

A Rare Presumed Hematogenous Campylobacter Osteomyelitis of the Foot Treated with a Novel Biologic Tendon Interposition and Functional Proprioceptive Reconstruction Following Hallux Interphalangeal Joint and First Metatarsophalangeal Joint Excision.

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Introduction

Campylobacter species are among the most frequent bacterial causes of gastroenteritis worldwide, typically transmitted through contaminated food or water. Although the gastrointestinal illness is usually self-limited, extraintestinal infection is uncommon and generally occurs in individuals with underlying medical conditions or transient bacteremia following enteric infection (1,2). Osteomyelitis due to Campylobacter is especially rare, with only a small number of cases reported in the literature, most involving the spine or large joints (3–6). Peripheral skeletal involvement is exceedingly unusual. Published cases of Campylobacter-associated osteomyelitis are scarce and usually involve either vertebral osteomyelitis due to Campylobacter jejuni in immunocompetent adults, long-bone osteomyelitis in the immunocompromised, or prosthesis-associated infection. A recent case in 2023 describes an immunocompetent adult with epidural abscess (3). In 2024, a literature review was conducted summarizing six Campylobacter jejuni vertebral cases (4). Cervical vertebral osteomyelitis was also described in 2021, which parallels our case as both had negative bone and blood cultures but positive stool PCR (5). Beyond C. jejuni, Campylobacter fetus has repeatedly caused vertebral osteomyelitis or spondylodiscitis (6, 7). Long-bone disease is exemplified by two-sided femoral osteomyelitis in acquired hypogammaglobulinemia (8). Prosthesis-associated osteomyelitis has been reported in a hip arthroplasty with AIDS (9). Pediatric involvement is rare but includes a probable C. jejuni osteomyelitis in a 14-month-old child (10). Collectively, the literature suggests vertebral predilection, hematogenous seeding after enteritis, frequent culture negativity, and host factors such as immunosuppression or prosthesis as recurrent themes. Accurate microbiologic identification of Campylobacter remains challenging because of its fastidious growth requirements. The organism thrives only under microaerophilic conditions and typically requires selective enrichment media and a narrow range of temperature and oxygen concentration for successful isolation. Even under optimal circumstances, recovery from non-enteric specimens is difficult, and culture sensitivity decreases further following prior antibiotic exposure or in mixed-flora samples (11–13). As a result, false-negative cultures are not uncommon, and the true frequency of invasive Campylobacter infections may be underestimated. Molecular techniques such as polymerase chain reaction (PCR) and 16S ribosomal RNA sequencing have improved diagnostic yield but are not universally available in clinical practice (14). Recent advances in limb reconstruction and amputation science have demonstrated that reestablishing physiologic tension between agonist and antagonist muscle groups can restore more natural proprioceptive feedback and improve functional motor control. The agonist–antagonist myoneural interface (AMI) model, pioneered in amputee studies, has shown that surgically coupling opposing muscle groups allows reciprocal lengthening and contraction patterns that reactivate afferent signaling from muscle spindles and Golgi tendon organs, improving limb position sense and reducing reliance on visual cues for movement (15–19). Translating this principle to joint-preserving surgery, biologic tendon interposition constructs can similarly maintain dynamic tension across a joint, acting not only as a soft-tissue spacer but also as a potential proprioceptive bridge that preserves the physiologic communication between flexor and extensor mechanisms. This concept informed the reconstructive approach described in the present case, in which interposed tendon tissue was used to create a biologic spacer and functional coupling after debridement of infected and degenerated articular structures.

Case Report

We present the case of a 55-year-old male patient with past medical history of tobacco use, liver steatosis, COPD, Nephrolithiasis, Lyme Disease, and in 2008 had Ehrlichiosis with Rocky Mountain spotted fever (RMSF) with Spotted Fever Rickettsioses (SFR). The patient presented to the clinic in August 2025 with his right great toe edematous, erythematous, and exquisitely tender, especially the hallux interphalangeal joint. The patient had been referred to us and to a local rheumatologist for evaluation. The patient reported that beginning about three months prior he first noticed the redness, swelling, and pain which had waxed and waned ever since and was presently in a flare. The patient explained that his right foot symptoms began around the time that he was hospitalized for Campylobacter infection in April 2025 which he contracted after eating an undercooked hamburger patty at a local fast-food restaurant. Campylobacter infection was initially detected from a stool sample with Enzyme Immunoassay (EIA) and confirmed with a culture.

Examination of the patient’s right foot revealed palpable pulses, intact gross and protective sensation, elevated temperature of the skin on the dorsum of the foot and hallux, with edema, erythema, induration of the right hallux extending from the interphalangeal joint into the dorsal medial forefoot.

We ordered lab work including complete blood count (CBC), basic metabolic panel (BMP), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and Uric Acid, all of which were unremarkable. Radiographs of the right foot demonstrated non-specific subcutaneous edema, degenerative joint disease, and diffuse osteopenia but were otherwise unremarkable. After a lengthy discussion of the risks and benefits, consent was obtained for joint aspiration. Using aseptic technique, an 18-gauge needle on a 5cc syringe was used to perform the aspiration of the right hallux interphalangeal joint which revealed chalky-white, gritty, crystals and blood-tinged synovial fluid. The syringe was replaced with the needle still in place intraarticularly and 0.5cc of Dexamethasone (10mg/mL) was then injected. The patient tolerated the procedure well with no complications.

The patient was issued a prescription for ten days of Doxycycline 100mg BID because the presentation of his symptoms was atypical and suggested possible infection. We advised the patient to follow up with his primary care provider for long-term management of gout, and he was prescribed Colchicine. The patient’s primary care provider had also consulted rheumatology and we recommended that he keep that appointment to seek their expertise. The rheumatologist performed an extensive laboratory evaluation including ceruloplasmin, alpha-1 antitrypsin, hepatitis B surface antibody (HBsAb), hepatitis B surface antigen (HBsAg), hepatitis A total antibody and IgM, hepatitis C virus antibody (anti-HCV), anti-smooth muscle (actin) antibody, anti-mitochondrial M2 antibody, anti-liver kidney microsomal (anti-LKM) antibody, antinuclear antibody (ANA) by indirect immunofluorescence assay (IFA) with reflex testing, creatine kinase (CK), and a comprehensive autoimmune and rheumatologic biomarker panel including lupus, rheumatoid arthritis, Sjögren’s syndrome, mixed connective tissue disease, antiphospholipid antibody syndrome, systemic sclerosis, myositis, and thyroid autoantibodies, as well as antineutrophil cytoplasmic antibodies (ANCA) by IFA and HLA-B27 typing. All results were within normal limits or negative.

A month after our initial encounter with the patient, we were contacted by their rheumatologist who informed us that the patient had initially improved for three weeks but over the past week had developed recurrence of the edema and pain in his right great toe with new onset body aches, malaise, fatigue, chills, night sweats, right ankle and knee pain, and ascending erythematous streaking extending from the hallux interphalangeal joint up the lower leg. We then contacted the patient and advised him to come to the Emergency Department for evaluation. Hospital Admission

The patient was seen in the Emergency Department and presented with a heart rate of 101 BPM, blood pressure of 152/92 mmHg, and afebrile. Labs obtained demonstrated leukocytosis and neutrophilia. Radiographs obtained of the right foot were again unremarkable. The patient was admitted for sepsis and septic arthritis and started on IV Vancomycin and Cefepime. Blood cultures were obtained at time of admission.

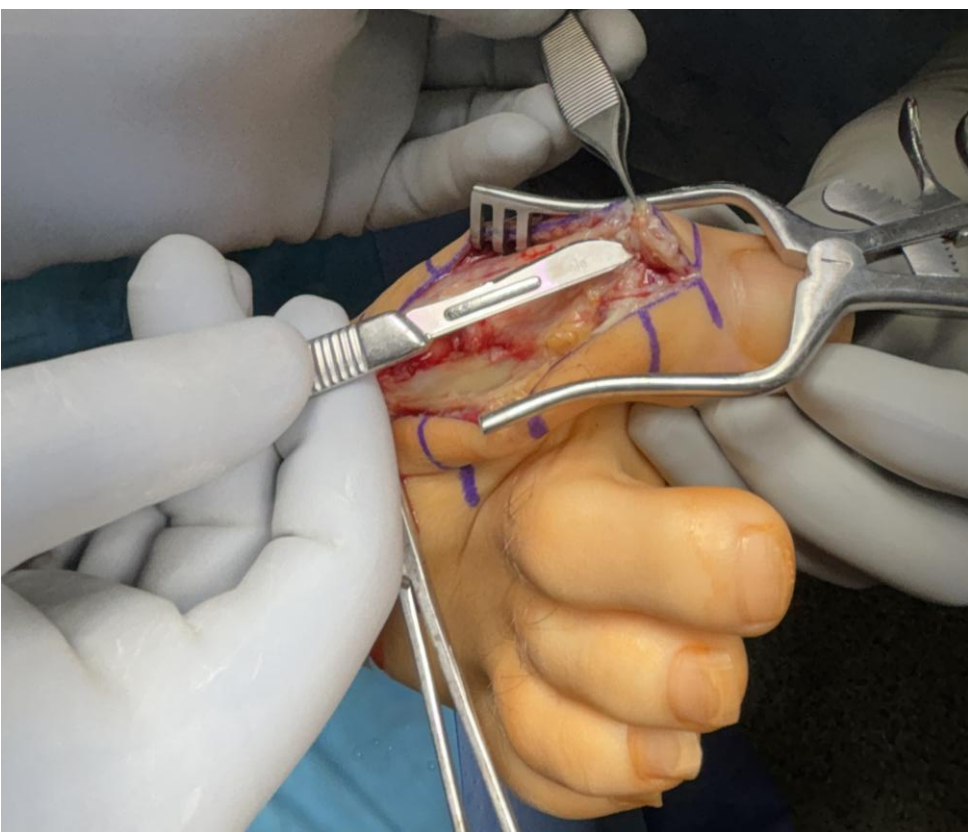
An MRI was obtained of the right foot which demonstrated small effusions of the first metatarsophalangeal head with underlying bone marrow edema and enhancement. Low T1 signal along the medial cortex and subcortical marrow. Additionally, MRI showed erosions on the plantar aspect of the head of hallux proximal phalanx with bone marrow edema and enhancement. MRI findings were suggestive of osteomyelitis.

After a lengthy discussion of the risks and benefits, consent was obtained for right hallux interphalangeal joint and metatarsophalangeal joint aspiration. Using aseptic technique, an 18-gauge needle on a 20cc syringe was used to perform the aspirations which demonstrated blood-tinged serous fluid negative for purulence and crystals. The patient tolerated the procedure well with no complications. The fluid was sent for pathology and culture testing.

Preliminary results from the blood cultures obtained at admission and on the aspirated joint fluid were negative. After a lengthy discussion of the risks and benefits, it was decided to take the patient to the operative room and surgically excise the diseased bone identified on MRI for source control, pathology, and culture.

Surgical Intervention

A linear incision was made dorsally and medial to the extensor tendon beginning a centimeter distal to the hallux interphalangeal joint and extending a centimeter proximal to the head of the first metatarsal. Using blunt and sharp dissection, the incision was carried down deep to bone. Using sharp dissection, the joint capsule and soft tissues were reflected away from the hallux interphalangeal joint and the first metatarsal phalangeal joint. Using a sagittal saw the head of the first metatarsal was resected at the neck, passed from the surgical field. A sagittal saw was then used to resect the base of the hallux proximal phalanx, which was passed from the surgical field. Both sections of resected bone were sent for gross pathology, culture and sensitivity testing. Using sharp dissection, the sesamoid complex was excised in its entirety. Pulse lavage was utilized to thoroughly irrigate.



Attention was then directed to the hallux interphalangeal joint where it was noted to have chalky white-yellow deposits, a sample of which was obtained and sent for crystal analysis. Using a sagittal saw the head of the proximal phalanx was resected at the neck, passed from the surgical field. A sagittal saw was then used to resect the base of the distal phalanx, which was passed from the surgical field. Both sections of resected bone were sent for gross pathology culture and sensitivity testing. Pulse lavage was utilized to thoroughly irrigate.

Following complete surgical debridement of infected and gout-involved bone and soft tissue, attention was directed to reconstructing both of the joint spaces and restoring balanced tendon mechanics. To achieve this, a biologic spacer was fashioned by interposing slips of the patient’s native flexor and extensor tendons into the prepared joint space. The tendon tissue was rolled and secured centrally within the defect, providing a soft-tissue buffer that preserved anatomic spacing while mitigating direct osseous contact. The residual ends of the flexor and extensor tendons were then tensioned and anchored to opposing sides of the joint to recreate a physiologic agonist–antagonist relationship. This construct was designed to maintain reciprocal length–tension dynamics during motion, potentially enhancing proprioceptive signaling and soft-tissue balance across the reconstructed site. Resorbable antibiotic loaded cement beads (Stimulan® Rapid Cure, Biocomposites®) were then prepared according to the manufacture’s recommendations using Vancomycin and Gentamicin and implanted into the space. The joint was ranged intraoperatively to confirm smooth excursion and absence of impingement before layered closure. The incision was then closed with layered sutures and the right hallux was splinted in a rectus slightly dorsiflexed position with sterile dressings. The patient was offloaded in a CAM boot.

Surgical Aftercare

Following surgery, the patient remained hospitalized for three more days receiving continuous IV antibiotic therapy, infectious disease consultation, and rehabilitation. Patient’s condition dramatically improved following the surgery with the pain, erythema, and swelling fully resolving. Following discharge from the hospital, the patient was seen on a regular basis outpatient for follow up care until completely healed. Pathology from the excised bone of the first metatarsal phalangeal joint revealed acellular amorphous material suggestive of gout that was non-polarizable. Analysis of the interphalangeal joint excised bone and metatarsal phalangeal joint excised bone showed extensive bone marrow fibrosis with neutrophil infiltration, confirming osteomyelitis. Bone cultures yielded no definitive findings.



Discussion

The unique pathophysiologic context of the timing of the infection, symptomatology, and systemic course lends itself to a presumed diagnosis of hematogenous Campylobacter osteomyelitis in the right foot.

Hematogenous osteomyelitis of the foot is uncommon in adults and usually arises secondary to bacteremia in the setting of predisposing systemic conditions like immunosuppression, diabetes, and peripheral vascular disease. Campylobacter infection is rare, and most reported infections occur in the gastrointestinal tract. Very few cases have been described of extraintestinal dissemination, and among those, osteoarticular involvement is typically in the spine or large joints. To our knowledge, presumed hematogenous Campylobacter osteomyelitis of the hallux has not been previously reported in association with gout.

The chronologic association between the patient’s acute Campylobacter enteritis and subsequent onset of monoarticular inflammation raises strong suspicion for a post-infectious of reactive process that evolved into osteomyelitis.

Campylobacter is well documented to trigger reactive arthritis, particularly in genetically predisposed individuals (notably those positive for HLA-B27). The organism’s lipooligosaccharides share molecular mimicry with human gangliosides, contributing to immune-mediated inflammation that may persist long after clearance of the intestinal infection. In this case, the chronicity and localization of pain, together with radiographic and MRI findings of cortical erosion and marrow enhancement, support hematogenous seeding or immune-mediated destruction of bone. An additional diagnostic challenge arose from the coexistence of crystal arthropathy. The aspiration of chalky, white crystals favored a diagnosis of gout; however, it didn’t exclude concomitant infection. Both conditions may present with erythema, swelling, and elevated inflammatory markers, complicating early differentiation. Although multiple cultures from blood, joint aspirate, and bone were negative, the absence of microbial growth does not preclude infection, particularly following antibiotic exposure. The patient’s rapid clinical improvement following debridement and broad-spectrum antibiotic therapy further supports an infectious or post-infectious component.

Surgical management was indicated for source control and diagnostic clarification. By utilizing a biologic tendon interposition technique designed to preserve balanced flexor–extensor tension and proprioceptive feedback, the reconstructed hallux maintained functional range of motion and stability. This approach supported durable wound closure and restoration of pain-free, functional use of the hallux, demonstrating the potential benefit of biologically coupled tendon reconstruction in complex infectious and inflammatory forefoot pathology. The patient progressed to full healing without postoperative complication or recurrence of infection. The use of bioabsorbable calcium sulfate antibiotic beads provided high local antibiotic concentrations to the surgical site, mitigating the risk of recurrence. The patient’s subsequent complete resolution of symptoms and radiographic stability on follow-up lend further weight to the presumption of an infectious etiology.

Despite the temporal and clinical association between the patient’s documented Campylobacter enteritis and subsequent osteomyelitis, the lack of organism recovery from bone or blood cultures precludes absolute causation. Culture-negative osteomyelitis remains a diagnostic challenge, particularly for fastidious organisms such as campylobacter, whose isolation requires specialized media, microaerophilic conditions, and prompt handling which are factors that may not have been optimized on this case. Even if cultures were successful, advanced molecular assays such as PCR or 16S RNA sequencing were not available in the rural health setting where this case took place.

The patient’s HLA-B27 negativity further complicates interpretation, as reactive arthritis secondary to Campylobacter jejuni typically occurs in genetically predisposed individuals. This finding suggests that the pathogenesis in this case may have involved direct hematogenous seeding or a non-HLA-B27-mediated inflammatory cascade. Diagnostic certainty was further limited by the coexistence of crystal arthropathy, which can clinically and radiographically mimic infection and may have delayed early surgical sampling.

Despite these constraints, the consistent chronology, imaging findings, and full resolution following surgical and antibiotic management strongly support presumed Campylobacter-associated osteomyelitis in a non-HLA-B27 host.

This case highlights the diagnostic complexity of overlapping crystal, infectious, and reactive arthropathy. It underscores the need for clinicians to maintain a broad differential diagnosis in atypical presentations of monoarthritis, especially in patients with recent gastrointestinal infections. While culture-negative osteomyelitis may pose diagnostic uncertainty, clinical judgment grounded in temporal association, imaging findings, and therapeutic response remains essential.

References – Scan QR Code

