Endoscopic Laser Surgery in Pediatric Airway Management

WEI-CHUNG HSU, MD

DEPARTMENT OF OTOLARYNGOLOGY, HEAD AND NECK SURGERY,

NATIONAL TAIWAN UNIVERSITY HOSPITAL

NO.7, CHUNG-SAN SOUTH ROAD, TAIPEI, TAIWAN

REPRESENTATIVE AUTHOR: DR. WEI-CHUNG HSU, TEL. 886-2-23123456

EXT. 5215, FAX: 886-2-23410905, E-MAIL: hsu@ha.mc.ntu.edu.tw

Headings: Endoscopic Laser Surgery

Abstract

Pediatric airway management is a life-threatening problem for children and always a challenge to pediatric otolaryngologists. Endoscopic techniques for evaluation and management of airway in pediatric patients have matured greatly in the past decade, especially with the introduction of Laser instrumentation. For example, to treat severe laryngomalacia, subglottic hemangioma, laryngeal papillomatosis, granuloma or web, subglottic or tracheal stenosis, bilateral vocal fold paralysis, tracheobronchial tumor etc. were all effective in selective cases. These developments have been proved that pediatric endoscopic laser surgery can be performed in the airway safely and effectively when a team approach is used. The appropriate choice of laser instruments, anesthesia access, post-operation intensive cares, cooperation and understanding of families were all essential factors for a successful endoscopic laser surgery in pediatric airway management.

Text

Introduction

Treatment of life-threatening pediatric airway lesions has been greatly enhanced by development of the laser and pediatric endoscopic techniques. Traditionally, tracheotomy and endotracheal intubation were the main procedures for securing pediatric airway, but we have to consider the long-term complications on the growth and development of pediatric patients. Endoscopic laser technical developments in the field of pediatric bronchoscopy have expanded the diagnostic possibilities of this procedure and also the therapeutic effectiveness at the same time to avoid invasive surgery or permanent tracheotomy on children [1]-[2]. We try to demonstrate our clinical experiences in endoscopic laser surgery for different diseases in pediatric airway management.

Indications

Current indications for endoscopic laser surgery include supraglottoplasty of severe laryngomalacia [3]-[4], ablations of recurrent respiratory papillomatosis[5]-[6], subglottic hemangioma [4], granulation tissues or tumor involving larynx or tracheobronchial tree, resection of selected regions of subglottic or tracheal stenosis,

TH3A-SS/T3-2

division of laryngeal or subglottic web and partial arytenoidectomy, cordectomy or tenotomy for bilaterally vocal fold paralysis[7]-[8]. With more and more precise laser instruments coupling with endoscopic techniques, there will be more and more diseases included into endoscopic laser surgery.

Choice of Laser

A variety of lasers have been trialed for use in endoscopic surgery for pediatric airway management, including the carbon dioxide (CO₂) laser, the neodymium-yttrium aluminum garnet (Nd: YAG) laser, the potassium titanyl phosphate (KTP) laser, argon dye laser and many more are still under development. The clinical application of different surgical laser is determined by its light emission paradigm, pulse character and wavelength, and by its absorptive characteristics in tissue. Therefore, the surgeon should consider the properties of each particular laser and control of focal length spot size (mm), power (watts), and exposure time (seconds). For example, the CO₂ laser is most commonly used in laryngeal microsurgery due to the precision of its microspot character when coupled to the operating microscope with a micromanipulator, which the surgical accuracy can be achieved within 0.1 mm[9]; the Nd-YAG contact probes facilitated its ablation for obstructing lesions of the tracheobronchial tree[10]; the KTP laser with 0.2 mm fiber could be introduced to the working channel of pediatric bronchoscope, which make distal management of airway problems more delicate and easier.

Laser safety with appropriate anesthesia

Optimal anesthetic management of patients for laser surgery in pediatric airway must include consideration between the safety of patients and the requirements of surgeon. First of all, a warning on the doors when using laser procedure is always necessary. Protecting patient's face, eyes and lips with moist towel as well as the operator's eyes with wrap-around spectacles should be kept in mind from time to time. To avoid laser fire during the operation, anesthesia without endotracheal tube if possible, otherwise using laser-protected tube or a small-diameter jet tube are suggested. Well communication and brief understanding between surgeon and anesthesiologist make an endoscopic laser surgery easier and successful.

Conclusion

With recent advancement in optic instrumentation and endoscopic techniques, therapeutic endoscopic laser surgery has replaced some traditional surgical techniques and become the primary option for pediatric airway management during the modern practices. Successfully coupling lasers to an endoscope represented a logical extension of the clinical application of the modern medical techniques. Using this modality, a pediatric otolaryngologist takes advantages of endoscopic access, precise tissue vaporization, better hemostasis, minimal local inflammation with relatively

painless and less subsequent edema of the narrow airway.

REFERENCES

- [1] S.M. Shapshay, R.K. Davis, C.W. Vaughan, et al, "Palliation of airway obstruction from tracheobronchial malignancy: Use of the CO₂ laser bronchoscope," *Otolaryngol Head Neck Surg*, (91), pp. 615-619 (1983).
- [2] A.H. Jr. Andrews, S.L. Horowitz, "Bronchoscopic CO₂ laser surgery," *Lasers Surg Med*, (1), pp. 35-45 (1980).
- [3] G.H. Zalzal, J.B. Anon, R.T. Cotton, "Epiglottoplasty for the treatment of laryngomalacia," *Ann Otol Rhinol Laryngol*, (96), pp72-76 (1987).
- [4] L.D. Holinger, R.P. Lusk, C.G. Green, *Pediatric Laryngology and Bronchoesophagology*, Lippincott-Raven, Philadelphia, 142, 160 (1997).
- [5] H.H. Dedo, K.C. Yu, "CO₂ laser treatment in 244 patients with respiratory papillomas," *Laryngoscope*, (111), pp. 1639-1644 (2001).
- [6] E.M. Saleh, "Complications of treatment of recurrent laryngeal papillomatosis with the carbon dioxide laser in children," *J Laryngol Otol*, (106), pp.715-718 (1992).
- [7] J.G. Bizakis, C.E. Papadakis, A.D. Karatzanis, C.E. Skoulakis, D.E. Kyrmizakis, J.K. Hajjioannou, E.S. Helidonis, "The combined endoscopic CO₂ laser posterior cordectomy and total arytenoidectomy for treatment of bilateral vocal cord paralysis," *Clin Otolaryngol*, (29), pp.51-54 (2004).
- [8] H.E. Eckel, M Thumfart, K Wassermann, et al., "Corpectomy versus arytenoidectomy and the management of bilateral vocal cord paralysis," *Ann Otol Rhinol Laryngol* (103), pp. 852-857 (1994).
- [9] R.H. Ossoff, J.A. Werkhaven, J. Raif, et al., "Advanced microspot microslad for the CO₂ laser," *Otolaryngol Head Neck Surg*, (105), pp. 411-414 (1991).
- [10] M. Unger, "Neodymium: YAG laser therapy for malignant and benign endobronchial obstruction," *Clin Chest Med*, (6), pp.277 (1985).