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## Case Report

# Retained wooden splinter migrated within a digital flexor tendon sheath: Ultrasonographic diagnosis for presurgical planning <sup>☆</sup>

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## ABSTRACT

A 29-year-old right-handed woman presented to an outside emergency department with right small finger pain, swelling, and concern for a retained wooden splinter. Diagnosis and treatment were delayed for 2 weeks due to the inability to identify the foreign body clinically or radiographically. Ultimately, ultrasonography by a fellowship-trained specialist was used to localize the wooden splinter. It was embedded within the flexor tendon sheath but had migrated away from its initial point of entry. The patient underwent subsequent surgical extraction, irrigation, and debridement. Two weeks following surgery, she had regained full range of motion through her digit without signs of infection. This case highlights the use of diagnostic ultrasound to identify a radiolucent foreign body, such as a wooden splinter, and to guide subsequent surgical extraction.

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## Introduction

Soft tissue foreign body injuries to the hands are a frequent reason for consultation to the emergency department and orthopedics. An undetected and retained foreign body can lead to significant complications, such as an inflammatory reaction, pain, impaired function, or an infection [1–7]. Often, the penetrating material at the hand can be visualized through

the entry point and extracted percutaneously. If the foreign body is not visible, further imaging may be necessary. A radiographic evaluation can be obtained and can identify radio-opaque materials, such as metal or glass. However, radiolucent materials, such as wood, organic debris, and plastic, will not be visible on a simple radiograph [2]. Additional modalities such as an MRI or US – the latter being more cost effective – can be utilized in further evaluation [2,5,8,9].

The following case report describes a 29-year-old woman with a symptomatic wooden splinter retained within the

**Abbreviations:** MRI, magnetic resonance imaging.; US, ultrasound.; CRP, C-reactive protein.; ESR, erythrocyte sedimentation rate.; PIP, proximal interphalangeal.; FDS, flexor digitorum superficialis.; FDP, flexor digitorum profundus.

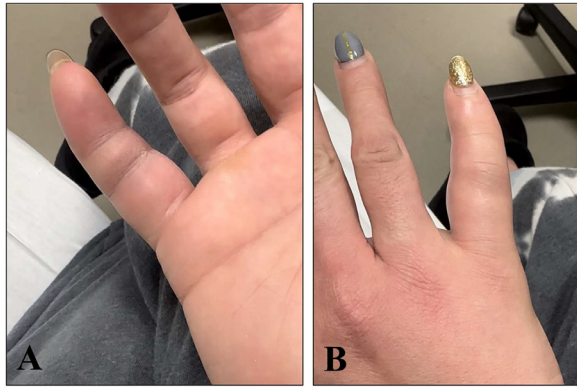
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**Fig. 1 – Clinical photograph demonstrating appearance of the small finger upon presentation to the hand surgeon two weeks following the initial injury. (A) Palmar and (B) dorsal views.**

flexor tendon sheath of the small finger, which had uniquely migrated within the sheath from its initial entry point. The splinter was identified through diagnostic ultrasound, 2 weeks following the initial injury, and was surgically removed.

## Case report

A 29-year-old right hand dominant woman presented to the emergency department at an outside hospital with swelling, pain, and paresthesia of her right small finger. Two weeks prior, she had been cleaning her kitchen when she suspected a wooden splinter entered her finger while wiping down a wooden board. At the time, she was unable to identify a foreign body in the small wound. In the following weeks, she developed pain, erythema, swelling and limited motion in the digit.

Upon presentation to the emergency department 2 weeks from the initial injury, the digit was notably swollen and erythematous (Fig. 1). At the point of entry on the radial border, a foreign body could not be identified on clinical evaluation or on plain radiographs (Fig. 2). The range of motion through the proximal interphalangeal joint was also significantly limited. Consequently, there was concern for possible disruption of the flexor tendon fibers. Laboratory studies were unremarkable, with normal white blood cell counts and inflammatory markers (CRP and ESR). A course of oral cefalexin was started. Due to continued high clinical suspicion for a retained foreign body, a bedside US was performed. A radiopaque foreign body was suspected deep to the digital flexor tendons and could not be removed percutaneously. The patient was thus referred to Hand Surgery at a specialized Academic Center for further evaluation and management.

Upon arrival, a thorough diagnostic US was performed by a fellowship-trained specialist at the small digit. A high-frequency (3–16MHz) linear-array transducer was utilized (Samsung RS80A, Korea, 2014) to assess tendon integrity and to localize the wooden foreign body within the soft tissues for presurgical planning. The right small digit had a small entry wound on the volar radial aspect of the base of the middle

phalanx, overlying the PIP joint. On US, there was mild soft tissue swelling surrounding the FDS and FDP tendons. There was disorganized tissue adjacent to and partially within the FDS tendon, at its most radial portion. Mild hyperemia was present. Possible partial disruption of the most radial fibers of the FDS tendon could not be excluded definitively at this level (Fig. 3A). No foreign body was identified at this portion of the tissues. Continued scanning demonstrated a hyperechoic needle shaped foreign object, surrounded by a hypoechoic ring, lying on the ulnar side, opposite to the site of entry. The wooden splinter was lying superficially along the FDP tendon at the PIP joint, and within the tendon sheath (Fig. 3B). Its length was estimated to be 0.5 cm long. The FDS and FDP tendon fibers appeared intact in this portion. There was no evidence of tendon retraction or ligamentous injury.

The patient was taken to the operating room for sterile surgical exploration and foreign body removal. The skin was incised to expose the flexor tendon sheath over the A3 pulley at the right small finger. There was visible bulging of the flexor tendon sheath on its ulnar side. The tendon sheath was incised, and a 0.6 cm long wooden splinter was removed (Fig. 4). The FDP and FDS tendons were explored and deemed intact, as were the radial and ulnar digital nerves. Inflammatory scar tissue was removed along the FDS tendon on the radial most fibers, corresponding to the findings on ultrasonography.

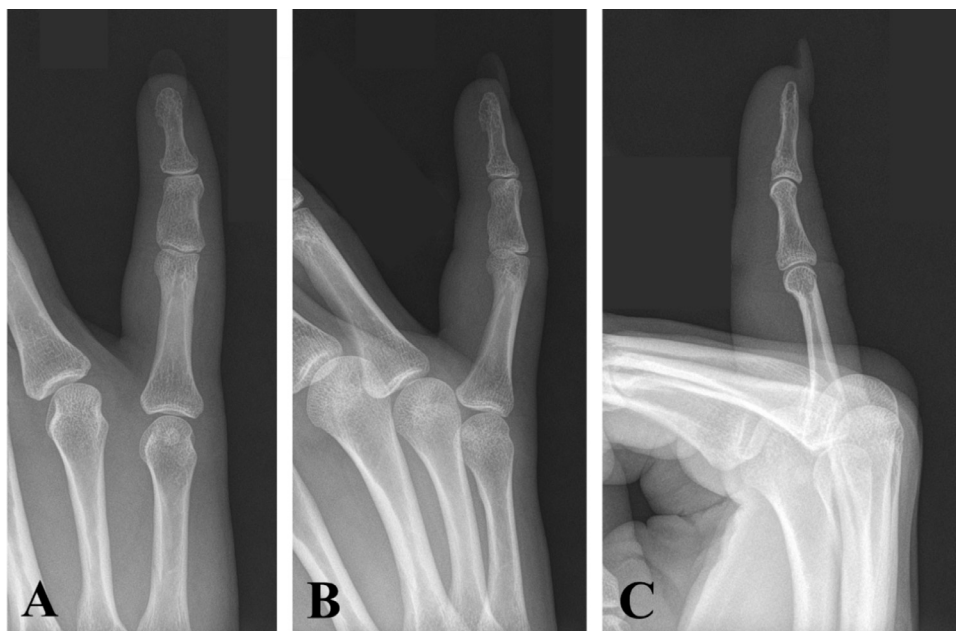
At the one-week postoperative follow-up visit, there was full resolution of pain and paresthesia in the small finger. The postoperative splint was removed, and the patient began a gentle range of motion exercise program. By her 2-week postoperative visit, she had regained full range of motion through her operative digit. There were no signs of infection.

## Discussion

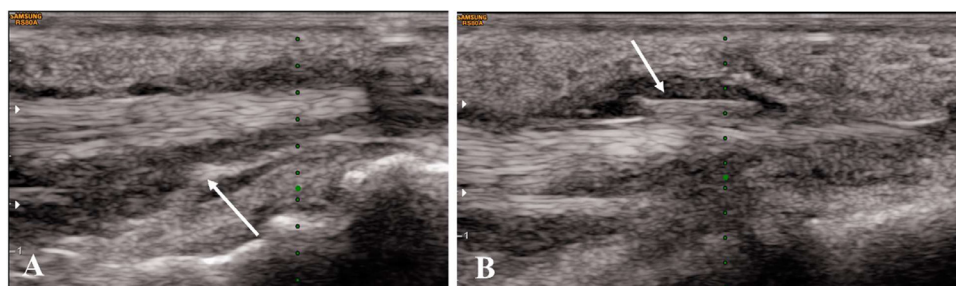
A retained wood splinter in a digit is uncommon and can present diagnostic challenges. Wood, a radiolucent material, is not readily seen on standard radiographs in most instances. In cases of high clinical suspicion, US is the diagnostic tool of choice because of its sensitivity, cost, and availability [6–9]. There have been some case reports of a wooden splinter penetrating the flexor tendon sheath [3,10] or within the pulp of a digit [4,11,12]. However, this is the first case reported, to the best of our knowledge, describing a retained splinter that migrated within the tendon sheath, away from the initial site of injury. Furthermore, the initial site of entry created an inflammatory reaction along the entry point and site of migration at the FDS tendon after being retained for over 2 weeks. This was confirmed on ultrasonographic evaluation and surgically managed.

Under US, this type of foreign object will appear hyperechoic and may present with a surrounding hypoechoic rim, as was our patient's case, particularly if the foreign object has been retained for some time. It is paramount to identify and remove possible retained objects, given the risk of infection and loss of function [2,11,12].

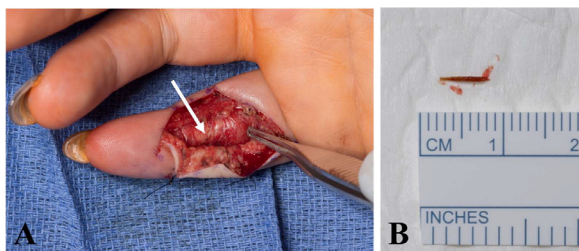
There are several advantages of using US over MRI to identify a splinter, including cost effectiveness, availability, and portability. Additionally, US can discern in greater fine detail small radiolucent structures in relation to complex surround-



**Fig. 2** – Plain radiographs of the small finger upon presentation to the emergency department. Soft tissue swelling is present, but the wooden splinter is not identifiable. (A) Anteroposterior, (B) oblique, and (C) lateral views.



**Fig. 3** – Ultrasonography of the small finger revealing a foreign body within the flexor tendon sheath. (A) Demonstration of disorganized tissue adjacent and partially within the FDS tendon at its most radial portion with mild hyperemia (white arrow). Possible disruption of part of the most radial fibers of the FDS could not be excluded. (B) Demonstration of a hyperechoic needle-shaped foreign object, surrounded by a hypoechoic ring, lying on the ulnar side of the digit (white arrow).



**Fig. 4** – Intraoperative images during surgical extraction of the wooden splinter. (A) Bulging of the flexor tendon sheath with visible wooden splinter penetrating the sheath (white arrow). (B) 6 mm by 1 mm wooden splinter following extraction.

ing structures such as tendons, ligaments, and scar tissue. There are several limitations to the use of ultrasound, including operator dependency and quality of the US and transducer, in being able to properly identify and assess foreign bodies and their relationship to surrounding complex anatomical structures such as in the hand [2,13–15]. Ultrasound-guided percutaneous foreign body extraction has a reported success rate of 88% to 95% [13–15]. Intraoperative use has similarly been considered both safe and effective [16].

## Conclusion

Retained radiolucent foreign objects, such as a wooden splinter, in the hand can lead to several complications, including pain, infection, and impaired function. A strong clinical sus-

pcion, without findings on standard radiographs, should trigger additional diagnostic testing. US is a study of choice to identify such objects, given its ability to identify radiolucent foreign bodies, availability, and cost-effectiveness. A thorough diagnostic evaluation can be necessary, as the foreign body may have migrated away from its initial site of entry. This can greatly assist in pre-surgical planification when percutaneous extraction is not possible.

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## Patient consent

Written informed consent was obtained from the patient for the publication of this case report, including for the accompanying images. A copy of the written consent is available for review, upon request, by the editor-in-chief of this journal.

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