Penn Medicine

CLINICAL BRIEFING™

Department of Otorhinolaryngology – Head and Neck Surgery

TransOral Robotic Surgery (TORS) for Obstructive Sleep Apnea

Surgeons with the Department of Otorhinolaryngology–Head and Neck Surgery at Penn are performing transoral robotic surgery (TORS) for the treatment of lingual tonsillar hypertrophy in patients with obstructive sleep apnea (OSA).

Lingual tonsil hypertrophy (LTH) has been recognized as a contributor to the pathology of OSA for at least a decade and is thought to be an explanation for the variable efficacy of uvulopalatopharyngoplasty (UPPP) and other surgical treatments for OSA. The addition of lingual tonsillectomy to these procedures has been shown to ameliorate OSA in a majority of patients. However, tongue base surgery is identified with a variety of challenges, including the difficulty of manipulating surgical instruments in a limited operative field, compromises in lighting and visualization with endoscopic instruments (including lack of depth perception), and occasionally, the need for concomitant tracheotomy and/or other external incisions during surgery.

To address these limitations, investigators at Penn have initiated a clinical trial that combines traditional surgery with transoral robotic surgical techniques first developed within the Penn Department of Otorhinolaryngology–Head and Neck Surgery. TORS offers surgeons improved dexterity and precision, advanced imaging techniques with three-dimensional depth perception and fewer limitations within the operative field than traditional or laparoscopic surgery. When used to perform lingual tonsillectomy, TORS permits removal of obstructive tissue in the tongue base and the potential to obviate the need for external incisions, pharyngotomy and tracheotomy.

The TORS sleep apnea procedure involves surgery and an average hospital stay of just under three days. During the first 36 hours post-surgery, the patient may require an endotracheal tube to protect against breathing difficulties. Duration of stay is dependent upon the patient's recovery in terms of pain tolerance and reduction of soft tissue swelling. Full recovery occurs in about three weeks. A post-surgical sleep study is obtained three months after surgery.

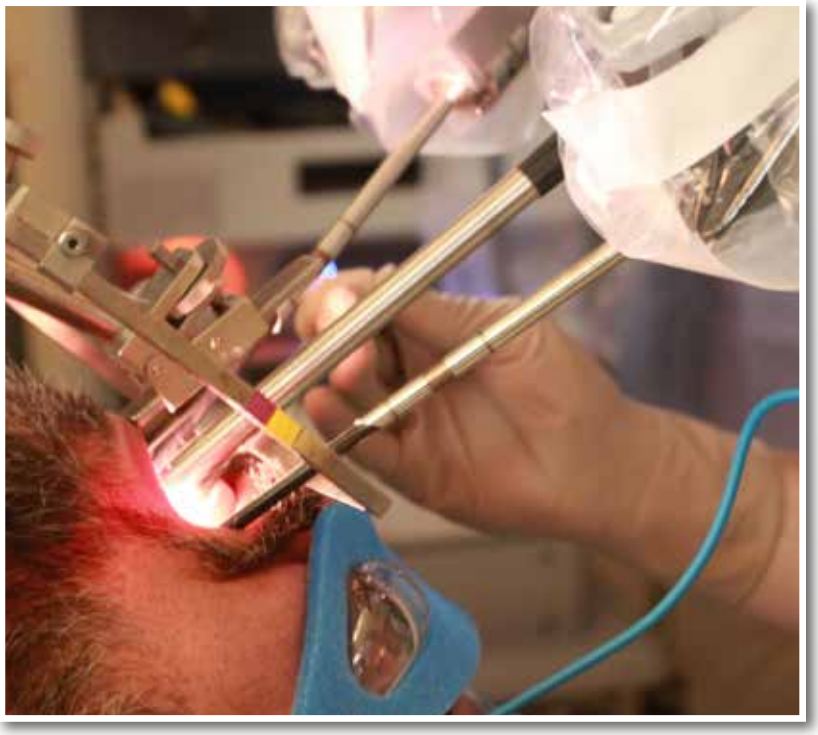

Figure 1: Patient receives combined uvulopalatopharyngoplasty/tongue based resection surgery via TransOral Robotic Surgery for sleep apnea

CASE STUDY

Mr. G, a 47-year-old male with a diagnosis of obstructive sleep apnea, was referred to the Department of Otorhinolaryngology–Head and Neck Surgery at Penn for evaluation. With the exception of moderate obesity (BMI 32), Mr. G's medical history at presentation was unremarkable. He was taking no daily medications or other treatments for OSA. Following his diagnosis, he had tried to use continuous positive airway pressure, but found the mask uncomfortable and soon became noncompliant. Mr. G had discussed stand-alone uvulopalatopharyngoplasty with an oral surgeon as an alternative to CPAP, but was discouraged by the potential lack of long-term efficacy.

At Penn, fiberoptic nasopharyngoscopy revealed hypertrophic lingual tonsils obstructing the airway in addition to palatal obstruction. After a consultation with his personal physician and a consideration of the risks and benefits of transoral robotic surgery, Mr. G agreed have a TORS procedure for his sleep apnea.

Surgery involved both UPPP and tongue base resection using TORS. The tongue base resection resulted in removal of the same volume of tissue as was removed with the UPPP, producing substantially greater airway than would be achieved with UPPP alone. Mr. G was extubated at the end of the procedure and had a relatively short hospital stay of 72 hours. At a follow-up visit three months after his surgery, Mr. G reported substantially improved OSA symptoms, including fewer night-time awakenings and diminished snoring.

FACULTY TEAM

The Department of Otorhinolaryngology–Head and Neck Surgery at Penn Medicine is actively involved in research, including investigations of the efficacy and safety of TransOral Robotic Surgery (TORS) in a variety of indications. TORS was invented and developed at Penn Medicine by the pioneering team of Gregory S. Weinstein, MD, and Bert W. O'Malley, Jr., MD.

Performing TransOral Robotic Surgery for OSA at Penn Medicine

Bert W. O'Malley, Jr., MD
Gabriel Tucker Professor and Chair
Department of Otorhinolaryngology
Head and Neck Surgery

Gregory S. Weinstein, MD, FACS
Professor and Vice Chair
Department of Otorhinolaryngology
Head and Neck Surgery

James J. Kearney, MD
Associate Professor of Otorhinolaryngology
Head and Neck Surgery

Rabie M. Shanti, DMD, MD
Assistant Professor of Oral and
Maxillofacial Surgery
Assistant Professor of Otorhinolaryngology
Head and Neck Surgery

Erica R. Thaler, MD
Director, Division of General Otolaryngology
Professor of Otorhinolaryngology
Head and Neck Surgery

ACCESS

Hospital of the University of Pennsylvania
Silverstein Pavillion, Fifth Floor
3400 Spruce Street
Philadelphia, PA 19104

Penn Presbyterian Medical Center
Medical Office Building, Room 205
38th and Market Streets
Philadelphia, PA 19104

Pennsylvania Hospital
811 Spruce Street
Philadelphia, PA 19107

Penn Medicine at Radnor
Head and Neck Surgery
250 King of Prussia Road
Radnor, PA 19087

Anesthesia Research in TransOral Surgery for Sleep Apnea

Researchers in the Department of Anesthesiology and Critical Care at Penn Medicine have developed a pharmacokinetic algorithm for the rapid titration of propofol during sleep nasoendoscopy when inducing moderate obstruction in the diagnosis of obstructive sleep apnea (OSA). A short-acting, intravenously administered hypnotic known to cause obstruction at the soft palate and epiglottis during sedation, propofol is useful as a means to identify the anatomic site of airway obstruction in patients with OSA. Identification of the site of obstruction is key to determining the medical and surgical course of treatment.

The ability to reliably achieve the correct level of sedation and maintain moderate obstruction can be challenging, however. Total obstruction with hypoxia is common, and measures such as jaw thrust and bag-mask ventilation make observation of the anatomic site of obstruction difficult. To address these concerns, Penn researchers developed a pharmacokinetic approach using rapid titration to moderate obstruction as the endpoint.[1]

Methods

This was a prospective study of screening sleep nasoendoscopy performed in 100 patients for an experimental transoral robotic tongue base reduction. Pharmacokinetic software was used to calculate the infusion rate and pause interval (during which the syringe pump is stopped) necessary to maintain the desired level of obstruction. All cases were performed in an OR with 2 LPM O2 oral canula. A nasopharyngeal laryngoscope was passed into the velopharynx and the induction sequence initiated. The target was considered the first instant of observed obstruction. The infusion was discontinued when adequate video confirmation of anatomic site was complete. To date, 15 patients have been evaluated.

Results

In all patients, stable moderate obstruction was produced permitting identification of the anatomic site of obstruction. In all patients except one, the endpoint of obstruction was obtained with the specified infusion sequence. The software was modified after this study to increase the target of the second infusion from 95% to 99%. All other patients have achieved obstruction during the interval of 90 – 390 seconds.

Conclusions

Titration of propofol to precise pharmacodynamic endpoints shows promise in simplifying challenging tasks such as sleep nasendoscopy. The proposed system employs an anesthesiologist in the loop for titration and may address present concerns with target-controlled infusion in clinical practice.

To refer a patient and/or consult with a physician: Call **800.789.PENN (7366)** or visit **http://PennMedicine.org/referral 28020 02/11.**

References

1. Mandel JE. A pharmacokinetic approach to rapid titration of propofol to moderate obstruction for diagnosis of sleep apnea. Presented at the 19th Annual Meeting of the International Society of Anesthetic Pharmacology, October 2010, San Diego, CA.

FY18-18073 02.18