Laryngeal Hyposensitivity in Obstructive Sleep Apnea

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Introduction

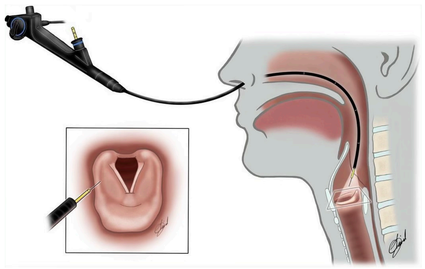
- Impaired laryngopharyngeal sensation has been implicated in obstructive sleep apnea (OSA) and may play an important pathophysiological role.
- Topical upper airway anesthesia can reduce dilator muscle activity, increase airflow resistance, and induce apneas and hypopneas in normal subjects.[1]
- Cheung-Bearelly monofilaments are a novel sensory testing mechanism to test laryngeal sensation in healthy adults[2-4]
- The laryngeal adductor reflex (LAR) is a brain-stem mediated protective reflex in which the vocal cords adduct in response to sensory stimuli.

Objectives

- Evaluate laryngeal sensory function in OSA by examining the LAR response rate and motoric profile following tactile stimulation using Cheung-Bearelly monofilament aesthesiometers.
- **Hypothesis: Laryngeal sensation is reduced when measured objectively with LAR as compared to controls without OSA.**

Methods

- Laryngeal sensation testing was performed in **awake** adults during endoscopy (Figure 1A) by stimulating the medial aryepiglottic (AE) fold or arytenoid (Figure 1B) using 5-0 and 4-0 nylon 30mm monofilaments.
- Study subjects: OSA confirmed on sleep study.
- Controls had no OSA symptoms and STOPBANG score </=2.
- Video analysis by two independent reviewers evaluated for presence of LAR response and latency (time in milliseconds from contact of monofilament with mucosa to initiation of vocal fold adduction, Figure 1C).
- **Responder status defined as presence of the LAR in ≥ 50% of satisfactory stimuli delivered.**



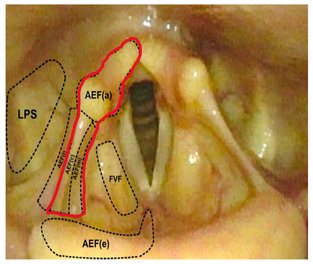


Figure 1A. Cheung-Bearelly monofilament is placed through the working channel of a flexible endoscope for laryngeal sensory testing

Figure 1B. Highlighted area represents region targeted for tapping

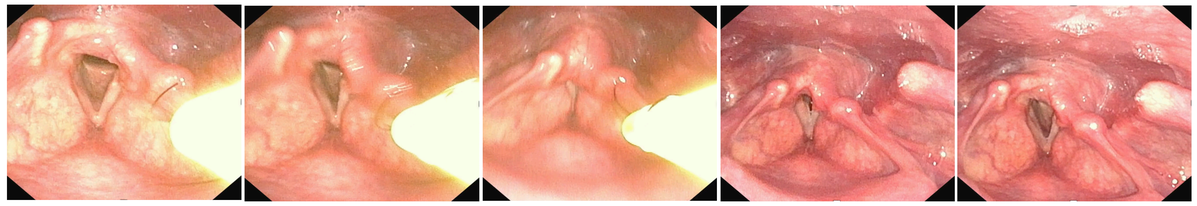


Figure 1C. Tap falls within target region and causes buckling of the monofilament by 10%-30% of total length; subsequent LAR response

Results

OSA subjects: N=26 (19% female); mean AHI 37 events/hour ±25
Control subjects: N =12 (67% female); mean STOPBANG 1 ±0.8
270 total taps assessed

LAR Response Rate is Reduced in OSA

- Responders: **48% of OSA group vs 100% of controls** (4-0 monofilament, p=0.04)
- Response Rate: **57% in OSA subjects and 92% in controls** (4-0 monofilament, p<0.001, Fig. 2)
  - ESS associated with response rate (p<0.01)
  - BMI, AHI, ODI, CPAP use not significant

LAR Latency is SHORTER in OSA

- OSA = 111.4±32.3ms vs Controls = 140.9±39.9ms (p=0.04, Fig. 3A)
- AHI (p=0.02) & T90 (p=0.02) were associated with mean latency
  - **AHI remained significant on multivariate analysis controlling for sex and age, among other factors**
  - **Higher AHI correlated with longer latency in the OSA group** (r=0.30, p=0.02, Fig. 3B)

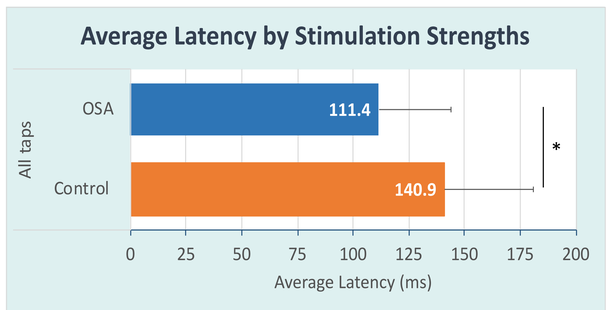


Figure 3A. LAR latency is shorter in the OSA group compared to control group

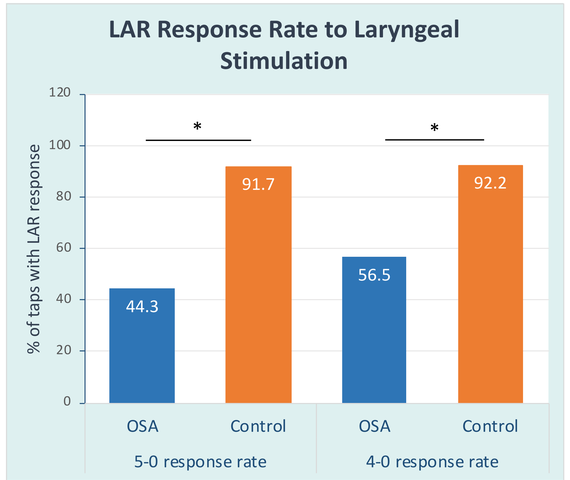


Figure 2. LAR response rate to 5-0 and 4-0 monofilaments

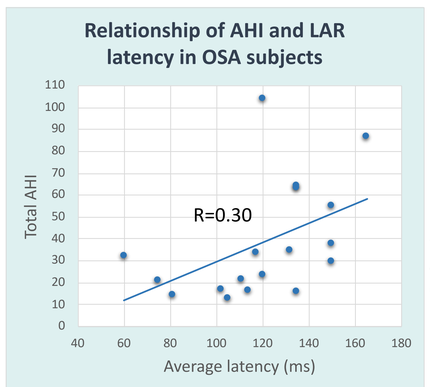


Figure 3B. LAR latency is positively associated with AHI within the OSA group

Discussion

With the use of an observable sensorimotor response metric triggered by tactile stimulation, this study validates prior work suggesting decreased laryngeal sensitivity in OSA. It also **demonstrates for the first time that OSA modulates the LAR latency.** Shortened latency may be a consequence of heightened baseline sympathetic tone associated with OSA and latency correlation with OSA severity may reflect central nervous system changes that modulate the LAR response[5]. Future research should explore whether the LAR latency can be used as a biomarker of increased sympathetic tone to identify patients at highest risk for OSA-related morbidity and of disease severity to reduce patient and resource burden associated with a formal sleep study. Innovative therapies may be created to improve upper airway sensation for restoration of upper aerodigestive tract sensorimotor function to treat OSA.

Conclusions

- **Laryngeal sensation is reduced** on objective LAR testing in OSA.
- **LAR latency to vocal fold closure initiation** is shorter in OSA, suggesting potential biomarker of increased sympathetic tone.
- **LAR latency is correlated with AHI**, suggesting OSA impacts supramedullary modulation of the LAR circuit.

References

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