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CASE REPORT

A rare case report of metacarpal osteomyelitis following a domestic cat bite

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ABSTRACT

Animal bites, particularly from domestic cats, represent a significant public health concern, accounting for a substantial number of emergency room visits annually. However, osteomyelitis of the metacarpal bone following a cat bite is a rare and underreported complication which presents unique diagnostic and therapeutic challenges. A 35-year-old male patient developed metacarpal osteomyelitis following a housecat bite, despite receiving early empirical antibiotic therapy. Unlike conventional osteomyelitis, cat bite-related osteomyelitis can progress insidiously due to rapid wound closure, creating an anaerobic environment that fosters deep-seated infection. This case underscores the importance of early radiological evaluation, aggressive surgical debridement, and prolonged targeted antibiotic therapy in managing such infections. In conclusion, the report highlights the need for heightened clinical suspicion and tailored management strategies to prevent delayed diagnosis and complications in similar cases.

Keywords: Antibiotic therapy, cat bite, metacarpal, osteomyelitis, rare complication, surgical management.

Animal bites are very common, accounting for more than one million cases per year and 1% of all emergency room visits. Dog bites account for approximately 80 to 90% of these bites, while cat bites account for 5%. The majority of injuries occur on the dominant hand, and the majority of cases are children.[1-3]

Animal bites are less aggressive than human bites due to their oral flora being less pathogenic. In both floras, aerobic microorganisms are found in greater numbers than anaerobic microorganisms, with a ratio of 10/1. In culture samples taken from wounds caused by dog and cat bites, *Pasteurella multocida*, a member of the Gram-negative bacillus family, is frequently isolated at a rate of 16 to 26%, and many other microorganisms have been detected.[1] The majority of animal bite injuries carry a high risk of developing infection due to the penetrating nature of the injury, the inoculation of bacterial flora, and secondary local tissue damage due to crushing injury of the bite. Delay in medical treatment (>12 h), advanced age, and the presence of serious and deep wounds can be considered as risk factors for infection.[4] Animal bites clinically cause cellulitis, lymphangitis, and often purulent drainage. Cats, whose thinner and sharper teeth compared to dogs, cause deeper puncture-type injuries rather than avulsion-type injuries, and infections are more common after cat scratches and bites.[5,6]

Cat scratch disease, known as *Bartonellosis*, is a zoonosis which can be seen all over the world, regardless of geographic differences. More than 24,000 cases are reported each year in the United

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States.[2-4] It is a clinical picture that is mostly seen in individuals who come into contact with cats, with fever and lymphadenomegaly. Some limited cases have been reported in Türkiye, and focusing on that can be confused with malignancy due to lymphadenomegaly and mass formation in various organs.[5-9] Gram-negative bacteria *Afipia felis* and *Rochalimaea (Bartonella henselae)* have been accused as pathogens which play a role in the disease.

The clinical presentation of *Bartonellosis* is that an erythematous lesion and primary papules and pustules appear within three to five days following the injury, followed by lymphadenopathy within five to 50 days. While the pain usually disappears within two weeks, lymphadenopathy may continue for almost six weeks, sometimes even up to a year. This situation causes it to enter the differential diagnosis with different types of malignancy.

Diagnosis is made by contact with cats via scratching and/or biting, histological findings specific to cat scratch disease, lymphoid hyperplasia with necrotic abscesses and granulomas in the center of the necrotic debris, and seropositivity with immunofluorescence staining. In the serology of the disease, specific immunoglobulin (Ig) M 1/16 and IgG 1/64-256 positivity in the acute phase is definitive. Seropositivity occurs within one to three months. A high specific IgG titer also indicates a past infection. Culture and polymerase chain reaction (PCR) are not significant in diagnosis. However, bacteria can be seen in erythrocytes in peripheral smears. Other laboratory tests are often not helpful in diagnosis.[8-11] In studies, leukocytosis, sedimentation, and C-reactive protein (CRP) elevation were detected in one-third of the cases.[10,11] Liver enzyme elevations, including alkaline phosphatase, may be seen in hepatosplenic involvement. A definitive diagnosis is made by demonstrating bacilli in biopsy material by immunohistochemical silver staining or by histopathologically shown granulomas.[9-11] In cases where osteomyelitis is suspected, X-ray and magnetic resonance imaging (MRI) can be used as a preliminary diagnosis.

Treatment is based on the selection of broad-spectrum antibiotics as prophylactic and the determination of the specific antibiotic according to the culture results. In treatment, beta-lactam and beta-lactamase inhibitors, anaerobic second-generation cephalosporins, or penicillin and first-generation cephalosporins or clindamycin or a combination of fluoroquinolones can be selected. The most preferred active ingredient is a drug combination containing amoxicillin and clavulanate.[10] Indications for surgical debridement and irrigation are the presence of visible infection, purulent discharge, pyarthrosis or pyogenic tenosynovitis, and osteomyelitis. The majority of bites treated in the acute phase heal with debridement of the wound edges. The main principles of treatment in cases where osteomyelitis develops are radical cleaning of necrotic tissues, filling of dead spaces, and long-term effective antibiotic therapy.[12-15] In cases where osteomyelitis develops, intraoperative culture and pathology samples should be taken, and extensive debridement of the bone tissue should be performed.

The hand is particularly vulnerable to such complications as tenosynovitis, septic arthritis, and osteomyelitis due to its dense connective tissue, limited blood supply in certain areas, and proximity of tendons and joints. Cat bites, in particular, have been implicated in deep-seated infections due to direct bacterial inoculation into joints and bones. Osteomyelitis of the metacarpal bones following a cat bite is an exceedingly rare condition, with limited cases reported in the literature.[8-14] Delayed diagnosis and treatment can lead to serious functional impairments, emphasizing the importance of early recognition and intervention.

In this article, we present a case of metacarpal osteomyelitis following a housecat bite, detailing the clinical course, diagnostic challenges, and integrated medical and surgical management and highlight the need for increased awareness among clinicians regarding the potential for deep infections following seemingly minor cat bite injuries.

CASE REPORT

A 35-year-old male patient with no family or comorbid conditions was bitten on the dorsal surface of his left hand by his cat. Three days later, he arrived at the Infectious Diseases and Clinical Microbiology clinic with erythema and edema at the site of the bite. During the initial consultation, empirical oral antibiotics were administered; however, due to the persistence of symptoms and the advancement of the infection, surgical intervention became necessary around two months post-bite. The patient was initiated on oral amoxicillin-clavulanic acid, a third-generation cephalosporin, and metronidazole therapy. Despite adhering to the prescribed medical treatment, the patient returned to the Infectious Diseases and Clinical Microbiology clinic after four

weeks due to a partial alleviation of symptoms and an exacerbation of redness and swelling, prompting a consultation with the Department of Orthopedics and Traumatology.

In the clinical examination of the patient, there was erythema, localized edema, and papule-pustule appearance on the dorsal side of the left hand (Figure 1). Increased temperature, tenderness, fluctuating mass, and discharge were detected around the bite area. Apart from the present findings, no systemic symptoms such as lymphadenomegaly or mass in the internal organs were observed. In addition to the previous blood tests, three-way X-ray radiography and MRI of the hand were requested. Since osteomyelitis was considered in the foreground and no systemic symptoms were observed, serological tests were not required.

Following the completion of the four-week antibiotic treatment recommended by the Infectious Diseases and Clinical Microbiology clinic, the patient was referred for orthopedic evaluation. The orthopedic consultation occurred within one week, during which clinical findings and persistent symptoms raised concerns for chronic osteomyelitis. An MRI was requested to further assess the extent of bone involvement, and scheduling and radiological interpretation required an additional five days. Surgical intervention was performed within three days after confirming the diagnosis. While logistical considerations such as MRI scheduling and result interpretation contributed to a brief delay, prompt referral and multidisciplinary coordination facilitated timely decision-making to optimize patient outcomes.

In radiological images, cortical irregularity, lysis, and a sequestered appearance in the cortex compatible with osteomyelitis were detected in the distal part of the third metacarpal. It was interpreted in favor of osteomyelitis, and surgical treatment was planned (Figure 2).

The patient was operated under peripheral nerve block anesthesia. After determining the surgical incision area under fluoroscopy, a 4-cm incision was made from the dorsal side of the third metacarpal, and the subcutaneous tissue and tendon sheath were debrided. The area compatible with the distal metaphyseal lesion of the bone was checked again under fluoroscopy and then fenestrated (Figure 3). Fenestration of the affected bone was performed to remove necrotic tissue and facilitate drainage. The area was thoroughly irrigated with saline solution, and a gentamicin-impregnated cement rosary was placed to provide local antimicrobial therapy. Due to the extent of the infection and associated bone loss, stabilization was necessary. A Kirschner wire (K-wire) was used to temporarily fix the affected metacarpal to maintain structural



FIGURE 1. Clinical appearance of the hand at the first orthopedics' consultation. **(a)** Preoperative clinical AP image of the case; the white arrow shows the bite marks of the cat. Four weeks after the bite, the superficial wounds are closed, but there is partial erythema around the bite mark area. **(b)** An oblique clinical image of the hand taken at the same time; a single white arrow shows the edematous appearance at the level of the third metacarpal on the dorsum of the hand.



FIGURE 2. Radiological images of the hand before surgical intervention. **(a)** Anteroposterior and oblique radiographs of the hand taken during the preoperative diagnosis phase of the case; two black arrows show the sequestered bone tissue on the dorsal side of the third metacarpal of the hand with a preliminary diagnosis of osteomyelitis. **(b)** Magnetic resonance imaging T1 and T2 images taken during the perioperative diagnosis phase, from left to right, respectively; two white arrows, destruction caused by osteomyelitis in the bone, cortical irregularity, and metacarpal distal ulnar cortex lysis.

alignment and prevent further instability. Also, given the substantial bone loss resulting from the infection, stabilization was implemented to prevent further structural compromise during the healing process. This step was crucial to preserving hand function and promoting optimal bone healing while awaiting definitive reconstruction or bone remodeling. Further follow-up with imaging and clinical assessment was planned to evaluate the success of the intervention and determine the need for additional procedures. The removed specimens were preserved for histopathological evaluation. After the surgical intervention was completed, the wound area was washed with a large amount of saline solution. After bleeding was controlled, it was closed appropriately.

Following surgical intervention, a short arm splint was applied for a duration of four weeks to ensure adequate immobilization and facilitate soft tissue healing. Upon splint removal, the patient was referred for physical therapy to restore range of motion and grip strength. The rehabilitation protocol included progressive mobilization exercises, with a focus on hand dexterity and strength training. At the final follow-up, conducted three months postoperatively, the patient demonstrated significant functional improvement, with a return to daily activities without limitations. Pre- and postoperative functional assessment using the Disabilities of the Arm, Shoulder, and Hand (DASH) score showed a marked reduction in disability, from an initial score of 45 to a

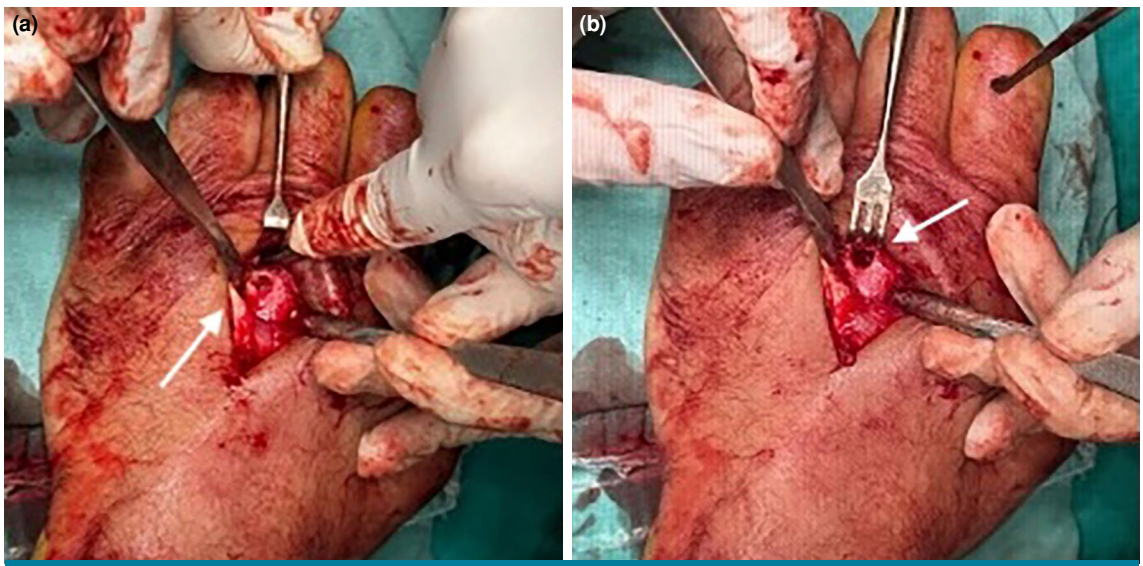


FIGURE 3. Intraoperative views of the case. **(a)** The white arrow shows the area where pathology specimens were sent from bone tissue with osteomyelitis. **(b)** The second white arrow shows the post-debridement view of the osteomyelitis area.

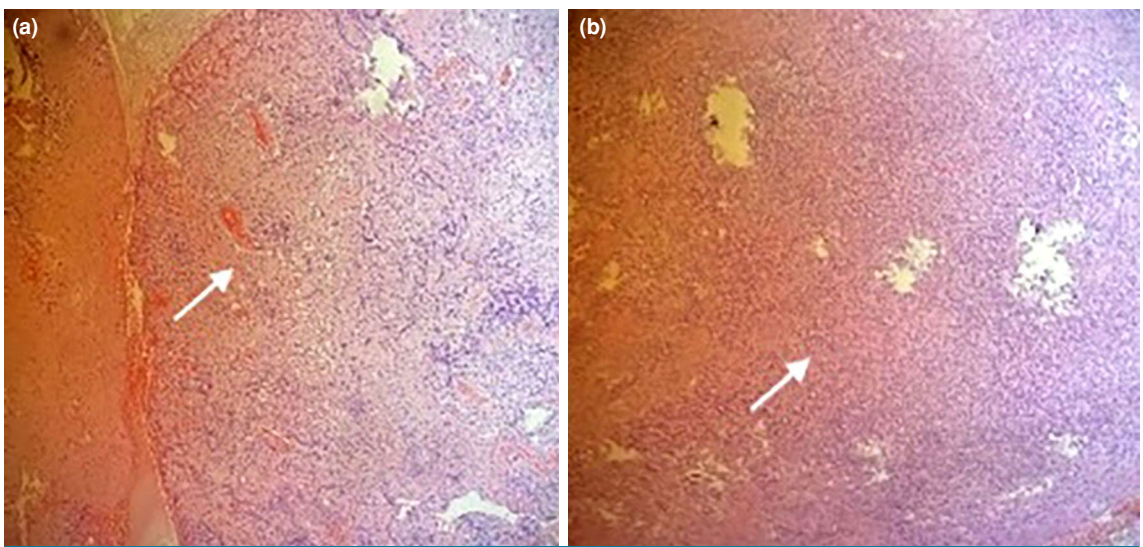


FIGURE 4. H&E, ×100 staining; white arrows show necrotic abscesses and granulomas in the middle.

postoperative score of 88, indicating a successful recovery.

In the sample obtained from the intraoperative curettage material, active-chronic inflammation and granulation tissue accompanied by eosinophils were reported to support the diagnosis (Figure 4). Surgical treatment was observed with early postoperative radiographs (Figure 5). At six months after the first surgical intervention, the second and final surgical treatment was performed to remove the K-wire and gentamicin cement rosary. Final radiological images of the hand and clinical appearance are shown in Figure 6 and Video 1. Written informed consent was obtained from the patient.

DISCUSSION

Hand osteomyelitis presents a diagnostic and therapeutic challenge, with potential for enhanced care through the systematic organizing of existing evidence. This case report contributes to the literature with the diagnosis and surgical treatment



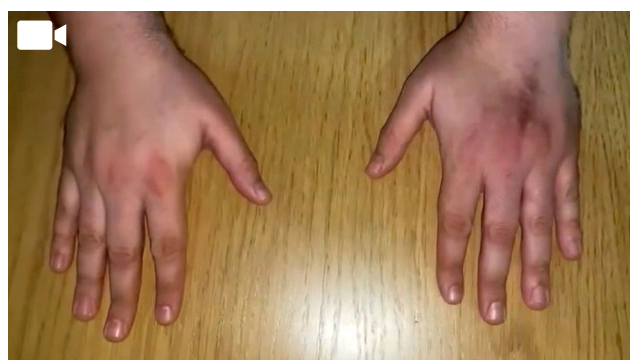
FIGURE 5. Early postoperative X-ray views. **(a)** Anterior-posterior view. **(b)** Lateral view.

of osteomyelitis, which is rarely seen after a delay in surgical treatment and rapid progression of a hand infection after a housecat bite. In our case, MRI played a critical role in confirming the diagnosis of osteomyelitis by revealing early bone marrow edema and cortical destruction, which were not as clearly visible on the initial X-ray. These findings provided essential information that supported the decision for surgical debridement, ensuring timely and effective intervention to prevent further complications.



FIGURE 6. Postoperative, nine months after the surgical intervention, X-ray and clinical views of the hand.

Cat bites are the second most common animal bites, particularly among animal bites. Cat bites are responsible for approximately 10% of all animal bite wounds, which leads to approximately 300,000 emergency room visits per year.[16-20] Cat bites cause injuries to the hand in 45 to 63% of cases.[17] Although cat bites are less common than dog bites, the probability of infection after the bite is twice as high.[16-18] Infection develops in 20 to 80% of patients who apply to the emergency room.[21] Cat teeth are thin, sharp, and long, allowing the wound to close quickly, and the formation of a suitable dead space environment for bacteria to multiply causes this situation. Since cat teeth can easily penetrate the joint capsule and bone, deep infections such as



VIDEO 1. Final clinical and functional appearance of the hand.

septic arthritis and osteomyelitis can easily occur. However, early diagnosis is often difficult.[19]

In case of a cat bite injury, local severe cellulitis usually occurs 12-24 hours after the bite and may progress to form an abscess. Lim et al.[22] reported that local osteomyelitis may also occur. In our case, despite the early start of oral antibiotics by the Infectious Diseases and Clinical Microbiology, the patient's complaints partially regressed and, then, flared up again. During this period, the process that started as a soft tissue infection progressed to osteomyelitis in a short time. Studies have shown that the hospitalization rate after cat bites is 37% and that 12% of these patients require surgery.[23] The most common soft tissue infection in patients with cat bites is *P. multocida*, which is detected in the culture results, and this is because it is the most common in the cat oral flora.[24] The study conducted by Westling et al.[25] on 78 cat bite patients supports this result. However, in our case, although the culture was negative based on the pathology samples, we believe that the causative pathogen is *Bartonella henselae*.

Although X-ray imaging is often the initial modality for evaluating suspected osteomyelitis, it has limited sensitivity in detecting early bone involvement. In general, MRI is the gold standard for early detection, particularly for its ability to identify bone marrow edema and soft tissue involvement However, logistical constraints, including availability and scheduling, may delay MRI acquisition, potentially impacting treatment initiation. In this case, the MRI was performed promptly following X-ray findings suggestive of osteomyelitis, minimizing any delay in surgical decision-making. Early imaging is crucial, as delayed diagnosis has been associated with increased morbidity and prolonged treatment courses in osteomyelitis cases.

A biopsy is taken for the diagnosis of the disease, and the pathological diagnosis is made by showing specific granulomas in the pathological examination of the biopsy material. The diagnosis may be confirmed serologically with a positive Ig antibody against Bartonella henselae. As in the presented case, culture positivity may not always be detected in 7 to 8% of cases.[26] In our case, we did not detect any microorganism growth in the culture samples we obtained. False negativity should not be ignored. This situation may be due to the chronic period due to delayed treatment and regular antibiotic use during this period. In the study conducted by Talan et al.,[26] it was reported that meeting one of the three main criteria (i.e., fever, abscess, and lymphangitis) and at least four of the five sub-criteria (i.e., >3 cm erythema at the wound edge, tenderness, edema, purulent discharge, and 12,000/mL or more white blood cell count) after the bite is sufficient to be considered infected.[26] In our case, one of the main criteria (abscess) and four of the sub-criteria (all except high WBC) were detected. Hospitalization should be considered for patients with severe cellulitis, systemic symptoms of infection (fever, vomiting, and confusion), clear evidence of bone, joint, ligament, or nerve involvement, rapid spread of infection within 24 to 48 h, or unresponsiveness to oral medications.[22] Mitnovetski and Kimble[23] emphasized the importance of early and appropriate treatment for patients with cat bites and concluded that treatment should be started immediately in case of infection. If there is a suspicion of osteomyelitis, as in our present patient, the diagnosis should be confirmed with relevant X-ray and MRI examinations without delay, and surgical treatment should be performed without delay.

Previous studies have reported cases of osteomyelitis resulting from cat bites, highlighting the risk of deep-seated infections due to *Pasteurella multocida* and other pathogens. Greene and Fritz[17] and Elcock et al.[18] described similar cases where delayed diagnosis led to progressive bone involvement, requiring surgical intervention. In comparison, our case underscores the importance of early imaging and antibiotic therapy to prevent extensive bone destruction. While the clinical course of our patient aligns with findings from prior reports, the specific surgical approach involving gentamicin cement placement and K-wire fixation presents a valuable addition to existing treatment strategies.[19]

In this case presented, the patient was hospitalized for surgical treatment after being consulted for a soft tissue infection that did not go away despite antibiotics, and osteomyelitis was detected. Due to the rapid progress of the clinic and the need for surgical intervention in addition to antibiotics, we performed the necessary surgical intervention without waiting for serological diagnoses and sent the samples to pathology to support our diagnosis. In the pathological interpretation of the sent tissue samples, granulation tissue and chronic infection findings support our diagnosis.

In conclusion, this case underscores the rapid progression of infection from soft tissue

to osteomyelitis despite early antibiotic therapy, emphasizing the need for timely imaging and surgical intervention in cat bite cases, which can be clinically ended up with acceptable results. There are differences in clinical approach and diagnosis stages in cases of osteomyelitis following cat bites compared to classical osteomyelitis cases. It should be kept in mind that particularly the rapid closure of cat bite holes would accelerate the development of abscesses and advanced stages. It is of utmost importance to follow the disease closely and carefully from the moment of first presentation, to organize appropriate empirical antibiotic treatment, and to perform outpatient clinic follow-up at frequent intervals. In addition, although systemic symptoms are not always seen, they should be kept in mind.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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