Key Points

- Epiglottoscopy
- Positioning and head elevation
- Bimanual laryngoscopy
- Apneic Oxygenation
- Videographic case review: direct and video
The larynx is a 3-dimensional structure. The epiglottis is at the top of the laryngeal inlet. The tip of the epiglottis is located much higher in the neck than the posterior cartilages.
Epiglottoscopy:
Visualize the epiglottis before exposing the larynx

1895 Kirstein: “The spatula is introduced in such a manner that its tip catches in the groove between the tongue and the epiglottis...the beginner is liable to hook it behind the epiglottis”

1912 Brunnings: “This process may be divided into three stages in the case of all direct examinations of the air-passages. First movement: Bringing into view the lingual surface of the epiglottis...”

1914 Jackson: “The introduction of the instrument should be considered in three stages: 1) exposure and identification of the epiglottis...”

“The epiglottis must always be identified before any attempt is made to expose the larynx”
1. Epiglottis
2. Interarytenoid notch
3. Glottic opening
4. Vocal cords
The “SECRET” of laryngoscopy, video laryngoscopy, fiberoptics, any intubation device --- is the EPIGLOTTIS

Epiglottis positioned at intersection of two critical curves. It is midway from mouth to larynx, and centered between right and left.
**Epiglottoscopy...The difference between novices and experts?**

Delson NJ, et. al. Anesth Analg 2002; 94; S-123

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**Novices:**
- 109 cm tip travel
- 36 sec time
- 3.4 Nm torque
- 63 N max force

**Experts**
- 52 cm tip travel
- 12 sec time
- 2.8 Nm torque
- 66 N max force

---

Trace profile of head

Mouth opening

Novice

Expert
Keys to Epiglottoscopy

★ Proceed slowly, methodically down tongue
★ Distract tongue and jaw forward, and lift epiglottis edge off the posterior pharynx
★ If epiglottis is not seen, march down the tongue midline and then control the tongue

Beware of epiglottis camouflage!
fluids, blood, saliva pool in hypopharynx – use suction tip if needed to clear hypopharynx and see epiglottis edge

epiglottis: - reliable anterior landmark
- able to be lifted out of fluids
- top of laryngeal inlet
Beware of epiglottis camouflage!
Imaging with Glidescope video system (Verathon)
Epiglottis rests on the posterior pharyngeal wall when starting
Czermak: pioneer of mirror laryngoscopy
Bimanual laryngoscopy 1858
By pressure applied with the thumb upon the middle of the thyroid cartilage the autoscopic field of vision toward the front can be considerably enlarged in many, especially in the young. By means of this manipulation—which may in operations be left to an assistant—the anterior commissure can be brought into view rather frequently.
Fig. 44.—Direct Operation on the Larynx by Means of Counter-Pressure Autoscopy.
“extreme atlanto-occipital extension necessary”
“head lower than chest”
“firm pressure”
15-20 cc / kg volumes, rates 12-15 breaths per minute
Cricoid Pressure Displaces the Esophagus:
An Observational Study Using Magnetic Resonance Imaging
Kevin J. Smith, et al. Anesthesiology 2003; 99: 60-4

- The esophagus lateral to cricoid in 52.6% of necks without CP
- Esophagus lateral to cricoid in 90.5% with CP (20-30 N)
- Unopposed esophagus in 47.4% of necks without CP
  - Unopposed esophagus in 71.4% with CP applied

- Lateral laryngeal displacement 66.7%
  - Airway compression in 81.0%

- Without CP, esophagus lateral to the cricoid in > 50%
- CP further displaced both the esophagus and the larynx laterally
Cricoid Pressure Displaces the Esophagus: An Observational Study Using Magnetic Resonance Imaging
Kevin J. Smith, et al. Anesthesiology 2003; 99: 60-4
Cricoid Pressure >> Airway Collapse

The effect of cricoid pressure on the cricoid cartilage and vocal cords: an endoscopic study.

<table>
<thead>
<tr>
<th>% Cricoid Deformation</th>
<th>Male (n=15)</th>
<th>Female (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Newtons:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-99%</td>
<td>1 (7%)</td>
<td>2 (13%)</td>
</tr>
<tr>
<td>100%</td>
<td>0</td>
<td>7 (47%)</td>
</tr>
<tr>
<td>30 Newtons:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-99%</td>
<td>1 (7%)</td>
<td>0</td>
</tr>
<tr>
<td>100%</td>
<td>2 (13%)</td>
<td>11 (73%)</td>
</tr>
<tr>
<td>44 Newtons:</td>
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<tr>
<td>51-99%</td>
<td>1 (7%)</td>
<td>1 (7%)</td>
</tr>
<tr>
<td>100%</td>
<td>4 (27%)</td>
<td>11 (79%)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Vocal Cord Closure</th>
<th>Male (n=15)</th>
<th>Female (n=15)</th>
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<tbody>
<tr>
<td>20 Newtons</td>
<td>6 (43%)</td>
<td>6 (50%)</td>
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<tr>
<td>30 Newtons</td>
<td>8 (57%)</td>
<td>7 (58%)</td>
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<tr>
<td>44 Newtons</td>
<td>11 (78%)</td>
<td>7 (58%)</td>
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</table>

<table>
<thead>
<tr>
<th>Difficult Ventilation</th>
<th>Male (n=15)</th>
<th>Female (n=15)</th>
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<tr>
<td>20 Newtons</td>
<td>6 (43%)</td>
<td>9 (75%)</td>
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<tr>
<td>30 Newtons</td>
<td>10 (71%)</td>
<td>12 (100%)</td>
</tr>
<tr>
<td>44 Newtons</td>
<td>12 (86%)</td>
<td>12 (100%)</td>
</tr>
</tbody>
</table>

Cricoid deformation, vocal cord closure and difficult ventilation all increase with increasing force of CP. 86-100% of patients have difficult ventilation at 44N.
The effect of cricoid pressure on airway patency.

– 50 anesthetized patients; CP applied by anesthesiologists
– Ventilated +/- CP and oral airway, observer blinded, order random
– CP - decreased mean expired tidal volume (TV)
– CP - increased peak inspiratory pressure (PIP)
– CP caused COMPLETE AIRWAY OCCLUSION in 11% of patients!

![Graph showing tidal volume (TV) and peak inspiratory pressure (PIP)]
Cricoid Pressure:
THE ROOT OF ALL EVIL!

– Sellick - never validated - Correct force? 44, 40, 30, 20 N
– Poorly performed by all different practitioner groups
– Aspiration despite CP well documented in anesthesia and EM
– Anatomic myth on CT / MRI: esophageal occlusion NOT reliable
– CP collapses cricoid ring, blocks tube passage
– In awake volunteers CP promotes regurgitation (LES effect)
– Detrimental effects on tip of blade positioning and DL view
– Difficult mask ventilation and inability to ventilate
– Detrimental for correct placement of LMA or ETC

Bimanual Laryngoscopy - By Laryngoscopist
the most effective difficult airway tool

- External laryngeal manipulation by laryngoscopist: “Bimanual laryngoscopy”
  - NOT B.U.R.P. (by an assistant)
  - NOT cricoid pressure (assistant, at cricoid ring)
- Manipulation most effective at thyroid cartilage – where vocal cords attach anteriorly
- Once view optimized by laryngoscopist, an assistant can maintain pressure at the right location if needed, freeing the operator’s right hand to place the tube
Bimanual Laryngoscopy - By Laryngoscopist

1) Moves tip of blade fully into vallecula
2) Drops larynx into line of sight, improves alignment

Mobility of larynx with external laryngeal manipulation

Courtesy of George Kovacs, Dalhousie NS
Bimanual laryngoscopy vs. Cricoid vs. BURP

Levitan RM, Kinkle W, Levin W, Butler K.

- 104 participants, 106 cadavers
- 1530 laryngoscopies
- POGO scores to report laryngeal view
- Improved exposure
  (Bimanual vs. CP vs. BURP – all \( p<.0001 \))
- POGO scores means +25% vs. 5% vs. 4%
- Worsened views: 4% vs. 27% vs. 33%
- Went to zero: 0.5% vs. 3% vs. 6%
- Mean POGOs Bimanual vs. CP, BURP: +20%, +21%
Cricoid Pressure:
Demoted in new AHA Guidelines

Cricoid pressure in nonarrest patients may offer some measure of protection to the airway from aspiration and gastric insufflation during bag-mask ventilation. However, it also may impede ventilation and interfere with placement of a supraglottic airway or intubation...

If cricoid pressure is used in special circumstances during cardiac arrest, the pressure should be adjusted, relaxed, or released if it impedes ventilation or advanced airway placement.

The routine use of cricoid pressure in cardiac arrest is not recommended (Class III, LOE C).

Part 8: Adult Advanced Cardiovascular Life Support:
2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care
AUTOSCOPY
OF THE
LARYNX AND THE TRACHEA.
(Direct Examination Without Mirror.)

By
ALFRED KIRSTEIN, M.D.,
BERLIN.

Authorized Translation (Altered, Enlarged, and Revised by the Author) by
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Professor of Clinical Laryngology and Otology, Cincinnati College of Medicine and Surgery; Laryngology and Aurist, Cincinnati Hospital, etc.

With Twelve Illustrations.

PHILADELPHIA,
THE F. A. DAVIS CO., PUBLISHERS.
1897.

The Francis A. Countway Library of Medicine

To
J. SOLIS-COHEN, M.D.,
OF PHILADELPHIA,
This translation is dedicated,
in
Grateful Recognition of Much Personal Kindness,
by
The Translator and Editor.
AUTOSCOPY.

DEFINITION AND THEORY.

By “autoscopy of the air-passages” I understand the direct linear inspection, through the mouth, of the lower pharynx, the larynx, the trachea, and the entrances into the primary bronchi.

The necessary conditions of such a complete linear inspection can be stated *a priori* to be:—

1. The body must be placed in such a position that an imaginary continuation of the laryngo-tracheal tube would fall within the opening of the mouth.

2. This imaginary straight line must be cleared of those parts of the body (epiglottis and base of the tongue) which obstruct it.
Kirstein 1897: "...the forward inclination of the body has the further advantage that the muscles of the neck become somewhat relaxed..."
POSITION OF THE PATIENT FOR PERORAL ENDOSCOPY

It is the author’s invariable practice to place the patient in the dorsally recumbent position. The sitting position is less favorable. While lying on a well-padded, flat table the patient is readily controlled, the head is freely movable, secretions can be easily removed, the view obtained by the endoscopist is truly direct (without reversal of sides), and, most important, the employment of one position only favors smoother and more efficient teamwork, and a better endoscopic technique.

General Principles of Position.—As will be seen in Fig. 47 the trachea and esophagus are not horizontal in the thorax, but their long axes follow the curves of the cervical and dorsal spine. Therefore, if we are to bring the buccal cavity and pharynx in a straight line with the trachea and esophagus it will be found necessary to elevate the whole head above the plane of the table, and at the same time make extension at the occipito-atlantal joint. By this maneuver the cervical spine is brought in line with the upper portion of the dorsal

Fig. 47.—Schematic illustration of normal position of the intra-thoracic trachea and esophagus and also of the entire trachea when the patient is in the correct position for peroral bronchoscopy. When the head is thrown backward (as in the Rose position) the anterior convexity of the cervical spine is transmitted to the trachea and esophagus and their axes deviated. The anterior deviation of the lower third of the esophagus shows the anatomical basis for the “high low” position for esophagoscopy.
Jackson applied positioning principles to supine patients.

Fig. 55.—Schema illustrating the technic of direct laryngoscopy on the recumbent patient. The motion is imparted to the tip of the laryngoscope as if to lift the patient by his hyoid bone. The portion of the table indicated by the dotted line may be dropped or not, but the back of the head must never go lower than here shown, for direct laryngoscopy; and it is better to have it at least 10 cm. above the level of the table. The table may be used as a rest for the operator’s left elbow to take the weight of the head. (Note that in bronchoscopy and esophagoscopy the head section of the table must be dropped, so as to leave the head and neck of the patient out in the air, supported by the second assistant.)
“Overextension of the patient’s neck is a frequent cause of difficulty. If the head is held high enough extension is not necessary, and the less the extension the less muscular tension there is in the anterior cervical muscles.”
The Modern Theory of Positioning -and 3 axis alignment- comes from Bannister and Macbeth’s 1946 article:


Radiograph shows face plane parallel to ceiling, drawing over-emphasizes degree of extension and has inadequate lift.
Effect of different head positions on upper airway dimensions and mechanics of jaw opening

Atlanto-occipital Extension
Neutral
Head forward positioning

...there's a reason everyone in respiratory distress positions their head forward relative to their chest
Atlanto-occipital extension (tilting head backward) does NOT open the airway.
Jaw mechanics:

Mouth opening:
widest with head brought forward relative to chest

Thyromental distance:
space tongue gets pushed into during laryngoscopy, enlarges with head forward
Changes in airway configuration with different head and neck positions using magnetic resonance imaging of normal airways: a new concept with possible clinical applications.


MRI validation of head elevation and face plane parallel to ceiling

Zeitels gave 1998 ASA Lewis H. Wright Memorial Lecture on Flexion-Flexion Positioning

Caudal and upward movements of the mandible and tongue base increase the distance between anterior and posterior obstacles...an increase of the submandibular space may be essential for caudal movements of anterior obstacles, allowing vertical arrangement of the anterior obstacles and larynx.

Lifting the head lengthens the submandibular space (from M – L), allowing the anterior structures to be distracted forward and upward. Note how axis of view steepens between positions.
Elevate the head until the ear is at the sternal notch.

*Universal* intubating and ventilation position
*Independent of age and size*
Laryngoscopy and Morbid Obesity: a Comparison of the “Sniff” and “Ramped” Positions

Jeremy S. Collins, MB, ChB¹; Harry J.M. Lemmens, MD, PhD¹; Jay B. Brodsky MD¹; John G. Brock-Utne, MD, PhD¹; Richard M. Levitan, MD²

Table 2. Comparison of views during laryngoscopy

<table>
<thead>
<tr>
<th>GRADED VIEW</th>
<th>GROUP 1 (n)</th>
<th>GROUP 2 (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 1. In the operating-room, patients in Group 1 were placed supine and had a 7-cm headrest placed underneath their occiput.

Figure 2. Patients in Group 2 had folded blankets placed under their upper body, head and neck until horizontal alignment between the sternal notch space and the external auditory meatus was achieved.

Laryngoscopy 100% success
View better with head elevation
"We have found that the external meatus and sternal notch reflect the positions of the clivus and glottis opening, respectively. These secondary markers may assist in correctly positioning any patients in the sniffing position before direct laryngoscopy in both non-obese and obese patients."
Head Elevated Laryngoscopy Position: Improving Laryngeal Exposure During Laryngoscopy by Increasing Head Elevation

Figure 2.
Laryngoscopy with the head flat on the table with an angle finder attached lengthwise to the laryngoscope handle. The laryngoscope angle is approximately 40°. Inset is the view of the larynx as displayed by the direct laryngoscopy video system worn by the laryngoscopist. The POGO score is approximately 30%.

Figure 3.
Laryngoscopy with the head fully elevated (ie, the head-elevated laryngoscopy position). The laryngoscopist is using the right hand to elevate the head. The laryngoscopy angle is approximately 80°, and the POGO score in the inset is approximately 90%.
Comparing the 3 positions, POGO scores significantly increased from a mean ± SD of 31% ± 10% (flat position) to 64% ± 12% (midposition) to 87% ± 13% (head-elevated laryngoscopy position; Figure 6). Both the midposition and the head-elevated laryngoscopy position compared with the flat position were statistically significant at a \( P \) value of less than .0001. The midposition also differed significantly from the head-elevated laryngoscopy position (\( P < .0007 \)). Additionally, there was a significant linear relationship among the 3 positions (\( P < .0001 \)). There were no differences between raters (\( P = .14 \)).

**DISCUSSION**

Our results validate the assertions of the early pioneers of laryngoscopy, who emphasized the importance of head elevation for optimal laryngeal exposure (Figure 7). Only 2 prior studies, however, have specifically examined how changing head and neck position in the same patient affects the resultant laryngeal view. Adnet et al compared laryngeal exposure in the “sniffing” position (defined as 7-cm occiput elevation) versus simple head extension (head flat) with a curved laryngoscope blade. They found no significant advantage to the sniffing position over simple head extension in routine practice. Their study used Cormack and Lehane grading, no objective recording of laryngeal views, and 7 different laryngoscopists performing the intubations. Our prior research has shown that Cormack and Lehane grading has poor intraobserver and interobserver reliability and that it is insensitive in detecting differences among the vast majority of patients at laryngoscopy. The most significant limitation of the study by Adnet et al is that they performed laryngoscopy with a Macintosh curved laryngoscope blade. Curved blades are significantly dependent on minor changes in the force applied to the hyoepiglottic ligament and tip placement in the vallecula. Collectively, these variables might have obscured the effect of changes in head positioning.
Head Elevated Laryngoscopy Position

Schmitt HJ, Mang H. Head and neck elevation beyond the sniffing position improves laryngeal view in cases of difficult direct laryngoscopy.


- 1500 consecutive cases in OR
- With laryngeal manipulation - 21/1500 epiglottis views
- Head elevation by assistant combined with laryngeal manipulation - only 2 cases epiglottis only views
the anterior commissure of the larynx is not readily seen, the lifting motion and elevation of the head should be increased, and if there is still difficulty in exposing the anterior commissure the assistant holding the head should with the index finger externally on the neck depress the thyroid cartilage.
Bimanual Laryngoscopy with Head Elevation
Straight-to-cuff stylet shape initially inserted into mouth; positioned behind maxilla and below line of sight.

Slight tilting of proximal tube and stylet brings distal tip upward, keeping tip visible as it approaches target. Tube is ALWAYS below line of sight until inserted.
Use the right corner to insert and pivot tube

Place tube behind the maxilla. Advance to target from below the line of sight. Toggle tube up to the target, going above the posterior cartilages and notch.
Breaking down laryngoscopy - intubation

**Epiglottoscopy**
- Face parallel to ceiling, roll blade down the tongue
- Mid-line if necessary; beware of camouflage

**Maximizing laryngeal exposure**
- Tongue control to open right side for tube delivery
- Bimanual laryngoscopy
- Increase head elevation if needed

**Tube delivery - straight-to-cuff < 35 degrees**
- Use right corner of mouth (right lateral dental arch)
- Insert tube from behind maxilla
- Come up from below line of sight, move tip over notch
- Bougie - optical stylet for epiglottis only views
General Rules for Imaging-based Laryngoscopes

1) SUCTION and EPIGLOTTOSCOPY
Suction BEFORE insertion, do not put tip into fluid/blood pool. Epiglottis is the reliable landmark, the on-ramp to the larynx.

2) LIFT the tongue and jaw
Imaging doesn’t work well if the jaw and tongue collapse backward. Lifting upward permits a set-off view of landmarks, and opens delivery space.

3) TILT the optics AWAY from the larynx
If you’re too close to the larynx, the area for tube delivery is reduced. Being too close, you cannot see the tube come into view. Tilt the device handle forward, creating more distance, wider view.

4) 2-STAGE DELIVERY
Bring the tube into view of the optics by following the blade slowly. After you see where the tube is going, adjust to bring tip to target.
Glidescope: Too close...tube delivery issue

elapsed time ~ 55 seconds
Glidescope: Excellent technique

Suctioning, epiglottoscopy, right distance, good tube placement
Glidescope: Epiglottitis -- Failed intubation
Imaging above the epiglottis limitation

Epiglottoscopy & suctioning; Courtesy Marvin Wayne, MD
For every device, three separate issues:
1) exposing larynx
2) getting tube to glottis
3) tube into trachea

Video or optics can get you around tongue, but you still have to get tube to the glottis, and then pass it into the trachea...

Oxygenation and Ventilation Strategy Based on Pulse Oximetry

Weingart S, Levitan RM

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Preoxygenation Period</th>
<th>Onset of Muscle Relaxation</th>
<th>Apneic Period during Intubation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(3 minutes)</td>
<td>(~60 seconds)</td>
<td>(variable duration depending on airway difficulty; ideally &lt; 30 seconds)</td>
</tr>
<tr>
<td>Hypoxemic SpO2 90% or less</td>
<td>CPAP or BVM with PEEP</td>
<td>CPAP or BVM with PEEP and Nasal Oxygen at 15 lpm</td>
<td>Nasal Oxygen at 15 lpm</td>
</tr>
<tr>
<td>High risk SpO2 91-95%</td>
<td>Non-Rebreather Mask or CPAP or BVM with PEEP</td>
<td>Non-Rebreather Mask, CPAP, or BVM with PEEP and Nasal Oxygen at 15 lpm</td>
<td>Nasal Oxygen at 15 lpm</td>
</tr>
<tr>
<td>Low risk SpO2 96-100%</td>
<td>Non-Rebreather Mask with maximal oxygen flow rate</td>
<td>Non-Rebreather Mask and Nasal Oxygen at 15 lpm</td>
<td>Nasal Oxygen at 15 lpm</td>
</tr>
</tbody>
</table>
Awaiting onset of relaxation...keep airway patent

Slow, small, easy squeeze. Low volume (6-7 cc/kg), slow rate (8/min)
Distends alveoli, opening more surface area for oxygen absorption

BVM only delivers O2 with ventilation.
Holding BVM over face without squeezing bag causes FiO2 of only 21%

Consider positive pressure if pre-intubation SaO2 <95% with 100% oxygen.
Use mask + PEEP or CPAP
How apneic diffusion oxygenation works

- CO2 has 25 times the solubility of O2 in blood (leaks out slowly)
- With apnea CO2 excretion declines; O2 absorption minimal decrease
- O2 absorption continues in apnea, due to partial pressure gradient, 300 million alveoli, 70 sq meters of absorption area

*** Apnea: smaller transfer of CO2 out than O2 gas in ***

Creating sub-atmospheric alveolar pressure (-240 ml/min)

The net effect: O2 is PULLED down the airway!

O2 movement
250 ml per min
Oxygen Reservoir in Lungs (~95%)

CO2 movement
10 ml per min
CO2 Reservoir in blood and tissues (~90%)
18-55 minutes without any ventilation, PaO2 98%-100%
When man becomes apneic after preliminary oxygenation, there is a marked difference in the rate of arterial deoxygenation on whether the airway is open to room air or attached to an oxygen reservoir.

Polarographic arterial studies PO2 studies show a rapid fall in PaO2 when atmospheric air (containing 80% nitrogen) moves down the airway. In the case of pure oxygen reaching the alveolar space, high PO2 values greater than 400mm of mercury were observed even after 5 minutes of apnea.

On the other hand, air with high nitrogen content dilutes alveolar oxygen... Oxygen uptake is inhibited as alveolar oxygen tension falls.
Pharyngeal Insufflation of Oxygen Prevents Arterial Desaturation During Apnea

- n=20, nasal airway s/p induction (36 Fr)
- 8 Fr Catheter inserted just beyond nasal trumpet, 3 liters per minute
- Sux, sedation, apnea until pulse ox 92% or, 10 minutes had elapsed
- Each patient served as their own control (with and w/o 3 lpm)

<p>| Table 1. Duration of Apnea (i.e., Time from Cessation of Ventilation Until Either (1) SaO₂ fell to 92%, or (2) 10 Min had Elapsed) and Minimum Observed SaO₂ With and Without Pharyngeal Oxygen Insufflation. Values are Means ± SE |</p>
<table>
<thead>
<tr>
<th>O₂ Insufflation</th>
<th>No O₂ Insufflation</th>
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</thead>
<tbody>
<tr>
<td><strong>First trial</strong></td>
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<tr>
<td>Duration of apnea (min)</td>
<td>10.0 ± 0</td>
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<tr>
<td>Minimum SaO₂ (%)</td>
<td>98 ± 1</td>
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<tr>
<td>Pre-apnea SaO₂ (%)</td>
<td>99 ± 1</td>
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<tr>
<td>Pre-apnea FₜO₂ (%)</td>
<td>87 ± 1</td>
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<tr>
<td>Pre-apnea PₑTCO₂ (mmHg)</td>
<td>26 ± 2</td>
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<td><strong>Second trial</strong></td>
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<tr>
<td>Duration of apnea (min)</td>
<td>10.0 ± 0</td>
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<tr>
<td>Minimum SaO₂ (%)</td>
<td>99 ± 1</td>
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<tr>
<td>Pre-apnea SaO₂ (%)</td>
<td>99 ± 1</td>
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<tr>
<td>Pre-apnea FₜO₂ (%)</td>
<td>90 ± 1</td>
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<td>Pre-apnea PₑTCO₂ (mmHg)</td>
<td>27 ± 1</td>
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<td>Duration of apnea (min)</td>
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<tr>
<td>Minimum SaO₂ (%)</td>
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<tr>
<td>Pre-apnea SaO₂ (%)</td>
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<td>Pre-apnea FₜO₂ (%)</td>
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<tr>
<td>Pre-apnea PₑTCO₂ (mmHg)</td>
<td>27 ± 1</td>
</tr>
<tr>
<td>N</td>
<td>12</td>
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</tbody>
</table>

* P < 0.01 compared with oxygen insufflation (same trial).
† P < 0.001 compared with oxygen insufflation.
APNEIC oxygenation via nasal cannula during oral intubation

NO DESAT: Nasal Oxygen During Efforts Securing A Tube
Passive Apneic Oxygenation During Laryngoscopy