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10-2019

Tricks to Minimize Airway Fire During Laser Surgery for Tracheal Stenosis

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Recommended Citation

D'Souza S. Tricks to Minimize Airway Fire During Laser Surgery for Tracheal Stenosis. American Society of Anesthesiologists (ASA) Conference, Oct 19-23, 2019, Orlando, Florida.

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Introduction

The primary goal during laser surgery on the airway is to avoid the risk of airway fire by avoiding the use of combustible material and fuel for combustion.

CASE Description

Airway device such as endotracheal tube close to the site of laser surgery on the airway and use of higher inspired oxygen (FIO₂) or use of nitrous oxide increases the risk of airway fire.

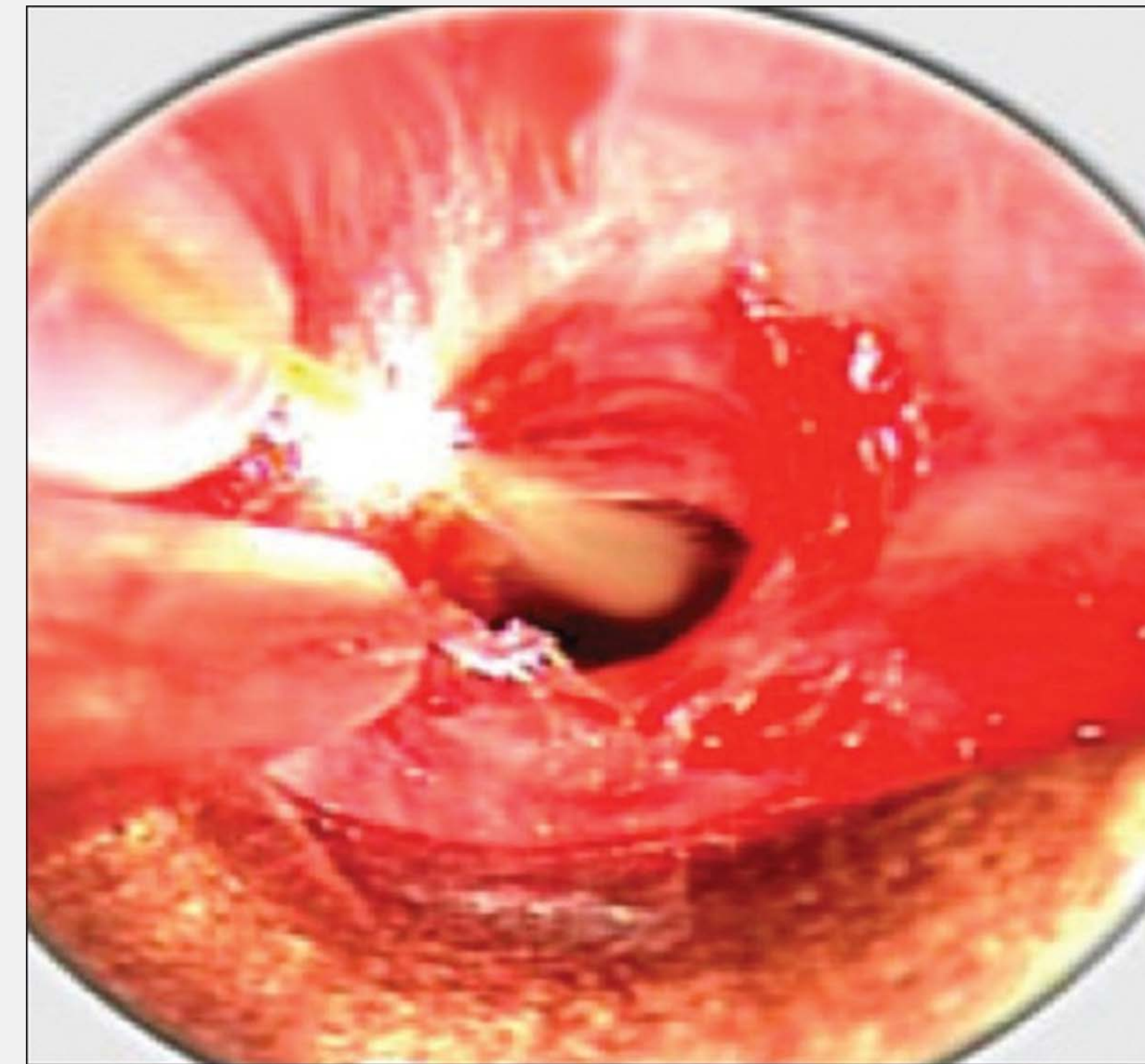
A 33 year old male presented for tracheal surgery with Neodymium-doped yttrium aluminum garnet (Nd:YAG) laser for tracheal stenosis. His tracheal stenosis resulted from prior prolonged intubation.

A laryngeal mask airway device was used as it increases the distance of the airway device from surgical site compared to an endotracheal tube. Air/oxygen mixture was used to keep FIO₂ below 0.3. Perioperative course was uneventful.

CASE Discussion

Measures to avoid airway fire during airway surgery

1. Maintain Inspired oxygen concentration (FIO₂) less than 0.3
2. Use air /oxygen mixture
3. Avoid nitrous oxide as it supports combustion
4. Use laser resistant tubes
5. Use of laryngeal mask airway is an alternative to endotracheal tube as it increases the distance between the airway and site of laser surgery
6. Fill the endotracheal tube cuff with saline instead of air
7. Use intermittent bursts of laser
8. Monitor the expired oxygen concentration prior to laser use . The goal is to keep the expired oxygen concentration below 0.3.



Sparking that may lead to airway fire.

Stahl DL, Richard KM, Papadimos TJ. Complications of bronchoscopy: A concise synopsis. *Int J Crit Illn Inj Sci.* 2015;5(3):189–95. Copyright: International Journal of Critical Illness and Injury Science. Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License.

Protect patient and OR personnel from laser

1. Post warning signs outside the OR
2. Cover the OR glass walls and windows and doors from laser resistant material
3. Remove all laser reflective material
4. Cover the patient's eyes with tape and laser protective eyewear
5. OR personnel should wear laser protective eye glasses
6. Laser fumes should be suctioned from the operation field
7. Personnel should wear a tight fitted mask for protection from laser fumes
8. Remove the mouth guards
9. Protect patient 's teeth and soft tissues with saline soaked wet gauze.

Laser resistant endotracheal tubes ¹

- Red rubber tubes: CO₂, KTP
- Silicone tube wrapped with aluminum foil: CO₂ and KTP lasers
- Stainless steel spiral endotracheal tubes for CO₂ & KTP laser
- Soft white rubber tube reinforced with corrugated copper foil: Argon, CO₂, nd:Yag laser
- Compared to a CO₂ laser, other lasers have shorter wavelength and deeper tissue penetration²
- Standard eye glasses protect the cornea from CO₂ laser only . They do not protect the eyes from other types of laser.

Management of airway fire ³

1. Turn off all the anesthesia gases
2. Pull out the endotracheal tube
3. Pour saline into surgical field
4. Mask ventilate with room air
5. Re-intubate
6. Ventilate with air
7. Assess the damage with laryngoscopy/glidescope
8. Assess the distal airway damage with fiberoptic bronchoscope

Conclusion

- We chose the laryngeal mask airway as it increased the distance between the airway device so burning of the airway device from heat could be avoided.
- We used air/oxygen mixture to keep the inspired oxygen concentration below 0.3.
- Our surgeon used short bursts of laser.
- Thus we effectively followed the laser management protocols to decrease the risk of airway fire during laser surgery for tracheal stenosis.

References

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