joint infections [2–9]. We report a case of *Salmonella enteritidis* infection of a prosthetic knee joint. The infection was cured with antibiotic therapy and partial replacement of the prosthesis.

### CASE REPORT

A 55-year-old-man presented with a 2-day history of fever and right knee pain. The patient had a right total knee arthroplasty performed 12 days prior to the onset of his symptoms. His past medical history was significant for type II diabetes mellitus, hypertension, and osteoarthritis.

On admission, his temperature was 39.7°C, blood pressure 116/60 mmHg, and pulse 120 beats/min. The right knee was swollen, tender, and warm, and had decreased range of motion. The incision site was healed without evidence of purulent drainage. Laboratory studies revealed: white blood cell (WBC) count  $18.1 \times 10^9/L$ , with

74% neutrophils, hemoglobin 122 g/L, and Westergren erythrocyte sedimentation rate (WESR) 106 mm/h. Aspiration of the right knee joint yielded 10 mL of bloody fluid containing  $0.67 \times 10^{12}$  red blood cells (RBC)/L and  $27.9 \times 10^9$  WBC/L, with 94% neutrophils. Gram stain did not reveal any microorganisms. Empirical therapy with intravenous cefazolin was initiated.

On the fifth hospital day, the knee joint was again aspirated. The fluid showed  $118 \times 10^9$  WBC/L, with 95% neutrophils, and  $0.42 \times 10^{12}$  RBC/L. The glucose level was 0.17 mmol/L (3 mg/dL). On that day, the initial culture of the joint fluid was reported to be growing *S. enteritidis*, resistant only to ampicillin. Cefazolin was changed to ceftriaxone, 2g daily, and the knee was surgically explored. No grossly purulent material was found, and all the installed components of the knee were intact. The tibial polyethylene component was removed. The joint was irrigated with saline with added gentamicin, a complete synovectomy was performed, and a new polyethylene tibial component was inserted. Synovial tissue yielded *S. enteritidis*.

Postoperatively, there was minimal drainage and swelling. By the seventh hospital day, the

patient was afebrile, the WBC count had fallen to  $9.9 \times 10^9/L$ , and the WESR had fallen to 84 mm/h. Multiple cultures of blood, urine, and stool did not reveal *S. enteritidis*. Ultrasound of the abdomen showed no cholelithiasis or other abnormalities of the gall-bladder or liver. The patient received a total of 6 weeks of ceftriaxone therapy; the WESR returned to normal, and clinical improvement continued. No oral suppressive antibiotics were used. Follow-up over the ensuing 6 years showed no recurrence of infection; the knee had only 80° of flexion, but full extension was attained.

## DISCUSSION

Septic arthritis is a rare consequence of salmonella bacteremia, noted in <1% of cases in several large reviews of salmonellosis [10]. Similarly, reviews of Gram-negative bacillary arthritis rarely mention *Salmonella* as a cause of septic arthritis [11], and it is even more uncommon as a cause of prosthetic joint infection [2–9]. In developing countries, septic arthritis due to *Salmonella* is encountered more frequently and is mostly an infection of young children [12].

Including the present case, only 12 patients with prosthetic joint infections due to *Salmonella* have been reported in the English-language literature [2–9] (Table 1). Ten of the 12 cases involved infected hip prostheses; only one infected prosthetic knee was reported prior to the present case [9]. Patients with native joint infections with *Salmonella* often have underlying problems with malnutrition [12], sickle cell disease [13], collagen vascular diseases [1,14], or other immunosuppressive diseases [4,15]. However, only one patient with prosthetic joint infection due to *Salmonella* had sickle cell trait [8], and none had SLE. Most of the patients had no underlying illnesses, except for osteoarthritis or prior trauma to the joint, which prompted the placement of the prosthesis.

The usual pathogenesis of salmonella septic arthritis is thought to be hematogenous, spread from the gastrointestinal tract, rather than direct inoculation into the joint. We assumed that our patient had acute salmonella gastroenteritis with bacteremia, which seeded the newly placed knee prosthesis. He later remembered having eaten some pork that tasted 'bad' and developing diarrhea a few days prior to admission; whether this was related to his subsequent infection is not clear. Only four of the 11 previously reported patients

with prosthetic joint infection had an episode of diarrhea prior to the onset of arthritis [2,5,6]. Five patients, including the present case, had onset of septic arthritis in the immediate postoperative period [5,6].

The symptoms and signs of prosthetic joint infection due to *Salmonella* did not differ from those of infections due to other Gram-negative bacilli. Systemic symptoms of fever, chills and malaise were common. The most prominent symptom was joint pain; erythema, swelling, and warmth were present to a variable degree. Drainage and fistula formation were seen only in those patients in whom long-term antibiotic therapy was given without removal of the prosthesis [5,6].

Joint fluid findings have been noted infrequently. When described, joint fluid was either cloudy or purulent [3,6,8,9]. WBC counts and Gram stain findings have not been reported among those with prosthetic joint infection. Our patient had non-purulent fluid aspirated initially, although a subsequent aspirate was purulent; no organisms were visible on Gram stain.

Treatment of prosthetic joint infections often requires removal of the prosthetic components [16–18]. Our prior experience in an elderly population with infected prostheses showed a dismal outcome unless the prosthesis was removed [16]. However, others have reported eradication of infection with prosthesis retention, especially in the setting of early prosthetic joint infection, when prompt surgical debridement and appropriate antibiotic therapy were given [17,18]. Overall, nine of 12 patients with salmonella prosthetic joint infection required prosthesis removal. Our patient had a successful outcome with removal and immediate replacement of one component of the joint, even though the site still yielded *Salmonella*.

Antibiotic choices for salmonella arthritis include ampicillin, chloramphenicol, trimethoprim-sulfamethoxazole, third-generation cephalosporins, and ciprofloxacin. Given the increasing rate of resistance among *Salmonella* strains, therapy should be guided by in vitro susceptibility studies. A cogent argument can be made for the use of a fluoroquinolone as the preferred agent for treatment of prosthetic joint salmonella infection, given the ability of this class of drugs to kill not only rapidly growing bacteria, but also those bacteria that are in a stationary phase and adherent to the prosthetic material [7].

**Table 1** Prosthetic joint infections due to *Salmonella*: review of the English-language literature

Ref.	Age/Sex	Underlying conditions	Joint/postoperative time	<i>Salmonella</i> species	Therapy	Outcome
[2]	42/F	Post-traumatic osteonecrosis	Hip/3.5 year	<i>newport</i>	Chloro, Amp, TCN 2 year; prosthesis removal	Cured
[3]	67/F	Osteoarthritis	Hip/9 month	<i>typhimurium</i>	Amp; prosthesis removal	Cured
[4]	40/M	Osteoarthritis	Hip/1 year	<i>typhimurium</i>	Amp; prosthesis removal	Cured
[5]	70/M	Osteoarthritis	Hip/20 days	<i>dublin</i>	Cephalexin, TMP/SMX; prosthesis retained	Recurred with sinus tract on chronic TMP/SMX Cured
[6]	69/M	Osteoarthritis; appendectomy 6 months before hip	Hip/4 days	<i>typhimurium</i>	Gentamicin; prosthesis removal	Cured
[6]	71/M	Traumatic fracture	Hip/3 days	<i>typhimurium</i>	Cephalothin, gentamicin TMP/SMX; prosthesis removal	Cured
[6]	24/F	Familial Mediterranean Fever	Hip/6 days	<i>typhimurium</i>	TMP/SMX; prosthesis retained	Cured
[6]	43/M	Ankylosing spondylitis, prior salmonella gastroenteritis	Hip/4 years	<i>muenchen</i>	TMP/SMX; prosthesis removal	Cured
[7]	42/M	Renal transplant recipient, avascular necrosis	Hip/8 years	<i>dublin</i>	Amox, TMP/SMX; prosthesis removal and replacement	Recurred, resolution following Cipro for 1 year Cured
[8]	51/M	Diabetes mellitus, HIV, sickle cell trait, post-traumatic osteonecrosis	Hip/9 years	<i>hirschfeldii</i>	Chloro, Amp, TMP/SMX, Oflox 2.5 years; prosthesis removal and replacement	Cured
[9]	67/F	Rheumatoid arthritis	Knee/5 years	<i>typhimurium</i>	Chloro, Amox, gentamicin; prosthesis retained	Cured, chronic Amox
PR	55/M	Diabetes mellitus, osteoarthritis	Knee/12 days	<i>enteritidis</i>	Ceftriaxone 6 weeks; replacement of tibial component	Cured

Chloro, chloramphenicol; Amp, ampicillin; TCN, tetracycline; TMP/SMX, trimethoprim-sulfamethoxazole; Amox, amoxicillin; Cipro, ciprofloxacin; Oflox, ofloxacin; PR, present report.

Septic arthritis in native joints due to *Salmonella* appears to have a good prognosis. Recovery of articular function is superior to that following infection with staphylococci and most other Gram-negative organisms [1,4]. Our case emphasizes the potential to cure salmonella prosthetic joint infection by utilizing prompt debridement, early component replacement, and appropriate antibiotics.

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