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Utilization of Silicone Sheet as a Protective Guide During Transoral Robotic Tongue Base Surgery

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Abstract

This article presents a simple technique where a silicone sheet is used during transoral robotic surgery (TORS) to protect the upper airway structures from thermal damage during a base of tongue procedure. We review 10 cases of TORS tongue base reduction with the use of this technique, with no complications and with reduction of thermal damage to the lingual epiglottis and surrounding pharyngeal wall. Furthermore, it served as a guide during tongue base dissection to provide visual and tactile feedback to the inferior limit of resection, as well as to protect the endotracheal tube. The silicone sheet is an ideal material for use as a thermal barrier due to its widespread availability, intrinsic thermal properties, and translucency. The technique of using the silicone sheet is easy to implement and may prove useful to many transoral robotic surgeons, especially for newly trained TORS users and trainees.

Keywords

transoral robotic surgery, Da Vinci Xi, obstructive sleep apnea, silicone, sheet, base of tongue

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Since its approval by the Food and Drug Administration in 2006, transoral robotic surgery (TORS) has become a commonly implemented technique for excision of tissue from the upper aerodigestive tract. According to a recent systematic review, the most common TORS procedures in head and neck cancer cases were resections of oropharyngeal tumors.[1] TORS has also been well described in the surgical treatment of obstructive sleep apnea, especially for reduction of the base of tongue (BOT).[2-4] Given the limited operative space in the upper aerodigestive tract, TORS resection risks damage to surrounding structures not involved by the pathology (eg, the epiglottis and posterior pharyngeal wall). The resultant injuries can lead to poor healing, prolonged pain, swallowing deficits, and poor surgical outcomes. Furthermore, the risk of airway fire exists in these cases when electrocautery is used near the endotracheal (ET) tube. In this article, we present a simple and economic technique with a silicone sheet, a material that is readily available in the operating room, as a protective guide to prevent injury to the epiglottis, pharyngeal wall, and/or ET tube as well as to facilitate more controlled dissection during TORS. This report was deemed exempt by the Kaiser Permanente Hawaii Institutional Review Board.

Methods

Seven patients were selected for TORS BOT/lingual tonsillectomy in cases of obstructive sleep apnea whose continuous positive airway pressure failed and who had a finding of a large BOT/lingual tonsil on physical examination and nasopharyngoscopy. Two patients underwent tongue base mucosectomy for unknown primary. One patient underwent TORS-assisted resection of lingual thyroid cancer. The da Vinci Xi robot (Intuitive Surgical Inc) was set up in the standard fashion, and the patient was appropriately positioned with a mouth gag in place. As the da Vinci Xi system is not Food and Drug Administration approved for TORS, special informed consent was obtained from all patients. If indicated, the patient first underwent bilateral palatine tonsillectomy. Prior to the start of the BOT reduction, a 1.02-mm silicone sheet (Medtronic) was inserted into the patient's mouth between the BOT and epiglottis (**Figure 1**). The sheet can be cut into various shapes to accommodate the differences in oropharyngeal anatomy. The BOT reduction was then carried out with

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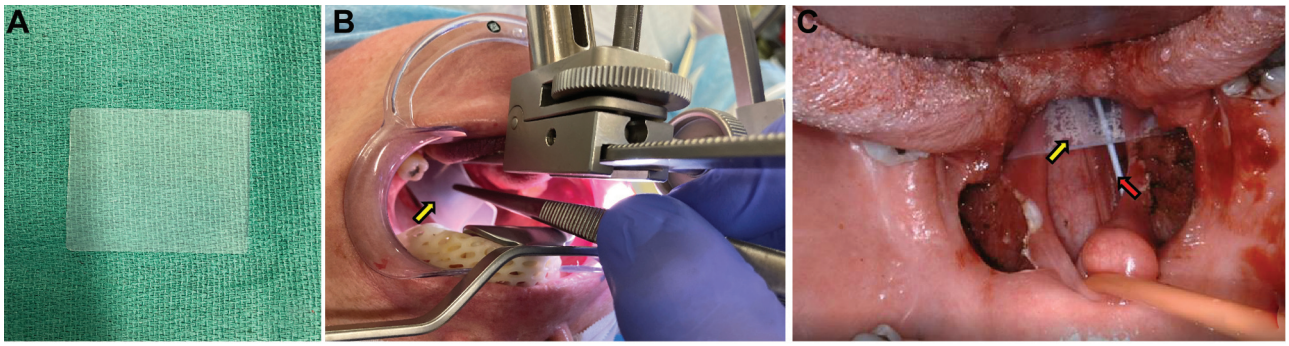

Figure 1. Silicone sheet: (A) 1.02 mm, (B) inserted into oropharynx (yellow arrow), (C) placed between the tongue base/lingual tonsil and epiglottis (yellow arrow). Endotracheal tube (red arrow).

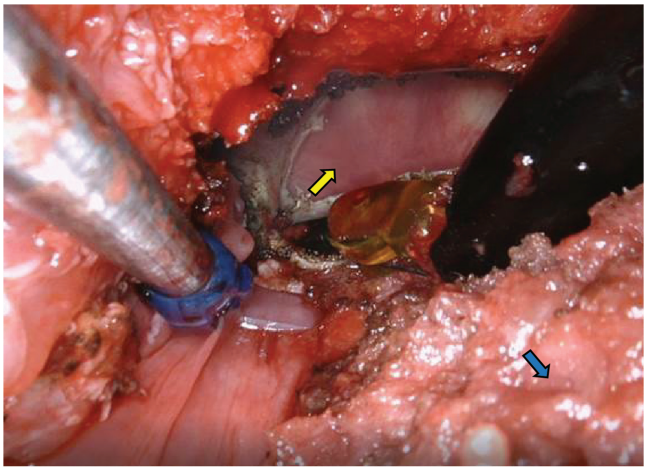

Figure 2. Completion of inferior aspect of dissection with silicone sheet (yellow arrow) protecting the surrounding structures and endotracheal tube. Excised portion of lingual tonsil and tongue base (blue arrow).

Maryland forceps and monopolar cautery from an anterior/superior to posterior/inferior direction. The silicone sheet served as a barrier between the posterior/inferior tongue and the lingual surface of the epiglottis and as a limit of dissection, as it lies within the vallecula (**Figure 2**).

Results

Ten patients underwent TORS BOT resection and/or palatine tonsillectomy with the use of a silastic sheet. The placement of the silicone sheet was straightforward and easy to manipulate during the case. Moreover, the ET tube was well protected from electrocautery tools during dissection. By visual inspection, no significant injury to the epiglottis and/or posterior pharyngeal wall was noted following each case. By comparison, 6 patients underwent BOT reduction without the use of silicone sheet prior to the inception of the technique. Most had noticeable thermal injury to the epiglottis by visual inspection. One patient had subjective dysphagia from epiglottic scarring. **Figure 3** demonstrates 1 case of particularly notable epiglottis thermal injury.

Discussion

As TORS becomes more popular, advances in technique for ease and safety are critical to optimizing outcomes. In our experience, mucosal injury to the epiglottis and the resultant scarring can lead to swallowing deficits and prolonged postoperative recovery. Therefore, methods to minimize thermal injury to normal structures are critical to improved surgical outcomes. The silicone sheet is a readily available product worldwide. It is cheap and pliable, conforming well to the shape of the BOT and posterior pharyngeal wall. The silicone

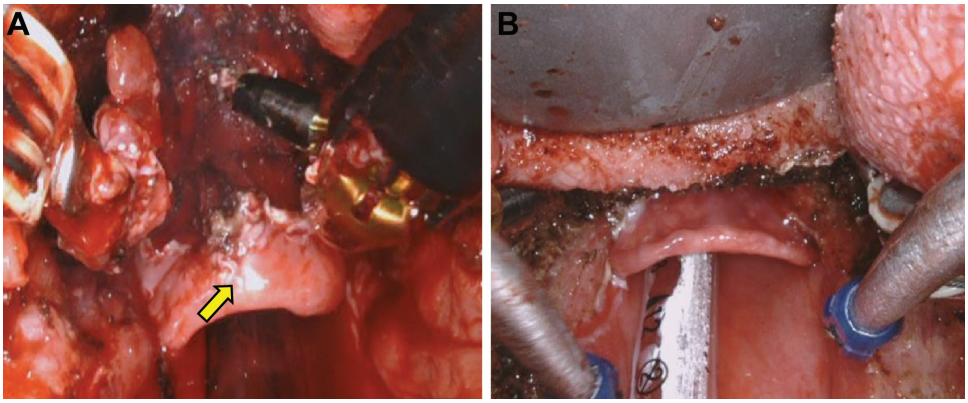

Figure 3. Comparison of mucosal injury to the lingual surface of epiglottis (A) without and (B) with the use of silicone sheet during transoral robotic surgery. Note the mucosal injury and edema to the epiglottis (yellow arrow).

material also has high heat resistance and thermal stability—features ideal for protecting mucosal tissue. These properties are due to a highly stable chemical structure inherent within the siloxane bonds (silicone and oxygen atom) that results in a high melting point (>1400 °C) and low thermal conductivity. For instance, the kelvin of silicon is 1.56 W/mK at room temperature as compared with the kelvin of aluminum (239 W/mK), meaning that aluminum conducts heat >200 times more efficiently than silicon.[5] Therefore, these properties make the silicone sheet suitable for preventing thermal injury during electrosurgery.

Although our findings are limited to a small number of patients undergoing TORS BOT/lingual tonsillectomy, the use of a silastic or other silicone sheet lying between the BOT and the epiglottis can be useful to protect the epiglottis, ET tube, and pharynx from cautery injury. It also serves as a guide for the dissection of the inferior aspect of the BOT, which can be challenging for those who are in the beginning phases of their TORS training, due to the difficulty gauging the limits and depth of dissection. In addition, our technique should be transferable to TORS for tongue base cancer. Future study is planned to objectively assess postoperative outcomes (eg, pain and swallowing) with the use of silicone sheet during TORS. The technique is simple, safe, reliable, and economic, hence making it easily adoptable by TORS users.

Author Contributions

Keith Volner, analysis, literary review, editing; **Joshua C. Mostales**, analysis, editing; **David Schoppy**, analysis, editing; **Jae Lim**, conception, design, analysis, conduct, editing.

Disclosures

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References

1. Fiacchini G, Vianini M, Dallan I, Bruschini L. Is the Da Vinci Xi system a real improvement for oncologic transoral robotic surgery? A systematic review of the literature. *J Robot Surg*. Published online August 4, 2020. doi:10.1007/s11701-020-01132-0
2. Arora A, Chaidas K, Garas G, et al. Outcome of TORS to tongue base and epiglottis in patients with OSA intolerant of conventional treatment. *Sleep Breath*. 2016;20(2):739-747. doi:10.1007/s11325-015-1293-9
3. Friedman M, Hamilton C, Samuelson CG, et al. Transoral robotic glossectomy for the treatment of obstructive sleep apnea-hypopnea syndrome. *Otolaryngol Head Neck Surg*. 2012;146(5):854-862. doi:10.1177/0194599811434262
4. Vicini C, Dallan I, Canzi P, Frassineti S, La Pietra MG, Montevecchi F. Transoral robotic tongue base resection in obstructive sleep apnoea-hypopnoea syndrome: a preliminary report. *ORL J Otorhinolaryngol Relat Spec*. 2010;72(1):22-27. doi:10.1159/000284352
5. Carvill J. Thermodynamics and heat transfer. In: Carvil J, ed. *Mechanical Engineer's Data Handbook*. Butterworth-Heinemann; 1993:102-145. doi:10.1016/B978-0-7506-1014-8.50008-8