

Case Report



Penetrating Neck Injury Involving Wooden Foreign Bodies: Case Report

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Conflict of Interest

The authors have no financial conflicts of interest.

ABSTRACT

Although rare, penetrating neck injuries can have grave consequences, and are associated with high mortality rates. Individuals with cervical injuries due to wooden foreign bodies are at an increased risk of developing infectious complications. In this case, a male patient aged 27 years presented with a cervical injury indicative of a penetrating wound caused by a wooden foreign body. Computed tomography (CT) scan revealed no signs of intracranial hemorrhage or fracture. Additionally, cervical CT scan showed no evidence of cervical corpus or longus colli muscle lesions. The medical team suggested a cervical magnetic resonance imaging (MRI) examination; however, the patient's family opted out. Subsequently, the patient underwent wound debridement, which involved the extraction of a fragment of impaling wood. Two days after the procedure, the patient developed a fever and weakness of the shoulder and arm on the ipsilateral side. Following the process of re-education, the family provided consent for MRI examination. A subsequent surgical procedure was performed on the patient based on the MRI findings and clinical presentation. Residual wooden fragments were effectively extracted, resulting in positive progression of the patient's condition.

Keywords: Tomography, X-Ray computed; Magnetic resonance imaging; Neck injuries; Foreign bodies; Wounds, penetrating

INTRODUCTION

Penetrating neck injuries are infrequent; however, they can result in severe morbidity and mortality, with an estimated mortality rate of 6%.¹ Most penetrating neck injuries are attributed to young males, with stab wounds being the most prevalent etiology.⁹ Various factors can affect the severity of penetrating neck injuries, such as upper airway obstruction caused by edema, significant blood loss due to damage to major blood vessels (e.g., carotid arteries and jugular veins), and the presence of a hematoma or emphysema that compresses the airway.¹⁰ Penetrating injuries to the neck are widely acknowledged as challenging to handle owing to a variety of factors, such as intricate anatomical structures, possible hemodynamic decline, direct exposure to critical structures, and swift airway impairment.^{3,13}

Wood is an organic material composed of fibrous layers with a porous structure that can facilitate bacterial growth.^{6,14} Typically, foreign objects within the human body can

be identified using computed tomography (CT). Radiolucent materials such as organic substances, plastics, and wood can exhibit low visibility on CT scans, contingent upon contextual factors.¹⁴ Magnetic resonance imaging (MRI) may be conducted to facilitate the detection of suspected wooden foreign bodies within the body. A case of a 27-year-old male who suffered a penetrating neck injury due to a wooden foreign object is presented in this report. The significance of MRI screening in identifying non-metallic foreign bodies, particularly those that penetrate the body and are made of wood, is underscored in this case report. This is because of the possibility of misinterpretation during CT scanning.

CASE REPORT

A male individual, aged 27, experienced an injury caused by a sharp object penetrating the anterior region of his neck in close proximity to the mandibular angle while engaged in the activity of sawing wood. The medical practitioner recommended cervical MRI; however, the patient's family declined the procedure, citing financial constraints. CT was expeditiously conducted as a corroborative diagnostic procedure during the initial surgery. CT of the head revealed no signs of intracranial hemorrhage or fracture. Additionally, cervical CT showed no evidence of cervical corpus or longus colli muscle lesions (**FIGURE 1**). Subsequently, the patient underwent wound debridement, which involved the extraction of a wooden fragment, performed by a plastic surgeon. Two days after the initial surgery, the patient's body temperature reached 38.5°C (101.3°F), which was recorded coinciding with the onset of fever and weakness in the shoulder and arm on the same side as the penetrating neck injury.

Following the re-education process, the family consented to undergo an MRI examination on the fourth day after the incident. MRI revealed significant findings in the spinal cord, specifically at the C2-C5 level (**FIGURE 2**). A thicker spinal cord with edema in the medulla spinalis was identified, displaying low intensity on T1 imaging and high intensity on T2 imaging with fat saturation. Furthermore, in the T1 imaging, the foreign body appeared isointense. However, in the T2 imaging, a hypointense appearance was noted. The foreign body extended and penetrated the left C3/4 and C4/5 foramen, with its tip touching and compressing the medullary spinalis towards the right. Edema was also observed in the soft tissue of the left paraspinal muscle.

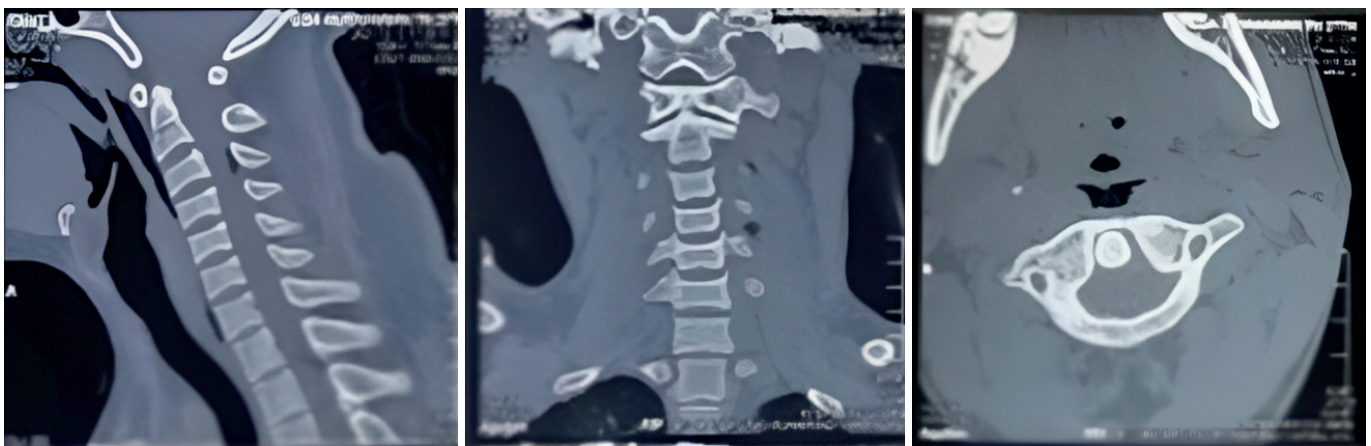


FIGURE 1. The computed tomography scan results indicated the absence of intracranial hemorrhage and fracture lines, as well as no evidence of cervical corpus fractures or lesions in the longus colli muscle.

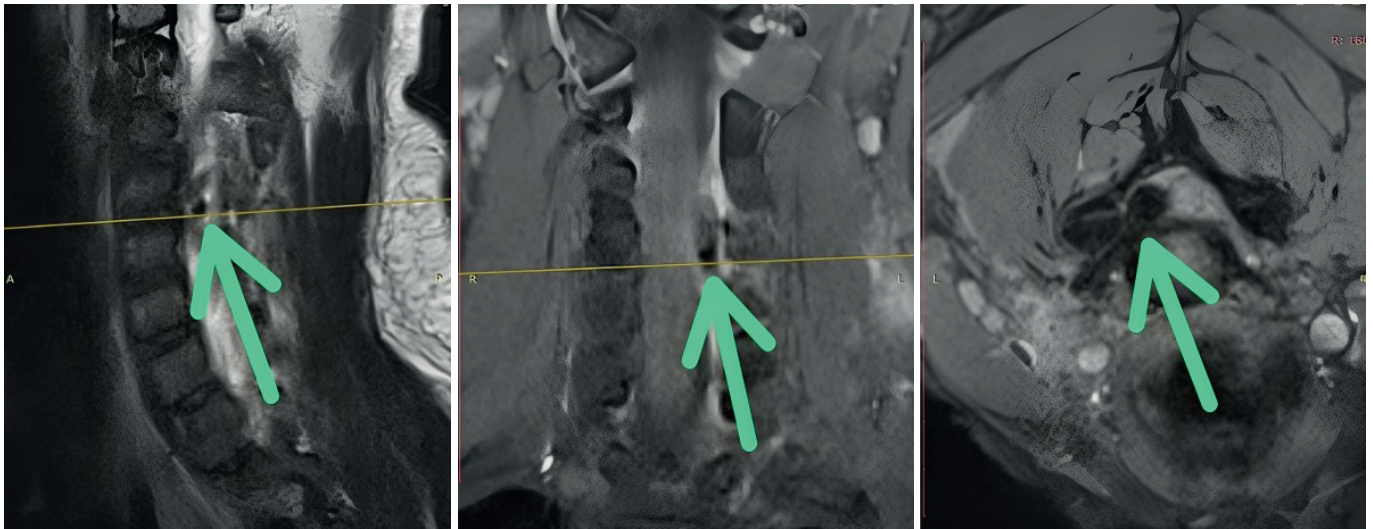


FIGURE 2. The magnetic resonance imaging results revealed the presence of remaining wood mass located within the intervertebral foramen. The wood mass extended and penetrated the left C3/4 and C4/5 foramen, with its tip touching and compressing the medulla spinalis towards the right.

Upon arrival at our emergency department, the patient was fully conscious and cooperative, with a Glasgow Coma Scale (GCS) score of 15. Vital signs were stable, with a respiratory rate of 19 breaths per minute and oxygen saturation of 97%–99% using a non-rebreathing mask at 10 L/min. The blood pressure was 118/65 mmHg and heart rate ranged between 50–60 beats per minute. A physical examination revealed no pallor, icterus, hematoma, otorrhea, or rhinorrhea. Chest auscultation revealed vesicular breath sounds, and cardiovascular examination revealed no abnormalities.

Blood test results supported the diagnosis, with an elevated leukocyte count of $13.4 \times 10^9/L$ indicating a potential inflammatory response, while hemoglobin and platelet levels were within normal limits. A neurological assessment revealed some weakness in the left upper extremities (C5–C8) with a strength rating of 2/5, whereas other areas of the body exhibited normal strength (5/5).

Based on the MRI findings and evaluation of the patient's clinical status, the following surgical plan was determined: urgent debridement and extraction of the foreign body to remove the wooden fragment that had penetrated the left C3/4 and C4/5 foramen, causing compression of the medullary spinalis. The surgical procedure was scheduled urgently to address the patient's condition and prevent further complications associated with the presence of a wooden foreign body in the spinal cord.

After the second surgery, the remaining 5 cm of the wooden piece was successfully removed (**FIGURE 3**). On the seventh day after the second surgery, the patient showed significant improvement. This was evident from the reduction in neck pain and increase in the ability to move the left hand. The patient's left hand could now be moved with an elbow flexor strength of 5/3 and wrist extensor strength of 5/3, demonstrating an improvement in the ability to move the left hand. The neurological status demonstrated varying levels of strength and sensory responses in the spinal segments, including the hands and legs, with good muscle strength in the arms (C5–C8) and legs (L2–S1). In addition, the results of the physiological reflex examination were normal, indicating good nerve function in the spinal segments.



FIGURE 3. A surgical specimen consisting of a large (5 cm) wooden piece was successfully removed.

Overall, the postoperative outcomes showed a positive progress in the patient's condition, providing hope for further recovery. Continued care and rehabilitation are essential in the patient's ongoing recovery process to ensure the optimal functional ability of the left hand and minimize the risk of any further complications.

Informed consent

Informed consent was obtained from the participants included in this study.

DISCUSSION

A penetrating neck injury is a traumatic event that results in skin penetration into the neck region. This type of injury may lead to the clinical suspicion of a violation of the platysma muscle.^{4,11)} The cervical region is a multifaceted anatomical region housing vulnerable vascular, aerodigestive, and neurological structures, with limited protective measures.^{10,11)} The prompt removal of foreign bodies located in the cervical region is imperative, particularly in cases where they penetrate the cerebral cortex or vasculature. Furthermore, patients are recommended to undergo expeditious surgical intervention in the presence of multiple indications, including pulsatile hemorrhage, hemodynamic instability, unilateral extremity pulse deficit, enlarging hematoma, audible bruit or palpable thrill, wound crepitus, airway obstruction, stridor, extensive subcutaneous emphysema, clinical manifestations of cerebrovascular accident or cerebral ischemia, and dysphonia.¹²⁾

Radiological examinations (MRI, ultrasonography, or conventional radiography) to detect foreign bodies should be tailored to their constituent materials (wood, glass, metal, teeth, splinters, etc.) to minimize negative findings.¹⁵⁾ Radiopaque foreign bodies composed of plastic, metal, or glass are typically identified using conventional radiography. The identification of wooden foreign bodies within the human body poses a significant challenge for neurosurgeons because of their elusive nature on plain radiographs, which frequently leads to delayed or missed diagnoses.¹⁴⁾

In this case, the patient underwent cranial and cervical CT scans to identify a wooden foreign body in the neck region. The initial surgical intervention successfully removed the foreign body. Two days after the procedure, the patient exhibited fever and weakness in the shoulder and arm on the same side as the puncture wound.

The delayed onset of motor weakness two days after the initial symptom-free period could be attributed to several factors. First, it is likely that the wooden fragment near the intervertebral foramen was present from the beginning but went unnoticed during the initial CT scan. The delayed discovery of this fragment on MRI may have contributed to the delayed onset of motor weakness. Additionally, the subsequent symptoms of fever and weakness in the shoulder and arm suggest that there might be an inflammatory response to the injury caused by the penetration of the neck by the foreign body. The elevated leukocyte count in the blood test further supports the presence of inflammation in the affected area. Inflammatory responses take time to develop and reach a level where they cause noticeable symptoms such as motor weakness. The presence of a foreign body in the neck can lead to pressure, inflammation, or compression of the nerves or spinal cord roots. Consequently, nerve impulses cannot efficiently travel from the brain to the body parts controlled by these nerves, resulting in weakness or paralysis of specific areas of the body. Moreover, penetration of a foreign body can cause inflammation and swelling around the injured area. This swelling may compress the surrounding nerves, disrupt nerve signal transmission, and eventually lead to motor weakness. Considering these factors, it is apparent that the delayed onset of motor weakness is a complex interplay between the inflammatory response, nerve injury, and the presence of the wooden foreign body itself.

CT scans serve as the primary modality for the initial evaluation of foreign bodies owing to their capacity to generate high-resolution images of deep-seated structures across a wide field of view.¹⁵⁾ The role and limitations of CT scans in patients with wooden foreign bodies in the craniofacial region remain a topic of debate in the field of neurosurgery. The radiographic appearance of a wooden foreign body on CT is characterized by a hypodense region that resembles air, which poses a challenge for detection.^{5,14)} This phenomenon may result in an increased likelihood of residual fragments persisting within the craniofacial and cervical regions, thereby leading to plausible complications.⁷⁾ Infection is a frequent postoperative complication in patients with penetrating neck injuries caused by wooden foreign bodies. Owing to the mixed bacterial flora, missing wood foreign bodies may cause severe bacterial infections, including *Escherichia vulneris*, *Escherichia coli*, *Bacillus cereus*, *Enterococcus durans*, gamma-haemolytic *Streptococcus*, and *Clostridium perfringens*.¹⁴⁾ Bacterial infections can be complicated with abscess formation, severe inflammation, or bacterial emphysema.¹⁴⁾

The utilization of MRI warrants consideration in the identification of non-metallic foreign bodies, given its superior ability to detect wooden foreign bodies. MRI is a valuable modality for detecting foreign bodies, particularly radiolucent objects situated in anatomical regions that are not amenable to ultrasonic scanning.⁸⁾ A penetrating injury to the neck caused by a wooden foreign body close to a major arterial line may result in vascular injury. The identification of vascular injury is facilitated by the presence of overt clinical manifestations, including, but not limited to, the absence of pulse, arterial hemorrhage, extensive hematoma, vascular oscillation, conspicuous ischemic alterations, and related indicators.⁸⁾

Nonetheless, in emerging economies, such as Indonesia, MRI assessments encounter numerous challenges, including equipment availability and costs. In 2013, the MRI machine

availability ratio in Indonesia was 0.286 per million people, according to the academic literature in the field of Neurosurgery.⁸⁾ The aforementioned ratio is lower than that of the majority of developing nations situated within the Southeast Asian region, such as Malaysia, Singapore, and Thailand.⁸⁾ Furthermore, expensive diagnostic and imaging equipment is mainly available in major cities and regions of Indonesia.⁸⁾

Subsequently, prompt medical intervention should be initiated after a comprehensive clinical and radiographic assessment, owing to the potential for displacement of foreign objects during cervical motion. The initial management of penetrating neck injuries involves proper wound cleansing and soft tissue management techniques. This may include the extraction of foreign objects and the reconstruction of delicate nerve structures and blood vessels.¹⁵⁾ The administration of antibiotics in the early management of penetrating neck injuries is essential for favorable outcomes.²⁾ Proper wound debridement with adequate antimicrobials is a major factor in reducing morbidity and mortality from penetrating neck injuries by wooden objects.¹⁰⁾

CONCLUSIONS

The implementation of suitable medical interventions is crucial for preserving patient survival and promoting postoperative well-being. The present case report highlights the potential for erroneous interpretation of CT scan findings in the identification of wooden foreign bodies in cases of penetrating neck trauma. Therefore, MRI should be considered for the detection of non-metallic foreign bodies, such as wooden foreign bodies to minimize the morbidity and mortality associated with penetrating neck injuries.

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