Anesthetic Challenges During Laser Surgery of the Larynx Part 2. Operating Room Fire

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Abstract

Theoretical basis: Laser is an acronym for *light amplification by stimulated emission of radiation*—a highly collimated beam of photons at a single frequency. Lasers are ubiquitous in the modern world and are increasingly used in the operating room. The **Aim** of the study is to determine different anesthetic techniques and complications during laser surgery of the larynx. **Results:** The ignition and propagation of fire requires a triad of components: ignition source, fuel and oxidizer. All parts of the *fire triad* are ubiquitous in operating room and may be in close proximity of each other during laser surgeries. When laser use is planned, the concentration of inspired oxidizers must be considered. When the surgical site is within or near the airway, coordination between the anesthesia and surgical teams is essential to consider the need for an ETT, which tube type to use, the oxygen enrichment plan, and mode of ventilation. Standard polyvinyl chloride (PVC), red rubber, and silicone ETTs are candidates for use during laser procedures near the airway, but all are ignitable and require protective measures. **Conclusion:** Lasers are increasingly used in the operating room. Understanding the technology is important to safe anesthetic practice.

Key words: Laser, operating room fire, protective measures.

Literature review

The ignition and propagation of fire requires a triad of components: ignition source, fuel, and oxidizer. All parts of the *fire triad* are ubiquitous in ORs and may be in close proximity of each other during laser surgeries. Lasers are highly effective and rapid sources of ignition.^{1,2} Laser operators need to be well versed and compliant with the standards and codes in place for the safest practice during laser use. Given the right fuel, ignition may occur with oxygen as the primary oxidizer at 21% (room air) or at lower percentages in certain conditions.³ Ignition potential is amplified in the presence of an enriched oxidizer concentration. This is true for either of the two prevalent OR oxidizers: oxygen or nitrous oxide (N₂O). Anesthesiologists and laser operators must work together to ensure the lowest possible fraction of inspired oxygen concentration (FiO₂) at critical points in all laser procedures. Common sources of fuel in the OR include the ETT and other plastic items, drapes and towels, and alcohol-based preparation solutions. Less common fuels include hair and skin ointments, which highlight the need for reminding patients to be ready for surgery with the face free of makeup and no products in the hair. Although a feared complication, the actual incidence of surgical fires per year in the United States varies widely, depending on the report, and is not clearly defined. The Emergency Care Research Institute (ECRI), an independent

nonprofit health service research agency, estimates between 550 and 650 surgical fires occur every year; an extremely small percentage of approximately 65 million annual surgical cases. Further, the ECRI reports that a high percentage of these surgical fires occur in the airway (34%) and head or face (28%)^{4,5} A report from TJC gives the incidence of OR fires at 20 to 30 per year.⁶ A report from 1984 that examined the complications associated with several thousand CO₂ laser surgeries reports the incidence of airway fires at 0.14%.⁷ Even higher (and older) estimates on the incidence of ETT fires during laser procedures of the airway are 0.5% to 1.5%.^{8,9} Surgical fire represents the most common major complication of endoscopic airway laser surgery and may result from direct or indirect laser beam contact with the ETT.¹⁰ Smoldering particles of tissue from the surgical site can ignite an ETT.¹¹ In an otolaryngologic survey published in 2011, during endoscopic airway and tracheal surgery, a laser was the ignition source in 26 of 27 fires, 15 of which involved the ignition of an ETT and 7 of which had the FiO₂ at 0.21.¹ A survey of otolaryngologists reported on 100 fires, with electrosurgery causing 59%, lasers causing 32%, and light cords causing the remaining 7%. Supplemental oxygen was involved in 81%; in 31% of these cases, the ETT caught fire.¹²

When laser use is planned, the concentration of inspired oxidizers must be considered. Ignition is facilitated and combustion is more intense in oxidizer-enriched environments, which occurs with the use of either oxygen or N₂O. The risk associated with N₂O might not be readily apparent. In its resting state, N₂O has no free oxygen. An oxygen analyzer will reflect the dilution of oxygen by N₂O (with a lowered FiO₂) when the two gases are used together. However, N₂O easily exothermically dissociates, releasing heat and free oxygen. The fire risk of an oxygen and N₂O mixture should be considered equivalent to administering 100% oxygen. In an updated 2013 ASA Practice Advisory for the Prevention and Management of Operating Room Fires, the majority of the ASA taskforce members „...strongly agree that the use of nitrous oxide (N₂O) should be avoided in settings that are considered high risk for fire.”¹³ Materials that resist ignition at a low FiO₂ may vigorously combust with an added oxidizer. As the temperature of the environment increases, the required FiO₂ needed to support combustion decreases. Flaming combus-

tion can occur at warm conditions in oxygen concentrations as low as 14% to 16% (National Fire Protection Agency 921 Guide for Fire and Explosion Investigations 1998). The 2013 ASA practice advisory does not give a maximum allowable FiO₂ for procedures at high risk for fire but states that it should be „kept as low as clinically feasible...” to „...avoid hypoxia.” Few clinicians would agree to allow laser use in the presence of a FiO₂ level greater than 0.4, or 0.5, which is considered dangerous in in vitro studies.¹⁴ Most want the FiO₂ under 0.3 in high-risk fire settings. A 2013 analysis of the ASA Closed Claims database, which dates back to 1985, found that laser fires during general anesthesia occurred with inspired oxygen concentrations greater than 30%.¹⁵ Analyses such as this one are used to establish *best practice* approaches to patient care.¹⁶ As a consequence, many institutions have enacted policies mandating the use of safer ETTs and an FiO₂ below 30% for all intra-oral surgeries with a provision to use an ignition source.¹⁷ When available, diluting 100% oxygen with helium offers a small advantage over an air-nitrogen mixture attributable to its higher thermal conductivity that can delay the ignition of an ETT for a few seconds.^{18,19} The index of flammability is reduced by only 1% to 2%.²⁰ Additionally, helium's lower density reduces the Reynolds number, transition to turbulent flow, and thus increased resistance to flow, allowing the use of a smaller ETT.^{21,22} Finally, reducing inspired FiO₂ does not protect from an increased airway oxygen concentration until expired concentration also decreases, which can take several minutes when low fresh gas flows are used.²³

When the surgical site is within or near the airway, coordination between the anesthesia and surgical teams is essential to consider the need for an ETT, which tube type to use, the oxygen enrichment plan, and mode of ventilation. If intubation is planned, then varied intubation options exist and include an assortment of available ETTs and jet ventilation catheters. A few oxygenation-ventilation strategies include ventilating through a cuffed or tightly fitting ETT, either continuously or intermittently using a ventilator with apnea during episodic removal of the ETT to allow unobstructed access to the surgical field. Either supraglottic or infraglottic catheter positioning may be selected for jet ventilation. In addition, the choice of anesthetic must be considered. There are series using sevo-

flurane and spontaneous ventilation²⁴; however, volatile anesthetics are not reliably delivered to the patient if jet ventilation is required, and the vapors can pollute the OR. Finally, although the volatile anesthetics currently used in clinical practice are nonflammable and nonexplosive in clinically relevant concentrations,²⁵ when exposed to flame, they may pyrolyse to potentially toxic compounds.²⁶ As such, the ANSI Z136.3–2011 standard conservatively recommends not using volatile anesthetics during airway laser surgery. ETT fires have their own set of elevated risks for the patient and require swift corrective measures. With the right conditions and if properly managed an ignited ETT may cause little if any harm. However, catastrophic injury may occur.^{27,28} If ignited and combustion breaches the ETT with its centrally flowing reservoir of oxidizer, a *blowtorch* scenario in the airway can occur. The potential for far-reaching thermal injury to the pulmonary tract exists. In addition, products of complete and partial combustion including smoldering debris, particulate matter, toxic gases, and compounds may cause further insult. When using a laser near the airway, the updated 2013 ASA Practice Advisory strongly agrees that „laser resistant tracheal tubes [and catheters] should be used, and that the tube choice should be appropriate for the procedure and the laser...” If a cuffed tube is used, then the cuff should be filled with saline rather than air whenever feasible.¹³ Methylene blue–dyed saline may help speed identification of cuff breaches.²⁹ Added protection from ignition may be achieved by using water-soaked sponges around the tube at the site of work and at the glottis. These sponges may seal leaks of oxygen around an ill-fitting ETT cuff, segregating the higher FiO₂ being delivered to the patient from the ambient air above the glottis and may protect the tube from laser strikes by adding a layer of water-saturated protection.

Standard polyvinyl chloride (PVC), red rubber, and silicone ETTs are candidates for use during laser procedures near the airway, but all are ignitable and require protective measures. Their dissimilar properties, reactions to various laser types, and by-products of combustion have been studied. Studies show that PVC easily absorbs far-infrared light and is vulnerable to CO₂ laser. Smith and colleagues¹ found a rapid (less than a 2-second) ignition of PVC ETTs exposed to 5 W CO₂ laser at 100% oxygen. Using a canine model, Ossoff and colleagues³⁰

studied CO₂ laser–ignited fires of PVC, red rubber, and silicone ETTs and found that all ignited into blowtorch scenarios in the setting of 1% halothane, 30% oxygen, and 70% N₂O. The effects of intraluminal fire on the larynx and trachea were assessed. Of the ETTs studied, the PVC type was not only the type that most readily ignited, but it also deposited carbonaceous debris and caused the most severe burns and cellular damage. The PVC ETT also produces more toxic by-products of combustion, such as hydrochloric acid. The red rubber ETT was more ignition-resistant and produced less debris and tissue inflammation. Silicone ETTs took the longest exposure to ignite, but the finding of silica ash raised concern for possible remote development of silicosis. Other studies^{7,31} have similar findings, except Ossoff¹⁸ found red rubber ETTs were slower to ignite than silicone ETTs. On the other hand, energy from Nd:YAG and visible laser light is not easily absorbed by clear PVC ETTs; however, if anything (e.g., blood, tissue, lettering on the ETT) disrupts the transparency, then energy will be absorbed at that point and will place the ETT at high risk for ignition. In a 1991 study, 1 minute of continuous exposure to an Nd:YAG laser at 70 W and 100% oxygen flowing produced no damage to the PVC ETT when aimed at the unmarked clear portion of a PVC ETT. However, when aimed at the ETT markings, ignition occurred at 2.6 seconds, and when aimed at blood or mucus, ignition occurred in less than 6 seconds.³² This same research group and another demonstrated that none of the three commonly used ETT materials—PVC, red rubber, and silicone—are safe when exposed to Nd:YAG laser energies.^{33,34}

Various strategies for the protection of ETTs from laser-strike damage have been evolving since the 1970s. Standard ETTs may be rendered more resistant to ignition by wrapping them with protective material, or the alternative is to use laser-resistant tracheal tubes (LRTTs), which are ETTs prefabricated with protective layering. In every case involving the use of lasers, the risk of airway fire must be considered and appropriate precautions taken if any appreciable chance of ignition is present. The first ETT laser protection option was a do-it-yourself wrapping with laser-resistant materials. Flammable-resistant, smooth, and flexible tapes including aluminum and copper foil and metallic-coated plastic are typically used. These tapes are available through trade and craft stores and have

proven to slow laser ignition.^{35,36} Although the practice of using metallic tapes to create LRTTs is well supported in the older medical literature, practitioners should realize that none of these products have FDA approval for this use. Practitioners opting to use the metal tapes to hand-wrap ETTs incur significant liability and patient safety risk. Even the one FDA-approved wrap, Merocel Laser-Guard Protective Wrap, is no longer marketed as a result of poor demand. FDA-approved LRTTs are commercially available. These LRTTs vary in design and intended use. Some of these products are no longer on the market, including the Norton, Xomed Laser-Shield, and Bivona Fome-Cuff ETTs. The Xomed Laser-Shield was withdrawn from use after its involvement in three airway fires, one of which resulted in a death.³⁷ The Medtronic Laser-Shield II ETT (Medtronic ENT, Jacksonville, Fla) is a redesigned version of the Xomed tube. Some of the other currently available LRTTs include the Sheridan Laser-Trach (Hudson RCI/Teleflex/Medical, Research Triangle Park, NC), Rusch Lasertubus (Teleflex/Medical, Research Triangle Park, NC), and the Mallinckrodt Laser-Flex, now branded as the Covidien Laser Oral/Nasal Tracheal Tube Dual Cuffed Murphy Eye (Covidien, Mansfield, Mass). The available LRTTs are made of metal or have a nonmetal tube core with a metallic overlay. The nonmetal core LRTTs are the following: (1) The Medtronic Laser-Shield II, which is intended for use with CO₂ and KTP lasers, is a silicone tube core wrapped with a flexible aluminum overlay topped by a fluoroplastic layer. It is a single-cuffed LRTT with dry methylene blue indicator in the unprotected silicone elastomer cuff. The covering is specified to withstand (in vitro) 35,000 W/cm² of CO₂ laser energy or 11,000 W/cm² of KTP energy for 3 minutes. In a laboratory test, a continuous laser beam at 20 W vaporized the fluoroplastic film, but the tube above the cuff did not perforate or ignite.³⁸ Blood on the surface of the tube did not result in ignition or burn-through, even when tested at increased beam power of 38 W.³⁹ (2) The Sheridan Laser-Trach, which is also intended for use with CO₂ and KTP lasers, is a red rubber tube core with a copper foil overlay. It has an unprotected single cuff. The tube above the cuff took 60 seconds to perforate when subjected to 40 W of continuous CO₂ laser, but it was readily ignited by a high-power Nd:YAG laser.⁴⁰ (3) The Rusch Lasertubus is intended for use with all medical laser types. It

has a central tube of flexible white rubber, „reinforced with corrugated copper foil and absorbent sponge” per product information provided by the manufacturer, Teleflex Medical, and has a dual cuff-inside-a-cuff system. Bench testing of this product by Teleflex Medical showed no damage to the tube integrity when exposed to a CO₂ laser at 20 W for 40 seconds. In independent testing, the area above the cuff withstood 90 seconds of a Nd:YAG laser set at 25 W and a CO₂ laser at 75 W.⁴¹ A metal LRTT is the Covidien Laser Oral/Nasal Tracheal Tube Dual Cuffed (Laser-Flex), and is intended for use with CO₂ and KTP lasers. It has an airtight flexible armored stainless steel shaft and two independent cuffs, positioned in series. It was shown that the shaft above the cuffs withstood 1 minute of a 69 W CO₂ laser. The shaft did not hold up to Nd:YAG laser at high power.⁴² With the CO₂ laser set at 38 W, this tube ignited one out of four times when dry and had almost immediate combustion if blood was on the surface. All LRTTs are merely *resistant* to laser damage. None, either metal wrapped or all metal, have protected shafts that are completely safe under all conditions, and all cuffed LRTTs have vulnerable cuffs and tips. LRTTs are no replacement for vigilant and thoughtful care by all present in the OR.

The thin pliable plastic or elastomeric envelope of the standard high-volume, low-pressure cuff found on ETTs and LRTTs is at risk for puncture from misdirected laser energy. If unrecognized, cuff punctures allow delivered gas, which is likely oxygen-enriched, to travel above the incompetent cuff and flood the surgical field, creating a high risk for an airway fire if using a laser. Other than the Bivona Fome-Cuff, which is no longer available, no other cuffs remain inflated after puncture. If laser use near the airway is planned, then implementing cuff-protective strategies such as the following is essential: (1) Use saline to fill the cuff. A cuff puncture may extinguish a small fire. The updated 2013 ASA Practice Advisory notes that the majority of members and consultants strongly agree that „the tracheal cuff of the laser tube should be filled with saline rather than air, when feasible.”¹³ (2) Tint the saline in the cuff with methylene blue to act as an early marker of cuff puncture.¹³ (3) Place the cuff as far away as possible (distal in the trachea) from the site of laser use. (4) Use moistened cotton pledgets or sponges to cover any exposed cuff. The usefulness of these practices in preventing or

delaying cuff ignition from CO₂ laser exposure has been confirmed.^{43,44}

Although not specifically related to laser procedures in the airway, vagal hyperactivity often occurs during instrumentation of the trachea and during suspension laryngoscopy, in particular. Immediate recognition and treatment, which potentially includes the release from suspension and the intravenous administration of a vagolytic drug, are essential. Intense (deep) neuromuscular blockade is often a surgical need during laser on minute targeted areas in the airway. The paraneoplastic syndrome, occasionally observed with small cell and other types of endobronchial tumors, may lead to prolonged weakness after the administration of neuromuscular blocking drugs.⁴⁵

The ASA OR Fire Management Practice Advisory and the ECRI have nearly identical algorithms for the essential steps of handling airway or other fires on the surgical patient.⁴⁸ The essentials are provided:

Fire in the airway:

1. Remove the tracheal tube or breathing circuit fire. Hand it off to be extinguished and inspected.
2. Stop airway gas flow (consider disconnecting the circuit).
3. Remove all flammable and burning materials from the airway.
4. Pour saline or water into the patient's airway (to extinguish the fire and cool the tissues).

References

1. Smith LP, Roy S: Operating room fires in otolaryngology: risk factors and prevention, *Am J Otolaryngol* 32:109-114, 2011.
2. Handa KK, Bhalla AP, Arora A: Fire during the use of Nd-YAG laser, *Int J Pediatr Otorhinolaryngol* 60:239-242, 2001.
3. National Fire Protection Agency NFPA 921 Guide for Fire and Explosion Investigations 1998
4. A clinician's guide to surgical fires: how they occur, how to prevent them, how to put them out, *Health Devices* 32:5-24, 2003.
5. ECRI Institute: New clinical guide to surgical fire prevention. Patients can catch fire—here's how to keep them safer, *Health Devices* 38:314-332, 2009.
6. Joint Commissions on Accreditations of Healthcare Organizations (JCAHO). Sentinel events alert: preventing surgical fires. Issue 29, 2003.
7. Healy GB, Strong MS, Shapshay S, et al: Complications of CO₂ laser surgery of the aerodigestive tract: experience of 4,416 cases, *Otolaryngol Head Neck Surg* 92:13, 1984.
8. Snow JC, Norton ML, Salvja TS, et al: Fire hazard during CO₂ laser microsurgery on the larynx and trachea, *Anesth Analg* 55:146, 1976.
9. Hermens JM, Bennett MJ, Hirschman CA: Anesthesia for laser surgery, *Anesth Analg* 62:218, 1983.
10. Fried MP: A survey of the complications of laser laryngoscopy, *Anesth Analg* 110:31, 1984.
11. Hirschman CA, Smith J: Indirect ignition of the endotracheal tube during carbon dioxide laser surgery, *Arch Otolaryngol* 106:639, 1980.
12. Smith LP, Roy S: Operating room fires in otolaryngology: risk factors and prevention, *Am J Otolaryngol* 32:109-114, 2011.
13. American Society of Anesthesiologists Task Force on Operating Room Fires: Practice Advisory for the Prevention and Management of Operating Room Fires: an Updated Report by the American Society of Anesthesiologists Task Force on Operating Room Fires, *Anesthesiology* 118(2):271-290, 2013.
14. Stuermer KJ, Ayachi S, Gostian AO, Beutner D, Hattenbrink KB: Hazard of CO₂ laser-induced airway fire in laryngeal surgery: experimental data of contributing factors, *Eur Arch Otorhinolaryngol* 270:2701-2707, 2013.
15. Mehta SP, Bhananker SM, Posner KL, Domino KB: Operating Room Fires: a Closed Claim Analysis, *Anesthesiology* 118:1133-1139, 2013.
16. Eichhorn JH: Review article: practical current issues in perioperative patient safety, *Can J Anaesth* 60:111-118, 2013.
17. Roy S, Smith LP: What does it take to start an oropharyngeal fire? Oxygen requirements to start fires in the operating room? *Int J Pediatr Otorhinolaryngol* 75:227-230, 2011.
18. Ossoff RH: Laser safety in otolaryngology—head and neck surgery: anesthetic and educational considerations for laryngeal surgery, *Laryngoscope* 99(8 Pt 2 Suppl 48):1-26, 1989.
19. Pashayan AG, Gravenstein JS: Helium retards endotracheal tube fires from carbon dioxide lasers, *Anesthesiology* 62:274, 1985.
20. Simpson JJ, Schiff GA, Wolf GL: The effect of helium on endotracheal tube flammability, *Anesthesiology* 73:538, 1990.
21. Lu T, Ohmura A, Wong KC, et al: Helium-oxygen treatment of upper airway obstruction, *Anesthesiology* 45:678, 1976.
22. Pashayan AG, Gravenstein JS, Cassisi NJ, et al: The helium protocol for laryngotracheal operations with CO₂ laser: a retrospective review of 523 cases, *Anesthesiology* 68:801, 1988.
23. Remz M, Luria I, Gravenstein M, Rice SD, Morey TE, et al: Prevention of airway fires: do not overlook the expired oxygen concentration, *Anesth Analg* 117:1172-1176, 2013.
24. Anttila HM, Illman HS, Hurme S, Grönman R: Tubeless anaesthesia with sevoflurane and propofol in adult laryngeal surgery, *Eur Arch Otorhinolaryngol* 268:93-99, 2011.
25. Leonard PF: The lower limits of flammability of halothane, enflurane, and isoflurane, *Anesth Analg* 54:238, 1975.
26. Hunton J, Oswal VH: Anaesthetic management for carbon dioxide laser surgery in tracheobronchial lesions, *Anaesthesia* 42:1222, 1987.
27. Cozine K, Rosenbaum LM, Askanazi J, et al: Laser-induced endotracheal tube fire, *Anesthesiology* 55:583, 1981.
28. Sosis MB: Airway fire during CO₂ laser surgery using a Xomed laser endotracheal tube, *Anesthesiology* 72:747, 1990.
29. Sosis MB, Dillon FZ: Saline-filled cuffs help prevent laser-induced polyvinyl chloride endotracheal tube fires, *Anesth Analg* 72: 187-189, 1991.
30. Ossoff RH, Duncavage JA, Eisenman TS, et al: Comparison of tracheal damage from laser-ignited endotracheal tube fires, *Ann Otol Rhinol Laryngol* 92(4 Pt 1):333-336, 1983.

31. Patel KF, Hicks JN: Prevention of fire hazards associated with the use of carbon dioxide lasers, *Anesth Analg* 60:885, 1981.
32. Sosis M, Dillon F: Hazards of a new, clear, unmarked polyvinylchloride tracheal tube designed for use with the Nd-YAG laser, *J Clin Anesth* 3:358-360, 1991.
33. Sosis MB: What is the safest endotracheal tube for Nd-YAG laser surgery? A comparative study, *Anesth Analg* 69:802, 1989.
34. Geffin B, Shapshay SM, Bellack GS, et al: Flammability of endotracheal tubes during Nd-YAG laser application in the airway, *Anesthesiology* 65:511, 1986.
35. Sosis MB: Evaluation of five metallic tapes for protection of endotracheal tubes during CO2 laser surgery, *Anesth Analg* 68:392, 1989.
36. Sosis M, Dillon F: What is the safest foil tape for endotracheal tube protection during Nd-YAG laser surgery? A comparative study, *Anesthesiology* 72:553, 1990.
37. Bauman N: Problem laser endotracheal tubes: one company is plagued with lawsuits and accidents, *J Clin Laser Med Surg* 8:4-7, 1990.
38. Green JM, Gonzalez RM, Sonbolian N, et al: The resistance to carbon dioxide laser ignition of a new endotracheal tube: Xomed Laser-Shield II, *J Clin Anesth* 4:89-92, 1992.
39. Sosis MB, Pritikin JB, Caldarelli DD: The effect of blood on laser-resistant endotracheal tube combustion, *Laryngoscope* 104:829-831, 1994.
40. Sosis MB, Braverman B, Caldarelli DD: Evaluation of a new laser-resistant fabric and copper foil-wrapped endotracheal tube, *Laryngoscope* 106:842-844, 1996.
41. Sosis M, Kelanic S, Caldarelli D: An in vitro evaluation of a new laser resistant endotracheal tube the Rusch Lasertubus, *Anesthesiology* 87S: A483, 1997.
42. Sosis MB, Heller S: A comparison of special endotracheal tubes for the use with the CO2 laser, *Anesthesiology* 69:A251, 1988.
43. Sosis MB: Saline soaked pledgets prevent carbon dioxide laser-induced endotracheal tube cuff ignition, *J Clin Anesth* 7:395, 1995.
44. Ahmed F, Kinshuck AJ, Harrison M, et al: Laser safety in head and neck cancer surgery, *Eur Arch Otorhinolaryngol* 267:1779-1784, 2010.
45. Hanowell LH, Martin WR, Savelle JE, et al: Complications of general anesthesia for Nd:YAG laser resection of endobronchial tumors, *Chest* 99:72, 1991.

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