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Case Report

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Laryngeal Fracture following Violent Sneeze: Management and Biomechanical Analysis

Laura Matrka, MD[1], and Michael Li[2]

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Laryngeal fractures are rare occurrences, usually the result of direct and high-force trauma.[1] Even in these cases, <1% of patients suffer a fracture of the larynx. Patients who suffer a fracture present with dysphonia, neck pain, dyspnea, and dysphagia.[1] Nontraumatic laryngeal fracture is exceedingly rare, and its occurrence should trigger suspicion for underlying neoplastic or inflammatory conditions. We report the case of a patient with acute odynophagia, pain with neck movement, and dysphonia after an episode of sneezing. In addition to appropriate management, we discuss the biomechanics of sneezing and the forces generated during sternutation to better understand the etiology of such events.

Case Presentation

A 35-year-old man presented with acute-onset neck pain, odynophagia, and dysphonia after a violent sneezing fit, preceded by 2 weeks of mild sore throat and dysphonia. Physical examination revealed normal respiration without stridor, oropharyngeal erythema, tenderness to palpation over the right thyroid ala, and anterior-posterior mobility of the right thyroid ala without crepitus. Contrast-enhanced computed tomography of the neck revealed a nondisplaced vertical fracture of the right thyroid ala, subcutaneous air in the anterior cervical fascial planes, and edema of the right true vocal fold (**Figure 1**). Reactive-appearing lymph nodes in cervical levels I and II were present bilaterally.

Flexible video laryngostroboscopy (VLS) demonstrated right-sided true vocal fold findings of edema, erythema, absent mucosal wave, intact mobility, and hemorrhage (**Figure 2**). The patient was diagnosed with a nondisplaced fracture of the thyroid cartilage. We consulted the radiologist, jointly reviewed the scan for neoplasms, and confirmed the reactive nature of the level I and II lymph nodes. We questioned the patient regarding a personal or family history of symptoms suspicious for conditions such as relapsing polychondritis, other cartilaginous neoplasms, or metabolic disorders. Only after assurance that the patient was free of neoplastic or inflammatory conditions was conservative management deemed appropriate. He was followed with

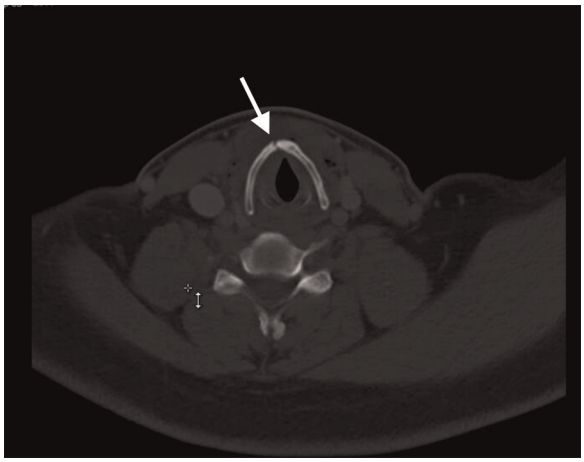

Figure 1. Axial section of computed tomography scan demonstrating fracture of the thyroid cartilage along the right anterior aspect of the cartilage (arrow). Surrounding emphysema within the cervical fascia of the neck can also be appreciated.

[1]Department of Otolaryngology, The Ohio State University, Columbus, Ohio, USA
[2]College of Medicine, The Ohio State University, Columbus, Ohio, USA

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Corresponding Author:
Laura Matrka, MD, The Ohio State University Wexner Medical Center Eye and Ear Institute, 915 Olentangy River Rd, Suite 4000, Columbus, OH 43212, USA.
Email: laura.matrka@osumc.edu

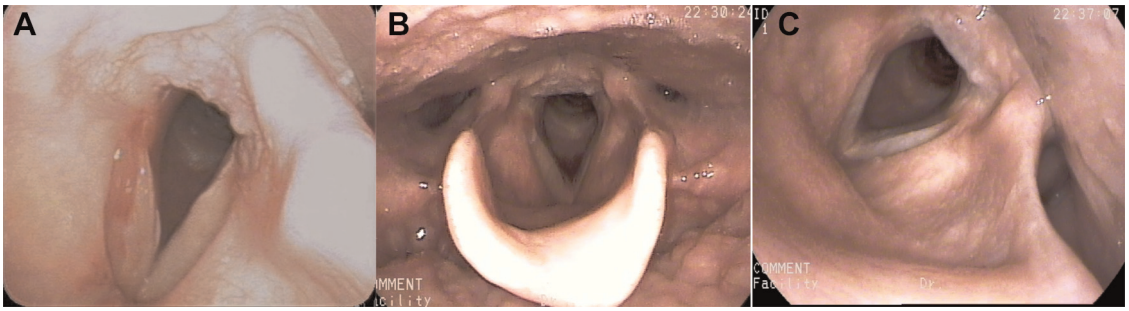

Figure 2. Flexible fiber-optic laryngoscopy examination demonstrating resolving mucosal hemorrhage: (A) day of presentation, (B) 5-day follow-up, and (C) 2-month follow-up. Note edema and hemorrhage of right vocal fold upon initial presentation that improves at 5-day follow-up and is completely resolved at 2-month follow-up.

repeat VLS and demonstrated complete resolution at 2-month follow-up. This study was deemed exempt from review by the Institutional Review Board.

Discussion

Laryngeal fracture is rare even in settings of high-force trauma. Complications can be life-threatening but are often preventable with early recognition, fracture reduction, and/or a temporary tracheostomy. Spontaneous laryngeal fracture should prompt consideration of pathologic fracture. The 2 most common neoplasms affecting laryngeal cartilage are enchondroma and chondrosarcoma. Both are more likely to arise from the cricoid cartilage, causing symptoms of slowly progressive dysphonia and occasional dyspnea. Physical examination is often unrevealing, but VLS may reveal subglottic fullness or separation of the arytenoid cartilages with a posterior glottic gap.[2] Inflammatory conditions of the cartilage should also be considered when pathologic fracture is a possibility. The most common of these is relapsing polychondritis, an autoimmune disease affecting cartilage, with 50% of patients having airway involvement.[3]

Few cases of thyroid cartilage fracture following a sneeze or cough have been reported since 1950, and none have included a biomechanical analysis of how such a seemingly preposterous event may occur. Variables contributing to the force of a sneeze include body position, open or closed mouth, and attempts to suppress the sneeze. Intratracheal pressures have been estimated at 0.43 kPa during an open-mouth, open-nares sneeze, rising to 42 kPa with a closed mouth.[4] When static pressure is applied, the estimated threshold required to fracture the thyroid cartilage is 210 kPa.[4] However, a sneeze is a dynamic process: biomechanical analysis of the force applied to the lower back during sternutation reveals that a standing and ''hunched'' position transmits more force to the back than do other positions, suggesting that the same is likely true for other sites in the body.[5] That is, depending on variables such as open/closed mouth, body position, and glottic position, a sneeze may generate enough force to fracture the laryngeal cartilages.

Conclusion

Laryngeal fracture is a rare occurrence and commonly the result of direct trauma. Nontraumatic laryngeal fracture is exceedingly rare and should prompt a workup for pathologic fracture due to neoplasm or inflammatory conditions. In the absence of such findings, biomechanical forces generated during a sneeze may approach levels known to cause fracture, but distribution of these forces depends on body position, ossification patterns of the cartilage, and open or closed configuration of the glottis, mouth, and nares.

Author Contributions

Laura Matrka, direct patient care, manuscript preparation; **Michael Li**, literature review, manuscript preparation.

Disclosures

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References

1. Jalisi S, Zoccoli M. Management of laryngeal fractures—a 10-year experience. *J Voice*. 2011;25:473-479.
2. Chin O, Dubal P, Sheikh A, et al. Laryngeal chondrosarcoma: a systematic review of 592 cases. *Laryngoscope*. 2017;127:430-439.
3. Hamdan A, Sarieddine D. Larngeal manifestations of relapsing polychondritis. *Open J Rheumatology Autoimmune Dis*. 2013;3:108.
4. Rahiminejad M, Haghighi A, Dastan A, Abouali O, Farid M, Ahmadi G. Computer simulations of pressure and velocity fields in a human upper airway during sneezing. *Comput Biol Med*. 2016;71:115-127.
5. Hasegawa T, Katsuhira J, Matsudaira K, Iwakiri K, Maruyama H. Biomechanical analysis of low back load when sneezing. *Gait Posture*. 2014;40:670-675.