

CLINICAL VIGNETTE

Successful Intubation of a Patient with Post-burn Contracture in an Under-resourced Area

Allison Woods, MD, Brianna Ortvals, CRNA, Maryte Gylys, MD and Reza Borna, MD

UCLA Department of Anesthesiology & Perioperative Medicine

Case

This patient was evaluated during a mission trip to a small and under-resourced village in Guatemala. The patient was an otherwise healthy 11-year-old female who suffered a severe burn on her jaw, neck, and upper chest after falling into the family's fire pit at age one. As the skin healed, extensive scar tissue formed, resulting in a post-burn contracture. In addition, the airway exam and evaluation revealed limited mouth opening, loss of neck range of motion, inability to protrude jaw, and decreased thyromental distance.

A 5.5-hour plastic surgery was planned to begin reconstructing her jaw, neck, and chest using skin grafts. This surgery necessitated general endotracheal anesthesia. However, this patient was anticipated to be a difficult airway. Given the location of her injury and contractures, successful bag-mask ventilation of this patient was potentially impossible, and with high probability of airway anatomy distortion. For these reasons, our team felt it was unsafe to proceed with direct laryngoscopy. It was determined that the safest intubation plan was awake intubation. However, the equipment available to our anesthesiology team was limited. There was no access to a fiberoptic bronchoscope, the method most commonly used for awake intubations at our home institution. Thus, we performed awake intubation using a video laryngoscope.

The patient's airway was first anesthetized with aerosolized lidocaine to prevent coughing upon laryngoscopy. The patient (31 kilograms) was then sedated with 30 mcg dexmedetomidine (1 mcg/kg), administered in two 15 mcg boluses, as well as 60 mg ketamine (2 mg/kg), administered in 3 boluses of 20 mg each. To help minimize secretions, she was also given 0.2 mg glycopyrrolate on induction. After adequate sedation, the video laryngoscope was inserted, pausing periodically to assess the patient's responsiveness and comfort. While maintaining visualization, the endotracheal tube was passed through the vocal cords successfully on the first attempt. The patient maintained spontaneous ventilation and appeared very comfortable during laryngoscopy and intubation. Once capnography was confirmed, general anesthesia was achieved with 90 mg propofol (3 mg/kg) and 30 mg rocuronium (0.1 mg/kg). The endotracheal tube was sutured to the teeth. In addition to the

induction medications, the patient was also given dexamethasone (4mg) and ondansetron (4mg) for nausea prophylaxis, as well as hydromorphone (30 mcg x 4 + 0.2 mg upon emergence) for pain control.

The plastic surgeons successfully took skin grafts from her groin bilaterally to begin the reconstruction of the patient's jaw, neck, and chest.

Discussion

According to Onah, post-burn mentosternal contractures can be categorized into four major groups based on the location of the contracting band and the extent of flexion or extension away from the anatomical position of the neck and jaws (Table 1).¹ The groups are further sub-classified based on the width of the contracture. Jeong et al. reported the Onah class could be an adequate independent predictor for difficult intubation.²

A summary on airway management in patients with post-burn contractures of the neck from Prakash et al. notes that awake fiberoptic-guided intubation is the gold standard in post-burn contractures of the neck.³ However, these airway management techniques used for adult patients with post-burn contractures need to be modified for the pediatric population.^{3,4} For a pediatric patient with post-burn contractures of the neck, Prakash et al. recommend induction with ketamine (0.2–0.8 mg/kg IV over 2–3 min), supplemented by local anesthetic nebulization to maintain spontaneous respiration during fiberoptic intubation.³ Although our team was more familiar with using fiberoptic guidance for awake tracheal intubations, a systematic review of video laryngoscopy versus flexible bronchoscopy for awake tracheal intubations in the adult population reported use of video laryngoscopy is associated with a shorter intubation time and comparable success rate and safety profile to flexible bronchoscopy.^{5,6} Additionally, Shehata et al. found similar results in patients with post-burn contractures of the face and neck.⁷

Although recent guidelines have streamlined suggested awake tracheal intubation procedure using either flexible bronchosco-

py or video laryngoscopy for the adult population, no guidelines exist for the pediatric population.⁵ We found one case study reporting successful awake tracheal intubation using video laryngoscopy in the pediatric setting.⁸

Based on the Onah classification system, our patient presented with a type 3 post-burn mento-sternal contracture, predictive of a more complicated airway. If this patient had presented at our home institution, we would have likely proceeded with a planned awake tracheal intubation using flexible bronchoscopic guidance. However, given the limited resources in an under-resourced hospital, our team only had access to a video

laryngoscope. Using non-respiratory depressing sedatives, this patient successfully underwent uncomplicated laryngoscopy with video laryngoscope and intubation while maintaining spontaneous ventilation.

At age 11, this patient finally had the opportunity to have surgery that would allow her to move her neck for the first time in more than a decade. This surgery aimed to enable the patient to increase her neck's range of motion so she could talk, eat, and socialize more comfortably. However, she will need 4-5 additional surgeries to fully reconstruct her injury.

Table 1. Clinical classification system for post-burn mento-sternal contractures.¹

| Type | Degree of Contracture |
|------|--|
| 1 | Mild anterior neck contracture. The patient is able to flex the neck and bring the neck and jaws to the anatomical position while erect. Limited extension away from the anatomical position is possible. |
| 2 | Moderate anterior contracture. The patient is able to flex the neck and bring the neck and jaws to the anatomical position while erect. Attempts at extension away from anatomical position result in significant pull at the lower lip. |
| 3 | Severe anterior mento-sternal contracture. The patient's neck is contracted in the flexed position, and the chin is occasionally restrained down to the anterior trunk. As a result, the patient is unable to reach an anatomical position of the neck and jaws. |
| 4 | Posteriorly located contracture. The contracting band at the back of the neck prevents full neck flexion and may hold the neck in some degree of extension. |

REFERENCES

1. **Onah II.** A classification system for postburn mentosternal contractures. *Arch Surg.* 2005 Jul;140(7):671-5. doi: 10.1001/archsurg.140.7.671. PMID: 16027332.
2. **Jeong IM, Seo WG, Woo CH, Bae JY, Mun SH, Kim KM.** Prediction of difficult intubation in patients with postburn sternomental contractures: modified onah class. *Korean J Anesthesiol.* 2009 Sep;57(3):290-295. doi: 10.4097/kjae.2009.57.3.290. PMID: 30625875.
3. **Prakash S, Mullick P.** Airway management in patients with burn contractures of the neck. *Burns.* 2015 Dec;41(8):1627-1635. doi: 10.1016/j.burns.2015.03.011. Epub 2015 Apr 11. PMID: 25868969.
4. **Unal D, Sumak Hazir M.** Airway Management in Pediatric Patients With Burn Contractures of the Face and Neck. *J Burn Care Res.* 2022 Sep 1;43(5):1186-1202. doi: 10.1093/jbcr/irac016. PMID: 35137105.
5. **Ahmad I, El-Boghdadly K, Bhagrath R, Hodzovic I, McNarry AF, Mir F, O'Sullivan EP, Patel A, Stacey M, Vaughan D.** Difficult Airway Society guidelines for awake tracheal intubation (ATI) in adults. *Anaesthesia.* 2020 Apr;75(4):509-528. doi: 10.1111/anae.14904. Epub 2019 Nov 14. PMID: 31729018; PMCID: PMC7078877.
6. **Alhomary M, Ramadan E, Curran E, Walsh SR.** Videolaryngoscopy vs. fiberoptic bronchoscopy for awake tracheal intubation: a systematic review and meta-analysis. *Anaesthesia.* 2018 Sep;73(9):1151-1161. doi: 10.1111/anae.14299. Epub 2018 Apr 17. PMID: 29687891.
7. **Shehata I, Fekry M, Khalik MMA, Abdullah AM.** Skin graft in post burn neck contractures. *Egypt J Plast Reconstr Surg.* 2012;36:225-228.
8. **Skelly JR, Wauchope J, Collreavey M, Walsh B.** Awake tracheal intubation: Videolaryngoscopy in a pediatric institution: Use of guidelines and multidisciplinary team preparation to facilitate performance of an unfamiliar technique in a pediatric setting. *Clin Case Rep.* 2022 Feb 18;10(2):e05466. doi: 10.1002/ccr3.5466. PMID: 35223020; PMCID: PMC8855332.