A Review of the Management of Complicated Facial Lacerations in the Emergency Department

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ABSTRACT

Background: Facial lacerations are commonly seen and managed in the emergency department. *Objectives:* We briefly review general principles for repair of facial lacerations and provide a detailed review of the more nuanced aspects of face, head, ears, eyes, nose and oral repair.

Discussion: Oral mucosa, lip, tongue, eyelid, ear, nasal and scalp lacerations are thoroughly discussed with close attention to indications for repair, indications for surgical consultation, procedural steps, anesthetic methods, and post-repair wound care.

Conclusions: Repair of facial lacerations is unique, principally due to the importance of good cosmetic outcomes. Techniques for repair can be technically challenging and fraught with pitfalls. Understanding indications for involving a surgical specialist is paramount.

INTRODUCTION

Lacerations represent over 8% of all emergency department visits annually with 28% of those being facial lacerations and 10% involving the head and neck.[1] Among patients with head and neck trauma, 41.8% suffer an open wound, and laceration repair accounts for 70% of the procedures performed.[2] Following treatment for facial lacerations, patients are prone to depression, poor self-image, alcoholism, jail and lower attractiveness score.[3] This review aims to focus on a current review of the literature with special attention to the nuanced aspects of facial laceration repair, indications for surgical consultation, procedural steps, anesthetic methods, and post-repair wound care.

General Principles

When evaluating facial lacerations, be sure to assess for additional injuries to include cranial nerve injuries. Once thorough evaluation has been performed, repair should prioritize good alignment and cosmesis. In planning the repair, regional nerve blocks may be preferred over local anesthesia to avoid distortion of tissue in an effort to optimize cosmesis. Of note, the face and scalp are highly vascular and unlikely to get infected and thus primary repair is generally safe to perform up to 24 hours after the injury (even for dog bites).[4] Interestingly, there is even evidence that wounds closed within 6 hours do not benefit from irrigation.[5] Non-gaping (<10 mm width) facial wounds less than 3 cm in length can be repaired with simple interrupted sutures in non-layered fashion without compromising cosmetic outcomes.[6] Alternatively, for simple linear lacerations in low tension areas, tissue adhesive (glue) can be used without compromising cosmetic outcomes.[7,8] If a layered repair seems indicated, subcutaneous or dermal sutures can be used to relieve surface tension. Classically non-absorbable sutures (5-0/6-0) are used for repair of the epidermis and absorbable sutures (4-0/5-0) are used for mucosal repair and deep buried sutures. While historically absorbable sutures were reserved for sub epidermal sutures, there has been increased use of rapidly absorbing sutures for repair of the epidermis to avoid the need for removal with good cosmetic outcome.[8,9] There is a somewhat nuanced approach to repair of the various areas of the face which will be discussed below in greater detail along with review of indications for surgical consultation.

DISCUSSION

Oral Mucosa Lacerations

Generally, oral mucosa lacerations heal on their own without intervention. However, primary closure is preferred for intraoral lesions where:[10] the wound is deep enough to trap food particles, the wound is greater than 2 cm in length, or the wound has a flap of tissue between the occlusal (chewing) aspects of the teeth. Small flaps can be excised.

Patients with intraoral lacerations should be evaluated for concomitant dental trauma, midface fractures, and jaw fractures. If there is any evidence of dental trauma, then there should be a thorough search for all fragments or missing teeth, which includes probing the wound. An x-ray can assist in identification of fragments within the soft tissue especially

if there is marked facial swelling. If a patient returns to the emergency department with an infected wound, consider an embedded tooth fragment as a cause.[11]

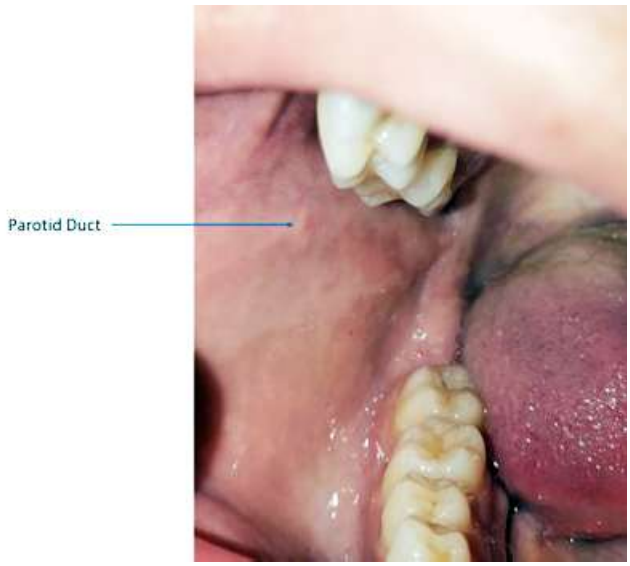
For closure of oral mucosa lacerations, absorbable 4-0 or 5-0 simple interrupted sutures is the standard. Polyglactin 910 is preferred over other absorbable material such as gut sutures because it is softer, less inflammatory, promotes faster healing, more resistant to breakdown by saliva, and is less abrasive to the surrounding mucosa.[12]

Contamination can be considerable so the clinician should thoroughly irrigate the wound once nonviable tissue and foreign bodies are removed. Lacerations that extend through all the layers of the mouth (i.e. through-and-through) should be closed in separate layers. Repair begins at the intraoral mucosa and proceeds outward to the muscle layer and finally towards the skin. After closure of the mucosal layer, copious irrigation of the external wound is indicated to remove lingering bacteria that otherwise would be incorporated into the wound. Intraoral sutures can become untied especially when manipulated by the tongue, so it is best to secure these down with at least four square knots.

The evidence on the use of prophylactic antibiotics is limited. In a small study involving 62 patients, prophylactic treatment with penicillin was associated with a decreased risk of infection after significant through-and-through lacerations.[13] This was further supported by a retrospective study that also observed benefit to antibiotics. However, the benefit was only statistically significant in immunocompromised patients.[14]

Prior to repair, any laceration near the parotid (Stensen's) or submandibular (Wharton's) duct should have a detailed evaluation for ductal integrity (Figures 1 and 2). The evaluation for ductal integrity first involves drying the inside of the buccal surface and next applying gentle pressure over the parotid gland. If the duct is intact, clear fluid (i.e. saliva) will appear at its opening. If either duct is involved or there is any doubt to ductal involvement, then a facial surgeon should be consulted to assist with stenting the duct open in order to preserve its function.[10,15] The presence of clear fluid discharge within a wound can hint at the involvement of the parotid tissue. A laceration over the parotid gland itself without damage to the duct is repaired by closing the skin over the gland.

Fig.1 . Parotid/Stenson's Duct.



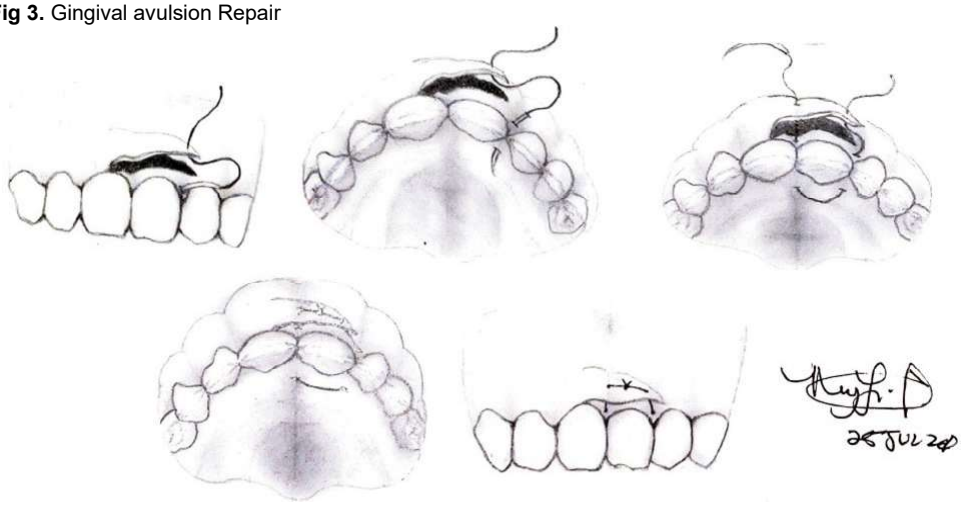
Laceration of the maxillary labial frenulum does not require repair. Because of the vascularity, the lingual frenulum of the tongue may need repair in which case an absorbable 4-0 is appropriate.

For gingival avulsions, there is a limited amount of submucosa to anchor the stitch so the mucosa on the inner side of the teeth should be incorporated into the repair as described below and depicted in Figure 3. The repair can be described in the following steps:[10]

1. Stretch the avulsed tissue back to its original size with finger pressure and wet cotton gauze.
2. Once readapted, a 4-0 or 5-0 absorbable suture should be inserted through the tip of the avulsed flap and brought circumferentially around the

Fig 2. Submandibular/Wharton's Duct.

Fig 3. Gingival avulsion Repair



closest tooth to provide the necessary support for repair. The suture should be "flossed" between the teeth if the space between them is too tight.
3. Once on the palatal side of the mouth, pass the needle through the palatal portion of the gums.
4. Pass the suture again circumferentially around the other side of the tooth.
5. Insert the needle through the facial portion of the gums and tie down the suture.

In patients that wear dentures, suture knots and loops should not interfere with the bridge of the denture.

The patients should be discharged on a soft diet for two to three days and encouraged to rinse their mouth with water after eating. Spicy or salty foods may be irritating until the wound is healed. The patients should be cautioned against the use of straws (negative pressure may increase ecchymosis or bleeding at the wound site). Wounds should heal rapidly (within three to five days). Follow up within 48 to 72 hours should be arranged for patients with risk factors for infection (e.g. diabetes mellitus, immunocompromised).

Lip Lacerations

The lip is composed of three layers: the mucosal layer (within the oral cavity), the middle muscular layer (orbicularis oris muscle), and the outer mucosal layer consisting of the wet vermillion (internal oral) and the dry vermillion (external oral). The cosmetic outline of the lip where the facial skin meets the vermillion is referred to as the vermillion border. Aesthetically, proper alignment of the vermillion border is crucial as misalignment by 1 mm will cause a noticeable scar.[16] Generally lip lacerations can be repaired in the emergency department, however a plastic or oral surgeon should be consulted when there is crushed or devitalized tissue, or when over 25% of the lip is missing.[17] Contamination can be considerable so the clinician should thoroughly irrigate the wound once nonviable tissue and foreign bodies are removed.

Key to repair of the lip is approximation of the vermillion border. For this reason, a mental nerve block or infraorbital nerve block is a suitable block for lip lacerations because it avoids tissue distortion though local anesthesia.

A mental nerve block is used to provide ipsilateral lower-lip anesthesia. The mental nerve exits the mental foramen on the bilateral anterior aspects of the mandible lateral to the mental protuberance. The mental foramen should be approached intraorally at the mucobuccal fold adjacent to the canine or first premolar tooth at a 45° angle with a 25 – or 27-gauge needle, and anesthetic should be infiltrated adjacent to (not directly in) the foramen as depicted in Figures 4 and 5.[18,19]

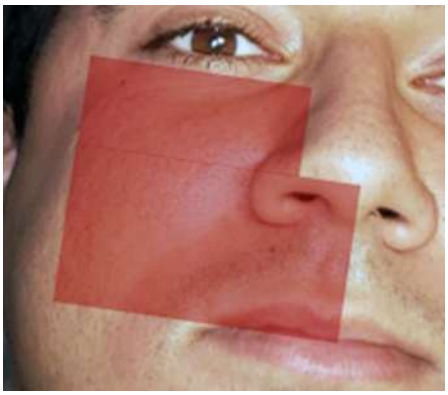
An infraorbital nerve block is used to provide ipsilateral upper-lip anesthesia. The infraorbital nerve exits the infraorbital foramen located on the infraorbital ridge approximately in midline with the eye. The infraorbital foramen should also be approached intraorally at the mucobuccal fold adjacent and parallel to the ipsilateral second maxillary premolar tooth with a 25 – or 27-gauge needle. The needle should be advanced approximately 2.5 cm, and anesthetic should be

Fig 4. Approach to mental nerve block (Blunt needle demonstration).

Fig 5. Nerve distribution for mental nerve block.

Fig 6. Palpating the infraorbital foramen.

Fig 8. Nerve distribution for infraorbital nerve block.



infiltrated adjacent to the foramen[18,19] as depicted in Figures 6, 7, and 8. Ultrasound can also be used to aid in performing this procedure.[20] Alternatively an extraoral approach can be performed in which the skin is cleaned and the needle is inserted directly over the foramen.[21]

When repairing the vermillion border, the clinician should first place a single interrupted suture at the vermillion border to ensure proper alignment using a 6-0 nonabsorbable suture. A 5-0 or 6-0 nonabsorbable suture should be considered for outer skin closure (absorbable 6-0 is preferred for children). Consider 5-0 or 6-0 absorbable sutures for mucosal layer (although most small mucosal lacerations do not need to be repaired).

Nonabsorbable sutures should be removed by a health care provider in three to five days, as should any absorbable sutures of the wet or dry vermillion that have not dissolved by five days.

Fig 7. Approach to needle insertion for infraorbital nerve block.

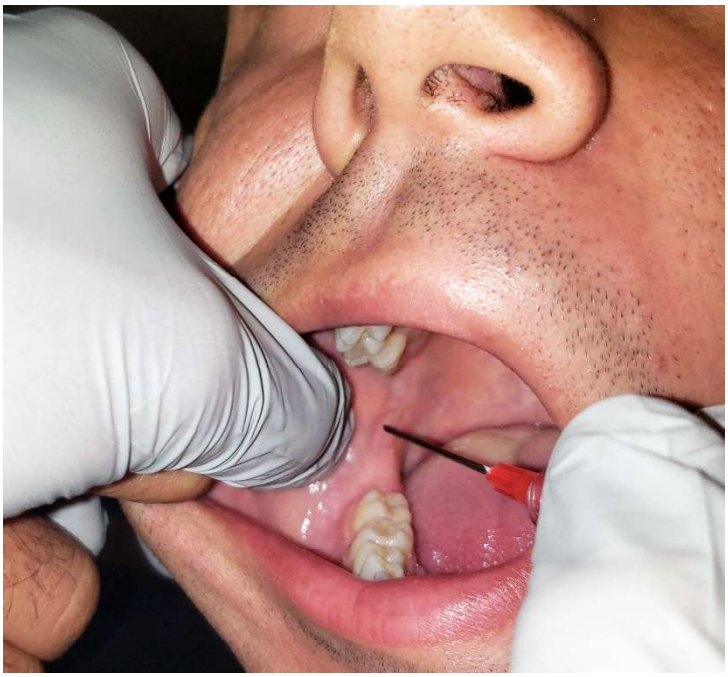
Tongue Lacerations

Most minor lacerations of the tongue can heal on their own without repair. The clinician should repair wounds if they are:[22] gaping, greater than 2 cm in length, involving the lateral border, actively hemorrhaging, extending into the muscular layer or through-and-through, and lacerations that may cause dysfunction if healed improperly (such as an anterior split/"-serpent" tongue). Consult a plastic or oral surgeon when there is amputation or avulsion of more than 30% of the tongue because these often require a flap procedure.[23]

The tongue is innervated bilaterally by the lingual nerve, which is located anterior and inferior to the inferior alveolar nerve. Anesthesia to the anterior two-thirds of tongue can be achieved with an inferior alveolar nerve block ipsilateral to the tongue laceration.[18] The injection site should be located with the following technique and is depicted in Figure 9.[18]

6. The thumb of the non-injecting hand is used to laterally retract the soft tissue adjacent to the coronoid notch of the mandibular ramus.
7. The injection point is located just lateral to the pterygomandibular raphe, a vertical fibrous band of fascia located on the buccal surface of the mouth anterior to the mandibular ramus.
8. The needle should start at the contralateral premolar with a vector directed towards the injection point. Movement of the needle should be parallel to the surface of the mandibular molars.
9. The needle should gradually proceed until contact with the mandibular sulcus and then slightly retracted prior to injection of 1 to 3 mL of anesthetic.
10. The patient should protrude their tongue and hold it with gauze. Alternatively, a silk suture can be sutured through the tongue and used to pull the tongue out of the mouth (after proper sedation). Absorbable 3-0 or 4-0 suture material should be used to suture the laceration.

Fig 9. Approach to the inferior alveolar nerve block.



The laceration should be anesthetized directly if it is located on the posterior one-third aspect of the tongue or midline. Bilateral inferior alveolar nerve blocks are not recommended because the complete loss of sensation of the tongue can result in a choking sensation.

A layered approach for deep lacerations will help prevent the collection of a hematoma. The clinician needs to carefully re-approximate because the suture line can involute and look like a bifid tongue/cleft. Wounds should be closed loosely to allow for swelling. Sutures should be tied with at least four knots. Frequent movements of the tongue can often untie the sutures which can be avoided by burying the knot.

Within the first 48 hours, complications of tongue laceration can include edema, hemorrhage, and aspiration of saliva and blood. Mild lingual edema may be controlled by application of cold objects (e.g. ice chips, ice pops). A single dose of steroids (e.g. dexamethasone 0.6 mg/kg) may be considered in more severe cases if no contraindications are present, however literature on this topic is sparse and efficacy unproven.[24,25] Hospitalization may be warranted until airway patency is ensured. Other complications of tongue laceration include dehiscence and infection. There is no convincing evidence to guide decisions regarding prophylactic antibiotics.[13,26] Prevention of dehiscence entails placing sutures loose enough to permit swelling.

The patient should be advised to avoid eating or drinking until the anesthetic wears off. The discharge instruction should include eating a soft diet, sucking on ice chips or ice pops to prevent tongue swelling, and following up in 48 hours for re-evaluation of sutures (checking for dehiscence).

Eyelid Lacerations

Proper management of eyelid lacerations requires careful examination and an understanding of pertinent anatomy (see Figures 10 and 11). It is important to recognize lacerations which should be repaired by a specialist such as an ophthalmologist or oculoplastic surgeon to avoid poor outcomes and morbidity (reviewed in Table 1). The clinician should ensure the patient is not suffering from an open globe before a more detailed assessment of the eye so as not to apply pressure to the eye. Irrigate the eye and inspect for foreign bodies. Assess the depth and location of wounds. A plastic or ophthalmic surgeon should be consulted in cases with: lacerations involving the eyelid margin, lacerations near the medial canthus concerning for canalicular system involvement, lacerations involving the lacrimal duct/sac, patients presenting with ptosis/protruding fat concerning for levator muscle involvement, and full thickness lacerations/lacerations involving the tarsus.[27-29] Certain mechanisms of injury, such as dog bites, may be more likely to result in injuries to the lacrimal apparatus.[30]

Repair of the wound should occur within 24 to 48 hours if possible. A small study of 143 patients failed to demonstrate a difference in post-operative wound infections for patients who had their repair delayed for over 24 hours, providing evidence for a generous window of time for repair.[31] There is also recent literature to suggest

Fig 10. Eyelid anatomy showing duct draining system.

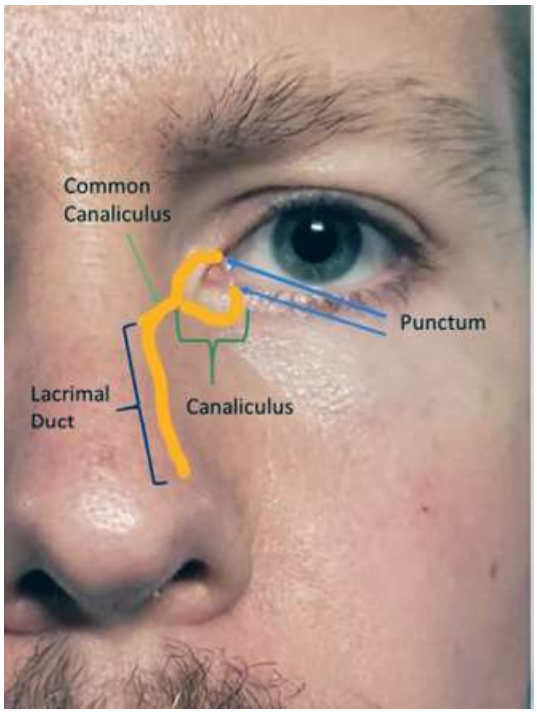
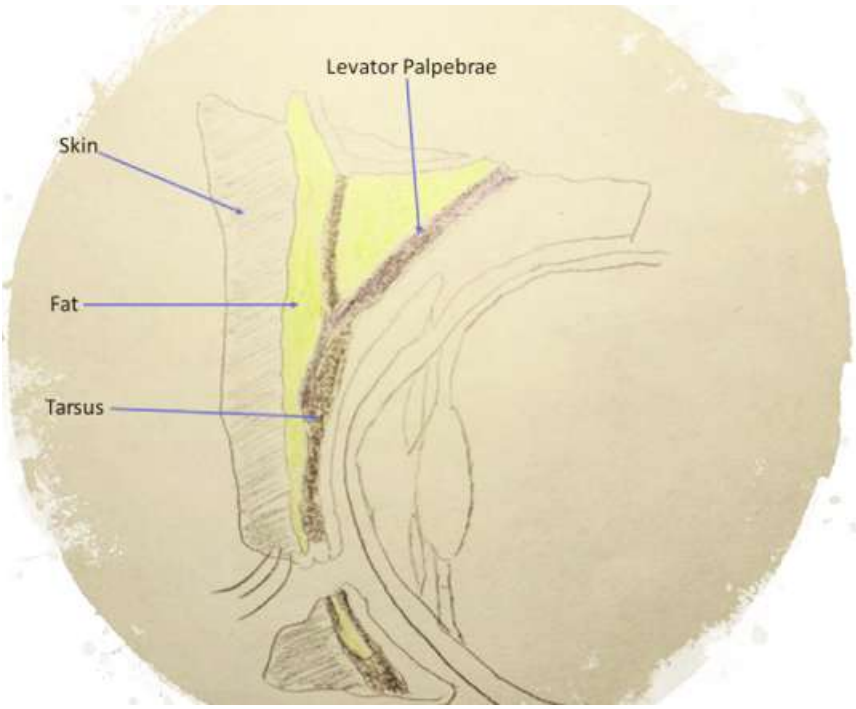


Fig 11. Eyelid cross-section showing fat anterior to levator muscle and location of tarsal plates.



repair can be delayed up to six days for certain injuries like lacerations involving the canalicular system.[27,28] For lacerations near the medial third of the eye where there is a suspicion for canalicular involvement, a fluorescein test can be performed which may demonstrate fluorescein collecting in the wound if the canicular system has been damaged. For full thickness lacerations (involving the tarsus) one should be diligent to evaluate for open globe injury.

Once more complicated injuries have been evaluated for and ruled out, repair of partial thickness lacerations can be performed in the emergency department. Given how thin the skin is, using 6-0 or 7-0 absorbable or non-absorbable sutures under gentle tension is recommended.[29] The clinician should consider tying the tails of the sutures nearest the eye down with adjacent sutures to avoid irritation to the eye[32] and take care not to puncture the eye with the needle. Although possible, the eyelid rarely gets infected due to its excellent blood supply.[33] Suture removal should be arranged in five to seven days.

Ear Lacerations

Repairing ear lacerations centers around effectively managing lacerations that involve the cartilage. The pinna, or external part of the ear, is covered in thin skin which is tightly adherent to the underlying perichondrium (Figure 12 and Figure 13).

It is critical for the emergency physician to attempt to debride devitalized cartilage and to suture the nutrient supplying skin completely over remaining viable cartilage to avoid poor cosmetic outcomes to include "cauliflower ear", hematoma formation, and infection.[29] Up to 5 mm of cartilage can be removed without significant deformity, and this can be performed to allow for better skin approximation.[34] Primary repair is preferred if the patient presents within 24 hours. For through-and-through lacerations, the cartilage should be reapproximated starting at the anatomic landmarks using 4-0 or 5-0 non-dyed absorbable buried sutures making sure the anterior and posterior perichondrium are included in the sutures and the cartilage itself is avoided, if possible, because it is known to tear.[35] Given that these buried sutures represent foreign bodies, the clinician should use as few as needed to repair the cartilage. After repair of the cartilage, the skin overlying the posterior ear should be repaired first (less cosmetically important) using 5-0 non-absorbable sutures followed by the anterior surface with 5-0 or 6-0 non-absorbable sutures.[29] The anatomic landmarks should be carefully lined up and enclosed with a compressive dressing to prevent hematoma formation and eventual deformity. One well described technique for bolstering the ear involves firmly suturing two dental rolls or pieces of gauze (petroleum preferred) to the ear parallel to

Table 1. Review of indications to involve a surgeon. [27-29]

Injury Requiring Surgeion	Examination Finding	Possible Complications
Canalicular system/lacrimal duct	Deep lacertaion to medial third of eyelid (medial to punctum), more common in lower eyerelid. Collection of flourescein in wind	Excessive tearing (epiphora)
Full thickness (involvmentn of tarsal plate)	Examine eyelid margins for discontinuity of notch	deformity that can cause irritaion and be cosmetically bothersome
Levator muscle	ptosis, extruding fat (especially in long horizontal laceration)	Chronic ptosis

Fig 12. Ear Lacerations.

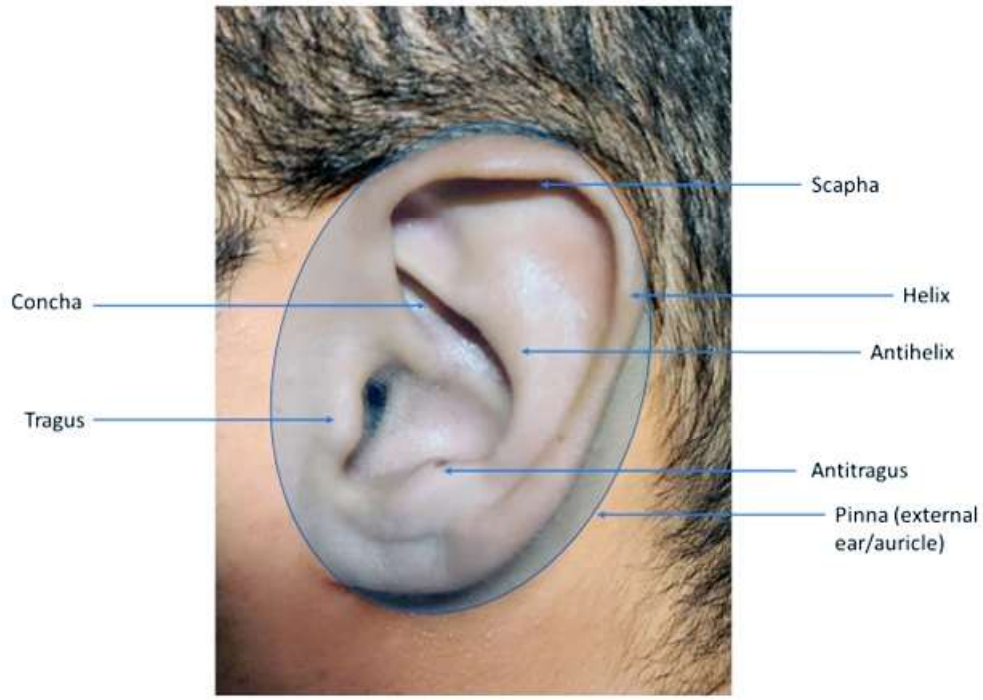
the suture, one to the anterior portion and one to the posterior portion, using a single 4-0 non-absorbable suture as depicted in Figure 14. Use of other bolstering devices such as suction catheter cut to size has also been described.[35]

Alternatively, the clinician can use a piece of petroleum-coated cotton or plaster molded to the helix/antihelix with cotton placed behind the ear followed by loosely wrapping a bandage around the head and ear allowing a more comfortable dressing.[36] Anesthesia is achieved through regional nerve blocks targeting the greater auricular nerve, lesser occipital nerves, auriculotemporal nerve and the auricular branch of the vagus nerve. A few classically described techniques for achieving regional anesthesia of the ear are depicted in Figures 15a and 15b. Ultrasound-guided occipital and auriculotemporal nerve blocks have been shown to be equally effective as well.[37] If using local anesthesia, the classic teaching is to avoid lidocaine with epinephrine to avoid necrosis, however recent literature shows no epinephrine induced complications in over 10,000 cases when administered into the ear and nose.[38]

It is reasonable to consider the addition of prophylactic antibiotics against *Pseudomonas* and skin flora to prevent perichondritis/chondritis although the evidence is lacking.[34] Avulsion injuries with a narrow pedicle, lacerations with associated basilar skull fracture (which may be appreciated due to clear fluid leakage), and lacerations extending into the external auditory canal should be referred to a specialist for repair.[34,40]

For split earlobe repairs, often related to earrings being suddenly removed, good apposition of the skin edges at the margin of the ear is important. Auricular nerve block or direct infiltration of the lobe can be performed for anesthesia. For partial or incomplete split involving the lower third of the earlobe, the split should be extended to the edge/rim using a number 11 or number 15 blade scalpel and wound edge excision should be performed. If only the upper two thirds are involved, wound edges can be excised followed by repair. For complete tears, the repair should begin at the rim by loosely placing a 6-0 non-absorbable suture that will serve to ensure good cosmetic alignment. This suture can remain untied and be held with slight tension by forceps until the remainder of the earlobe has been repaired using simple interrupted sutures.[41] A 2-0 nylon suture can be left at the apex as an earring site spacer but should not be exchanged for an earring for one month. Alternatively, if the earring site is closed, re-piercing can occur after three months somewhere other than the scar site.[42,43]

Fig 13. External ear (Pinna) anatomy.



Nasal Lacerations

Given its prominence, the nose is a commonly injured area of the face and is frequently seen in both motor vehicle accidents and assaults.[29,44] Laceration repair within 6 to 8 hours is preferred while repairs delayed beyond 24 hours is associated with morbidity.[44] Repair of lacerations secondary to dog bites is safe, similar to other areas of the face.[45,46] Simple nasal

Fig 14. Demonstrating bolster device with suture tied at anterior and posterior side of ear.

Fig 15a. Demonstrating ring block performed by encircling the ear with four separate injections of 2 to 3 mL of lidocaine.

Fig 15b. Demonstrating auriculotemporal and field block performed by injecting 3 to 4 mL anterior to the tragus and posterior to the ear along the posterior sulcus.[39]

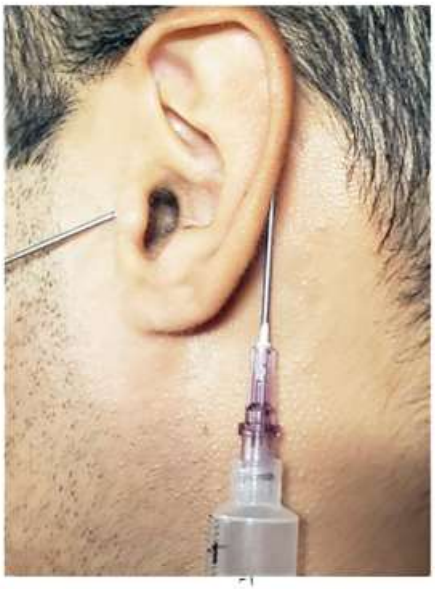
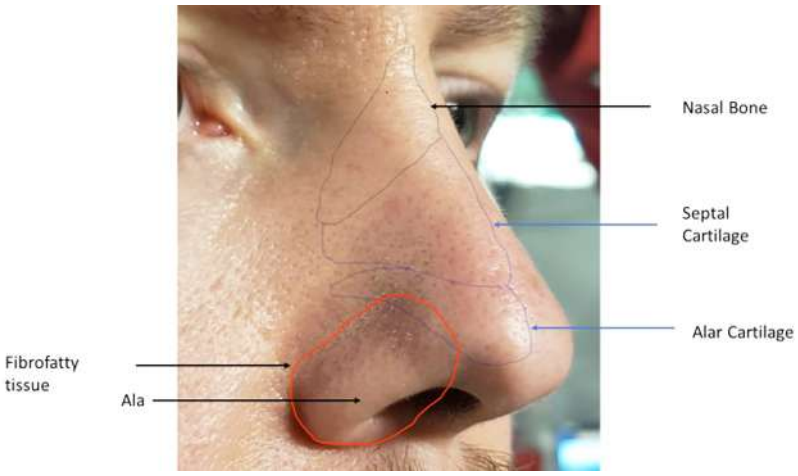


Fig 16. Nasal anatomy



lacerations can be closed with 6-0 non-absorbable sutures. For incisions that extend through the alar margin (Figure 16), the clinician should begin by aligning the margin with a 5-0 non-absorbable suture leaving the sutures untied until the end, and applying gentle traction as the repair is continued to the mucosal and skin surfaces to ensure alignment. Through and through lacerations should be performed in a three-layered fashion beginning with absorbable 5-0 sutures in the mucosa followed by the cartilage (if necessary) and finally the epidermis using 5-0 or 6-0 nonabsorbable sutures.[29] Extensive mucosal involvement would likely benefit from repair by a surgeon given the technical difficulty in repairing the mucosa without microscopic tools.

Generally, the cartilage does not need to be repaired if involved assuming minimal trauma (i.e. no significant deformity) to the cartilage. The clinician should irrigate between layers. Infraorbital nerve blocks (described in the "Lip Laceration" section) are an excellent method of achieving anesthesia as are lidocaine-soaked cotton swabs in the nasal mucosa.[47] Lidocaine soaked swabs can aid in achieving anesthesia of the nasal mucosa as the infraorbital nerve block is often inadequate for this.[35] For lacerations overlying a suspected palpable fracture or bony deformity, or for considerable tissue injury, the clinician should consider involving a surgeon.

Scalp Lacerations

Proper management of scalp lacerations requires an understanding of the skin layers (Figure 17). Unless the entire outer layer (composed of the skin, superficial fascia, and galea) are traversed, scalp lacerations generally will not be gaping. When evaluating a gaping wound, which raises concern for laceration through the entire outer layer, the galea itself is often difficult to appreciate and the thin periosteum (which cannot be sutured) is often mistaken for the galea. The wound should be probed with a sterile gloved finger to evaluate for fracture. The emissary veins which are tethered open due to their connection to the connective tissue, and therefore cannot retract, may cause persistent bleeding and are also a portal for infection to enter the central nervous system and skull. For this reason, and because of the role the galea has in a symmetric eyebrow raise, repair of the galea is important. Bleeding can interfere with repair. Direct pressure, everting the galea with forceps, figure-of-eight suture, and lidocaine with epinephrine all can assist to control bleeding for repair. Brushing the hair aside or matting it down with ointment is preferred to shaving in order to reduce the risk of infection. Single, simple interrupted 3-0/4-0 non-absorbable sutures should be used for repair making sure to include subcutaneous fascia and galea. As mentioned, since the galea itself can be difficult to identify, buried sutures should be avoided as they can serve as a nidus for infection. If the clinician is able to find the galea, and a defect greater than 5 mm is identified, a layered repair with 3-0 or 4-0 absorbable sutures can be attempted.[48,49] When repairing the scalp, long tails should be left (ideally with sutures of a different color than the hair) to facilitate suture removal during follow-up. Scalp wounds can be safely repaired up to 24 hours after injury.

For smaller (less than 10 cm), simple, shallow lacerations that are hemostatic, the hair apposition technique can be considered instead of staples or simple interrupted sutures. The hair apposition technique is associated with a reduction in

Fig 17. Cross-section of the scalp, notice the outer layer is considered functionally one layer.

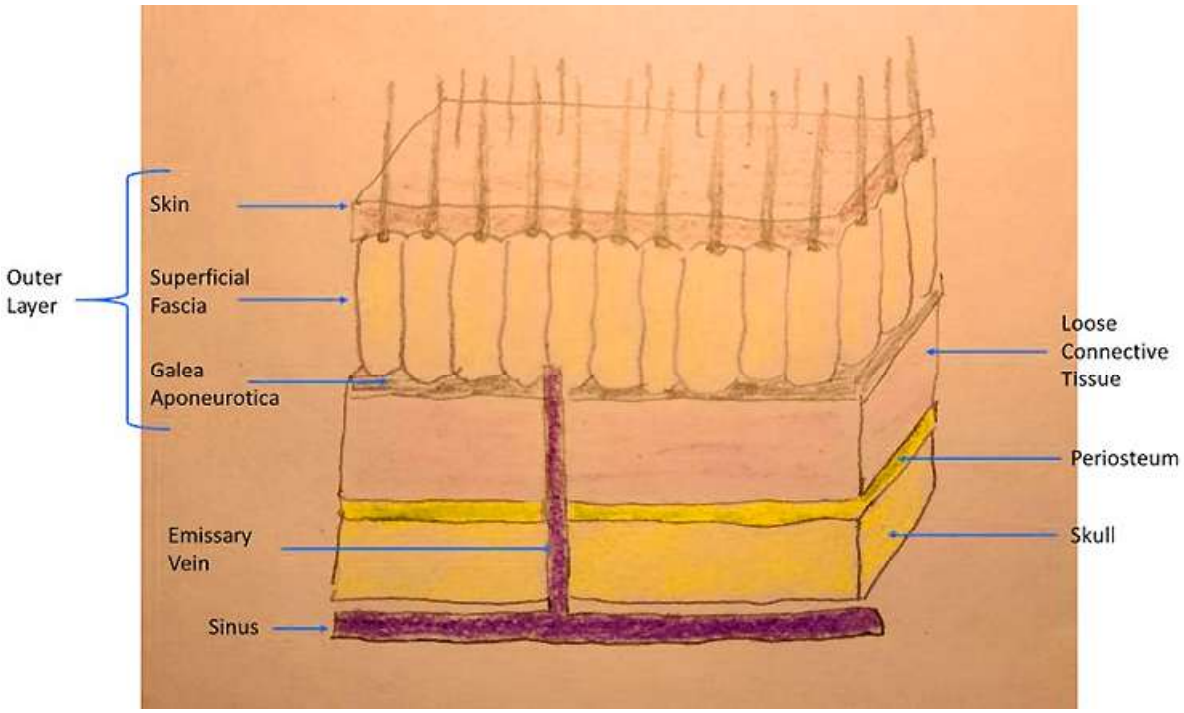
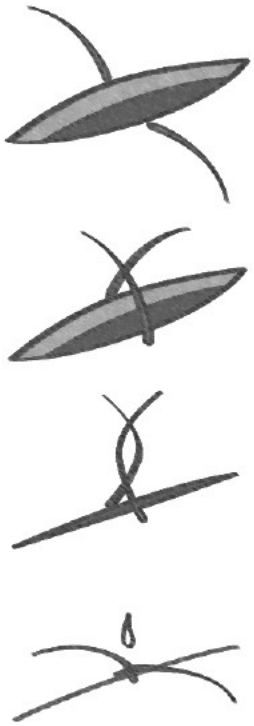


Fig 17. 18 Hair apposition technique (image top to bottom showing suture material being twisted and application of glue after twisting is complete)



complications and increased satisfaction compared to staples and sutures.[50] This technique involves twisting four to five hairs that are at least 1 cm in length and then gluing the hair together, taking care not to glue the scalp/wound itself (depicted in Figure 18). For shorter hair, 5-15 hairs should be grasped on either side of the wound to perform the same technique. Patients should be encouraged to avoid showering/bathing for two days.

When repairing the eyebrow, shaving or clipping should be avoided and the clinician should be fastidious about lining up hair margins. A supraorbital nerve block should be considered for anesthesia.[47]

Other Considerations

How does one dress the wound?

For wounds repaired with simple interrupted sutures, the patient can keep the area moist with a petroleum-based jelly. A non-adherent dressing can be placed for 48 hours with daily dressing changes afterwards until follow up.[51]

When can the wound get wet?

The wound can be washed within 12 to 24 hours. Daily gentle washing with mild soap and water to remove dried blood and exudate is beneficial, especially in areas such as the face or the scalp. Vigorous scrubbing of wounds should be discouraged. Patients may bathe with sutures in place but should not immerse the wound for a prolonged time.

What comes after suture removal?

The wound is not completely healed the day the sutures are removed. The recommended time of suture removal is a delicate balance between achieving tensile strength, the effect of the foreign body, and the consequent risk of granuloma and scarring. The most dangerous time of wound dehiscence is the day the sutures are removed. After initial suture removal, the wound can be reinforced with surgical tape after. Then, the patient to not stretch or pull with shaving, and advise the patient to minimize activity increasing tension across the wound for at least two weeks.[51]

Which anesthetic should be used?

Although it has a slightly slower onset than lidocaine, bupivacaine is preferred for longer procedures such as complex, multi-layered, or lengthy lacerations. Lidocaine is preferred for shorter procedures, especially those that require quick resolution of anesthesia such as lip laceration repair. Prolonged anesthesia in this case can lead to accidental biting of the lip or disruption of the repair by the patient (Table 2).[18]

Table 2 Anesthetics used in laceration repair

Agent	Onset	Duration	Maximum Dose	Maximum Dose with epinepthrine
Lidocaine 1% or 2%	< 2 minutes	30-60 minutes (longer with epinephrine)	3 mg/kg	5 mg/kg
Bupivacaine 0.25% or 0.5%	5–10 minutes	> 200 minutes (up to 540 minutes with epinephrine)	2.5 mg/kg (1.3 mg/kg for the face)	3 mg/kg (1.3 mg/kg for the face)

CONCLUSION

Head and neck trauma and subsequent laceration management is common in the emergency department. Repair of facial lacerations is unique, principally due to the importance of good cosmetic outcomes and the distinct anatomic considerations for the various areas of the face. Although the face has an excellent blood supply and rarely gets infected, there is the potential for significant morbidity if facial lacerations are not optimally managed. Techniques for repair can be technically challenging and fraught with pitfalls, therefore understanding indications for involving a surgical specialist is paramount.

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Point of Care Ultrasound Evaluation Prevents Anchoring Bias in Active-Duty Male Presenting with a Musculoskeletal Complaint of Neck Mass

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ABSTRACT

Musculoskeletal injury is among the most common presenting complaints of active-duty populations both in garrison and deployed environments. The risk, however, is that many more serious pathologies can be mistaken for musculoskeletal pathology. The high incidence of musculoskeletal injury may contribute to an anchoring bias that leads to premature closure of diagnostic inquiry and ultimately delayed diagnosis and potentially poorer outcomes.

We describe the case of a Soldier presenting to the Emergency Department with a musculoskeletal complaint of neck mass that was characterized by point of care ultrasound (POCUS) as cervical lymphadenopathy concerning for malignancy. Although POCUS is an established, integral component of the workup for neck mass in children, emergency physicians may use the modality less frequently with adults. POCUS has advantages over computed tomography (CT), including expediting care and reducing length of stay, improving patient satisfaction, preventing unnecessary radiation exposure, and cost-savings.

In the context of combat, POCUS may be present at Role 1 and Role 2 facilities, forward of CT, found at a Role 3. In the case at hand, POCUS prevented premature diagnosis of musculoskeletal pathology, rapidly refined the diagnosis, and shifted the focus of the workup and treatment plan.

BACKGROUND

In the active-duty U.S. military population, musculoskeletal injuries are a leading cause of medical evacuation from a theater of operations and lost duty days, with concomitant accrued costs.[1,2] Emergency physicians must be able to "anticipate and recognize [this] most common medical disorder," and the high incidence of musculoskeletal injuries has "implications for … preventative interventions."[2] At the same time, the very pervasiveness of musculoskeletal injury can bias emergency physicians towards premature closure of diagnostic inquiry, and more serious conditions may be missed.

Though less frequent in the literature on morbidity in the active-duty population, neck masses are a common presentation in the Emergency Department (ED), and the differential is broad, warranting an extensive evaluation. In addition to history and physical, expedited imaging may be of value in acute characterization of the mass.

While ultrasound and computed tomography (CT) are both imaging options for neck masses, point of care ultrasound (POCUS) has numerous, distinct advantages. It can rapidly narrow or reframe the differential, may obviate the need for CT and concomitant ionizing radiation exposure, and has the potential to reduce costs associated with the workup and reduce ED length of stay. Moreover, in the combat context, POCUS has the added advantage of potential availability forward of a Role 3, the first facility in the deployed environment at which CT is available. Our review of the literature suggests that POCUS may be under-utilized in the assessment of adult neck masses.

We present the case of an adult male active-duty Soldier complaining of a musculoskeletal neck mass, but POCUS immediately reoriented his workup to focus on infectious or malignant causes of cervical lymphadenopathy.

Case Presentation

A 19-year-old male active-duty Soldier presented to the Emergency Department at a military treatment facility with an acute, palpable right-sided anterior neck mass. He reported waking up with the mass two days prior to presentation, and he believed that he had injured his neck while weight-lifting the day prior to the appearance of the mass. The patient denied pain, unintentional weight loss, or night

sweats, and he had no known sick contacts. After the onset of the neck mass, the patient endorsed development of sore throat and subjective fever.

In the Emergency Department, the patient's vital signs were temperature 37.3 degrees Celsius, heart rate 77, respiratory rate 18, blood pressure 132/66, and SpO2 97%. Physical examination was significant for a non-fluctuant, soft mass at Level III of the right anterior neck (superior to the distal aspect of the cricoid cartilage),[5, 6] that was tender to palpation and lacked overlying skin changes, including erythema. His labs revealed a leukocytosis to 15.8, hemoglobin of 15.1, platelets of 229, a negative bandemia, unremarkable electrolytes, elevated ALT at 78, and elevated AST at 66. A streptococcus PCR was negative, but a mononucleosis screen was positive.

Using a Fujifilm Sonosite PX ultrasound system with a linear 15-4 MHz transducer and MSK settings, POCUS of the neck mass revealed normal appearance to the musculature and multiple, enlarged cervical lymph nodes at Level III. Color Doppler confirmed organized hilar blood flow to the lymph nodes. (Fig. 1 and Fig. 2.)

Because the profusion of enlarged lymph nodes was concerning for malignancy, a CT neck soft tissue with IV contrast was obtained, which was negative for peritonsillar abscess, concerning for bilateral tonsillitis, and confirmed "[m]oderate-to-severe bilateral cervical lymphadenopathy," favored to represent an inflammatory reactive process, but "malignancy not excluded."

As the balance of the patient's presentation and workup suggested that patient's neck mass was secondary to a mononucleosis infection, he was discharged with supportive care and instructions to avoid contact sports. He was advised to follow up with primary care in one-to-two weeks for reevaluation of his cervical lymphadenopathy.

Fig 1. Ultrasound image confirming organized hilar blood flow to lymphnodes.

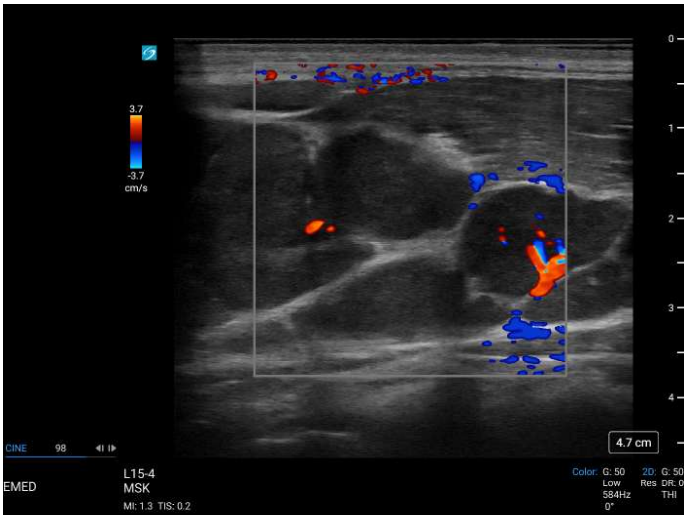
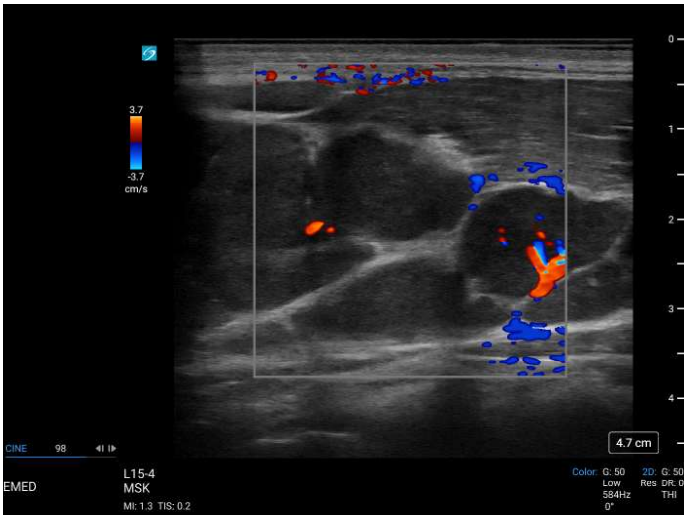


Fig 2. Ultrasound image confirming organized hilar blood flow to lymphnodes.



Two weeks later, the patient reported complete resolution of the cervical lymphadenopathy and all other symptoms.

DISCUSSION

Historically, radiologists performed the majority of neck ultrasounds.[4] With improvements in technology, clinicians are increasingly incorporating POCUS into their neck exams.[4] A recent study of utilization rates of clinician-performed neck ultrasound identified rising rates of neck POCUS by endocrinologists, surgeons, and otolaryngologists, but emergency physicians were not included in the analysis.[5]

A literature review indicates limited utilization of ED POCUS for adult neck masses. While neck anatomy is complex, POCUS nonetheless appears to be an established approach to the pediatric neck mass.[1, 6, 7, 8, 9] Yet the literature is sparser in the case of adults.[10]

The rationale for this distinction may relate to the acceptability of exposure to ionizing radiation in the different Emergency Department populations.[11] Though research is necessary to test this hypothesis, emergency physicians may be more liberal with neck CT scans for adults and may adjudge POCUS of neck masses unlikely to change management. Due to the range of structures and organs in the relatively small space of the neck, lack of confidence with interpretation of neck ultrasound images may also play a role.

That said, the structures and organs of the neck tend to be superficial, making them particularly well-suited for visualization with POCUS, and calls for emergency physicians to adopt POCUS for neck mass evaluation are long-standing.[12] Moreover, the increased cost of CT, potential harm from ionizing radiation exposure, and increase in ED length-of-stay for CT have provoked efforts to reduce

ED use of CT.[13] In addition, in the deployed environment, CT is not an option forward of a Role 3.[4] "POCUS-first" approaches to other ED presentations have likewise shown potential in cost-savings, avoidance of preventable radiation exposure, and decrease in ED length of stay.[14]

In the reported instance, ED POCUS of the patient's neck prevented anchoring bias from causing premature closure of the diagnostic inquiry: the history provided by the patient, and the patient's main concern when presenting, was a musculoskeletal injury, but POCUS immediately established that the neck mass was not musculoskeletal in nature. POCUS amplified attention to another part of the patient's history, that of sore throat and subjective fever developing subsequent to the appearance of the neck mass.

Although persistent neck masses in adults are concerning for malignancy,[15] cervical lymphadenopathy may have a myriad of causes, including viral, bacterial, or fungal infection, along with systemic diseases like sarcoidosis or amyloidosis.[2] Upon establishing that the neck mass was lymphadenopathy and not a muscular injury, the emergency physician was able to direct the workup to infectious and malignant causes, as appropriate and in accordance with the shared decision-making plan agreed-upon with the patient.

In this case, the emergency physician opted for CT to further evaluate the lymphadenopathy, in part because differentiating benign from malignant lymph nodes on B-mode and Doppler ultrasound remains challenging.[16] "Normal anatomical structures can mimic … pathological lymph nodes …. Lymph nodes in lymphomas may be indistinguishable from reactive lymph nodes in ultrasound[.]"[17] Indeed, even with CT evaluation, the radiologist was unable to rule out malignancy, cautioning that the possibility was "not excluded."

Although CT was performed in this case, on the basis of the POCUS images, the emergency physician and patient could have opted, consistent with the standard of care, for a "watch and wait" approach in the context of the patient's upper respiratory symptoms, positive mononucleosis screen, and significantly decreased pretest probability of malignancy should the neck mass resolve, as it did within a matter of days.

CONCLUSION

While identification of musculoskeletal injuries in the active-duty U.S. military population is a critical initial step in reduction of morbidity and associated costs, the pervasiveness of musculoskeletal pathology can give rise to anchoring bias that may foreclose diagnostic inquiry that would uncover a more serious disease process. Where musculoskeletal injury of the neck is suspected, POCUS can prevent early closure of diagnosis, refine the differential, focus the workup, and expedite diagnosis. "POCUS first" for neck masses (regardless of whether they are suspected to be musculoskeletal in nature) may also allow emergency physicians to adopt a more conservative approach to CT for neck masses, sparing patients' preventable radiation exposure and decreasing ED costs. In the deployed setting, POCUS may enable imaging of neck masses forward of a Role 3. Further research may help elucidate why ED POCUS for adult neck masses has not been as rapidly integrated into the workflow as other forms of POCUS and facilitate its implementation.

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