Case Series

Surgical removal of retained soft tissue foreign bodies in the surgical outpatient: a case-based discussion

Abstract

This observational study shows the successful removal of retained acute and chronic foreign bodies within the subcutaneous tissue in the surgical outpatient setting as well as the challenges of prolonged embedding of soft tissue foreign bodies, especially in asymptomatic cases where the decision for removal is prompted by a need for a scheduled diagnostic magnetic resonance imaging (MRI) for an unrelated health concern, thus, raising the question of whether detected asymptomatic foreign bodies should initially be left in place or swiftly removed to prevent future complications or procedural interruptions. Furthermore, we will outline suggestions on the best options for the prompt and successful removal of foreign bodies during the initial presentation in the outpatient setting.

Keywords: foreign body removal, soft tissue, outpatient surgery, retained foreign body, imaging guidance

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Adebola Obayan, Ifunanya Igwenagu
General Surgery, Willowgrove Medical Group, Canada

Correspondence: Adebola Obayan MD PhD FRCSC, College of Physicians and Surgeons of Saskatchewan, Address: 2-527 Nelson Road, Saskatoon, Saskatchewan, Canada, Tel (306) 653-1543; Fax (306) 653-0422; Email ado579@usask.ca

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Abbreviations: MRI, magnetic resonance imaging; FRCSC, fellow of the royal college of surgeons of canada; B0, static magnetic field; RF, radiofrequency; ED, emergency department

Introduction

The removal of foreign bodies in acute care settings can often face procedural challenges, which include the inability to localize or visualize the foreign body using available imaging modalities, location near delicate or vital structures prompting the clinician to weigh the potential damage the procedure would cause to tissues against the risk posed by leaving the foreign body in-situ, and the availability of trained personnel and equipment in cases requiring techniques such as fluoroscopy-guided removal. Furthermore, the procedure could be time-consuming, leading to pressure from a list of waiting and dissatisfied patients, further impacting the quality of care. These dilemmas often result in the decision to forego treatments in asymptomatic cases or subsequent referral to the surgical outpatient for expert care.

These foreign bodies, ranging from radiolucent glass to magnetic metals, necessitate varying approaches for successful assessment and removal. These include using ultrasonography or fluoroscopy for image-guided extraction, magnetic localization of metallic foreign bodies, irrigation and exploration of open wounds or simple palpation and use of surface markers in cases of prolonged embedding to indicate the point of blunt tissue dissection and extraction of the foreign body.[1] As illustrated in this study, the indications for soft tissue foreign body removal include alleviating symptoms such as pain and abnormal sensation and preventing procedural interference in patients needing an MRI.

The following case studies, culled from our surgical outpatients, will help elucidate the indications for foreign body removal, the challenges associated with prolonged embedding in asymptomatic patients who are being managed conservatively, alternative management options, and the necessity of timely removal for alleviation of symptoms and prevention of future complications and procedural interruptions.

Case report

Case 1

The patient was a 68-year-old man with a history of chronic back pain necessitating further investigation through MRI. Upon evaluation for the MRI appointment, the patient disclosed that he had a metallic foreign body in his chest for over 40 years, originating from a workshop accident where he was struck by fragments of a shattered metallic rod, propelled by a hammer, and had remained asymptomatic ever since. He was subsequently referred to the surgical clinic to remove the foreign body.

On examination, there was no chest wall tenderness or abnormal respiratory findings. However, a chest X-ray revealed a radio-opaque, irregularly shaped foreign body in the fifth right intercostal space along the mid-clavicular line. It is estimated to be 1 mm (about 0.04 in) long and positioned 16 mm (about 0.63 in) deep from a point marked with a safety pin taped to the overlying skin surface.

Description: A lateral view chest X-ray of case 1 revealing a radio-opaque, irregularly shaped foreign body located in the fifth right intercostal space along the mid-clavicular line. The foreign body was estimated to be 1 mm in length and the depth in relation to a safety pin taped to the overlying skin, estimated to be about 16.05mm **(Figure 1)**.

Description: Antero-posterior (AP) view of Chest X-ray of case 1 taken after initial attempt of foreign body removal. Foreign body (blue arrow) noted to still be in place **(Figure 2).**

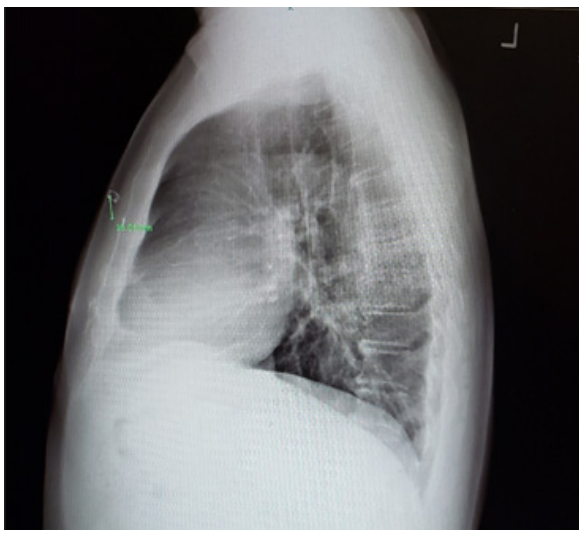

Figure 1 Preoperative Chest X-ray of Case 1.

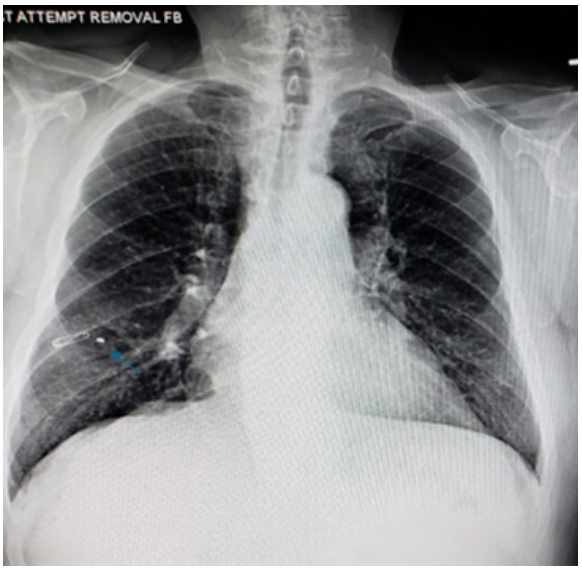

Figure 2 Post 1st Attempt Removal of Foreign Body Chest X-ray of Case 1.

Procedure

The procedural approach involved meticulous planning and execution. A landmark was identified, and the skin over the anterior chest wall was prepped. A 2cm (about 0.79 in) incision was made under local anesthesia and deepened by blunt dissection of the underlying muscles. Digital exploration was initiated, but the first attempt proved unsuccessful as the foreign body was adeptly concealed beneath granulomatous tissue. After a confirmatory X-ray, the foreign body was successfully located and extracted during the second attempt, revealing the intricacies of prolonged embedding in soft tissue.

Case 2

A 75-year-old woman with a month's history of foreign body sensation on the plantar surface of her right foot just proximal to her great toe after stepping on a piece of broken glass. An initial x-ray revealed no foreign body. However, a subsequent ultrasound performed on re-evaluation revealed a 4 mm x 1.5 mm shard of glass. On examination, there were no signs of infection, point tenderness or loss of function of the affected toe. A repeat ultrasound revealed a linear focus of echogenicity measuring approximately 1.5 mm x 4 mm within the plantar subcutaneous tissue of the first metatarsophalangeal joint with some surrounding nonspecific subcutaneous edema/ adventitial bursitis.

Procedure

The incision line was marked using a surface marker with ultrasound guidance. Under local anesthesia, a scalpel was used to make an incision through the skin. This incision was sufficiently broad to allow the insertion of surgical forceps and the removal of the foreign body. The procedure was successful, with an unremarkable post-op recovery.

Case 3

The patient was a 41-year-old man who presented acutely with a feeling of foreign body sensation a couple of hours after he felt a piece of metal shard broken off while hammering a dowel at work hit his left cheek. Upon physical examination, the foreign body was not palpated. However, a small erythematous spot was noted on his left cheek. An x-ray of the facial bones/zygoma revealed a metallic foreign body measuring 4 x 2 x 9 mm projecting over the expected location on the left cheek. The site was prepped and incised under local anesthesia, and the foreign body was successfully extracted. The skin was closed with absorbable sutures and there were no post-procedural complications.

Description: An AP view of the pre-operative x-ray of the facial bones and zygoma of case 3 showing a metallic foreign body (blue arrow) measuring 4 mm x 2 mm x 9 mm projecting over the expected location on the left cheek (Figure 3).

Description: A lateral view of the pre-operative x-ray of the facial bones and zygoma of case 3 showing a metallic foreign body (blue arrow) projecting over the expected location on the left cheek (Figure 4).

Figure 3 Pre-operative Facial X-ray of Case 3 (Antero-posterior view).

Figure 4 Pre-operative Facial X-ray of Case 3 (Lateral view).

Case 4

A young adult male presented to the surgical outpatient with a retained bullet pellet embedded underneath his chin. He accidentally shot himself 15 years prior while fiddling with a shotgun. He had been asymptomatic; however, he developed a dull pain, which prompted his presentation to the clinic for removal of the foreign body.

A magnet and surface marker were used to mark the location of the foreign body on the anterior neck, and with ultrasound guidance, the pellet was successfully extracted. Post-procedure follow-up was unremarkable, with complete resolution of presenting symptoms.

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Discussion

Foreign bodies embedded in soft tissue can cause toxic and allergic reactions, inflammation, or infection, but the severity of these complications varies widely. Removal can be difficult and time-consuming, and the potential damage to tissues caused by the procedure must be weighed against the risk posed by a particular foreign body.[2] In some cases, the patient can be asymptomatic and managed conservatively for a prolonged time when there is an anticipated high risk of damage to surrounding tissues such as the neurovascular bundle. However, retained foreign bodies are often a cause of malpractice lawsuits in the emergency and outpatient departments.[3] Also, retained metallic foreign bodies could prospectively impede clinical assessment when an MRI is strongly indicated thus, prompt and prudent removal is advised.

Amongst the recommended imaging modalities, ultrasonography has been reported to have high specificity and moderate sensitivity for detection of retained foreign bodies.[4] It can depict all materials as they appear echogenic on ultrasound and often demonstrates posterior shadowing or reverberation artifacts.[5] However, ultrasonography is highly operator dependent, requiring specialist skill and training in accurate interpretation.[6] Acoustic shadowing from echogenic structures such as calcification, tendons, and bones can obscure foreign bodies and there could be false positives resulting in unnecessary procedures.[7] Furthermore, detecting foreign bodies that are more deeply embedded can pose a challenge thus, necessitating the use of other imaging modalities, including multiple-projection radiographs, fluoroscopy, and computed tomography.

Indications for foreign body removal

The decision to remove a foreign body is typically guided by several indications as reflected in our study scenarios. They include the type of foreign body, risk of complications, symptomatic presentation such as abnormal sensation (cases 2 and 3), and pain from impingement on surrounding structures, as seen in case 4.

Additionally, the need for MRI necessitates the removal of metallic foreign body to ensure accurate imaging and prevent any potential complications during the procedure. The presence of a metallic foreign body poses risks, such as interference with imaging studies and potential complications during an MRI procedure.

There are three major magnetic fields in an MRI scanner that have potential safety risks:

1. The strong static magnetic field (B0) in MRI scanners can attract and accelerate ferromagnetic objects toward the center of the machine, turning them into dangerous projectiles. This magnetic field can also displace implants or affect the function of devices such as pacemakers and pumps.
2. The radiofrequency (RF) field that RF coils create can cause tissue heating, especially in the presence of implants.
3. The Time-varying fast-switching gradient magnetic field function is a spatial encoding of the MRI signal and can stimulate muscles or peripheral nerves and induce implant heating.

These magnetic fields in MRI scanners can cause five dangerous interactions in patients with metallic foreign bodies: projectile effect, twisting, burning, artefacts, and device malfunction (interference with a pacemaker).[8] Therefore, all patients must be thoroughly screened individually for foreign bodies before undergoing an MRI scan. Despite being asymptomatic, this qualified our patient in case 1 for the removal of the metallic foreign body.

Challenges associated with prolonged embedding of foreign bodies

While foreign bodies can sometimes be left in situ for extended periods without causing symptoms or complications, each case must be evaluated individually. The potential complications linked to embedded foreign bodies are multifaceted, encompassing infection, migration, and tissue reactions[9] as seen in our first case where the foreign body remained concealed beneath granulomatous tissue. Other challenges include the cost of extensive surgical procedures in cases where conservative or minimally invasive techniques fail and more importantly, the longer recovery periods following such procedures.

Comparison with existing literature reveals the rarity of cases where foreign bodies remain asymptomatic for an extended duration. A case was reported of a 12-year-old boy with low back pain and radiculopathy six years after falling with his back on shattered glass. A piece of glass had been retained and migrated to the lumbar spinal canal, resulting in the delayed manifestation of neurological symptoms.[10] The granuloma formation in our index case decades after foreign body retention posed a challenge in removal, necessitating adaptability in surgical exploration. It could have resulted in the need for more invasive surgery, which would impact the overall post-op recovery of the patient. Also, the patient would have been unable to have an MRI if the procedure was unsuccessful and this would have crippled accurate diagnosis of his current ailment.

Remarkably, the postoperative course was uneventful, with no immediate or delayed complications observed. The patient exhibited no signs of infection, hematoma, or wound dehiscence and subsequently, underwent a seamless MRI to evaluate his chronic back pain, the initial reason for seeking intervention. The imaging study facilitated a comprehensive diagnosis and further management of his underlying condition. This successful integration of the surgical procedure with subsequent diagnostic efforts highlights patient care's collaborative and multidisciplinary nature, ensuring a holistic approach to addressing the patient's health concerns.

Alternative management options for asymptomatic patients with retained foreign bodies

These include conservative management with regular monitoring for symptoms or complications as was depicted in our fourth case. Gunshot injuries can result in retained bullet pellets and they oftentimes, are left in situ and managed conservatively especially when they are located close to vital structures or removal would result in additional tissue damage or complications such as infection, iatrogenic neurovascular injury and deep vein thrombosis.[11] However, with the development of delayed complications, prompt clinical re-evaluation and removal are advised.

Other options include real time imaging guidance which entails the use of ultrasonography or fluoroscopy to locate the foreign body for extraction, and the use of sterile surgical magnets to locate and extract retained ferromagnetic metallic foreign bodies in a minimally invasive way.[12] In some cases, extensive surgical exploration and debridement with the involvement of a multidisciplinary team, including a vascular surgeon is strongly indicated.

Recommendations

To ensure successful identification and prompt removal of retained foreign bodies, it is crucial to conduct a thorough clinical evaluation at the initial clinic visit. This evaluation should incorporate patient-specific factors (anatomical location of the foreign body, nearness

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to vital structures, patient's preference) and consider the future implications of retained chronic foreign bodies. Timely intervention minimizes the risk of unforeseen complications during diagnostic procedures and optimizes patient care thereby, reducing malpractice lawsuits.

The surgical approach in our first case, guided by radiography and performed under local anesthesia, was chosen to ensure the complete removal of all metallic fragments. This shows the need to make room for flexibility in the operative plan when faced with unexpected anatomical complexities and further highlights the need for integrating advanced technologies, such as increased fluoroscopy availability in surgical clinics, combined with the expertise of skilled surgeons, thereby enhancing the safety and efficacy of foreign body removal.

Conclusion

This observational study demonstrates the successful removal of both acute and chronic subcutaneous foreign bodies in the surgical outpatient setting, highlighting the challenges associated with prolonged embedding, particularly in asymptomatic cases. With prompt removal emphasized, especially when future diagnostic procedures like MRI are anticipated, our findings underscore the importance of thorough clinical evaluation and patient-specific considerations at initial presentation to avoid future complications and procedural interruptions. By adopting a tailored approach for each case, integrating advanced imaging techniques, and ensuring timely intervention, we can enhance patient outcomes and mitigate potential risks associated with retained foreign bodies.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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