

The upper airway: Cross-disciplinary conversations

Thoughts on the upper airway gleaned from conversations with my colleagues across disciplines, considered from an evolutionary and public health point of view.

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Thinking about upper-airway problems, three themes emerge. First, many health care practitioners, including doctors, dentists, chiropractors, physiotherapists, and nutritionists, are involved in treating patients with upper-airway issues, but in very siloed ways. Second, humans have an inherent cognitive bias to treat rather than do nothing (called *action fallacy* in the psychology literature) once a disease is present. Third, surgery is becoming less invasive. That can mean not leaving patients with huge incisions on their bellies but rather four small laparoscopic holes sewn up with a stitch or two each. It can also mean not performing surgery at all, when the downsides of complications are fully written into the equation. The conservative approach that neurosurgeons now take toward doing a lumbar laminectomy is the poster child for this approach. The approach is to wait and see while using muscle strengthening of hip extensors and flexors to restore a more normal lumbar anatomical lordosis.

Anatomy of the upper airway

Anatomically the upper airway goes from a patient's glabella to the thyroid cartilage (top of nose to bottom of voice box). It is the basic oxygen delivery structure. In humans, the upper airway includes dozens of bones, muscles, nerves, arteries, and veins. All of this anatomy, from the erectile tissue in the turbinates of the

nose to the mitochondria in the cells of the arytenoid muscles, acts in an integrated way.

Nature versus nurture

The upper airway has to be thought of in evolutionary terms; however, nothing garners more emotion than an empiric study that says human trait A or B or C is 30% or 60% or 90% genetic. This is especially true for traits such as facial esthetics. The willpower versus biology arguments are generally a waste of time as nature and nurture are like the sides and ends of an ever-changing rectangle, too integrated to separate in any meaningful way. The phrase used in a recent evolutionary biology publication is "heredity interacting with experience filtered through the inherent randomness of development"; in other words, nurture acting on nature through time.¹

Nitric oxide

Nitric oxide (NO) is a biological signaling agent. A Nobel Prize was awarded in 1998 for the discovery of its cardiovascular dilating effect. Sildenafil uses these NO biochemical pathways for its effects. The initial enthusiasm about the nitric oxide pathway has fizzled somewhat. In my field of anesthesiology, it is only used in parts-per-million concentrations for open heart patients with bad pulmonary hypertension or right-ventricular dysfunction to alter ventilation perfusion (or V/Q) mismatch for better oxygenation (oral communication from Dr John Bowering, anesthesiology, Providence Health Care) or in the ICU to buy some time with severe sepsis (oral communication from Dr Demitrios Sirounis, anesthesiology,

Providence Health Care). It is expensive, polluting, and exogenous. Much recent interest in nitric oxide is the endogenously produced NO from the sinuses.

Anesthesiologists

Outside the operating room, when an anesthesiologist is consulted for an upper-airway situation in the hospital, it continues to be for some extremis situation. What has changed dramatically is the technology used to intubate. Decades ago, with an old-fashioned direct laryngoscope, it was not uncommon for the operator to not be able to visualize the larynx for intubation because they were basically trying to look around a corner with direct vision. This was especially so if the patient had a small mentohyoid distance (short chin); had decreased neck mobility, which meant inability to put the head in a sniffing position (flexion of the cervical spine and extension of the atlanto-occipital joint); or was obese, which increased the odds of not being able to bag mask ventilate optimally. There has been remarkable improvement in intubating equipment over the last few decades, which started with various bougies (thin bent tubes that are inserted somewhat blindly into the trachea and an endotracheal tube then threaded over them to achieve intubation), then moved on to fiberoptic endoscopes (introduced by our respirologist colleagues who did bronchoscopies), and now video laryngoscopes (laryngoscopes with small video cameras at the end so seeing around the corner is easy). This technological development, along with "improved communication and situational awareness" that the CMPA stresses, should lead to safer airway management.²

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Otolaryngologists

Pediatric surgical practice has changed a lot since the Tonsil Hospital of the 1920s in New York City, which was built to do tonsillectomies on kids to prevent recurrent infections and the dreaded complication of rheumatic heart disease from strep throat.³ The famous Paradise Study of 1984 showed that while a tonsillectomy prevented recurrent bouts of tonsillitis, so did waiting.⁴ It is not uncommon for an ENT surgeon to be consulted about removing tonsils, especially if they are “kissing.” Surgery is reserved for the most severe cases with a well-established diagnosis of sleep apnea. Most kids do not have sleep apnea, and it doesn’t correlate well with tonsil size (oral communication from Dr Paul Moxham, otolaryngologist, BC Children’s Hospital).

Sinus surgery is becoming more and more of a subspecialty in otolaryngology. One reason for this is the remarkable development of sinus surgery endoscopic technology, as has also happened for the anesthesiologist. There is a growing recognition that sinus surgery has a downside, which has led to a much more conservative selection of patients for surgery (oral communication from Dr Andrew Thamboo, otolaryngologist, Providence Health Care). It is known that nitric oxide, which is produced in the paranasal sinuses, upregulates the ciliary action in the mucosa with effects on the microbiota of the upper airway.

Orthodontists

Traditional orthodontics says crooked teeth are inherited from parents and can be treated very well with braces. Orthodontics treatment gets excellent results if patients wear retainers for years after braces come off. Dr Mike Mew (the most-known orthodontist in the world as measured by YouTube subscribers⁵) questions this from an evolutionary point of view (braces treat the symptom of crowded teeth, resulting in a nice smile, but the causal factor is weaker muscles/a smaller jaw). He says that in the last few hundred years technology has created softer, higher-calorie foods that we essentially breastfeed/suckle versus having to chew using muscles of mastication. His treatment (called *orthotropics*) is basically to sit up straight and chew your food well (electronic communication

from Dr Robert Sapolsky, professor of biology/neurosurgery, Stanford) along with specific swallowing exercises (the pharyngeal constrictor and longitudinal muscles are involuntary skeletal muscles, not smooth [oral communication from Dr Arman Abdalkhani, otolaryngologist, UBC]), and taping the mouth shut while

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sleeping. Some heavy hitters from Stanford in academic biology have chimed in to support this, claiming that these concepts warrant a thorough scientific attempt to falsify.⁶

Oral surgeons

Oral surgeons in our health care system take out molar teeth. Also included in their practice are the LeFort mandibular and maxillary osteotomies for orthodontic reasons. After working for many years with a very skilled maxillofacial surgeon, I find myself questioning the risk-reward ratio of these procedures, especially considering that less than 100 years ago no one did these types of procedures and there is no historical record of a molar health care crisis.

Respirologists

The respirologist is consulted more and more for queries on obstructive sleep apnea.⁷ This malady is becoming a public health issue as its incidence goes up. The list of diseases associated with sleeping disorders is also getting longer. A large percentage of these patients are overweight, and it is up to the respirologist, who more often than not orders a sleep study, to figure out if the mechanism of the sleep apnea is obstructive or central. A CPAP device is usually recommended and very often helpful but compliance with the apparatus is not great. The people in pulmonary medicine usually say that if you are not breathing well when you are asleep then you are not healthy

(oral communication from Dr Pierce Wilcox and Dr Najib Ayas, respirologists, UBC).

Family practitioners

Breathing exercises are big these days.⁸ Techniques date back to ancient yogis (pranayama), are numerous, and are commonly tied to meditative practice. Family practitioners see a lot of this attached to stress management. The underlying evolutionary principle is that all animals (except humans and maybe dogs) breathe through the nose rather than the mouth, which has the advantages of filtering pollutants in the air, humidifying the air, and increased sinus nitric oxide production. Breathing/meditative techniques stress the diaphragmatic rather than chest wall muscles for gas exchange in the lungs. There is undoubtedly a modicum of truth to the idea that breathing less (just like eating less) will increase parasympathetic tone over the excessive sympathetic tone present in stressed patients.

The future

How will the shift to less-invasive treatment of the airway play out in 100 years? It’s possible to imagine that we will look back at today’s treatment of the upper airway like we now look back on bloodletting, the rack, or even leeches. ■

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