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Case Report

Calcaneal osteomyelitis with retained wooden foreign body (acacia thorn) presenting five years after prick: A case report with review of literature

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Abstract

Foreign body-related calcaneal osteomyelitis is a relatively uncommon type of osteomyelitis that poses a diagnostic challenge owing to its indolent onset and limited systemic response. Here, we present a case of chronic osteomyelitis of the left calcaneum with retained foreign body presented 5 years after a thorn prick in an 11-year-old boy. The patient presented with long-standing pain and swelling over the left heel, recalcitrant to conservative management. Intensive inquiry of the parents revealed a history of a thorn prick in the left heel of the patient while walking through a forest five years ago. Magnetic resonance imaging revealed an elongated hypointense linear structure (foreign body) within the lytic lesion on the lateral aspect of the calcaneum. The patient was managed with surgical exploration, foreign body removal, and curettage, followed by a prolonged course of antibiotics. The patient showed a complete resolution of symptoms without any sign of recurrence at 1 year follow-up.

Keywords: Calcaneum, Osteomyelitis, Foreign body, Thorn, Curettage.

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1. Introduction

Osteolytic lesions of the tarsals, metatarsals, talus, and calcaneum can result from tumors, chronic infection, and foreign bodies. Unlike penetrating wounds to the feet, which are common, penetrating injuries to the bones are rare. Foreign body-related penetrating injuries to the hand and foot are frequent causes for consultations in emergency rooms.[1-3] In majority of the cases, foreign bodies are superficially embedded and only cause momentary discomfort. However, in rare cases, they can remain lodged inside the bone and go unnoticed for years.[4] Foreign body retention in the bone can result in various complications, such as osteomyelitis, tenosynovitis, a draining sinus, and an abscess.[5,6]

Osteomyelitis is an acute or chronic inflammation of bone and bone marrow caused by infection. It mostly affects the bones (43% of the cases) of the foot, specifically the tarsal and metatarsal bones.[7,8] The calcaneum is a less common site, accounting for 7%–8% of all cases of osteomyelitis.[9-11] The symptoms of calcaneal osteomyelitis are typically less severe compared with osteomyelitis of other areas and may be disregarded as localized discomfort, and blood tests usually show no abnormalities, adding to the perplexity and unpredictability of this condition.[12,13] Therefore, one must be extremely suspicious in order to identify this particular form of osteomyelitis.

Only a few cases of a wooden foreign object lodging in the calcaneus and causing chronic osteomyelitis are reported in the literature.[14] Here, we present a rare occurrence of chronic osteomyelitis in the calcaneum, caused by a foreign body that was retained for five years, along with a review of the literature on foreign bodies retained in the foot bones and calcaneal osteomyelitis.

2. Case Report

An 11-year-old boy presented to the out-patient department of our hospital with chief complaints of swelling and pain over his left heel since 5 years. The pain and swelling had worsened over the past few months at presentation. The pain

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was localized, dull, aching, non-radiating, aggravated after walking and running, and relieved after taking rest and medications. The patient also complained of intermittent fever but denied any history of night sweats, chills, rashes, loss of appetite, or weight loss.

On intensive inquiry, the parents revealed a history of a thorn pricking his left heel while walking through a forest five years ago, for which he consulted a local practitioner. The wooden piece was removed from the heel by a physician in the emergency room, and he had been discharged on antibiotic therapy after ascertaining the absence of any foreign body on plain radiography. Six months later, the patient consulted an orthopaedic surgeon with complaints of pain and swelling in left heel. He was diagnosed with soft tissue infection and prescribed nonsteroidal anti-inflammatory drugs and oral antibiotics. Because of persisting pain and swelling, the patient visited several orthopaedic surgeons, but no definitive diagnosis could be made.

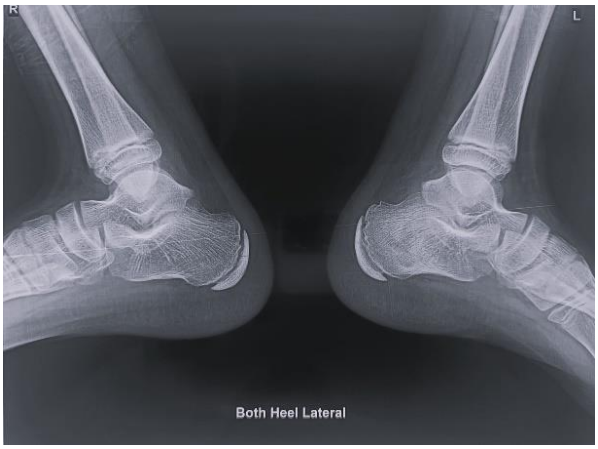

Figure 1: Preoperative X-ray showing a small lytic lesion in the posterior aspect of left calcaneum with associated surrounding rim of sclerotic changes. No radio-opaque structure is seen within the soft tissue of the ankle.

Figure 2: Left foot showing a discharging sinus in the posterolateral aspect of the heel.

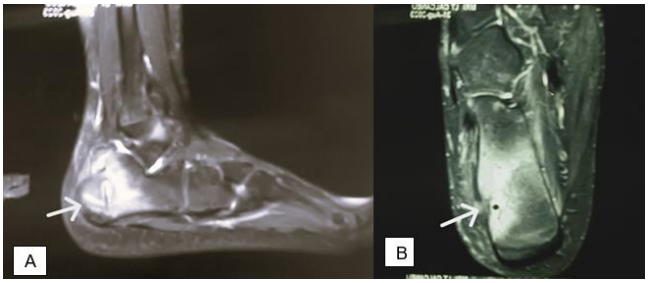

Figure 3: A and **B:** Altered signal intensities are seen at the posterolateral aspect of the left calcaneum corresponding to a small lytic lesion showing a linear elongated structure within it, which is hypointense in all the sequences (T1W1/T2W1) with associated surrounding marrow oedema. A T2hypertense structure is noted connecting the lytic lesion to the skin and soft tissue corresponding to sinus tract.

Figure 4: Fragments of acacia thorn, which was embedded in the calcaneum, after removal.

On physical examination, swelling and erythema were observed in the left heel. On palpation, lateral calcaneum was extremely tender. A single discharging sinus was present over the lateral aspect of the left heel. (**Figure 2**) Routine blood investigations revealed a normal white blood cell count and C-reactive protein levels and a slightly increased erythrocyte sedimentation rate. On X-ray, a geographic osteolytic lesion was seen in the posterior body of the left calcaneus with surrounding sclerotic change. (**Figure 1**) Magnetic resonance imaging (MRI) showed a small lytic lesion, approximately 23 × 9.5 × 8 mm in size, in the lateral aspect of the calcaneus, appearing hypointense on T1 weighted and hyperintense on Turbo inversion recovery magnitude (TIRM), with overlying cortical erosions and surrounding bone marrow oedema. A small, elongated, hypointense linear structure (a foreign body), approximately 18.5 × 2.8 mm in size, was seen within this lytic lesion on T1/TIRM. (**Figure 3**) A sinus tract was also seen in the overlying subcutaneous soft tissue communicating with this lytic lesion and showing skin opening in the posterolateral aspect of the heel. A provisional diagnosis of chronic osteomyelitis of the calcaneus with retained foreign bodies was made. However, an osteolytic tumorous condition was not completely ruled out.

Table 1: Reported cases of foreign body induced osteomyelitis in the foot/ankle

S.No.	Author	Year	Age/Sex	Location	Side	Duration	Material	X-ray	Treatment	Remarks
1	Weston[32]	1963	14 Y/F	Fifth metatarsal	NA	NA	Box thorn	Periosteal reaction	NA	
			7 Y/M	Cuboid			Plum thorn	Osteolysis		
2	Swischuk et al[33]	1974	5 Y/M	Second metatarsal	Right	6 months	Toothpick	Periosteal new bone along metatarsal shaft	Wide incision and drainage	Mimicking pseudotumor
			3 Y/F	Fourth metatarsal	Left	2 months	Toothpick			
3	Moda and Maini[35]	1978	7 Y/M	Second metatarsal	NA	NA	Thorn	Osteolytic lesion with sclerotic edges	Surgical exploration and removal	
			14 Y/F	Third metatarsal			Thorn			
			14 Y/F	Cuneiform			Wooden splinter			
4	Singh and Sharma[34]	1993	14 Y/F	Second metatarsal	NA	NA	Thorn	Osteolytic lesion	Surgical exploration and removal	
5	Hughes et al.[36]	1992	10 Y/M	Medial cuneiform	NA	NA	Date palm thorn	Osteolytic lesion	Surgical exploration and removal	Histology revealed an aseptic granuloma
6	Dürr[3]	2001	56 Y/F	Fifth metatarsal	Right	8 months	Date palm thorn	An eccentric lytic lesion of the cortex and the medullary space in the diaphysis of the fifth metatarsal	Surgical exploration and removal	
7	Dhillon et al.[16]	2005	37 Y/M	Second metatarsal head	Right	6 months	4.5 cm long wooden splinter	An osteolytic, expansile lesion of the head of the second metatarsal	Surgical exploration and curettage followed by excision of metatarsal head followed by re-exploration	*Staphylococcus aureus*-positive culture
8	Vidyadhara et al.[4]	2006	24 Y/M	Calcaneum	Left	NA	Thorn	Lytic lesion	Surgical exploration and curettage	*Pseudomonas aeruginosa*-positive culture

			42 Y/F	Fifth metatarsal base	NA	4 months	6 mm long thorn inside the lytic lesion	Osteolytic lesion	Surgical exploration, removal of thorn and curettage	*Staphylococcus aureus*-positive pus culture
			18 Y/M	Fifth metatarsal base	NA	6 months	1.5 cm long thorn	Osteolytic lesion at the base of fifth metatarsal	Surgical exploration, removal of thorn Surgical exploration and curettage	
			14 Y/M	Cuboid	Right	5 months	0.5 cm long thorn inside cavity in the cuboid	Lytic lesion in the cuboid		Culture negative
9	Abu Hassan[7]	2008	13 Y/F	First metatarsal	Right	2 years	4 cm long toothpick	Osteolytic lesion	Surgical exploration and removal	
10	Wegener et al.[25]	2009	17 Y/M	First and second intermetatarsal region	Right	10 years	Toothpick	NA	Surgical exploration and removal of toothpick	Simulating pigmented villonodular synovitis
11	Harris[26]	2010	10 Y/F	Metatarsal	Right	2 months	Hawthorn fragment	Osteolytic lesion	Surgical excision of thorn	Deep infection caused by *Enterobacter cloacae* and *Pantoea agglomerans* was associated with the retained thorn
12	Guner et al.[14]	2011	16 Y/M	Calcaneum	Left	10 months	Two pieces of wooden foreign body	Osteolytic lesion in the calcaneum	Surgical debridement	On MRI, no foreign body was detected
13	Suresh[24]	2011	10 Y/M	Fourth metatarsal			Date palm thorn	Periostitis	Curettage of the lesion and removal of the thorn embedded in the periosteum of the metatarsal	
14	Madhar et al.[8]	2013	20 Y/M	Fourth metatarsal	Right	2 years	2.5 cm date palm thorn	Periostitis of the base of the fourth metatarsal	Surgical exploration and removal	

15	Kumar et al.[37]	2013	45 Y/M	Calcaneum	Left	NA	Various soil particles of different sizes of approximately 5 mm	Bony erosion with sclerotic margins	Surgical debridement	Four sinuses were present in the heel Gaenslen's split heel approach used
16	Challawar et al.[23]	2014	5 Y/M	Lower-end fibula	Left	7 months	4 cm long thorn penetrating the fibula	Cylindrical osteolytic lesion (4 ×1 cm) with sclerotic margin	Surgical exploration	Resembling pseudotumor
17	Lee[38]	2017	9 Y/M	Calcaneum	Right	NA	1.5 cm long rod-shaped wooden fragment	Osteolytic lesion in the anterior body of the calcaneum and surrounding sclerotic changes	Surgical exploration and curettage	MRI showed a 1.5 cm-long low signal intensity tubular lesion in the calcaneal body
18	Huang et al.[27]	2020	59 Y/M	Cuboid	Right	2 years	Rubber fragment of size 10 × 8 mm	Osteolytic lesion that mimicked a pseudotumor	Surgical debridement	MRI showed a multilocular fluid collection over right cuboid bone
19	The present case	2024	11 Y/M	Calcaneum	Left	5 years	18.5 mm long Acacia thorn	A small lytic lesion in the lateral aspect of the calcaneum	Surgical exploration and removal of thorn	A discharging sinus was present. MRI showed a small lytic lesion of size 23 × 9.5 × 8 mm, with an embedded linear structure of size 18.5 × 2.8 mm in the calcaneum

After anaesthetic clearance, the patient was planned for surgical exploration and curettage. A wooden foreign body embedded in the lateral wall of the calcaneus was detected during the surgery. It was surrounded by an inflammatory granuloma in the posterior body of the calcaneus. The wooden foreign bodies were removed, (**Figure 4**) and curettage of the granulation tissue was performed. Following surgical debridement of the dead and infected tissue, the samples were sent for microbiological and histopathological assessment. The culture was sterile, and the result of the histopathological examination indicated osteomyelitis. Intravenous antibiotics were administered for 2 weeks, and oral antibiotic therapy was continued for another 6–8 weeks. The patient recovered without any sequelae and has not complained of pain or recurrence at follow-up.

3. Discussion

Patients frequently present to the emergency room with penetrating injuries to the extremities caused by foreign objects. In majority of the cases, the foreign bodies retained in the extremities are superficial and seldom observed in deeper bone tissue.[6,15] They are most commonly encountered in the hand, followed by the foot.[1-3] Penetrating wounds of the foot with foreign bodies retained in soft tissues are not uncommon. However, retained foreign body injuries to the bone are rare. The reaction to foreign material can result in infection and might lead to osteomyelitis.[28] A perusal of the published literature shows that the majority of retained foreign bodies detected in the foot bones are thorns, wooden splinter, rubber and plastic materials, and toothpicks.[7,16,28] (**Table 1**).

In cases of acute foreign body injuries, diagnosis is rather simple; however, in older neglected cases or in cases where it is believed that the foreign body has been entirely removed, diagnosis becomes more challenging.[17] Diagnosing a retained foreign body that has been embedded in the bone is more challenging than diagnosing one that has become embedded in soft tissue, and it is even more challenging when dealing with a radiolucent wooden foreign body.

In spite of the absence of recalled trauma, differential diagnosis should include the possibility of a foreign body reaction when considering a foot lesion observed on plain film X-ray. Other possibilities should include osteomyelitis and bone tumours, and MRI, which has a high sensitivity for the detection of pathologic changes in bone, should be relied upon in discriminating the various options. However, in some cases, detection may be achieved only on surgical exploration.[29,30] Organic foreign material in contact with bone causes irritation and inflammatory changes, which might induce osteolytic and osteoblastic changes that can sometimes mimic bone tumours. In most cases, following an embedded foreign body injury, inflammation or infection occurs after a few days, but in some cases it may occur months or even years later.[1,3,31]

The majority of cases of retained foreign bodies in the foot have been reported previously for the metatarsal bones.[7,8] Other less common sites are cuboid, cuneiform, and calcaneum.[14] The reason for this could be that the soft tissue of the heel is thicker than that of the forefoot and mid foot, making it more difficult for foreign objects to enter the calcaneum. Additionally, for the foreign body to pass through the calcaneus, a powerful, vertically loaded force must be applied, similar to weight bearing when walking or running on the foreign body. In the present case, a thorn that pierced the heel during walking broke through the calcaneal cortex and became embedded in the calcaneus. An abscess, draining sinus, tenosynovitis, and osteomyelitis can all result from a retained foreign body.[5,6]

Approximately 7%–8% of all cases of osteomyelitis are calcaneal osteomyelitis.[9-11] Similar to Brodie's abscess, osteomyelitis of the calcaneum can go unnoticed for months or even years before exhibiting any symptoms, and neither the patients nor their parents may recall anything about the injury. This could result in misdiagnosis of the lesion. In the present case, on intensive inquiry, parents gave a history of a thorn prick while walking in the forest five years ago. When orthopaedic infections do not improve with treatment, a history of foreign bodies should be investigated.[14,18]

When compared to osteomyelitis at other sites, the clinical symptoms and signs of calcaneal osteomyelitis are less severe and can easily be mistaken for typical, localized discomforts.[9] General symptoms, such as fever or chills, are uncommon, whereas localized pain is the most prevalent. During the examination, swelling and tenderness may or may not be evident. Blood tests for total and differential white blood cell counts are typically within the normal range.[9,12,13] Most frequently observed radiographic alterations in foreign body-related calcaneal osteomyelitis occur in the posterior third, also known as the "metaphyseal equivalent" of the calcaneus. This area has been described by Nixon.[19] Flat and irregular bones have anatomic subdivisions comparable to those of long bones. This concept is useful in the radiographic evaluation of solitary bone lesions. Areas adjacent to cartilage are metaphyseal-equivalent locations. Prior to skeletal maturation, metaphyseal-type vascular anatomy predisposes these sites to involvement by hematogenous osteomyelitis. Approximately 30% of cases of hematogenous osteomyelitis affect these metaphyseal-equivalent sites and often present difficult diagnostic challenges. It is crucial to identify the exact location of the foreign body before surgery through imaging techniques. Failure to do so can lead to greater harm to the surrounding soft tissues and a longer operation time.[19]

There are numerous differential diagnoses that can be linked to the radiolucent lesion in the calcaneus. Malignant lesions, such as osteosarcoma, clear cell chondrosarcoma, and metastases, as well as benign lesions, such as osteoid osteoma, fibrous dysplasia, osteonecrosis, giant cell tumour,

Brodie's abscess, intraosseous ganglion, aneurysmal bone cyst, and unicameral bone cyst, are crucial to rule out. In the differential diagnosis of lytic lesions of the bone, radiolucent foreign bodies should be taken into consideration even if the patient has no history of trauma.[6]

Many types of foreign bodies can be retained in soft tissues after a penetration injury. Metal or ceramic material can easily be identified on plain radiographs but plastic, rubber, thorn or other radiolucent foreign bodies are more challenging to recognise. However, MRI provides detailed images and can show the sinus tracts, soft tissue oedema, and sometimes even the radiolucent foreign body itself. Computed tomography and MRI are useful diagnostic tools in situations where X-ray results are negative.[5] In the present case, an MRI showed a retained foreign body inside a lytic lesion in the calcaneum, even though the foreign body was not visible on the X-ray. The foreign body was hypointense on T1-weighted and TIRM images. According to Peterson et al., the MRI appearance of patients with wooden foreign bodies showed a target appearance, where the central foreign body appeared as a signal void or hypointense area in contrast to the surrounding hyperintense inflammatory tissue.[18] The retained foreign body may, however, occasionally be obscured by the high signal intensity of the granulation tissue on a T2-weighted image, making identification challenging.[13] The degree of visualization diminishes as the extracellular fluid and blood from the surrounding tissues are absorbed by the wooden body.[20] As a result, in delayed cases, the success of imaging techniques decreases. MRI identification is also challenging if the wooden foreign body is small and there is no inflammatory response, that is, no collection or abscess.[18] The clinical and imaging features of a lesion typically provide distinction, but a bone biopsy is necessary for a conclusive diagnosis.

The size and activity of the abscess determine the treatment of foreign body-related osteomyelitis. For successfully treating a single localized lesion in a healthy patient, aseptic drainage, foreign body removal, curettage, and a strict course of systemic antibiotics are necessary.[12,13] Failure to remove foreign bodies leads to a breeding ground for microorganisms, making it impossible for the osteomyelitis to heal. Three consecutive negative cultures are a strong indicator that the infection has been eradicated.[21] Partial or complete removal of the calcaneum through the Gaenslen's approach has been recommended as a final treatment option for chronic calcaneal osteomyelitis in patients with open wounds and underlying conditions, such as diabetes or vascular disease, that have not responded to other forms of treatment.[22,23,32]

4. Conclusion

Penetrating wounds of the foot with retained foreign bodies in soft tissues are not uncommon. However, retained foreign body injuries to the bone are rare. The reaction to foreign material can result in infection and might lead to osteomyelitis. Foreign body-related calcaneal osteomyelitis is a relatively uncommon type of osteomyelitis. The diagnosis is challenging, and a high degree of suspicion arises in this type of osteomyelitis. It may remain in latent form for months or years before becoming clinically evident. Imaging is essential in the treatment of foreign body-related calcaneal osteomyelitis. Diagnosing a retained foreign body that has been embedded in the bone is more challenging than diagnosing one that has become embedded in soft tissue, and it is even more challenging when dealing with a radiolucent wooden foreign body. MRI is very useful and helps in differentiating osteomyelitis from bone tumours. Surgical debridement, followed by a prolonged course of antibiotics, is the preferred method of treatment. A partial or total calcanectomy may be required in patients with open ulcerations, diabetes, and peripheral vascular disease.

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6. Conflict of Interest

None.

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