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Delayed traumatic Horner's syndrome and lower trunk brachial plexus neuropraxia following penetrating neck injury: a case report

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Abstract

Penetrating Neck Injuries (PNI) are uncommon but potentially life-threatening due to high density of vital neurovascular and aerodigestive structures within the cervical region. Neurological complications including Horner syndrome are rare but clinically significant and may present in a delayed manner. We report the case of a 14-year-old boy who sustained a penetrating neck injury following a motorcycle accident in which a side-mirror handle became lodged in the left side of his neck. Despite being conscious and hemodynamically stable on arrival, an elective intubation was performed for airway protection. Contrast-enhanced computed tomography demonstrated the trajectory of the foreign body without evidence of major vascular or aerodigestive injury. Surgical exploration with endoscopic assistance allowed safe removal of the foreign body. Postoperatively, the patient developed transient right upper limb weakness consistent with the lower trunk brachial plexus neuropraxia and delayed onset ipsilateral Horner syndrome. Both neurological deficits gradually resolved with conservative management. This case underscores the importance of systematic assessment of PNI including recognition of soft signs, appropriate use of imaging and intraoperative endoscopic evaluation. Delayed neurological complications likely secondary to transient compression or neuropraxia of the cervical sympathetic chain and adjacent neural structures. Vigilant multidisciplinary management of penetrating neck trauma is essential to prevent missed injuries and manage delayed uncommon neurological complications. Careful evaluation, appropriate imaging and timely surgical intervention are essential to optimize patient outcomes.

Key words: penetrating neck injury, Horner syndrome, brachial plexus, trauma.

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Introduction

Penetrating Neck Injuries (PNI) are defined as an injury to the neck associated with a breach in the platysma muscle layer.[1] The neck consists of a complex arrangement of neurovascular and aerodigestive structures that are vulnerable to injury if the platysma is violated. Therefore, comprehensive anatomical knowledge of the neck is essential to guide clinical assessment and subsequent diagnostic and therapeutic interventions.

PNI account for approximately 1% of all trauma presentations with reported mortality rates ranging from 3 to 76%.[2] These injuries are traditionally categorized based on clinical findings into hard and soft signs.[3] Massive subcutaneous emphysema or air bubbling through the wound, airway compromise, expanding or pulsatile hematoma, active bleeding, shock, hematemesis or hemoptysis and neurologic deficit were presentations of hard signs. Hard signs occur in fewer than 10% of patients with PNI. Soft signs (nonexhaustive) include proximity of the wound to major vascular structures, non-expanding haematoma, voice change or hoarseness, dysphagia, upper extremity pulse deficit and palpable crepitus.[3] These clinical findings are highly specific for serious injury, with a positive predictive value of nearly 90% for vascular or aerodigestive tract involvement.[4]

Although Horner Syndrome is a rare manifestation of trauma, it may result from an injury at any point along the oculo-sympathetic pathway. It is classically characterized by ipsilateral miosis, ptosis, anhidrosis and facial vasodilation. When occurring after a penetrating neck injury, it may serve as an important clinical clue to underlying cervical neural involvement and therefore warrants careful evaluation.

We describe a case of a penetrating neck injury caused by a motorcycle side-mirror handle, complicated by lower trunk brachial plexus neuropraxia and delayed onset Horner Syndrome.

Case Report

A 14-year-old boy was involved in a motor vehicle accident while riding a motorbike without a helmet. During the accident, the motorcycle skidded and fell onto its left side, causing the side-mirror handle to penetrate the left side of his neck. On arrival at the emergency room, he was alert, with a Glasgow coma scale of 15/15, hemodynamically stable and not in respiratory distress.

An elective endotracheal intubation was performed to secure his airway, given the presence of the penetrating foreign body that may compromise his airway during evaluation and transport. Intubation was successfully achieved on the first attempt using a video laryngoscope with a size 7.0 endotracheal tube. Neck exam-

ination revealed a 10-cm metal side-mirror handle embedded lateral to the left sternocleidomastoid muscle, below the level of the thyroid cartilage, with surrounding hematoma and no exit wound (Figure 1). There was minimal oozing from the entry site, no subcutaneous emphysema and bilateral palpable carotid pulses and preserved laryngeal crepitus. He was able to move his left upper limb actively, however, his right shoulder abduction and flexion were limited. All reflexes were preserved, and distal pulses were felt. Contrast-Enhanced Computed Tomography (CECT) of the neck and upper thorax revealed a metallic foreign body entering from the left neck, coursing posterior to the trachea and anterior to the cervical spine C6/C7, exiting through the right side. There was no evidence of vertebral injury, vascular compromise or esophageal perforation. Flexible laryngoscopy examination revealed normal laryngeal structures. The patient underwent neck exploration via an apron incision incorporating the entry wound. Intraoperatively, the blunt end of the metal rod was noted to pass posterior to the left sternocleidomastoid (SCM), carotid sheath structures and piercing through the left scalenus muscle (Figure 2a and 2b). The foreign body was carefully removed, intact along its trajectory without complication (Figure 3). The posterior esophageal wall was intact, and a nasogastric tube was inserted prophylactically. The neck wound was closed primarily.

The patient was extubated four hours post-surgery, with no dysphonia, and all the limbs' movements were initially normal. On the following day, he complained of numbness in his right hand. Neurological examination revealed decreased sensation over the C6 and C7 dermatomes, and reduced power (4/5) in right elbow extension, consistent with medial and lower trunk brachial plexus neuropraxia involving (C7-T1). On postoperative day three, the patient developed right ptosis and anisocoria, with preserved extraocular movements. A diagnosis of right Horner syndrome secondary to neck trauma was made. All the other cranial nerves were intact. During follow up at two weeks post trauma, the patient made full neurological recovery, and the neck movement was normal (Table 1).

Discussion

PNI can affect multiple anatomical structures, with reported incidences of deep tissue injury (39%), vascular injury (37%), aerodigestive tract injury (17%), and neurological injury (7%).[4] Cervical esophageal injuries are uncommon, ranging from 0.6% to 3%. Recent literature continues to emphasize the complexity of PNI and the importance of selective imaging-guided management strategies in hemodynamically stable patients.[6,7]

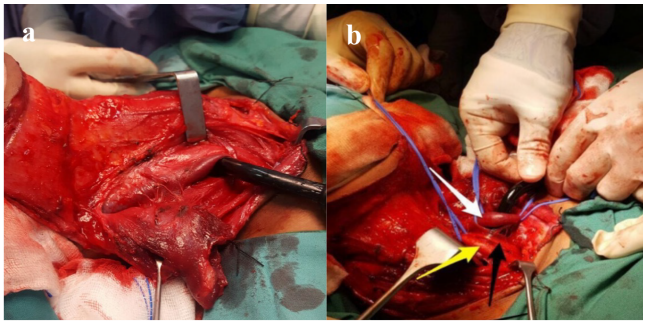


Figure 2. a) Intraoperative view showing the trajectory of the metal rod passing posterior to the left sternocleidomastoid muscle. **b**) The distal end of the metal rod penetrating the left scalene muscle avoiding the vital structures; internal jugular vein (white arrow), vagus nerve (black arrow), internal carotid artery (yellow arrow).



Figure 1. Penetrating neck injury showing a 10-cm metal side-mirror handle embedded at the left lateral neck with surrounding hematoma.



Figure 3. The metal foreign body was removed intact, observed the angulated course of it highlighting the careful course of extraction to avoid neurovascular injury.

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Table 1. Timeline of neurological findings following penetrating neck injury.

Time point	Clinical findings
Admission (Day 0)	Patient alert and hemodynamically stable. No cranial nerve deficits. Mild limitation of right shoulder movement.
Postoperative (Day 1)	Numbness in right hand. Decreased sensation over C6-C7 dermatomes and mild weakness of right elbow extension (power 4/5), consistent with transient brachial plexus involvement.
Postoperative (Day 3)	Development of right-sided ptosis and anisocoria with preserved extraocular movements, consistent with Horner Syndrome
Follow up at two weeks	Gradual resolution of neurological symptoms with conservative management and full functional recovery

Initial management of PNI follows Advanced Trauma Life Support guidelines, starting with airway assessment and inspection to determine if the platysma is breached, confirming PNI.[8] Management hinges on identifying hard or soft signs of PNI. The presence of hard signs mandates immediate surgical exploration with or without imaging, whereas soft signs necessitate further imaging and clinical evaluation.[9] In the absence of both, observation for 24-48 hours is appropriate.[5] Our patient exhibited soft signs, prompting further diagnostic workup. Adjunct procedures including video-assisted esophagoscopy rapid sequence of intubation is recommended for safer airway management in PNI, offering improved visualization and higher first-pass success rates (87.6%).[10,11] In this patient, video laryngoscopy enabled safe first-attempt intubation and supraglottic assessment. Tracheostomy should be considered in tracheal injury, preferably below the injury site, or at the level if necessary to secure the airway.[1]

Multidetector helical Computed Tomography with Angiography (MDCT-A) is the recommended imaging modality for stable PNI as it reduces the need for exploratory surgery.[12] When MDCT-A is not available, CECT neck supplemented with endoscopy, is a reasonable alternative, particularly for suspected aerodigestive injury, for which a positive predictive value of 67%.[13,14] In this case, CECT neck was opted to determine the foreign body trajectory, and exclude major vascular, vertebral and aerodigestive tract injuries, followed by endoscopic assessment in controlled settings. If laryngotracheal injuries are suspected, panendoscopy and bronchoscopy are required under general anesthesia prior to surgical exploration.[15] Our patient had completed the laryngeal and esophageal exams before foreign body removal, and a nasogastric tube was placed to aid identification and protect the esophagus during extraction.

Neurological complications of PNI range from spinal cord damage to isolated nerve root or plexus injury. A comprehensive and repeated neurological exam are essential.[15] Although uncommon, brachial plexus injuries have been reported in up to 58.3% of PNI with neurological involvement.[16] It may also involve the cervical sympathetic chain, which forms part of the oculosympathetic pathway responsible for pupillary dilation and eyelid elevation. This pathway descends from the hypothalamus to the ciliospinal center (C8-T2) and ascends via the cervical sympathetic chain to the superior cervical ganglion before innervating ocular structures. Injury or compression of this pathway results in Horner Syndrome, characterized by ipsilateral ptosis, miosis and anhidrosis.[14]

In the present case, the trajectory of the foreign body passed deep within the lateral neck, in close proximity to the cervical sympathetic chain and the brachial plexus roots. The delayed-onset Horner Syndrome was likely secondary to compression or disruption of the sympathetic chain or postoperative tissue edema rather than direct neural transection. The associated upper limb neurological deficit was consistent with involvement of the lower trunk brachial plexus neuropraxia, which arises from the C8-T1 nerve roots and supplies motor and sensory innervation to the distal upper limb. Transient neuropraxia may occur following blunt compression or traction of these neural structures during trauma.[15] Fortunately, the patient recovered fully which supports this proposed pathophysiology. Further neurodiagnostic studies such as MRI or electromyography were not conducted as the clinical course was transient and full recovery was achieved with conservative management.

Conclusions

This case underscores the importance of systematic multidisciplinary evaluation in penetrating neck injuries, including early recognition of clinical signs, timely imaging and careful surgical exploration to prevent missed injuries. Clinicians should remain vigilant for delayed neurological complications such as Horner syndrome, which may occur due to transient sympathetic chain involvement and can resolve with conservative management when no permanent neural damage is present.

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