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Transoral robot-assisted carbon dioxide laser surgery for hypopharyngeal cancer

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ABSTRACT: *Background.* Transoral robotic surgery (TORS) has been used as a novel procedure for the resection of laryngopharyngeal cancers with promising outcomes. There are several studies proposing the benefit of combining TORS with a carbon dioxide (CO_2) laser in resecting upper aerodigestive tract tumors. The purpose of this study was to illustrate transoral robot-assisted carbon dioxide laser surgery (TORS-L) for hypopharyngeal cancers.

Methods. A 59-year-old patient with T1N0M0 cancer at the lateral hypopharyngeal wall was selected for TORS-L.

Results. Tumor was excised in 1 piece with adequate surgical margins. There was no perioperative complication. The patient was extubated immediately after surgery. Oral diet was initiated within the first 24 hours. No gastrostomy or tracheostomy tube placement was required. A video demonstration of TORS-L is included, which can be viewed online on *Head & Neck*'s home page at http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1097-0347.

Conclusion. TORS-L hypopharyngectomy is a safe and feasible procedure for the resection of selected hypopharyngeal tumors. © 2015 Wiley Periodicals, Inc. *Head Neck* **37:** 743–745, 2015

KEY WORDS: transoral robotic surgery (TORS), carbon dioxide laser, hypopharyngeal cancer, carbon dioxide (CO_2)

INTRODUCTION

The overall survival rate and prognosis for hypopharyngeal cancer is relatively poor in spite of aggressive combined modality treatment. There has been no significant change in the survival rate for decades and no consensus yet about the best treatment modality.[1] Recent studies demonstrate the feasibility of minimally invasive surgical approaches in the treatment of hypopharyngeal cancers with promising oncologic and functional outcomes.[2,3] Transoral robotic surgery (TORS) has emerged as a novel procedure for the resection of hypopharyngeal cancers.[3] In addition, there are several studies describing the use of transoral robot-assisted carbon dioxide (CO_2) laser surgery (TORS-L) in upper aerodigestive tract cancers.[4–6] Potential benefits of TORS-L over TORS with electrocautery are precise resection with protection of margin for further analysis, minimal thermal injury, and postoperative edema.[5,6] The purpose of this article was to illustrate TORS-L for hypopharyngeal cancers.

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Patient information

As an example, we chose 1 patient to demonstrate the technique. A 59-year-old man with a history of a hypopharyngeal lesion on the left side was found to have squamous cell carcinoma on biopsy. The lesion was approximately 1 cm in greatest dimension and <0.5 cm in depth. It was located on the lateral hypopharyngeal wall, left and inferior to the epiglottis (see Figure 1). True vocal cords were mobile. There was no lymphadenopathy on imaging or physical examination. This T1N0M0 cancer underwent TORS-L hypopharyngectomy with concurrent bilateral neck dissections under an institutional review board approved clinical trial.

Surgical technique

In addition to conventional surgical indications, the preferred patients for TORS-L should have mobile vocal cords, with at least one intact arytenoid cartilage, and adequate transoral exposure. Patients with insufficient transoral view and/or involvement of thyroid cartilage or prevertebral fascia should be excluded.

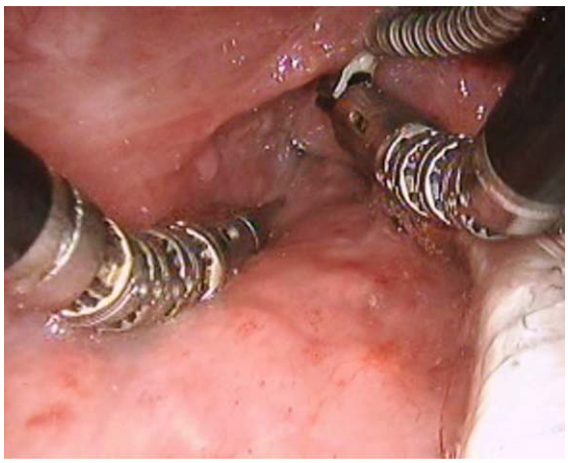

FIGURE 1. The view of a 1-cm lesion located on the lateral hypopharyngeal wall. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

Patient positioning and transoral exposure. TORS was performed with the patient under general anesthesia using the da Vinci SI Surgical System (Intuitive Surgical, Sunnyvale, CA). Nasotracheal intubation was achieved with a laser safe tube. A Feyh–Kastenbauer retractor (Gyrus ACMI, Southborough, MA) was used to establish transoral exposure. The optimal transoral view was obtained with a 3 to 4 cm vertical mouth opening without deteriorating horizontal vision.

Robot docking and laser settings. The daVinci SI Surgical System was positioned on the patient's right side. A 30-degree robotic camera was placed in the midline. A Maryland dissector was placed on the left arm and CO_2 laser fiber threaded into flexible coil (OmniGuide, Cambridge, MA) was installed on the right arm via needle driver. The laser was used in pulse mode (0.1 ms pulses) at a power range of 10 to 14 W. The approximate working distance between the laser fiber and the tissue was 10 to 15 mm.

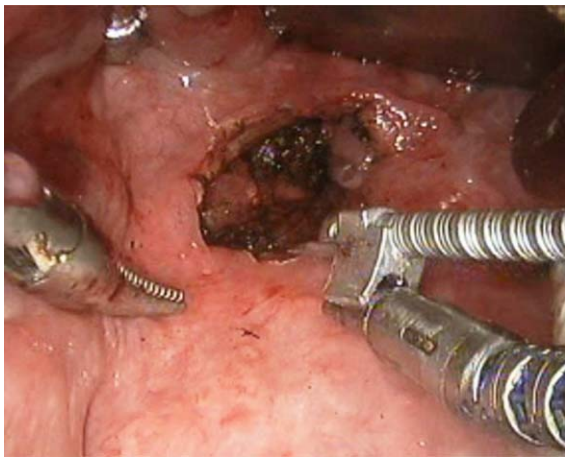

FIGURE 3. The view of surgical field after complete tumor excision. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

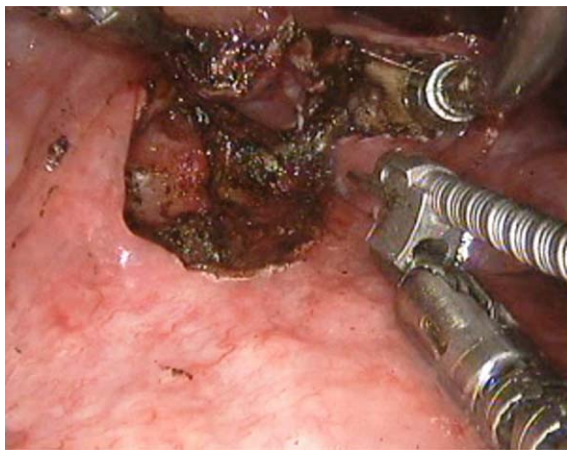

FIGURE 2. The release of the specimen from deep attachments. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

An assisting surgeon was available at the surgical field with a baby Yankauer suction in hand to assist dissection, as well as smoke and blood evacuation. Medium sized hemiclips and a suction bovie were kept within the assistant's grasp in case of brisk bleeding.

Transoral robotic resection. The procedure started using the CO_2 laser to make cuts around the lesion, giving at least 10 mm visual margins. Then the incision was deepened laterally through the pharyngeal constrictor muscles but staying medial to the parapharyngeal structures. The constrictors were included in the specimen forming the deep margin. The specimen was released from the lateral and posterior pharyngeal walls (see Figure 2). En bloc resection was completed after excising the tumor from inferior and medial (laryngeal) attachments (see Figure 3). Because the lateral surgical margin was determined to be close on gross specimen evaluation, it was re-resected to ensure clear margins. Hemostasis was achieved with suction bovie and cautery. Blood loss was minimal.

Closure. The surgical bed was then irrigated and inspected for any bleeding. Tissues were taken for biopsies from the surgical margins and sent for frozen section analysis. The daVinci robot was undocked and the Feyh–Kastenbauer retractor was removed. The patient was then prepped and draped for bilateral neck dissection. Negative surgical margins were confirmed before the end of the surgery.

The patient was safely extubated and transferred to recovery. He tolerated oral diet within the first 24 hours. No gastrostomy or tracheostomy tube placement was required.

CONCLUSIONS

TORS-L hypopharyngectomy is a safe and feasible procedure for the resection of selected hypopharyngeal tumors.

REFERENCES

1. Chan JY, Wei WI. Current management strategy of hypopharyngeal carcinoma. *Auris Nasus Larynx* 2013;40:2–6.

2. Martin A, Jäckel MC, Christiansen H, Mahmoodzada M, Kron M, Steiner W. Organ preserving transoral laser microsurgery for cancer of the hypopharynx. *Laryngoscope* 2008;118:398–402.
3. Park YM, Kim WS, De Virgilio A, Lee SY, Seol JH, Kim SH. Transoral robotic surgery for hypopharyngeal squamous cell carcinoma: 3-year oncologic and functional analysis. *Oral Oncol* 2012;48:560–566.
4. Remacle M, Matar N, Lawson G, Bachy V, Delos M, Nollevaux MC. Combining a new CO_2 laser wave guide with transoral robotic surgery: a feasibility study on four patients with malignant tumors. *Eur Arch Otorhinolaryngol* 2012;269:1833–1837.
5. Desai SC, Sung CK, Jang DW, Genden EM. Transoral robotic surgery using carbon dioxide flexible laser for tumors of the upper aerodigestive tract. *Laryngoscope* 2008;118:2187–2189.
6. Solares CA, Strome M. Transoral robot-assisted CO2 laser supraglottic laryngectomy: experimental and clinical data. *Laryngoscope* 2007;117: 817–820.