

Case Report

Preservation-oriented management of combined superior thyroid artery, internal jugular vein, and hypoglossal nerve injury with delayed airway compromise after pediatric Zone II penetrating neck trauma: A case report

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Received: March 18, 2026 Accepted: May 20, 2026 Published online: July 08, 2026

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Abstract

Penetrating neck injury (PNI) in children is uncommon but potentially fatal because vascular, aerodigestive, and neural structures are concentrated within a confined anatomic space. We report a 7-year-old boy with hemodynamically unstable Zone II PNI after accidental impalement by a metallic rod. Because he presented with active external hemorrhage and hypotension, immediate surgical exploration was undertaken without preoperative computed tomographic angiography. Operative findings demonstrated complete transection of the right superior thyroid artery, a partial laceration of the right internal jugular vein, and a segmental right hypoglossal nerve injury. The superior thyroid artery was reconstructed with a short polytetrafluoroethylene (PTFE) interposition graft, the internal jugular vein was repaired primarily, and the hypoglossal nerve underwent epineural end-to-end repair under microscopy. Although the early postoperative course was initially satisfactory, progressive stridor and oxygen desaturation developed on postoperative day 3, and tracheostomy was required for airway protection. Serial Doppler ultrasonography confirmed vascular patency, and multidisciplinary rehabilitation enabled decannulation after 3 months. This case emphasizes that unstable pediatric Zone II PNI warrants immediate operative control of hemorrhage, that preservation-oriented vascular and neural repair can be feasible in selected patients, and that delayed airway compromise may occur when postoperative edema coexists with hypoglossal dysfunction.

Keywords: Pediatric trauma, penetrating neck injury, zone II, superior thyroid artery, hypoglossal nerve

INTRODUCTION

Penetrating neck injury (PNI), defined as trauma that violates the platysma muscle, accounts for approximately 5-10% of trauma admissions and carries a mortality rate of 3-10% [1,2]. Although uncommon, PNI can be rapidly fatal because major vascular, aerodigestive, and neural structures are concentrated within a narrow cervical compartment. Pediatric PNI is considerably less frequent than adult PNI, and current management principles are largely extrapolated from adult experience [3,4]. The neck is classically divided into three zones, with Zone II-between

the cricoid cartilage and the angle of the mandible-being the most frequently involved region [2,5]. Because this zone contains the carotid system, the internal jugular vein, the lower cranial nerves, and important aerodigestive structures, even a small penetrating wound may injure multiple critical tissues [1,2,5,6]. Contemporary management is guided primarily by hemodynamic status: unstable patients or those with hard signs of vascular or aerodigestive injury require immediate exploration, whereas stable patients are commonly evaluated with computed tomography (CT) angiography for selective management [1,3].

CITATION

Wibowo MD, Sidharta IS, Susetio BA. Preservation-oriented management of combined superior thyroid artery, internal jugular vein, and hypoglossal nerve injury with delayed airway compromise after pediatric Zone II penetrating neck trauma: A case report. Turk J Vasc Surg. 2026;35(2):179-83.



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We present a pediatric Zone II PNI complicated by combined superior thyroid artery transection, internal jugular vein laceration, and hypoglossal nerve injury, followed by delayed postoperative airway compromise, to highlight operative decision-making in an unstable child and the importance of continued airway surveillance after apparently successful initial repair.

CASE REPORT

A 7-year-old boy with no previous medical or surgical history presented to the emergency department after accidental

impalement of the right anterior neck by a metallic rod while playing. On arrival, he was conscious but hypotensive (systolic blood pressure 78 mmHg) and had active bleeding from an approximately 3 cm penetrating wound in the right anterior triangle, about 3 cm inferior to the angle of the mandible (Zone II) (Figure 1). Initial assessment and resuscitation were performed according to pediatric trauma principles. Because persistent hemorrhage and hemodynamic instability represented hard signs of vascular injury, the patient was transferred directly to the operating room without preoperative CT angiography.

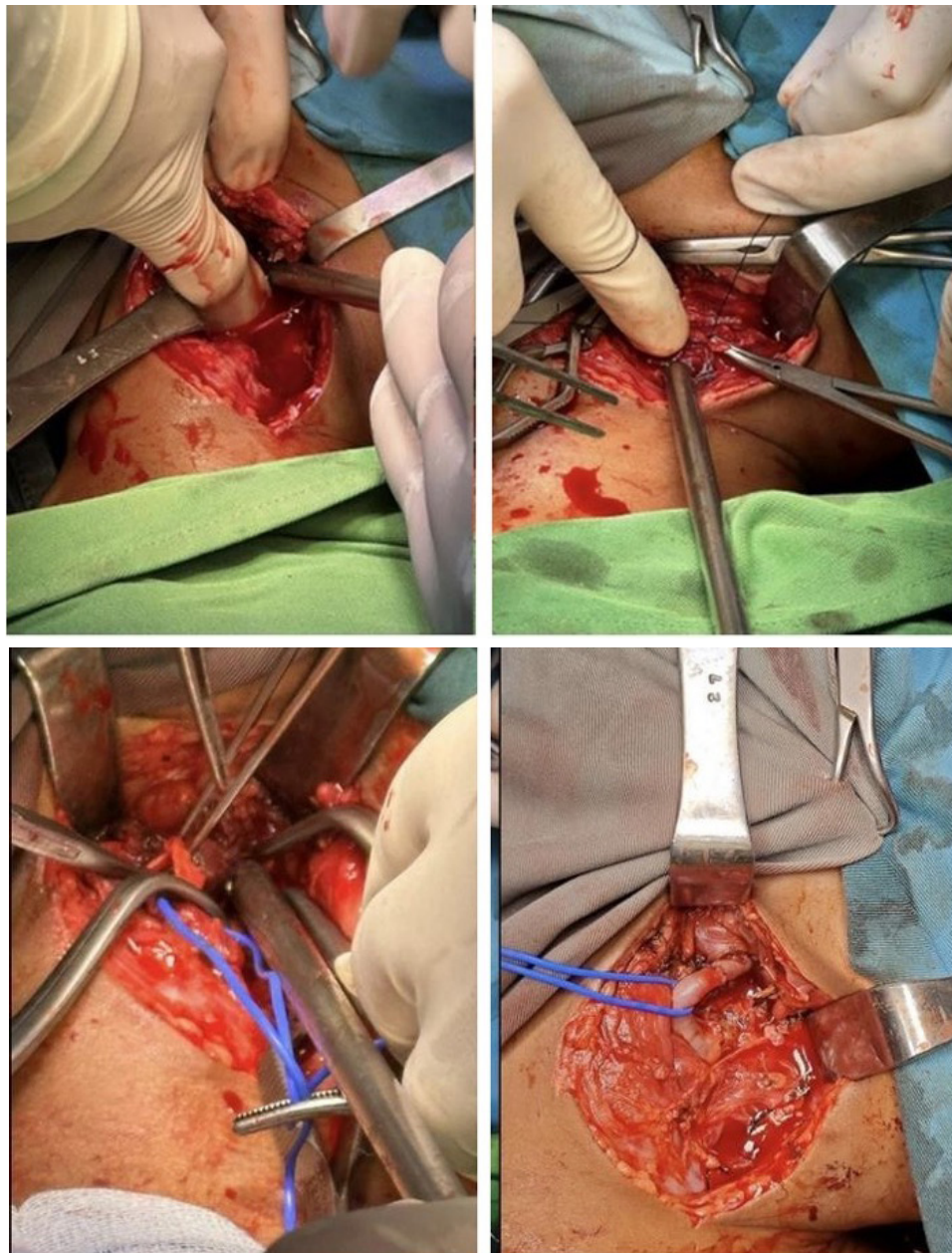


Figure 1. Representative intraoperative views of the right Zone II penetrating neck injury during emergency exploration and initial vascular control

Exploration was performed through an extended transverse cervical incision. Intraoperative findings included complete transection of the right superior thyroid artery, an approximately 30% lateral wall laceration of the right internal jugular vein with controllable bleeding, and a segmental injury of the right hypoglossal nerve (cranial nerve XII (CN XII)) measuring about

1 cm. No injury to the carotid arteries or esophagus was identified (Figure 2). Because the arterial ends could not be reapproximated without tension after debridement, a preservation strategy was chosen and the superior thyroid artery was reconstructed with a short polytetrafluoroethylene (PTFE) interposition graft rather than ligation.



Figure 2. Definitive repair of the right Zone II injury; Intraoperative views show short PTFE interposition graft reconstruction of the superior thyroid artery and the exposed field during preservation-oriented vascular and hypoglossal nerve repair

The internal jugular vein defect was repaired primarily with running 6-0 Prolene to preserve venous continuity, and the hypoglossal nerve was repaired with epineural end-to-end anastomosis using 9-0 nylon under the operating microscope. A suction drain was placed, and the wound was closed in layers. The patient was extubated on postoperative day 1 after initial stabilization. On postoperative day 3, he developed progressive stridor and oxygen desaturation. This delayed airway deterioration was considered clinically multifactorial; with evolving soft-tissue edema and impaired tongue control due to hypoglossal dysfunction likely contributing to posterior tongue-base collapse. Although direct endoscopic confirmation was not available, the airway compromise was judged significant enough to require urgent tracheostomy.

The tracheostomy tube was maintained for 3 months while the patient underwent intensive speech therapy, swallowing rehabilitation, and tongue physiotherapy. Serial Doppler ultrasonography at 2 weeks and 3 months demonstrated maintained vascular patency. The patient was successfully decannulated at 3 months. At follow-up, mild right tongue deviation persisted, but speech and swallowing function were near normal.

DISCUSSION

Pediatric PNI remains uncommon, and the available pediatric literature more often describes isolated penetrating wounds, airway injury, or carotid injury than a concurrent branch arterial, major venous, and hypoglossal nerve injury pattern [3,4,7,8]. Accordingly, the value of the present report lies not in presenting a case series or a new operative algorithm, but in documenting a rare and clinically instructive combination of injuries and their sequelae. The case is particularly informative because it links superior thyroid artery transection, internal jugular vein laceration, and hypoglossal nerve disruption with delayed postoperative airway compromise in a single Zone II wound.

Current management of PNI has evolved from mandatory zone-based exploration toward a symptom-driven strategy in which hemodynamic status and hard signs determine the need for urgent intervention [1-3,5]. In hemodynamically stable patients without hard signs, CT angiography is the preferred screening modality because it reduces nontherapeutic exploration while maintaining diagnostic safety [2,6]. In contrast, hypotension accompanied by active external hemorrhage remains a clear indication for immediate exploration without delaying care for

imaging [1,3]. Our patient's presentation, therefore, justified direct operative management. This case also reiterates that, in children, rapid hemorrhage control and airway protection must remain simultaneous priorities during the initial management sequence [4,9].

Although the superior thyroid artery is a branch vessel, its transection can still result in clinically important blood loss in a child with limited physiological reserve. When tissue loss or debridement precludes a tension-free primary anastomosis, selective reconstruction may be reasonable if bleeding is controlled and preservation is technically feasible. In the present case, a short PTFE interposition graft restored arterial continuity after debridement of the injured segment. The same preservation logic applied to the internal jugular vein: because the wall defect was limited and bleeding remained controllable, primary venous repair was preferred to ligation in order to maintain cervical venous outflow [10,11]. The maintained Doppler patency at follow-up supports the technical durability of this preservation-oriented approach.

The most distinctive postoperative issue in this case was the probable contribution of hypoglossal nerve injury to delayed airway compromise. CN XII palsy can produce tongue deviation, dysarthria, and dysphagia, and it may also reduce upper-airway dilator function, thereby facilitating posterior tongue displacement, especially in the presence of postoperative edema [8]. We, therefore, interpret the postoperative day-3 stridor cautiously: because endoscopic documentation of tongue-base collapse was unavailable, the mechanism cannot be proven definitively. Nevertheless, the temporal association among documented hypoglossal injury, subsequent tongue dysfunction, delayed respiratory deterioration, and later functional improvement after tracheostomy and rehabilitation suggests that hypoglossal dysfunction was a clinically meaningful contributor rather than an incidental finding [4,8,9].

Microsurgical epineural repair was undertaken to maximize the likelihood of functional recovery, while the duration of tracheostomy was individualized according to airway stability and rehabilitation progress rather than a fixed timetable. Multidisciplinary therapy was essential for swallowing, speech, and safe decannulation [8,9]. This report has limitations inherent to a single emergency case: it cannot establish incidence or comparative effectiveness, and the absence of quantified perioperative variables, detailed anesthetic parameters, and objective endoscopic airway findings limits mechanistic certainty. Even so, the case remains clinically relevant because it integrates vascular reconstruction, neural repair, and prolonged airway management within one pediatric Zone II injury.

CONCLUSION

Combined superior thyroid artery, internal jugular vein, and hypoglossal nerve injury should alert clinicians to the possibility of complex multi-structure damage after pediatric Zone II penetrating neck trauma. In unstable patients, prompt exploration is appropriate, and preservation-oriented vascular and neural repair may be considered when technically feasible. Postoperative surveillance must extend beyond immediate hemorrhage control to include delayed airway obstruction, particularly when hypoglossal dysfunction is present. Multidisciplinary rehabilitation may support successful decannulation and near-normal functional recovery.

Patient Consent for Publication: Written informed consent has been obtained from the patient's guardian and will be provided upon request.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: All authors contributed equally to the article.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

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