No. 2 in zone 2: a case report of penetrating neck trauma in a child

Rami Jason Bustami,1 Alex Moses,1 Ahmad Saeed Imam,1 Ross Morgan2

INTRODUCTION
Penetrating neck trauma is common in adults but is rare in the pediatric population. Reports on penetrating neck trauma in the pediatric population is sparse. We describe the case of a 9-year-old boy presenting with a pencil penetrating the neck, discuss management, and review the literature.

CASE PRESENTATION
A 9-year-old boy with no medical history presented to the trauma bay by emergency medical services (EMS) approximately 45 min after falling onto a Number 2 (No. 2) pencil which penetrated the left preauricular space. The pencil was stabilized with gauze and tape by EMS prior to arrival. In the trauma bay, the patient denied loss of consciousness, profuse bleeding, headache, dizziness, and lightheadedness.

PHYSICAL EXAMINATION
Vital signs were stable. The patient was lying supine in an EMS stretcher with the dull end of a No. 2 pencil protruding from the left preauricular area, pointing caudally and posteriorly. Pencil was stabilized in gauze and tape. No active bleeding was present. Patient was awake, alert, and oriented. The patient had full range of motion of the mandible.

WORKUP AND TREATMENT
Initial evaluation was performed with CT without contrast (figure 1). On poor visualization of the associated vasculature within the carotid sheath, a CT with contrast was performed. The radiologist reported no rupture of the blood vessels (figure 2).

The patient was subsequently taken to the operating room. The child was placed under general anesthesia with appropriate preparation in the supine position. Gauze and tape were removed, and the pencil was visualized pulsating at its location (online supplementary video 1). Pencil was grasped and removed. Wound was packed, sterile dressing placed. The patient’s postoperative course was uneventful. He was discharged 2 days later. At 2 weeks follow-up, the patient was in good health and wound site was healing appropriately with mild scarring.

DISCUSSION
Penetrating neck traumas have been studied extensively in adults but are under-reported in the pediatric population. In fact, only one pediatric cervical zone 2 penetrating trauma was found when reviewing the literature.1 A study in 2016 using the National Trauma Data Bank found that pediatric penetrating neck trauma has an incidence of 0.28%.2 This makes studying pediatric neck trauma difficult. Much is adopted from adult experiences.3

Currently, there are two diagnostic approaches used to assess the need for surgical intervention in penetrating neck trauma: zone-based approach and no-zone approach. The zone-based approach is an older approach, which decides management strategy based on zone, whereas the newer no-zone approach uses CT angiography after the patient’s hemodynamic stability is determined.

More recent literature indicates that the no-zone approach can adequately identify aerodigestive and vascular injuries in penetrating neck wounds, although avoiding invasive diagnostic procedures used in the zone-based approach.4 5 Additionally, in favor of the no-zone approach, there have been reports of a 100% sensitivity and 95% specificity for CT angiogram in adults with zone 2 penetrating traumas; however, these cases had direct zone 2 penetration.6

Against the favor of the zone-based approach, penetrating neck traumas externally entering a specific zone of the neck are not confined internally to that same zone. Low et al found that there was a high incidence of non-correlation between the location of the external injury and damaged internal structures.7 Case in point, our case describes a zone 3 penetrating trauma that, due to the directionality of the penetration, almost compromised zone 2 structures (internal jugular vein, carotid artery, vertebral artery, esophagus, larynx, trachea, thyroid, thoracic duct, and major cervical nerves).8
CONCLUSION
Penetrating trauma to the neck is an uncommon emergency in the pediatric population. Penetrating neck trauma due to a pencil is exceedingly rare. Rapid identification, proper workup and subsequent removal in the operating room can prevent significant blood loss, disfigurement, or death.

Contributors RB is the primary author of the case report. AM, ASI and RM are co-authors in the report. RM is the faculty advisor for the report.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/.

REFERENCES
1. Hewett RM, Mellick L. A case of penetrating neck trauma in a child. Pediatr Emerg Care 2012;28:49–51.
2. Stone ME, Farber BA, Olornufemi O, Kalata S, Meltzer JA, Chao E, Reddy SH, Teperman S. Penetrating neck trauma in children: an uncommon entity described using the National trauma data bank. J Trauma Acute Care Surg 2016;80:604–9.
3. Cotton BA, Nance ML. Penetrating trauma in children. Semin Pediatr Surg 2004;13:87–97.
4. Shiroff AM, Gale SC, Martin ND, Marchalik D, Petrov D, Ahmed HM, Rotondo MF, Gracias VH. Penetrating neck trauma: a review of management strategies and discussion of the ‘No Zone’ approach. Am Surg 2013;79:23–9.
5. Munera F, Danton G, Rivas LA, Henry RF, Ferrari MG. Multidetector row computed tomography in the management of penetrating neck injuries. Semin Ultrasound CT MR 2009;30:195–204.
6. Azuaje RE, Jacobson LE, Glover J, Gomez GA, Rodman GH, Broaddie TA, Simons CJ, Bjerkel HS. Reliability of physical examination as a predictor of vascular injury after penetrating neck trauma. Am Surg 2003;69:804–7.
7. Low GM, Inaba K, Chouliaras K, Branco B, Lam L, Benjamin E, Menaker J, Demetriades D. The use of the anatomic ‘zones’ of the neck in the assessment of penetrating neck injury. Am Surg 2014;80:970–4.
8. Kim MK, Buckman R, Szemreta W. Penetrating neck trauma in children: an urban hospital’s experience. Otolaryngol Head Neck Surg 2000;123:439–43.
9. Hall JR, Reyes HM, Meller JL. Penetrating zone-II neck injuries in children. J Trauma 1991;31:1614–7.
10. Aras MH, Miloglu O, Barutcuoglu C, Kantarcı M, Ozcan E, Harorli A. Comparison of the sensitivity for detecting foreign bodies among conventional plain radiography, computed tomography and ultrasonography. Dentomaxillofac Radiol 2010;39:72–8.