

## Case Report

# Use of magnetic port finder for metallic foreign body extraction in hand

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## ABSTRACT

Foreign bodies are defined as any foreign object that enters the human body due to various circumstances. FBs are a common reason for emergency department visits. The hand's complex vascular and nervous structures make aggressive exploration dangerous. FBs can be composed of various materials, making their detection with a single imaging study difficult. We propose using a magnetic tissue expander locator for intraoperative FB localization, presenting the case of a 50-year-old female patient who, after falling from her height, presented with a foreign body in her right hand. Due to the complexity of locating the FB, we used the magnetic finder, successfully extracting it without damaging any underlying structures. Use of magnetic tissue expander locators are effective, practical, and safe alternative to help for locating magnetic foreign bodies.

**Keywords:** Foreign bodies, Magnetic finder, Hand injury

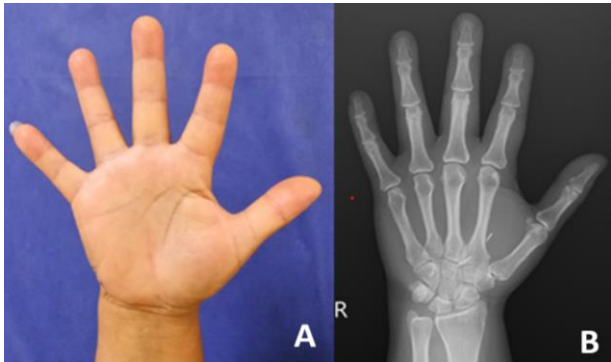
## INTRODUCTION

Foreign bodies (FBs) are any inert object that partially or entirely penetrates the body. The presence of an FB is a common reason for consultation in the emergency and hand surgery departments, causing pain and concern in patients, as well as potential legal implications for the resulting sequelae.<sup>1</sup> Due to the hand's structural complexity, an FB poses a high risk of injury and potential damage to structures during extraction.<sup>2</sup> Different materials make it impossible to standardize a 100% reliable method for locating FBs due to variations in material density. Materials like metal, which are radiopaque, can be located using X-rays in two projections, but precise 3D localization remains challenging.<sup>3</sup> In this work, we intend to introduce a novel method using a magnetic locator typically used for tissue expansion.

## CASE REPORT

A 50-year-old right-handed female patient reported falling on the street with no apparent wounds on her hand. Two weeks later, she presented to our emergency department with constant pain and edema in the thenar region of her hand. Clinical examination did not reveal any neurological or functional impairments. Following a clinical examination, radiographs were taken, revealing the presence of three radiolucent FBs in the thenar region (Figure 1). Inflammatory markers in laboratory tests were within normal ranges. The patient underwent surgery under local anesthesia, involving surgical irrigation and direct exploration, but the FBs were not found initially. Due to their radiopaque nature, a sterile magnetic locator was used to provide 3D guidance for localization (Figure 2-3). All three FBs were successfully extracted without causing secondary damage to any structures (Figure 4).

Post-operative X-rays confirmed their removal (Figure 5).



**Figure 1: A) Initial clinical presentation of the patient in the emergency department due to pain, B) Initial anteroposterior hand X-ray showing 3 FBs.**



**Figure 2: Magnetic locator for tissue expander port.**



**Figure 3: Magnetic locator during hand exploration.**

The patient was discharged with an antibiotic and analgesic regimen, and stitches were removed without complications after 14 days. The patient experienced complete relief from discomfort and was definitively discharged after two months of post-operative follow-up.



**Figure 4: Foreign body wholly extracted.**



**Figure 5: Postoperative X-ray showing adequate removal of the FBs.**

## DISCUSSION

FBs in the hand are one of the leading reasons for visits to emergency centers and hand surgery units. Patients often attempt to remove the FB themselves, which can result in incomplete extraction, leading to complications such as infections or granulomas. During clinical examination, the presence of FBs can be overlooked, potentially lead to legal implications due to infections or chronic pain. FBs can be composed of various materials, including wood, glass, metal, plastic, and stingers, among others. Because of the diverse materials, there is no single imaging method for accurate localization. Approximately 15-38% of FBs go unnoticed during the initial evaluation, depending on the patient's symptoms and the surgeon's experience. In this work, we introduce a novel method to aid in localizing metal FBs using a magnetic locator. This device consists of a freely moving magnet on a support medium that can be sterilized. These devices are traditionally used to locate ports for tissue expander filling.<sup>4</sup>

Contemporary magnets are primarily made of an alloy of neodymium, iron and boron. The exact composition varies depending on the use given to the magnet and the strength required. A 2-gram neodymium magnet that measures 8 millimeters in diameter and 5 millimeters long generates a force of over 1700 grams.<sup>5</sup> The hand has various compartments, including the thenar, hypothenar, central adductor, space of Parona, and interosseous space. Therefore, the presence of an FB poses an imminent risk to adjacent structures during manipulation. Although clinical references like Kaplan's cardinal line are used as a guide to avoid damaging vascular structures, they are not always precise due to anatomical variations and discrepancies in deep hand structures. Hence, supplementary navigation methods are needed.<sup>6</sup> X-rays are a cost-effective and widely available technique in most plastic surgery centers, providing accessible support for metal FBs. Typically, the denser the FB, the better it can be visualized. X-rays in at least two projections are considered the first-line standard. The ability to visualize materials decreases for materials like wood or plastic, which are radiolucent with densities similar to surrounding soft tissues and increases for materials like metal, which are easily identifiable due to their radiopaque properties. In computed tomography (CT), these FBs are hyperattenuating and may cause beam-hardening artifacts, except aluminum, which has a low atomic number and radio intensity. Fluoroscopy is an excellent tool for structures susceptible to visualization using X-rays. However, it is not available in all facilities and can have associated complications, such as dermatitis and radiation burns, with prolonged use.<sup>7</sup> During tissue expansion, localization devices are used to locate the metal base port for directing the syringe and performing the instillation, avoiding damage to the expander. Magnetic tissue expander locators aim to be an alternative tool for localizing FBs through magnetism, providing a fast, accessible, and safe method, as most plastic surgery centers already have such a device. Main limitation of this devices relies in the metal properties of the FB to be attracted.

## CONCLUSION

The magnetic tissue expander locator is a valuable tool for localizing magnetic FBs. This tool offers accessible

3D navigation, low cost, and widespread availability, making it a quick, effective, safe alternative.

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