FINAL SCRIPT: APPROVED FOR FILMING

Submission ID #: 68479
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Project Page Link: https://review.jove.com/account/file-uploader?src=20886143

Title: Preoxygenation Techniques for Tracheal Intubation in Critically Ill Adults Utilizing Oxygen Mask and Noninvasive Ventilation

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Author Questionnaire

1. **Microscopy**: Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or something similar? **No**

2. **Software:** Does the part of your protocol being filmed include step-by-step descriptions of software usage? **No**

3. **Filming location:** Will the filming need to take place in multiple locations? **It may be more than one place in the same building.**

4. **Testimonials (optional):** Would you be open to filming two short testimonial statements **live during your JoVE shoot**? These will **not appear in your JoVE video** but may be used in JoVE's promotional materials. **No**

Current Protocol Length
Number of Steps: 16
Number of Shots: 31

Introduction

Videographer: Obtain headshots for all authors available at the filming location.

Videographer's Note: In section 1, rather than speak the script exactly, another speaker was added to the video and the two speakers were more free-flowing with what they covered.

Note: Please note that the other speaker is Mona Lisa Carson from OHSU Respiratory Care Department. It is not clear which statement was delivered by her. Please review video and add the name.

INTRODUCTION:

~~What is the scope of your research? What questions are you trying to answer?~~

1.1. **Akram Khan:** The scope of our research is optimizing preoxygenation for critically ill adults before intubation using conventional masks and noninvasive ventilation.

1.1.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

~~What are the most recent developments in your field of research?~~

1.2. **Akram Khan:** Recent development in trials show NIV preoxygenation causes less peri-intubation hypoxemia than conventional oxygen masks, with similar aspiration risk.

1.2.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

CONCLUSION:

~~What significant findings have you established in your field?~~

1.3. **Akram Khan:** Significant findings of our research indicate noninvasive ventilation reduces severe hypoxemia during emergency intubation in ill adults without increasing complications.

1.3.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

~~What research gap are you addressing with your protocol?~~

1.4. **Akram Khan:** We aim to compare noninvasive ventilation and conventional oxygen during emergency intubation to address evidence gaps for high-risk ICU patients.

1.4.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

~~What advantage does your protocol offer compared to other techniques?~~

1.5. **Akram Khan:** Our protocol standardizes mask and noninvasive ventilation preoxygenation with safety checks and monitoring to prevent desaturation during real-world ICU intubations.

1.5.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

Videographer: Obtain headshots for all authors available at the filming location.

Ethics Title Card

This research has been approved by the Institutional Review Board (IRB) at Oregon Health and Science University and not considered human research.

Protocol

2. Oxygen Mask–Based Preoxygenation

Demonstrator: Akram Khan

2.1. To begin, position the patient supine in the bed with the head of the bed elevated to at least 30 degrees in a semi-fowler position **[1]**. ~~If tolerated, use a head-tilt and chin-lift to optimize airway patency **[2].**~~

2.1.1. WIDE: Talent adjusting the hospital bed to elevate the patient's head to a semi-fowler position.

2.1.2. ~~Talent gently performing a head-tilt, chin-lift maneuver on the patient~~.
Videographer's Note: Shot deleted by authors

2.2. Apply continuous cardiac monitoring and place pulse oximetry sensors on the patient **[1]**. Ensure the blood pressure cuff is secured and set to cycle every 3 to 5 minutes to monitor hemodynamic stability **[2]**.

2.2.1. Talent attaching ECG leads and placing a pulse oximeter on the patient's finger.

Added shot: 2.2.1 B

2.2.2. Talent securing a blood pressure cuff to the patient's arm and adjusting the monitor to cycle at set intervals.

Added shots 2.2.3

2.3. Connect a non-rebreather mask or bag-valve mask to a high-flow oxygen source to prepare the oxygen delivery system **[1]**. Allow the oxygen reservoir to fully inflate before placing the mask on the patient **[2]**.

2.3.1. Talent connecting the oxygen delivery device to a high-flow oxygen source.

2.3.2. Talent confirming the reservoir bag is fully inflated before use.

2.4. Set the oxygen flow rate to at least 15 liters per minute **[1]**. If using wall-mounted oxygen, turn the regulator to its maximum setting to achieve flush rate oxygen delivery **[2]**.

2.4.1. Talent adjusting the oxygen flowmeter to 15 liters per minute or higher.

2.4.2. Talent turning the wall-mounted oxygen regulator to its highest setting.

2.5. Now, secure the oxygen mask on the patient's face and ensure a tight seal **[1]**. Maintain preoxygenation for a minimum of 3 minutes to allow for adequate de-nitrogenation and oxygen reserve buildup **[2]**.

2.5.1. Talent placing the oxygen mask over the patient's face and adjusting the straps.

2.5.2. Talent holding the mask in place and monitoring the patient during the 3-minute preoxygenation phase.

2.6. Continuously monitor for signs of preoxygenation failure such as declining oxygen saturation, apnea, or patient desynchrony during the preoxygenation phase **[1-TXT]**.

2.6.1. Talent observing the monitor for SpO2 levels and checking for any signs of respiratory distress. **TXT: Administer anesthesia after 3 min of pre-oxygenation**

2.7. Immediately after anesthesia induction, perform a jaw thrust to maintain airway patency **[1]**. Continue oxygen support until laryngoscopy begins **[2-TXT]**. If oxygenation becomes inadequate, switch to manual bag-mask ventilation to maintain oxygen levels **[3]**.

2.7.1. Talent performing a jaw thrust on the anesthetized patient.

Added shot: 2.7.2 : shot of bed being lowered

2.7.2. Talent maintaining the oxygen mask in place while preparing for laryngoscopy. **TXT: Monitor and adjust oxygen delivery as needed**
Videographer's Note: This is now 2.7.3

2.7.3. Talent switching to manual bag-mask ventilation and continuing respiratory support. **Videographer's Note: This is now 2.7.4**

Added shot: 2.7.5

3. Non-Invasive Ventilation (NIV) Preoxygenation

Videographer's Note: 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.2.3, 3.3.1 and 3.3.2 were all skipped at the author's discretion. Since these steps repeated the same actions seen previously, they wanted to reuse footage in those parts.

3.1. Position the patient supine in bed with the head of the bed elevated to at least 30 degrees in the semi-fowler position **[1]**. If tolerated, apply a head-tilt and chin-lift to enhance upper airway patency **[2]**.

3.1.1. WIDE: Talent raising the head of the bed to achieve a semi-fowler position.

3.1.2. Talent performing a head-tilt and chin-lift on the patient.

3.2. Apply standard monitoring, including continuous cardiac monitoring and pulse oximetry devices **[1]**. Secure the blood pressure cuff and set it to cycle every 3 to 5 minutes to track hemodynamic stability **[2]**. Position the pulse oximeter and cuff on opposite limbs when possible, to avoid signal loss during cuff inflation **[3]**.

3.2.1. Talent attaching ECG leads and placing the pulse oximeter sensor.

3.2.2. Talent placing the blood pressure cuff and setting the monitor to auto-cycle.

3.2.3. Shot of the monitors placed on opposite extremities.

3.3. Apply a tight-fitting NIV *(N-I-V)* mask on the patient to minimize oxygen leakage **[1]**. Connect the mask to a bilevel positive airway pressure machine for NIV use **[2]**.

3.3.1. Talent securing a snug NIV mask over the patient's nose and mouth.

3.3.2. Talent connecting the mask to the bilevel positive airway pressure machine.

3.4. Check the system to ensure a tight mask-device connection, an adequate oxygen supply, and that the ventilator circuit is leak-free for effective preoxygenation **[1]**.

3.4.1. Talent inspecting the ventilator circuit and verifying all connections are secure and leak-free.

3.5. Now, set the fraction of inspired oxygen to 100 percent **[1]**. Adjust the expiratory pressure and the inspiratory pressure **[2-TXT]**. Set the respiratory rate to above 10 breaths per minute **[3]**.
Videographer's Note: 3.5.1-3.5.3 were combined into a single shot

3.5.1. Shot of the ventilator interface as the FiO2 is being set to 100%.

3.5.2. Shot of the instrument screen with EPAP/PEEP to >5 cm H_2O and IPAP to >10 cm H_2O. **TXT: EPAP: >5 cm H2O; IPAP: 10 cm H2O**

3.5.3. Shot of the instrument screen showing the respiratory rate being set to above 10 breaths per minute.

3.6. Preoxygenate the patient for at least 3 minutes to allow for denitrogenation and to increase oxygen reserves before apnea **[1]**. Continuously monitor for signs of preoxygenation failure, including declining oxygen saturation, apnea, and patient desynchrony **[2-TXT]**.

3.6.1. Talent monitoring the patient during the 3-minute preoxygenation period.

3.6.2. Talent watching the monitor for SpO2 levels and patient respiratory effort. **TXT: Administer anesthesia after 3 min**

3.7. Perform a jaw thrust immediately following induction to ensure airway patency **[1]**. Continue oxygen support up until laryngoscopy begins **[2]**.

3.7.1. Talent performing a jaw thrust after the patient loses consciousness.

3.7.2. Talent keeping the NIV mask in place and monitoring oxygen support.

3.8. Monitor the patient's oxygen saturation and assess tolerance to non-invasive ventilation **[1]**. If oxygenation worsens or patient distress occurs, adjust ventilator settings or switch to manual bag-mask ventilation **[2]**.
Note: Reuse footage from 2.5 and 2.6 since videographer did not film. Authors wanted to reuse the older footage

3.8.1. Talent assessing patient comfort and SpO2 trends on the monitor.

3.8.2. Talent adjusting ventilator settings or switching to manual ventilation if needed.

Results

4. Results

4.1. The incidence of oxygen desaturation during preoxygenation and intubation was lower with non-invasive ventilation compared to the oxygen mask **[1]**, hypoxemia during intubation **[2]**, and peri-intubation SpO2 *(S-P-O-Two)* less than 80% **[3]**.

4.1.1. LAB MEDIA: Figure 3. *Video editor: Highlight the NIV bar labelled "SpO2 < 92% During Preoxygenation"*

4.1.2. LAB MEDIA: Figure 3. *Video editor: Highlight the NIV bar labelled "Hypoxemia During Intubation (SpO2 < 85%)"*

4.1.3. LAB MEDIA: Figure 3. *Video editor: Highlight the NIV bar labelled "Peri-intubation SpO2 < 80%*

4.2. No significant difference in aspiration rates was observed between non-invasive ventilation and oxygen mask techniques **[1]**.

4.2.1. LAB MEDIA: Figure 4. *Video editor: Sequentially highlight the NIV bars then the light blue bar for Oxygen mask*

4.2.2. LAB MEDIA: Figure 4. Video editor: Highlight the bar labelled "Adverse Events **[13]**" showing 41.3% for Oxygen Mask and 17.8% for NIV

4.3. First-pass intubation success was higher in the non-invasive ventilation group compared to the oxygen mask group **[1]**.

4.3.1. LAB MEDIA: Figure 5. *Video editor: Highlight the NIV bar labelled "First Intubation Success*

Pronunciation Guide:

 Preoxygenation
Pronunciation link: https://www.merriam-webster.com/dictionary/preoxygenation
IPA: /ˌprē-ˌäk-sə-jə-ˈnā-shən/
Phonetic Spelling: pree·ok·suh·juh·nay·shuhn
 Tracheal
Pronunciation link: https://www.merriam-webster.com/dictionary/tracheal
IPA: /ˈtreɪkiəl/
Phonetic Spelling: tray·kee·uhl
 Intubation
Pronunciation link: https://www.merriam-webster.com/dictionary/intubation
IPA: /ˌɪn(t)-tə-ˈbeɪ-shən/
Phonetic Spelling: in·tuh·bay·shuhn
 Noninvasive
Pronunciation link: https://www.merriam-webster.com/dictionary/noninvasive
IPA: /ˌnɑːn-ɪnˈveɪ-sɪv/
Phonetic Spelling: non·in·vay·siv
 Ventilation
Pronunciation link: https://www.merriam-webster.com/dictionary/ventilation
IPA: /ˌvɛn-tə-ˈleɪ-shən/
Phonetic Spelling: ven·tuh·lay·shuhn
 Hypoxemia
Pronunciation link: https://www.merriam-webster.com/dictionary/hypoxemia
IPA: /ˌhaɪˌpɑːkˈsiːmiə/
Phonetic Spelling: hy·pok·see·mee·uh
 Peri-intubation
Pronunciation link: No confirmed link found
IPA: /ˌpɛri ɪn(t)-tə-ˈbeɪ-shən/
Phonetic Spelling: peh·ree in·tuh·bay·shuhn
 Aspiration
Pronunciation link: https://www.merriam-webster.com/dictionary/aspiration
IPA: /ˌæs-pə-ˈreɪ-shən/
Phonetic Spelling: as·puh·ray·shuhn
 Desaturation
Pronunciation link: https://www.merriam-webster.com/dictionary/desaturation
IPA: /ˌdiːˌsætʃəˈreɪʃən/
Phonetic Spelling: dee·sa·chuh·ray·shuhn
 Oximetry
Pronunciation link: https://www.merriam-webster.com/dictionary/oximetry
IPA: /ɑːkˈsɪmətri/
Phonetic Spelling: ok·SIH·muh·tree

 Hemodynamic
Pronunciation link: https://www.merriam-webster.com/dictionary/hemodynamic
IPA: /ˌhiːməˈdaɪnæmɪk/
Phonetic Spelling: hee·muh·dy·na·mik
 Patency
Pronunciation link: https://www.merriam-webster.com/dictionary/patency
IPA: /ˈpeɪtənsi/
Phonetic Spelling: pay·tuhn·see
 Denitrogenation
Pronunciation link: https://www.merriam-webster.com/dictionary/denitrogenation
IPA: /ˌdiː-ˌnaɪ-trə-jə-ˈnā-shən/
Phonetic Spelling: dee·ny·truh·juh·nay·shuhn
 Apnea
Pronunciation link: https://www.merriam-webster.com/dictionary/apnea
IPA: /ˈæpniə/
Phonetic Spelling: AP·nee·uh
 Laryngoscopy
Pronunciation link: https://www.merriam-webster.com/dictionary/laryngoscopy
IPA: /ˌlærɪnˈgɑːskəpi/
Phonetic Spelling: la·rin·GOS·kuh·pee