Case Presentation #3: “The Case of the Perilous Pencil”

Presented by Timothy Horeczko, MD, Marianne Gausche-Hill, MD, and David Burbulys, MD

A 4 year-old girl was running around the house with a pencil in her mouth. Her mother heard screaming and found her on the floor with the pencil lodged in the back of her throat. Her father pulled out the pencil, noticed some bleeding from her mouth and brings her into the ED. On examination, she is alert and somewhat scared but comfortable in her mother’s arms, breathing normally, with normal skin color.

Begin discussion of assessment and management of this patient.

The PAT is as follows

- **Appearance**: Normal. The girl is uncomfortable and in pain, but she is alert, interactive, and consolable in her mother's arms.
- **Work of Breathing**: Normal. The girl’s respirations are at a normal rate and depth. There are no retractions, stridor, or abnormal positioning.
- **Circulation to the skin**: Normal. The patient has normal skin color.

Vital Signs Include

- Heart rate: 145 bpm
- Respiratory rate: 24 breaths/min
- Blood pressure: 110/60 mmHg
- Temperature: 37.5°C
- Weight: 14 kg

Initial Assessment

- A: Open, no stridor.
- B: Breath sounds clear.
- C: Color normal, skin warm and dry, tachycardic, brachial pulse strong, capillary refill < 2 seconds.
- D: Tone normal.
- E: There is dried blood around the mouth but no external evidence of swelling or trauma.

Focused History

- S: Minimal bleeding from the mouth and the child refuses fluids by mouth. No drooling.
- A: No allergies.
- M: No medications.
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- P: Born full-term NSVD; She has attained all of her appropriate milestones. Her immunizations are up-to-date per history, and mother does not recall her tetanus status.
- L: Had dinner 2 hours ago.
- E: The child’s parents were alarmed to find her screaming on the floor with a pencil fixed into the back of her mouth, at which time they pulled it out. The parents cannot recall whether the pencil was completely intact. The bleeding from her mouth had stopped by the time she had arrived to the ED. She did not seem to have lost consciousness, hit her head, or to have had difficulty breathing after the event. There are no other signs of trauma.

Detailed Physical Exam
- Skin: Warm, dry; no ecchymosis or abrasions.
- Head and Neck: Puncture wound 2 to 3 mm hematoma in the right peritonsillar area with erythematous anterior and posterior tonsillar pillars. Uvula midline and hard palate are intact. No evidence of trauma to tongue, teeth, or perioral structures. There is normal jaw occlusion. There is no bruises or subcutaneous emphysema. Normal nasopharynx and tympanic membranes and no tenderness to palpation scalp or cervical spine.
- Chest: Clear to auscultation, without stridor, rales or wheeze.
- Heart: Without murmur, regular rhythm.
- Abdomen: Soft without tenderness.
- Neurologic examination: Child is scared and will not talk other than to mutter to mother, so quality of speech cannot be assessed; however, mother feels she is responding normally. Extraocular movements intact, pupils equal, round, and reactive. Facial muscles and sensation grossly intact, child has normal tone, and is moving all extremities normally.

Key Questions
What is your general impression of this patient?

Ask the audience to characterize the patient’s condition as one of the following:
- Stable
- Respiratory Distress
- Respiratory Failure
- Shock
- Primary CNS/Metabolic Dysfunction
- Cardiopulmonary Failure/Arrest
Core Knowledge Points – General Impression

- This patient is stable.
- Although this child appears physiologically stable at this time there is the potential for serious injury and later airway compromise. It is important to continue the assessment to confirm initial findings in the PAT.
- Patient has a normal startled appearance, normal breathing and circulation but a concerning head and neck examination. She is stable at this time but there is concern for a possible evolving airway obstruction or neurovascular injury due to peritonsillar trauma.

Key Questions

What are your initial management priorities?

- Place the patient on a cardio-respiratory monitor and continuous pulse oximeter.
- Place saline lock and begin infusion of resuscitation fluids if the patient’s appearance or vital signs change to suggest hypovolemia, or for any change in mental status or airway compromise.
- Obtain lateral neck films to assess for retained foreign body or ectopic air.
- Treat the child’s pain and preferably minimize stimulation to help calm child.

Case Development

- Child calms and remains stable.
- The lateral neck film for this child is shown in Figure 3-1.
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Key Questions
What space was entered by the pencil?
Is a foreign body seen on this film?
- Lateral neck films reveal air in the retropharyngeal space which tracks down to the level of C4. There is no foreign body visualized.

Case Development
- This child has trauma to the peritonsillar region with resulting hematoma. The differential diagnosis should be based on the possible trajectory and structures involved (see Figure 3-2: Relationship of Carotid Sheath to Oropharynx, simplified)

![Diagram of Carotid Sheath to Oropharynx](image)

Figure 3-2: Relationship of Carotid Sheath to Oropharynx

- **Soft palate**: Penetrating trauma in a posterior to postero-cephalad direction involves the soft palate, which is the mobile posterior third of the palate. The *aponeurotic palate* is the membranous portion of the soft palate which attaches to, and is supported by, the posterior portion of the hard palate. The *muscular palate* is the fibromuscular posterior portion of the soft palate, supported by the levator veli palatini (CN V3), tensor veli palatini, musculus palatovulvae, palatoglosssus, and palatopharyngeus muscles (CN XI via pharyngeal...
branch of CN X: the pharyngeal plexus). The greater and lesser palatine arteries and nerves supply the mucosa of the soft palate and the pterygoid venous plexus drains it.

- **Palatine tonsils**: The tonsils lie on each side and are masses of vascular lymph tissue with blood supply and innervation as above. Lymphatics drain to the retropharyngeal nodes and the superior deep cervical nodes.

- **Pharyngeal musculature**: A puncture wound posterolateral to the peritonsilar area involves the superior pharyngeal constrictor, styloglossus, stylohyoid, and stylopharyngeus muscles supplied by CN XII and the ascending pharyngeal artery.

- **Buccopharyngeal fascia/retropharyngeal space/prevertebral fascia**: A puncture wound posterior and midline may involve the two bands of fascia separating the pharyngeal musculature from the anterior cervical spine musculature. The retropharyngeal space is a potential space which spans cephalad from the base of the skull down and along the anterior longitudinal ligament of the spine.

- **Carotid sheath**: The sheath is located posteromedial to each palatine tonsil. Its three components include, from anterior to posterior: the internal carotid artery, CNs IX, X and XII and the internal jugular vein. The superior cervical sympathetic ganglion rest just medial to the sheath. Damage to this structure may result in a Horner’s syndrome.

**Key Question**

*What do these results indicate?*

- Although the physical exam shows minor trauma with a resulting small hematoma, the lateral neck film with air in the retropharyngeal space indicates a significantly deep penetration into an area rich in important nerves and vessels.

**Core Knowledge Points – Possible Diagnosis: Suspected Carotid Sheath Involvement**

- Penetrating trauma of the oropharynx in children.
  - Oropharyngeal trauma is common in younger children with case reports of hard and soft palate impalement with objects such as pencils, toothbrushes, ballpoint pens, sticks, silverware, etc.
  - A large majority of cases involve only the soft tissues without neurovascular compromise.
  - A rare but disastrous complication is involvement of the internal carotid artery with subsequent devastating neurological deficits.
  - The key to management of these patients is to identify risk factors for potential critical structure injury, assess for neurological or vascular changes and assess the caregiver’s ability to participate in the child’s care and follow-up.
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Critical Actions - Suspected Carotid Sheath Involvement

- Close observation and cardiorespiratory monitoring while in department.
- Meticulous oral exam; children may need to be sedated in order to assess the extent and location of the oral injury.
- Meticulous age-appropriate neurological exam.
- A doppler may be used to determine carotid artery flow, but this exam is not sufficiently sensitive to be used alone.
- In patients with suspected neurological compromise, bilateral carotid angiography is warranted. An interventional radiologist experienced in pediatrics is key in the quality of the exam, as incorrect positioning of catheter can cause arterial spasm and slow dye injection may yield a misleadingly constricted stream of contrast, both yielding a false-positive study. If general anesthesia is necessary for the procedure, its side-effect of intracranial artery vasodilation is helpful in the evaluation of the study results.
- Contrast-enhanced CT angiography has been suggested as a screening exam to help determine which children should be discharged from the ED and which should be admitted to undergo more definitive carotid angiography. Although there is limited data to support use of CT angiography specifically in oropharyngeal trauma, it is a well described tool in the evaluation of adult and pediatric trauma patients, and is commonly available twenty-four hours a day. Carotid angiography remains the consensus gold standard for diagnosis of internal carotid artery damage in oropharyngeal trauma. However, contrast CT angiography in a sub-set of patients with low-risk injury and non-focal exam may be helpful in deciding disposition.

Core Knowledge Points — Carotid Artery Damage

- Seemingly innocuous injuries to the soft palate and peritonsillar tissues may conceal damage to the internal carotid artery due to their close proximity.
- Direct damage to the internal carotid artery is possible due to a rapid, blunt blow to the posterolateral soft palate, compressing the artery against the transverse process of the second or third cervical vertebrae.
- Intimal damage may occur from shearing forces after blunt trauma even in the absence of arterial penetration. Intimal damage promotes thrombus formation with potential disastrous neurological sequelae. Case reports of carotid injury describe a range of mechanism from blunt trauma by a toothbrush with no mucosal penetration to significant laceration with exposure of the medial parapharyngeal space.
- One commonly found significant clinical feature of intraoral trauma with neurologic sequelae is a “lucid interval” ranging from 3 and 48 hours. Another often seen before the development of any neurologic findings is vomiting, irritability, drowsiness, or listlessness.
• Possible neurologic manifestations are contralateral hemiplegia, homonymous hemianopsia and aphasia if the dominant cerebral hemisphere is involved. Less severe findings are thought to be due to the showering of small emboli from thrombogenic damage to the intimal wall.

Critical Actions — Carotid Artery Damage
• Close monitoring of airway and neurologic status.
• Bilateral carotid angiogram is recommended before any treatment is initiated.
• Anticoagulation is controversial. It is important to rule out dissection, as anticoagulation may extend this type of injury.
• Head and Neck Surgery consultation is recommended in any case of intraoral trauma that involves the soft palate, especially above the level of C3, which carries a higher risk of internal carotid injury.

Core Knowledge Points
• Assessing severity of oropharyngeal trauma.
• Although the first case of internal carotid injury after intraoral trauma was reported in 1872, it remains a rare complication. The vast majority of patients sustain minor soft tissue trauma without neurovascular compromise. Since intraoral injury is not an uncommon complaint in the ED, carotid injury is rare and the “lucid interval” may approach 48 hours, it is often not practical or feasible to admit every child with this presentation.
• The management consensus is as follows:
  o Patients with a normal neurologic exam may be discharged home with instructions to return for any change in status such as nausea/vomiting, irritability, listlessness, or focal neurologic symptoms. This requires a reliable caregiver and a child with a low-risk injury. A next-day follow-up may be prudent to ensure no progression of symptoms.
  o Admission and consultation are warranted for a non-reassuring neurologic exam, i.e. any change in mental status and/or question of focality on exam, or need for surgical debridement/repair of palate. Infants or young children in whom mental status may be difficult to assess or have an unreliable home situation also warrant admission.
  o Hospitalization and consultation are required for the subset of patients at risk for an adverse outcome. This includes impalement of the lateral portion of the soft palate or tonsillar tissue, regardless of a benign appearance. In addition, patients with retropharyngeal involvement (i.e. ectopic air on lateral neck films), mediastinal involvement and/or inability to feed should be admitted for observation.
  o Prophylactic antibiotics should be considered to cover mouth flora and tetanus status must also be assessed.
Case Development

- The patient was admitted due to retropharyngeal involvement and angiography was performed. Angiography was normal and showed no evidence of carotid injury.
- She was treated with prophylactic antibiotics, given tetanus toxoid and observed for twenty-four hours.
- She did well and went home with close follow-up.

References


Pitner SE. Carotid Thrombosis due to Intraoral Trauma: An Unusual Complication of a Common Childhood Accident. NEJM 1966 274(14): 764-767

