

# Ultrasound for the Detection of Retained Plastic and Undetected Metallic Foreign Bodies in the Foot

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## ABSTRACT

Foreign bodies in soft tissue may cause serious problems for both emergency physicians and orthopaedic surgeons. Wooden or plastic foreign bodies which are diolucent can not be diagnosed with direct graphy and they are more prone to cause soft tissue complication unless they detect. We present two cases with retained plastic and metallic foreign bodies including in their right feet of a farmer and a constructor which could not diagnosed with plain film and magnetic resonance imaging (MRI). Definitive treatment was done after detecting the foreign bodies with ultrasonography (US).

**Key words:** Foreign body, ultrasonography, soft tissue, foot

## Bacakta Ultrasound ile Tespit Edilen Metal ve Plastik Yabancı Cisim

### ÖZET

Yumuşak dokudaki yabancı cisimler hem acil hemde ortopedik cerrahlar için ciddi problemlere yol açabilirler. Tahta ve plastik yabancı cisimler radyolusen oldukları için direk grafiyle teşhis edilmezler ve daha fazla yumuşak doku problemlerine yol açarlar. Biz direk grafi ve magnetik rezonans ile tespit edilememiş ayağında plastik ve metalik yabancı cisimleri olan ve kesin tedavileri ultrason ile tespit edildikten sonra yapılan iki olguyu sunduk

**Anahtar kelimeler:** Yabancı cisim, ultrasonografi, yumuşak doku, bacak

## INTRODUCTION

Radiolucent foreign bodies in soft tissue such as plastic or wooden materials can cause problems for emergency physicians and orthopaedic surgeons. Detecting such objects can sometimes be difficult, especially in patients who are not aware of foreign body penetrance and if there is not any puncture wound over the painful area. Several reports have suggested to use US to detect foreign bodies in the soft tissue (2,3,7,8,14,19). Metallic foreign body normally can be seen with plain film but it can be missed because of the hidden localization of the foreign body. Detection and removing are important because retained foreign bodies may lead to serious complications like infection, synovitis or abscess and mimic

even a tumor (1,4,9). We present two cases with foreign bodies (plastic and metallic) which could not diagnosed with plain film and, MRI but easily identified by a skilled radiologist at US.

## CASE 1

A 33-years-old female farmer presented with pain and swelling on dorsum of the right third intermetatarsal region for a month. The patient didn't go through a trauma before and she didn't have a history of foreign body penetrance. She didn't have any systematic illness either. Range of motion of the fourth and the fifth metatarsophalangeal joints were normal and there was not

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Received: 29.03.2011, Accepted: 20.04.2011

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any sign of foreign body penetration. Foot radiographs failed to identify the foreign body. MRI of the foot revealed soft tissue edema at the dorsal aspect of the foot mostly anterior to fourth metatarsal bone. The edema was extending to the palmar aspect of the foot surrounding the 4th metatarsal. After administration of intravenous contrast material, marked enhancement at dorsal and palmar aspects of foot especially around the fourth metatarsal bone was seen in MRI. Mild bone marrow edema without contrast enhancement was also seen in the 4th metatarsal bone. However US examination explained the exciting cause which revealed 0.5x0.5 cm foreign body with linear hyperechogenic structure associated with hypoechoic rim of edema over the fourth metatarsal head (Figure 1). After sonographic examination MRI was rereviewed and a focal linear flow void which may represent the foreign body could be seen (Figure 2). The following day, the patient underwent an operation under local anaesthesia. Common synovitis and hypertrophy were seen on extensor tendons. Beneath the extensor tendons of the fourth finger, a plastic body of 0.5x0.5 cm was seen. It was removed with surrounding synovia. The patient was discharged 1 day postoperatively.

## CASE 2

A 27 years-old male patient presented with pain and swelling at the dorsal aspect of third and fourth metatarsals of left foot for 2 months. He told about a penetrating trauma by a pin which is approximately 5 centimeter in length 5 years ago at work and the pin has been taken out by himself. He did not take any consultation and as

he told he had no complaint since other than swelling. The pain started 2 months ago and did not respond to medication. On physical examination a painful swelling was seen without any redness or warmth. Laboratory examination revealed no abnormality including normal sedimentation and c-reactive protein levels. On plain film no osseous or soft tissue pathology was seen. Non specific cellulitis like inflammation was seen in dorsal and palmar aspects of the foot with MRI. High signal intensity on T2 weighted images and marked enhancement of the soft tissues without any osseous enhancement consistent with cellulitis without osteomyelitis on T1 weighted images obtained after administration intravenous contrast material. At ultrasound a hyperechogenic linear structure surrounded by thick rim of hypoechogenic edema was seen (Figure 3). Retrospectively a nodular flow void could be detected at MRI after ultrasonographic examination. The patient underwent an operation under local anaesthesia and the metallic foreign bodies was removed. The patient recovered well after the operation.

## DISCUSSION

The crucial criteria for the diagnosis of a retained radiolucent foreign body is the surgeon's and radiologist's suspicion. The lack of any puncture wound or soft tissue laceration together with a poor patient's history make the diagnose more difficult.

The first step in imaging uncertain foreign bodies is plain film. Its percentage in detecting all foreign bodies ranges from 80% to 90% (1,14). Although plain film is cheap and

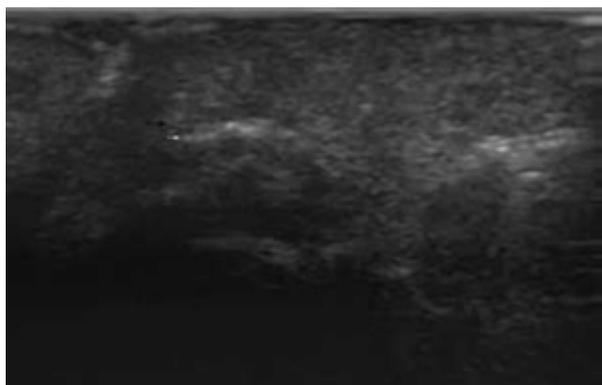


Figure 1. Transverse ultrasonographic image reveals the hyperechogenic foreign body (white arrow) surrounded by a thin rim of hypoechoic area (black arrow) representing edema.

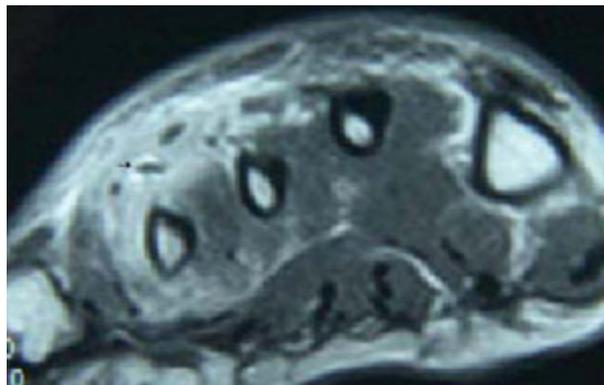
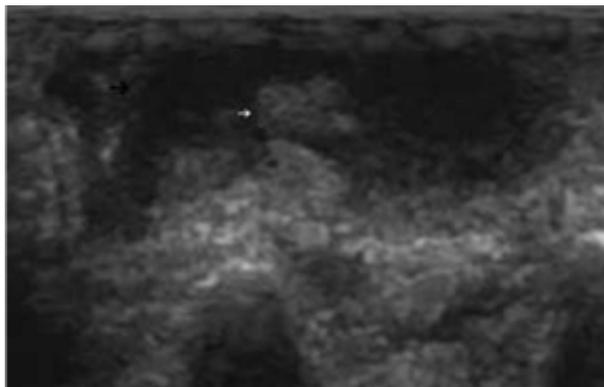


Figure 2. Retrospectively a linear flow void surrounded by hyperintense artefact (arrow) could be seen.



**Figure 3.** Transverse ultrasonographic image demonstrates hyperechoic nodularity (white arrow) surrounded by thick rim of hypoechoic area (black arrow) representing edema.

convenient, the main drawback is that wooden or plastic materials are usually not visible on radiographs. But in this particular case (case 2) the metallic foreign bodies was hidden beneath the cortex and missed in plain X ray. To the best of our knowledge there is not any report that metallic foreign bodies did not identify in plain X ray.

Anderson et.al performed a retrospective study of 200 patients, which showed that most of the foreign materials were glass, wood and methal (1). Metallic materials were visible in all of the radiographic studies.

Ultrasonographic evaluation provides important information of the foreign body and also associated complications (2,5,6,10,13) USG has a definite advantage over conventional radiography and fluoroscopy in detection and localization of foreign bodies in the soft tissues of the extremities especially for radiolucent foreign bodies (15). The reported sensitivity of ultrasound for the detection of radiolucent foreign bodies ranges from 70 to 100 % and its spesivity ranges from 59-100% (3,12,16-19) but in a prospective study to determine the usefulness of USG in detecting foreign bodies in soft tissue model, it was shown that the sensitivity of USG for plastic was 40% and false positiveness was 30% (11). Calcification, atypical sesomaid bone, hematoma, sutures can sometimes give false positive results in USG by forming a foreign body image. The authors suggested that USG should not be relied on to rule out the possibility of a retained foreign body in the distal extremities (19).

In a study the diagnostic sensitivity of ultrasound, non-enhanced computed tomography (CT) and nonenhanced

magnetic resonance (MR) imaging in detecting wooden foreign bodies in the canine manus were evaluated and found that CT was the most accurate modality for detection of wooden foreign bodies (13), however in an other study authors reported that US was more effective than CT (15).

In our case, the first patient didn't have a history of foreign body penetration or a scar of a punctured wound. She was referred to our hospital with plain film and MRI. The findings in MRI were nonspecific and considered to be cellulitis, infection, vascular malformation or sarcoma. Among this nonspecific edematous signal changes, focal milimetric flow void representing foreign body can easily be missed.

However USG evaluation of the patient by a radiologist who is experienced in ultrasound scanning showed that there is not a tumor actually, a foreign body was the main abnormality. We and the patient could not explain how that plastic material embedded in the soft tissue without any puncture wound. She would go several operation unless the radiologist's found the foreign body, because the main problem was to be in the plantar not in the dorsal aspect of the foot according to the MRI. However, this particular patient underwent operation under local anaesthesia, she did not have any problem and could work in the farm 15 days postopratively after removing the sutures.

In conclusion sonography is very effective especially in detecting radiolucent foreign bodies in the soft tissues. But the most important criteria is surgeon's and radiologist's suspicion and the correlation between these departments. Despite being a good diagnostic method, MRI should be combined with US for soft tissue pathologies when MRI findings do not guide a definite diagnosis. The metallic foreign bodies can easily be identified by plain film but occasionally when the foreign body is hidden beneath the cortex, it may be missed as in our case.

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