Safety and efficacy of concurrent neck dissection and transoral robotic surgery

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ABSTRACT: *Background.* The literature is scarce regarding transoral robotic surgery (TORS) with simultaneous neck dissection. This study evaluates the safety and efficacy of concurrent neck dissection in oropharyngeal squamous cell carcinoma (SCC) treated with TORS.

Methods. Analysis of 113 patients with oropharyngeal SCC treated with TORS and concurrent neck dissection.

Results. Six intraoperative communications between the pharynx and neck region were recognized. After pharyngeal mucosal flap advancement, 1 defect was closed primarily and another one was reinforced with acellular dermal matrix. In 1 case, submandibular gland was transposed posteriorly over the sutured defect as a support. One omohyoid and 2 digastric muscular pedicle rotation flaps were used in the remaining 3 patients for the reconstruction of pharyngeal communications. None of the patients developed postoperative pharyngocutaneous fistula.

Conclusion. The advantage of TORS oropharyngectomy, when compared with open approaches, is the avoidance of pharyngocutaneous fistula even in the presence of concurrent neck dissection © 2015 Wiley Periodicals, Inc. *Head Neck* **38**: E519–E523, 2016

KEY WORDS: transoral robotic surgery, oropharyngeal carcinoma, concurrent neck dissection, pharyngocutaneous fistula, squamous cell carcinoma

INTRODUCTION

The epidemiology, diagnosis, and treatment of oropharyngeal cancers are in a period of transition. New imaging techniques are making early diagnoses more common, and new treatment modalities are proving to have roles in the management of these cases. The optimal treatment of oropharyngeal squamous cell carcinoma (SCC) remains controversial and continues to evolve with transoral surgery, which provides a minimal invasive surgical option in appropriately selected patients.[1–3] Transoral surgical techniques have been developed to reduce the morbidity of conventional surgery and preserve postoperative organ function.[4] Transoral robotic surgery (TORS), a minimally invasive method, allows for a more precise operation with lower morbidity because it proceeds through the natural oral cavity without making an external skin incision.[5,6]

Cervical lymph node metastasis is an important prognostic factor in patients with head and neck squamous cell carcinomas (SCCs). Appropriate management of neck lymph nodes is vital to maximize locoregional control and overall survival. Neck dissection is an effective procedure for treating occult and clinically evident neck metastasis.[7,8] One of the main goals in neck dissection is to remove cervical lymph nodes involved in metastasis or at risk while preserving the normal anatomic structures. Our practice has been to perform concurrent neck dissection at the time of primary surgery of oropharyngeal carcinoma.

We carried out this study to analyze our institutional data regarding TORS with concurrent neck dissection and to evaluate the safety and efficacy of this approach in patients with oropharyngeal SCC.

MATERIALS AND METHODS

Institutional review board approval was obtained from The Ohio State University Office of Responsible Research Practices. Patients were identified from the prospective TORS trial studying clinical and quality of life outcomes. Among 181 patients who underwent TORS, a total of 113 patients had TORS oropharyngectomy between 2008 and 2013. All the selected patients had transorally resectable oropharyngeal SCC based on predictive imaging and physical examination. Patients with infiltrative diseases to the major vessels of the neck, pterygoid musculature, skull base, mandible, hyoid, and deep tongue muscles, or patients with a major communication between the primary tumor site and the neck at images were excluded. Patient data was retrieved from operative dictations, final pathology reports, hospital progress notes,

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TABLE 1. Pathologic information.

Disease characteristic	No. of patients	(%)
pT classification	107	
T1	43	40.2
T2	54	50.4
T3	8	7.5
T4	2	1.9
pN classification	113	
N0	12	10.6
N1	13	11.5
N2a	32	28.3
N2b	42	37.2
N2c	7	6.2
N3	7	6.2
pOverall stage	107	
I	7	6.6
II	4	3.7
III	12	11.2
IVa	76	71
IVb	8	7.5
HPV status	102	
HPV positive	75	73.5
HPV negative	27	26.5
p16 status	102	
p16 positive	88	86.3
p16 negative	14	13.7

Abbreviations: pT, pathologic tumor classification; pN, pathologic node classification; HPV, human papillomavirus; p16, cyclin-dependent kinase inhibitor 2A.

and all subsequent visit documentation via the head and neck multidisciplinary team. All reviewed medical records had appropriate documentation regarding the presence, absence, or development of a pharyngocervical connection.

All patients underwent TORS resection of their oropharyngeal SCC. The tumors were exposed with the aid of the Feyh–Kastenbauer retractor (Gyrus ACMI, Southborough, MA). Utilization of the da Vinci surgical robot (Intuitive Surgical, Sunnyvale, CA) aided in oropharyngeal tumor extirpation via techniques described previously by Weinstein et al[2] and Hurtuk et al.[9] The superior pharyngeal constrictor muscle was resected in conjunction with the tumor, and, when oncologically feasible, the buccopharyngeal fascia was not disrupted. Negative margins were confirmed in all patients via frozen section analysis, and no attempts at transoral robotic resection were aborted in favor of alternative approaches. The robotic resected tonsillar primary tumors and unilateral tongue base tumors were coupled with ipsilateral neck dissections. Base of tongue malignancies extending across the midline and clinically evident contralateral necks were paired with contralateral selective neck dissections. After neck dissection, the neck wound was carefully examined for any communication with the pharynx by direct visualization. Any identified defect was repaired, the wound was irrigated, and drains were placed appropriately (away from the parapharyngeal sites to avoid active negative pressure to this region). The neck wound was closed primarily.

After surgery, antibiotics were continued for 7 days. An oral diet was started 3 to 5 days postoperatively after the removal of all drains.

TABLE 2. Clinical nodal staging.

cN classification	113	
N0	18	15.9
N1	11	9.7
N2a	33	29.2
N2b	38	33.7
N2c	8	7.1
N3	5	4.4

Statistical methods

The analyses were performed using the SPSS 16.0 software (SPSS, Chicago, IL). Survival probability was calculated using Kaplan–Meier analysis with comparisons by Wilcoxon test. Pearson's chi-square test and Fisher's exact test were used in the analysis of other clinical data. Any p value $< .05$ was considered statistically significant.

RESULTS

A total of 113 patients underwent TORS for oropharyngeal SCC with concurrent neck dissection at the same surgical setting between 2008 and 2013. Ninety-one patients (80.5%) were men and 22 (19.5%) were women. The mean age at surgery was 58 years (range, 39–81years). Eighty-three patients (73.5%) were current or former smokers. Average follow-up time was 35.6 months (range, 6.2–69.1 months). Patient and tumor details are summarized in Table 1.

After conclusion of the robotic part, 97 unilateral (85.8%) and 16 bilateral (14.2%) neck dissections were performed. The type of procedure on the ipsilateral side in 95 patients (84.1%) was selective or modified radical type III neck dissection. Only 1 patient (0.9%) required radical neck dissection. The remaining 17 cases (15%) underwent level I to V neck dissection with preservation of at least one nonlymphatic structure. Selective neck dissection was preferred on contralateral necks. Clinical nodal staging is provided in Table 2. The most commonly preserved nonlymphatic structure was accessory nerve (111 cases; 98.2%). Sternocleidomastoid muscle and internal jugular vein were protected in 107 patients (94.7%) and 97 patients (85.8%), respectively. The external carotid artery was involved by tumor and ligated unilaterally in 5 cases. None of the patients had injury or ligation of the internal carotid artery. In 81 patients (71.7%), level I lymph nodes were included in the neck dissection. Six of them had positive level I lymph nodes. The submandibular gland was generally preserved, except 2 cases, during level IB neck dissections in our series. Neck dissection details are summarized in Table 3.

TABLE 3. Details of neck dissections.

Level of lymph nodes included in neck dissection	No. of patients
Level 1–5	56
Level 1–4	25
Level 2–5	8
Level 2–4	24

TABLE 4. Management of intraoperative communications.

Age, y/sex	T	N	Stage	Repair technique
56/male	T2	N2b	4a	Primary closure
54/male	T4	N3	4b	Primary closure with Alloderm reinforcement
52/male	T2	N2b	4a	Submandibular gland transposition
56/male	T2	N2c	4a	Rotational flap with anterior belly of digastric muscle
53/male	T2	N2a	4a	Rotational flap with posterior belly of digastric muscle
55/male	T2	N2a	4a	Rotational flap with omohyoid muscular pedicle

After removal of the specimens, the neck was irrigated and inspected for bleeding, chyle leak, and intraoperative communication. Six intraoperative communications between the pharynx and neck region were recognized. After pharyngeal mucosal flap advancement, 1 defect was closed primarily and another was reinforced with acellular dermal matrix (AlloDerm; LifeCell, Bridgewater, NJ). In 1 case, the submandibular gland was transposed posteriorly over the sutured defect as a support. One omohyoid, 1 anterior belly of digastric, and 1 posterior belly of digastric muscular pedicle rotation flaps were used in the remaining 3 patients for the reconstruction of pharyngeal communications. None of the patients developed postoperative pharyngocutaneous fistula. Before neck closure, patients were checked for chyle leak with Valsalva maneuver, performed by the anesthesia team. Only 1 patient had intraoperative chylous fistula. This was repaired using sternocleidomastoid muscle rotation flap. Management of the intraoperative communications details are given in Table 4. All patients were discharged home on a full oral diet without any patient requiring nasogastric feeding during their hospital stay.

DISCUSSION

Most of oropharyngeal tumors originate in the tonsils and base of tongue, and more than 90% of oropharyngeal cancers are SCCs.[10] Approximately 136,622 cases of oropharyngeal cancer are registered annually worldwide and its frequency is rising. In the United States, 13,590 new cases were estimated in 2013.[11] According to the National Cancer Data Base, upfront surgical ablation of oropharyngeal neoplasia followed by radiation therapy yields a survival benefit compared to chemoradiation or radiation alone.[12] An ideal treatment for oropharyngeal carcinoma would result in high locoregional and distant control rates, and minimize treatment time, cost, and morbidity. Transoral resection of the primary tumor, accompanied by neck dissection with or without adjuvant therapy based on the overall stage and extent of the disease, is an approach that attempts to accomplish these goals in selected patients.

TORS is a minimally invasive method allowing for a more precise operation with lower morbidity in treatment of oropharyngeal SCC.[13,14] The surgical treatment of oropharyngeal carcinoma frequently involves neck dissection to obviate locoregional metastases, but many surgeons hesitate to perform concurrent neck dissection because of the risk of postoperative pharyngocutaneous fistula development.[15] Postponing the neck dissection as a staged surgery may have some other advantages, such as allowing the surgeon another opportunity to address positive primary site tumor margins recognized on final pathology, reducing the need for tracheostomy secondary to laryngopharyngeal edema. Although these opinions are acceptable to some extent, staged neck dissection has some apparent disadvantages, such as putting the patient through an additional general anesthesia, increasing the cost of therapy with additional hospitalization, and potentially delaying the time of possible adjuvant therapy.

Neck dissection has evolved during the last 4 decades from a radical approach in which all of the lymph nodes were resected, to a more selective approach in which only the at-risk lymph nodes are resected. In light of this trend toward more conservative and individually tailored surgery, the question arises whether it is required to remove the submandibular gland in neck dissection. If the submandibular gland is directly invaded by the primary tumor or by adjacent metastasis, there is no question to remove the gland in continuity with the primary tumor or the adjacent metastasis. An additional reason to excise the gland may be metastasis in the gland itself. However, metastasis to the submandibular gland from primary sites through hematogenous route of spread is extremely rare.[16–18] The submandibular gland has a unique structure and its capsule displays resistance against tumor invasion. It is technically feasible to remove all lymph nodes within sublevel IB without routinely sacrificing the gland.[19] Dissecting only the capsule of the gland with the surrounding lymph nodes would not compromise oncologic outcomes.[19,20] Preservation of the gland reduces the risk of orocervical defect in the upper neck, and lowers the risk of injury to the lingual and hypoglossal nerves.[20] Our decision of submandibular gland resection was determined during the operation with the help of inspection and frozen sections, rather than preoperative planned gland resection.

The literature contains reports of transoral resection of oropharyngeal neoplasms via various modalities with simultaneous neck dissection.[14,21] Howard et al[21] reported on 253 patients who underwent transoral oropharyngectomy with concurrent neck dissection. Of these, 96 patients underwent ipsilateral submandibular gland preservation and 157 underwent ipsilateral submandibular gland removal at the time of neck dissection. The prevalence of intraoperative communication between the neck and oropharynx was significantly lower in cases with submandibular gland preservation (2 of 96; 2.08%) compared with those with submandibular gland removal (22 of 157; 14.13%). No postoperative fistula developed in the gland preservation group (0 of 96; 0%) compared to a fistula prevalence of 8.92% (14 of 157) when the gland was

removed ($p = .0041$). The literature is scarce regarding TORS with simultaneous neck dissection. Moore et al[8] reported on 148 patients treated for oropharyngeal SCC with TORS and concomitant neck dissection. All the patients underwent submandibular gland resection as a part of neck dissection. They documented 42 (29%) intraoperative orocervical communications. Of these, 6 (4%) developed a subcutaneous pharyngeal fluid accumulation requiring postoperative management.

In the current study, 113 patients underwent TORS oropharyngectomy with concurrent neck dissection with no subjects sustaining postoperative pharyngocutaneous fistula. Six intraoperative communications between the pharynx and neck region were recognized. After pharyngeal mucosal flap advancement, 1 defect was closed primarily and another was reinforced with acellular dermal matrix (AlloDerm; LifeCell). In 1 case, the submandibular gland was transposed posteriorly over the sutured defect as a support. One omohyoid, 1 anterior belly of digastric, and 1 posterior belly of digastric muscular pedicle rotation flaps were used in the remaining 3 patients for the reconstruction of pharyngeal communications. None of the patients developed postoperative pharyngocutaneous fistula. Submandibular gland preservation during neck dissection in patients with oropharyngeal SCC significantly reduces the risk of intraoperative and postoperative salivary leaks without compromising oncologic outcomes.

External carotid artery ligations in our series were all due to advanced stage (N2–3) neck disease. Even though most of the clinically positive neck lymph nodes were addressable with neck dissections with the preservation of all the nonlymphatic structures, this was not possible after intraoperative evaluation for these patients. Further studies are needed to better stratify and sequence the treatment regimens of bulky, infiltrative neck disease with small primaries.

Oropharyngeal SCCs are known to show a marked tendency of lymphatic spread, even at an early stage. On initial presentation, more than half of the patients had neck metastasis.[22,23] This present study also proved that 89.3% of patients (101 of 113) with oropharyngeal carcinoma showed neck metastasis, including 13 who were N1 (11.5%), 32 who were N2a (28.3%), 42 who were N2b (37.2%), 7 who were N2c (6.2%), and 7 who were N3 (6.2%). The mean number of total lymph nodes dissected was 31.8 and the mean number of positive lymph nodes on final pathologic review was 2.7.

The presence of a cervical node metastasis is one of the most significant prognostic factors in patients with head and neck SCC. Whether cervical lymph nodes are addressed in N0 necks depends heavily on the primary tumor site. Most controversial of those levels to address have been level I. In this study, level I involvement was detected in $<10\%$ of patients. Half of these patients showed extension of the primary T4 oropharyngeal carcinoma to the floor of the mouth. The other half demonstrated multiple adverse features, such as N3 neck disease and perineural, lymphovascular, and extracapsular invasion. Three of 6 intraoperative communications were seen in patients having level I involvement. Preservation of level I might be an option in the absence of direct tumor extension to the oral cavity and adverse histopathologic features.

The main limitations of this study include a retrospective analysis from a prospective single center clinical trial. The removal of the lymph nodes in sublevel IB seems to be feasible without removal of the submandibular gland as a strategy of conservation of this important salivary gland. However, clinical studies to verify this concept have yet to be reported. Further double-blind, controlled, and multi-institutional studies are needed to further verify these results.

CONCLUSION

Advantage of TORS oropharyngectomy, when compared with open approaches, is the avoidance of pharyngocutaneous fistula even in the presence of concurrent neck dissection. Based on our clinical experience, we assume that TORS with concomitant neck dissection is a safe, efficient, and cost-effective primary treatment modality in selected patients with oropharyngeal malignancies without compromising oncologic outcomes.

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