The Neglected Orifice

by Richard Levitan, MD on May 29, 2013
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Why the lowly nose is the optimal route for oxygenation and ventilation

I occasionally enjoy intellectual jousting, especially with other airway enthusiasts, and its fun to prognosticate about the future of our practice. So let me give you my controversial take on the future of airway management. As I see it, the future of oxygenation in emergency airways is through the nose, not the mouth. We will suction vomit and blood through the mouth, and we will continue to insert tubes via the mouth, but oxygenation, actively or passively, will be done through the nose.

The nose is, in my opinion, "the neglected orifice". At birth we are obligate nose breathers, and we breathe just fine with a breast in our mouth. As adults we forget about the importance of our nose until we get complete nasal obstruction from a bad URI. One night of trying to sleep breathing only through our mouth is an ordeal. Oxymetazoline in such situations is a miracle. It's interesting to realize how comfortably we passively breathe through the nose, whether we are drunk with mother's milk, or unconscious from exhaustion. Conversely, mouth breathing is an active effort.

Breathing through the mouth takes active effort and fully expanding your lungs when flat on your back is a chore. Whether due to excessive soft tissue or sedation, mouth breathing is challenging as the soft tissue of the palate and upper airway collapse backwards, causing airway obstruction. Consider the difficulties of getting oxygen to go down the mouth and into the airway. One needs to lift the mandible so the tongue and soft palate doesn't cause occlusion, and an oral airway is frequently needed to deal with the tongue. The tongue is a marvel of anatomic engineering for eating and phonation; but when we are in a supine position with the head held midline, the tongue is a dangerously effective airway blocker. During one of my anesthesia rotations, while trying to mask ventilate a patient, I was asked by a quirky supervisor, "Richard, why is your head round?" I had no answer as I kept trying to ventilate the patient. I had kept the patient's head straight; when he allowed the head to roll to the side, the tongue went to that side, and the patient became easy to mask ventilate.
Laying flat causes a marked decrease in functional reserve capacity. The dependent parts of the lung collapse, decreasing alveolar expansion and the effectiveness of oxygenation. As noted in a recent bestseller about forefoot running and endurance running, "Born to Run," humans are designed to breathe upright. Numerous studies in both normal and obese patients have shown that during pre-oxygenation the time to desaturation can be extended by 60-100+ seconds if you pre-oxygenate your patients upright before changing position to perform intubation.

Upright positioning is also beneficial when trying to avoid passive regurgitation and aspiration. Gravity may be a weak force in the world of physics, but when it comes to the stomach, in a patient with poor lower esophageal tone, I think "stomach lower than larynx" is a good rule of thumb. If you have any doubt about the importance of upright positioning, just conjure an image of your last patient in respiratory

distress. Patients in distress position themselves as upright as possible for a reason, and we should too if we're intervening in their airway.

I recently had an experience where I was perhaps a little too impatient waiting for the drugs to kick in so I could reduce a morbidly obese man's dislocated shoulder. The shoulder had been dislocated a long time, he'd received high doses of narcotics during an extended transport by EMS, and he was in severe distress from pain. I ultimately achieved a very good state of sedation—and his shoulder went in easily—but then I noticed the pulse oximeter was 70% and falling fast. Of course the bag mask was out of arm's reach on the wall, and not on. I did have a nasal cannula in place (which had not been on). I had passive oxygenation on my brain because of a recent article I had written on oxygenation (2) as well as an EP Monthly column I wrote called NO DESAT (Nasal Oxygen During Efforts Securing a Tube) (3). I cranked the nasal cannula to 15 lpm, sat the patient as upright as possible, and pulled his mandible forward. Within 30 seconds his pulse ox was corrected. I distracted his mandible for about 3 or 4 minutes until he opened his eyes and began breathing. When he awoke he said, "Hey Doc, my shoulder feels pretty good, but my jaw is a little sore, and I have a slight pressure in my ears." I pointed out to him and his wife that he'd stopped breathing after we gave the sedation medicine to reduce his shoulder.

"You stopped breathing! Wicked bad!" his wife chimed in in a thick Boston accent.

I call this response to desaturation during sedation "OOPS" – Oxygen On, Pull the mandible forward, Sit the patient upright.
Take a look at the CT cross-sectional images of a normal-sized person and one that weighs 150 kg (Fig 1). These images highlight some amazing aspects of upper airway anatomy that we should keep in mind when we are trying to oxygenate and ventilate. First, the nasopharynx is an oxygen reservoir. By filling it with oxygen, the next breath the patient takes has a higher FiO2 that simply by putting oxygen over the mouth. With face-masks, the patient rebreathes their own CO2. At flow volumes commonly used in wall oxygen sources, the nose creates a higher FiO2 than a non-re-breather at the same flow (4). Second, the nose, even in a massive person, is a patent, open channel direct into the larynx. The mouth, with the tongue filling the oropharynx, is not. With the patient upright and the mandible distracted forward, the soft tissues of the palate and epiglottis and tongue are brought forward, allowing oxygen to reach the larynx. Oxygen flowing (or nasal mask ventilation—such a thing does in fact exist) pushes open the soft tissues, allowing oxygenation through the nose even when mask ventilation is impossible (5, 6). It's also important to realize that during apnea we continue to absorb gas. After we deplete the oxygen in our alveoli, we entrain air down our upper airway. By filling the nasopharynx and pharynx with oxygen, it is passively drawn down an oxygen gradient into the lower airway (alveoli) (2).

There's a lot more to discuss about nasal oxygenation, but for now, just remember "OOPS" when the pulse ox falls during procedural sedation or difficult intubation. Oxygen on, pull the mandible forward, sit the patient upright. It's simple, fast, and effective. If mask ventilation becomes required, it's better to do it as upright as possible.

Years from now, when we all acknowledge the nose is the best way to oxygenate and ventilate, remember you heard it here first.

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http://www.ceme.org/emergency-airway-management-course

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