

Retained Metallic Foreign Body Following Penetrating Zone II Neck Trauma Caused by an Angle Grinder: A Case Report and Literature Review

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Citation: Elouahab S, Rsaissi C, Lahjaouj M. Retained Metallic Foreign Body Following Penetrating Zone II Neck Trauma Caused by an Angle Grinder: A Case Report and Literature Review. *Medi Clin Case Rep J* 2026;4(3):1866-1870. DOI: doi.org/10.51219/MCCRJ/Elouahab-Sara/497

Received: 07 July, 2026; **Accepted:** 14 July, 2026; **Published:** 16 July, 2026

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ABSTRACT

Background: Penetrating neck trauma is a potentially life-threatening condition because of the high density of vital vascular, aerodigestive, and neurological structures within a confined anatomical region. High-velocity metallic fragments generated by industrial tools such as angle grinders may penetrate deeply despite minimal external injury, resulting in retained cervical foreign bodies that pose significant diagnostic and therapeutic challenges.

Case presentation: We report the case of a 34-year-old man who presented to the emergency department following a workplace accident involving an angle grinder. Clinical examination revealed a small puncture wound on the left lateral aspect of the neck (Zone II). The patient was conscious, hemodynamically stable, and showed no evidence of airway compromise, vascular injury, or neurological deficit. Plain cervical radiography demonstrated an 8-mm metallic foreign body embedded within the left sternocleidomastoid muscle. Because the clinical examination suggested a superficial injury and the metallic fragment was clearly localized on plain radiography without suspicion of vascular or aerodigestive tract involvement, computed tomography was not performed. Surgical exploration was undertaken within six hours of injury through a limited Paul-André mini-cervicotomy performed by an otorhinolaryngology surgeon. The metallic fragment was successfully removed without injury to adjacent neurovascular structures. The postoperative course was uneventful. The patient received prophylactic amoxicillin-clavulanic acid, metronidazole, and tetanus prophylaxis, and was discharged on postoperative day one without hematoma, infection, or neurological complications.

Conclusion: This case illustrates that apparently minor penetrating neck wounds caused by high-velocity industrial tools may conceal retained metallic foreign bodies. Careful clinical evaluation combined with appropriate imaging is essential for diagnosis. Although multidetector computed tomography remains the preferred imaging modality for most hemodynamically stable patients with penetrating neck trauma, individualized management based on clinical findings and targeted surgical exploration may be appropriate in carefully selected cases.

Keywords: Penetrating neck trauma; Retained foreign body; Angle grinder injury; Zone II neck injury; Sternocleidomastoid muscle; Surgical exploration

Introduction

Penetrating neck trauma (PNT) accounts for approximately 5–10% of all traumatic injuries but remains one of the most challenging emergencies because of the high density of vital vascular, aerodigestive, and neurological structures within a confined anatomical region. Even seemingly minor cervical wounds may conceal significant underlying injuries; therefore, prompt diagnosis and appropriate management are essential to reduce morbidity and mortality^{1,2}.

Occupational accidents involving high-speed power tools, particularly angle grinders, represent an uncommon but potentially devastating mechanism of penetrating cervical trauma. Angle grinders operate at rotational speeds that may exceed 10,000 rpm, and fragmentation of the abrasive disc can generate high-velocity projectiles capable of penetrating deeply into soft tissues despite producing only a small cutaneous wound. Consequently, retained metallic foreign bodies may remain clinically occult during the initial assessment, increasing the risk of delayed infectious, vascular, or neurological complications³.

Traditionally, penetrating neck injuries were managed according to the anatomical three-zone classification described by Monson, with mandatory exploration frequently recommended for Zone II injuries. However, advances in multidetector computed tomography angiography (MDCTA) have shifted contemporary practice toward a selective “no-zone” approach, in which management is guided primarily by the patient’s hemodynamic status, clinical findings, and imaging results rather than by the anatomical location of the injury alone^{4,5}.

Although MDCTA is currently considered the imaging modality of choice for hemodynamically stable patients with penetrating neck trauma, treatment should remain individualized according to the mechanism of injury, clinical presentation, and characteristics of the foreign body. Metallic foreign bodies identified by plain radiography in carefully selected patients with no clinical evidence of vascular or aerodigestive injury may be safely managed by targeted surgical exploration⁶.

We report the case of a retained metallic fragment originating from a fractured angle grinder disc embedded within the sternocleidomastoid muscle following a penetrating Zone II neck injury. This case emphasizes the importance of maintaining a high index of suspicion in apparently minor cervical wounds and discusses current diagnostic and therapeutic strategies based on recent literature.

Case Presentation

A 34-year-old previously healthy man presented to the emergency department less than six hours after sustaining a workplace injury involving an angle grinder. During metal cutting, the abrasive disc fractured, projecting a high-velocity metallic fragment into the left side of his neck.

On admission, the patient was conscious, alert, and hemodynamically stable. He complained of localized pain over the left lateral aspect of the neck associated with mild bleeding from a small puncture wound. He denied dyspnea, dysphagia, dysphonia, or loss of consciousness.

Clinical examination revealed a puncture wound measuring approximately 5 mm in diameter located in the left lateral cervical region (Zone II) (**Figure 1**). No active bleeding,

expanding hematoma, subcutaneous emphysema, or signs of airway compromise were observed. Palpation suggested that the injury was confined to the superficial soft tissues. Neurological examination demonstrated no motor or sensory deficits, and no evidence of cranial nerve injury was identified. Peripheral pulses were symmetrical, and no clinical signs suggestive of vascular injury were present.

Despite the apparently superficial nature of the wound, the high-energy mechanism of injury raised suspicion of a retained foreign body. Plain cervical radiography demonstrated an approximately 8-mm radiopaque metallic fragment embedded within the left sternocleidomastoid muscle (**Figure 2**). The fragment appeared distant from the carotid sheath and other major cervical neurovascular structures.

Considering the patient’s stable clinical condition, the absence of hard or soft signs of vascular or aerodigestive injury, the superficial localization of the foreign body on clinical examination, and its clear identification on plain radiography, computed tomography was not performed. After multidisciplinary discussion, immediate surgical exploration was considered the most appropriate management strategy.

Under general anesthesia, an otorhinolaryngology (ENT) surgeon performed surgical exploration through a limited Paul-André mini-cervicotomy centered on the entry wound. Careful dissection through the superficial cervical planes allowed identification of an approximately 8-mm metallic fragment lodged within the fibers of the sternocleidomastoid muscle. The foreign body was removed completely without injury to adjacent vascular or neurological structures (**Figure 3**). After meticulous hemostasis, a closed suction drain was inserted, and the wound was closed in anatomical layers.

Postoperatively, the patient received intravenous amoxicillin–clavulanic acid combined with metronidazole as prophylaxis against deep cervical infection. Tetanus prophylaxis was administered according to institutional recommendations. The postoperative course was uneventful, with no cervical hematoma, wound infection, neurological deficit, or airway compromise. The drain was removed without incident, and the patient was discharged on postoperative day one in good clinical condition.



Figure 1: Small puncture wound located in the left lateral cervical region (Zone II) following penetration by a fractured angle grinder disc.

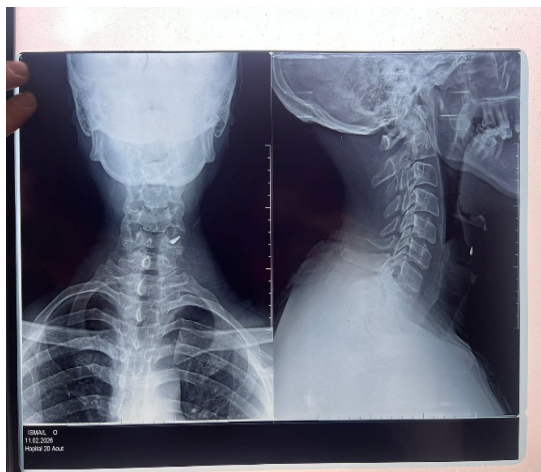


Figure 2: Plain anteroposterior cervical radiograph demonstrating an approximately 8-mm radiopaque metallic foreign body embedded within the left sternocleidomastoid muscle (arrow)



Figure 3: Metallic fragment removed during surgical exploration through a limited Paul-André mini-cervicotomy

Discussion

Penetrating neck trauma (PNT) remains a challenging clinical entity because of the close anatomical relationship between the major cervical vessels, the aerodigestive tract, and critical neural structures. Although PNT accounts for only 5-10% of traumatic injuries, delayed diagnosis or inappropriate management may result in life-threatening complications, including massive hemorrhage, airway compromise, neurological deficits, and deep neck infections^{1,2}. Consequently, even apparently minor cervical wounds should never be underestimated, particularly when they result from high-velocity mechanisms.

Occupational accidents involving angle grinders are uncommon but potentially devastating causes of penetrating cervical trauma. These devices operate at high rotational speeds, and fragmentation of the abrasive disc may generate high-energy projectiles capable of penetrating deep cervical tissues despite producing only a small cutaneous wound. This discrepancy between the external appearance of the injury and the extent of underlying tissue damage has been consistently emphasized in the literature and highlights the importance of maintaining a high index of suspicion for retained foreign bodies and associated cervical injuries³.

Historically, the management of penetrating neck trauma relied on the anatomical three-zone classification described by Monson, with mandatory surgical exploration frequently recommended for Zone II injuries. However, advances in multidetector computed tomography angiography (MDCTA) have profoundly changed contemporary practice. Current trauma guidelines advocate a selective “no-zone” approach, in which management is based primarily on the patient’s hemodynamic status, clinical examination, and imaging findings rather than on the anatomical location of the wound alone^{4,5}. This strategy has significantly reduced unnecessary surgical explorations while maintaining excellent diagnostic accuracy for vascular and aerodigestive injuries.

MDCTA is currently considered the imaging modality of choice for hemodynamically stable patients with penetrating neck trauma because it accurately identifies vascular injuries, aerodigestive tract lesions, retained foreign bodies, and their relationship to adjacent vital structures^{4,5}. Nevertheless, clinical judgment remains fundamental, and management should be individualized according to the mechanism of injury, the patient’s condition, and the characteristics of the foreign body.

In the present case, CT imaging was not performed because the patient was hemodynamically stable, had no hard or soft signs of vascular or aerodigestive injury, and plain cervical radiography clearly demonstrated a superficially located metallic foreign body embedded within the sternocleidomastoid muscle. Furthermore, the clinical examination suggested that the injury was confined to the superficial cervical planes. Based on these findings, immediate surgical exploration was considered the most appropriate management strategy. Although this approach proved successful in our patient, it should not be regarded as an alternative to current recommendations favouring MDCTA in stable patients but rather as an individualized decision based on the specific clinical circumstances.

Retained metallic foreign bodies of the neck generally require surgical removal because of the potential risks of deep neck infection, abscess formation, migration, chronic pain, fibrosis, vascular erosion, pseudoaneurysm formation, and neurological injury^{6,7}. Delayed migration of metallic fragments has been reported even in initially asymptomatic patients, reinforcing the importance of early diagnosis and timely intervention. Complete surgical extraction is therefore recommended whenever the foreign body is accessible and the anticipated benefits outweigh the risks of exploration^{6,8}.

In the present case, the metallic fragment measured approximately 8 mm and was lodged within the left sternocleidomastoid muscle without involvement of the carotid sheath or adjacent neurovascular structures. This favourable anatomical location enabled safe removal through a limited Paul-André mini-cervicotomy, providing adequate surgical exposure while minimizing tissue dissection and operative morbidity. Complete extraction was achieved without intraoperative complications, and the postoperative course was uneventful. The patient received prophylactic intravenous amoxicillin-clavulanic acid combined with metronidazole, together with tetanus prophylaxis, and was discharged on the first postoperative day without hematoma, wound infection, airway compromise, or neurological deficit.

To better contextualize the present observation, a review of previously published reports describing retained cervical foreign bodies caused by angle grinder injuries was performed (**Table 1**). Although angle grinder-related trauma is relatively common in industrial settings, cervical injuries caused by fractured abrasive discs remain rare. Most reported patients were young male workers who sustained occupational injuries involving high-velocity projectiles. In the majority of published cases, multidetector CT or CT angiography was performed to accurately localize the foreign body and to exclude associated vascular or aerodigestive injuries. Surgical exploration was the treatment of choice in nearly all cases, with favourable outcomes when diagnosis and management were undertaken promptly⁹⁻¹².

Compared with previously reported cases, our patient presented several distinctive features. First, the foreign body originated from fragmentation of the abrasive grinding disc itself rather than from the material being cut. Second, despite the high-energy mechanism, the metallic fragment remained confined to the sternocleidomastoid muscle without injury to major vascular, neurological, or aerodigestive structures. Finally, early surgical exploration guided by clinical examination and plain radiography resulted in complete removal of the fragment and an uncomplicated recovery. This case therefore illustrates

that apparently trivial cervical wounds may conceal retained foreign bodies and emphasizes the importance of careful clinical assessment, appropriate imaging, and individualized surgical decision-making.

The principal limitation of this report is the absence of preoperative CT imaging, which is currently recommended in most hemodynamically stable patients with penetrating neck trauma. However, this decision was based on the patient’s stable clinical condition, the absence of clinical evidence of vascular or aerodigestive injury, the superficial localization of the lesion on examination, and the unequivocal identification of the foreign body on plain radiography. Another limitation is the relatively short postoperative follow-up. Nevertheless, the absence of early complications and the favourable clinical outcome support the effectiveness of the selected management strategy in this particular case.

Overall, this case highlights an uncommon mechanism of penetrating neck trauma caused by fragmentation of an angle grinder disc and reinforces the principle that the severity of cervical injuries cannot be reliably predicted from the size of the skin wound alone. Early recognition, appropriate imaging, timely surgical intervention, and multidisciplinary management remain the key factors for achieving favourable outcomes.

Table 1: Summary of published cases of retained cervical foreign bodies caused by angle grinder injuries and comparison with the present case.

Author	Year	Mechanism of injury	Neck zone	Imaging	Surgical management	Outcome
Meherzi et al.	2024	Fractured angle grinder disc causing penetrating injury with internal jugular vein laceration	Zone II	CT angiography	Emergency neck exploration and venous ligation	Full recovery without neurological deficit (PMC)
Marek et al.	2012	Broken metallic saw fragment retained in the neck	L a t e r a l neck	Plain radiography ± CT	Surgical removal	Uneventful recovery (ScienceDirect)
Gayathri et al.	2018	Retained glass foreign body after penetrating neck trauma	Cervical region	CT scan	Surgical removal	Complete recovery (Scholars Middle East Publishers)
Present case	2026	Fractured abrasive angle grinder disc with retained metallic fragment in the sternocleidomastoid muscle	Zone II	Plain radiography	Early removal through Paul-André mini-cervicotomy	Complete recovery without hematoma, infection or neurological deficit

Conclusion

Penetrating neck injuries caused by fractured angle grinder discs are uncommon but potentially life-threatening because of the close proximity of vital cervical structures. This case demonstrates that a seemingly insignificant puncture wound may conceal a retained metallic foreign body despite the absence of neurological, vascular, or aerodigestive symptoms. Careful clinical assessment combined with appropriate imaging is therefore essential to avoid missed diagnoses.

Although multidetector computed tomography angiography remains the recommended imaging modality for hemodynamically stable patients with penetrating neck trauma, management should be individualized according to the clinical presentation and the characteristics of the injury. In carefully selected cases, early targeted surgical exploration may provide safe and effective treatment. Prompt diagnosis, complete removal of the foreign body, and close postoperative monitoring are fundamental to minimizing complications and ensuring favorable clinical outcomes.

Learning Points

- Penetrating cervical injuries caused by fractured angle grinder discs may appear deceptively superficial despite

- significant underlying tissue penetration.
- A retained metallic foreign body should always be suspected following high-velocity occupational injuries, even in the absence of neurological or vascular signs.
- Multidetector CT angiography is the preferred imaging modality in stable patients when deep cervical injury is suspected.
- Plain radiography remains useful for detecting radiopaque foreign bodies and may assist surgical planning in selected superficial injuries.
- Early surgical removal of accessible retained foreign bodies reduces the risk of infection, migration, vascular injury, and neurological complications.
- Clinical management should be individualized according to the patient’s condition, imaging findings, and the anatomical location of the foreign body.

Declarations

Ethics approval

Ethical approval was waived by our institution because this manuscript describes a single case report and does not involve experimental research.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and the accompanying clinical images.

Availability of data

All data generated or analysed during this study are included in this published article.

Funding

The authors received no financial support for the preparation of this manuscript.

Conflict of interest

The authors declare that they have no conflicts of interest.

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