



IED (Improvised Explosive Device) Blast Injury: An Ultrasound Diagnosis



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History

36-year-old Afghan male presented to a Role 2 following an improvised explosive device (IED) blast injury.

At the point of injury, he was noted to have a penetrating fragment wound to the left neck with copious bleeding concerning for vascular injury. He was treated with a pressure dressing and evacuated by rotary wing aircraft.

The patient complained of mild left neck pain and numbness of the left thumb. He had no other complaints on initial evaluation.

He did not report any significant past medical history.

Physical

General: Patient was ambulatory on arrival. His initial trauma evaluation, including eFAST exam and chest x-ray, were negative. He had no other injuries. Vital signs were within normal limits.

Neck: Soft, supple, no lymphadenopathy, no masses, thyroid normal. Bilateral carotid pulsations palpable and midline tracheal landmarks present. Single 2-3mm puncture wound noted to the left neck, Zone II, with small surrounding ecchymosis. Similar ecchymoses noted on the posterior neck overlying the trapezius and left neck near the upper shoulder. There was obvious swelling to the area. No expanding hematoma or crepitus. There was mild tenderness to palpation.

Questions

1. What are some immediate concerns for Zone II penetrating neck wounds?
2. How can you evaluate these wounds and determine the need for surgical intervention when you do not have access to a CT scanner?



Figure 1. Initial presentation and external physical exam findings. Small penetrating injury noted (arrow).

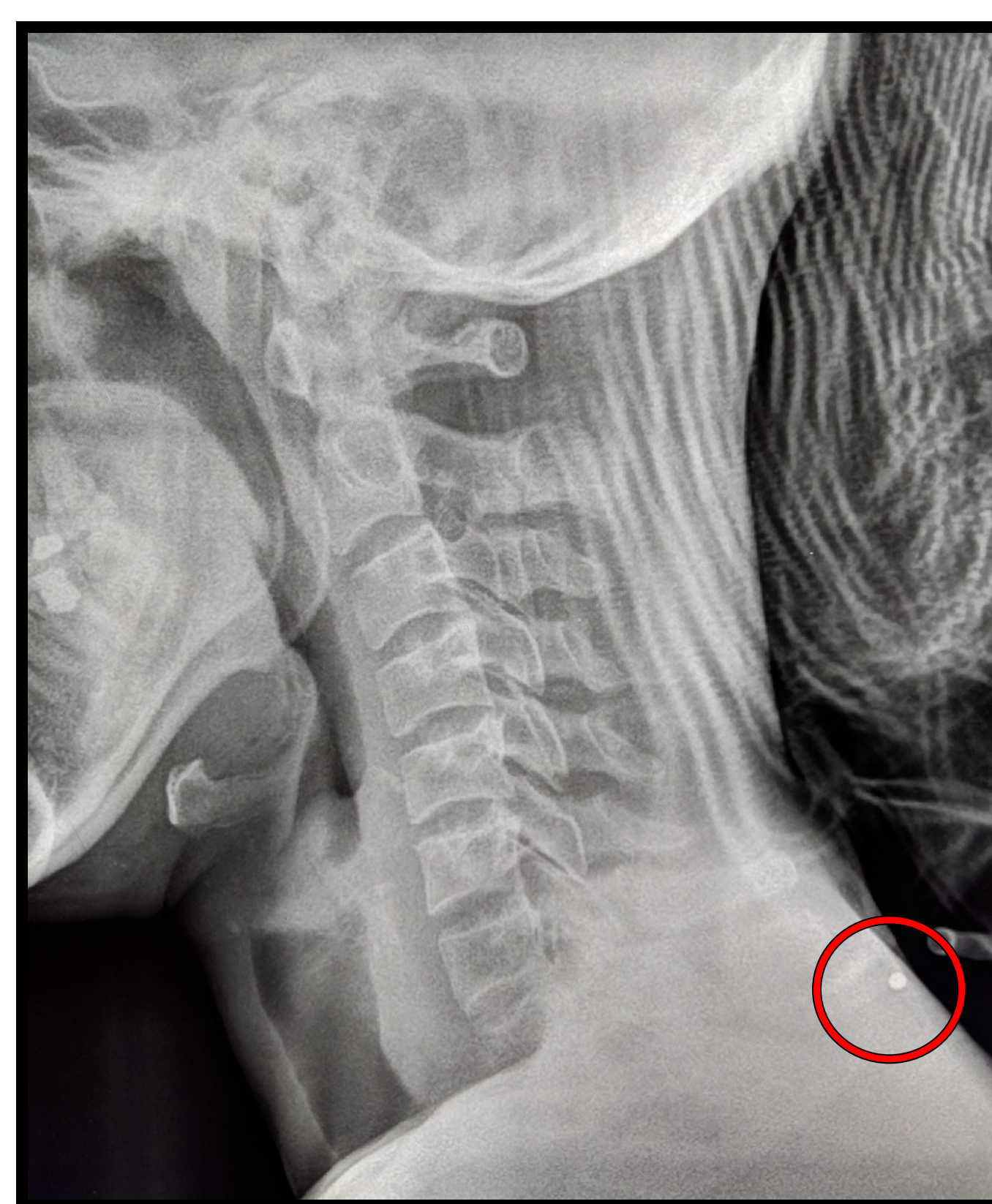


Figure 2. Initial X-ray with foreign body visualized (circle), demonstrating likely trajectory.

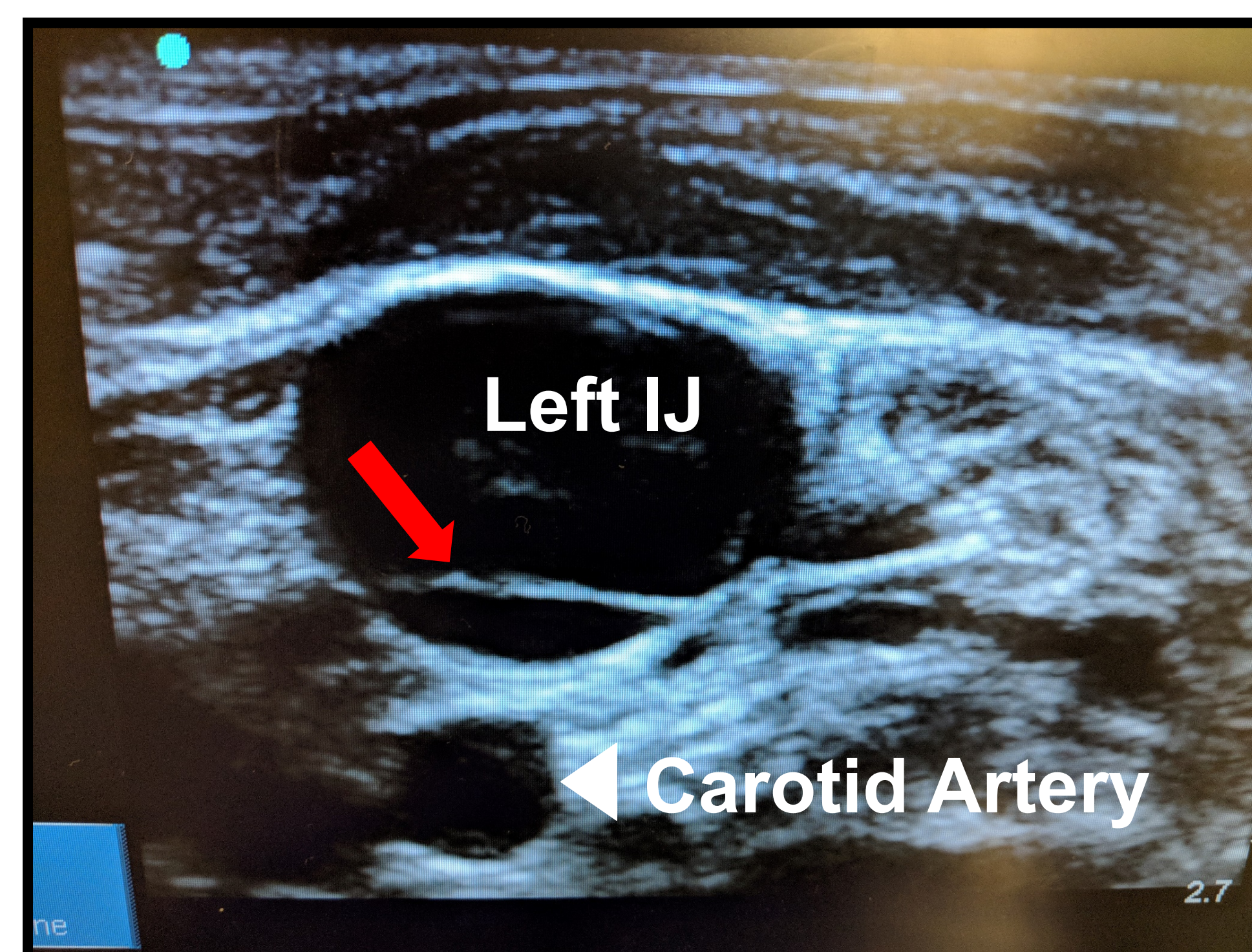


Figure 3. Bedside ultrasound demonstrating intimal tear/flap (arrow) within the lumen of the left internal jugular (IJ) vein.

Answers

1. Penetrating Zone II neck wounds are concerning for injury to the carotid and vertebral arteries, jugular veins, esophagus, trachea, larynx, and spinal cord.
2. Traditionally, neck wounds that do not violate the platysma are not life threatening and do not require operative management. Physical exam and wound exploration are often adequate to determine the extent of injury. However, in the case of blast fragments, trajectory is much less predictable and the size and shape of the foreign body are unknown, so physical exam alone may not be sufficient.¹ In these cases, radiographs and bedside ultrasound can be used to further categorize the size and shape of the fragment, location in relation to deep structures, and extent of neurovascular or soft tissue damage.

Discussion

Physical exam was not initially impressive, the patient did not have significant complaints, and the entry wound was small. However, the trajectory of the fragment could not be determined and the wound was small enough that direct visualization and exploration were limited. Due to concern for injury to the structures of the neck, plain films were performed at bedside. A small, 2mm metallic fragment was visualized on radiographs (Figure 2) with an apparent anterior to posterior trajectory. To better determine the need for neck exploration prior to transport, bedside ultrasound was performed (Figure 3).

Ultrasound revealed intimal damage to the internal jugular vein with thrombus formation. The patient was evacuated to a higher level of care where he underwent CT evaluation approximately 16 hours later. CT revealed dilated external and internal jugular veins on the left without extravasation of contrast and identified the 2mm fragment near the skin on the left posterior neck without significant hematoma. There were no arterial injuries, and the patient's paresthesia was thought to be a neuropraxia. He required no further intervention and had an uncomplicated hospital course.

Clinical Pearls

- Improvised explosive devices (IEDs) may cause a variety of injuries. Blast injuries are divided into primary injuries, caused by initial blast waves from explosive devices; secondary injuries, caused by the impact of fragments or other airborne debris; tertiary injuries, caused by the impact of the patient against a hard surface following a blast; and quaternary injuries, which include burns, inhalation, chemical, biological, and radiation injuries. All of these must be taken into consideration when evaluating a patient following blast trauma.
- Fragmentation wounds are highly unpredictable and there should be significant concern for migration, injury to adjacent structures, and embolization. Direct contact with structures is not necessary to cause injury. Most fragments are left in place unless they are organic matter or found to be close to vital structures. Damage to the internal jugular vein, as seen on the ultrasound of this patient, should raise suspicion for possible arteriotomy, aneurysm, dissection, or injury to adjacent nerves. Further imaging or surgical exploration are indicated.
- Ultrasound is a valuable resource in both the evaluation of foreign bodies and of neurovascular structure injuries. Computed tomography may not be available in austere environments and may also be inaccessible if the patient is too unstable to undergo CT evaluation. In these cases, determination of potential life-threatening injury to vascular structures can be determined quickly using ultrasound at the bedside².

References

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2. Demetriades D, Theodorou D, Cornwell E, et al. Evaluation of penetrating injuries of the neck: prospective study of 223 patients. *World J Surg* 1997; 21:41.