Selective Neck Dissection and Deintensified Postoperative Radiation and Chemotherapy for Oropharyngeal Cancer: A Subset Analysis of the University of Pennsylvania Transoral Robotic Surgery Trial

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Objectives/Hypothesis: The purpose of this study was to determine the regional recurrence rate of node-positive oropharyngeal squamous cell carcinoma (OPSCC) in patients undergoing transoral robotic surgery (TORS) and selective neck dissection (SND) followed by observation, radiation, or concurrent chemoradiation.

Study Design: A prospective, phase I, single-arm study was conducted. All OPSCC patients who voluntarily participated in a surgical trial with TORS and SND at an academic tertiary referral center from May 2005 to July 2007 were included.

Methods: Thirty-one patients with previously untreated OPSCC undergoing TORS and SND (29 unilateral and two bilateral) were included. There were 29 males and two females, with ages ranging from 36 to 76 years (median = 55 years) with one palate, one lateral wall, 17 tonsil, 11 base of tongue, and one vallecula primary tumor classified as follows: T1 (n = 9, 29%), T2 (n = 15, 48.4%), T3 (n = 7, 22.6%), N0 (n = 6, 19.4%), N1 (n = 15, 48.4%), N2b (n = 10, 32.3%), and N2c (n = 1, 3.2%). There were three stage I (9.7%), two stage II (6.5%), 15 stage III (48.4%) and 11 stage IVa (35.5%) patients. Twenty-two patients were treated postoperatively with adjuvant therapy (12 radiation alone and 12 combined radiation and chemotherapy). Primary outcome measured was regional recurrence rate.

Results: There was one regional recurrence on the contralateral, non-operated neck and one distant recurrence among the 31 patients who underwent SND.

Conclusions: SND after TORS resection of primary OPSCC enables the use of selective and deintensified adjuvant therapy to reduce regional recurrence rates.

Key Words: Chemotherapy, da Vinci surgical robot, head and neck squamous cell carcinoma, oropharyngeal squamous cell carcinoma, radiation therapy, selective neck dissection, transoral robotic surgery.

Level of Evidence: 1b

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INTRODUCTION

Neck dissection has evolved during the last four decades from a radical approach in which all of the at-risk lymph nodes were resected, as well as the sternocleidomastoid muscle, accessory nerve, and jugular vein, to a more selective approach in which only the at-risk lymph nodes are resected; the extent of the nodal resection is now tailored to the primary anatomic site. Whereas a comprehensive account of how this evolution occurred is both beyond the scope of this report and, as with all history, certainly subject to opinion, most would agree that at present, selective neck dissection (SND) is a standard option for node-positive disease; an exception would be select cases of bulky hypomobile nodal disease,

in which radical neck dissection continues to be the procedure of choice.

A preponderance of recent articles have reported on the effectiveness of SND in the postchemoradiation neck.[1–3] These studies have shed little light on the use of SND when surgery is the primary treatment. Earlier reports of SND used in conjunction with an upfront surgical approach for the primary site had focused on SND for the N0 neck.[4] More recent studies have analyzed the use of SND for node-positive neck disease. The authors of these reports advocating SND for node-positive disease have concluded that SND is a reasonable approach; their reported regional failure rates after SND for node-positive disease have varied from 5.7% in the series by Anderson et al[5] to as high as 29% in the series by Spiro et al.[6] This range (5.7%–29% neck recurrence) occurred even with the use of postoperative radiation.[5,6] A number of confounding issues exist in these studies, including 1) evaluation of multiple regions for the primary site (i.e., oral cavity, pharynx, and larynx); 2) variability in the number of nodal levels dissected within reports and between reports; 3) inconsistency in the indications for adjuvant postoperative radiation within and between reports; 4) retrospective analysis in almost all of the studies; and 5) local failure at the primary site (or no discussion of outcomes at the primary site), which begs the question of whether regional recurrence was related to inadequacy of the SND or to failure or inadequacy of the primary oropharyngeal squamous cell carcinoma (OPSCC) resection.[7,8] Finally, none of the reports in the literature have discussed the use of postoperative concurrent chemoradiation following SND.

In an effort to address these issues, we have chosen to study a population of patients who all underwent SND and had oropharyngeal carcinoma that was treated primarily with transoral robotic surgery (TORS) with the da Vinci Surgical System (Intuitive Surgical Inc, Sunnyvale, CA).[9,10] TORS utilizes a minimally invasive transoral approach to resect the primary lesion en bloc through the mouth. This population was appropriate for studying oncologic outcome following SND because in addition to having similarly treated primary lesions in one region (the oropharynx), they also had the following attributes: 1) in all patients, the surgical margins were negative at the primary site, and therefore the indications for postoperative chemoradiation were based entirely on the pathologic status of the nodes; 2) patients underwent SND that included levels II a and b, III, and IV; 3) there was only one local recurrence in this group, which means that the regional control rate for almost all patients was directly related to the adequacy of SND combined with adjuvant therapy as indicated. In addition, since this was a prospective, single-arm cohort study, the indications and type of postoperative treatment (i.e., observation, radiation, or chemoradiation) were decided at the inception of the study. The primary outcome that was evaluated in this study was regional control, and the secondary outcome evaluated were surgical complications. There was one local recurrence in the contralateral neck of a patient who did not undergo surgery; there was no local recurrence in the patients that underwent SND in our series, yielding a regional control rate in this group of 100%. The clinical benefits of the outcomes will be discussed in terms of the role of SND in the paradigm that includes TORS as the primary treatment as well as implications for future studies.

MATERIALS AND METHODS

Beginning in 2005, we prospectively screened and enrolled eligible patients with a diagnosis of head and neck squamous cell carcinoma (HNSCC) for consideration of treatment with a primary TORS approach. This phase I protocol was performed with ethics approval from the University of Pennsylvania Institutional Review Board. Eligibility criteria included subjects who 1) were a minimum of 18 years of age at the time of surgery, 2) had indications for diagnostic or therapeutic treatment for benign and malignant diseases of the head and neck, and 3) were capable of providing informed and written documented consent. Exclusion criteria included patients who 1) had a fever of unknown origin or signs of active infection at the time of surgery, 2) were pregnant at the time of treatment, 3) had been previously treated for head and neck cancer, which resulted in anatomical changes that precluded a TORS approach, 4) had a medical condition that was a contraindication for general anesthesia or a TORS approach, or 5) had upper airway anatomy that did not allow adequate visualization for a TORS approach. Of the 162 patients who were initially screened and found to be eligible for TORS, nine patients were excluded because they elected not to participate in TORS. From the 153 remaining intent-to-treat patients, three patients were excluded owing to inadequate exposure for performing TORS at the time of surgery.

Of the 150 patients who underwent TORS, 38 patients with previously untreated squamous cell carcinoma in the oropharynx voluntarily participated in treatment with TORS and SND between May 2005 and July 2007. Of the 38 patients, three were lost to follow up (phone number changed and no response to letters). The primary outcome measure was regional recurrence rate, which was determined in follow-up outpatient visits, as well as periodic radiologic evaluations that included positron emission tomography computed tomography (PET/CT), magnetic resonance imaging (MRI) with gadolinium, or CT with contrast per discretion of the surgeon. A minimum postoperative follow-up period of 18 months was required. Of the remaining 35 patients, four patients with no evidence of disease had less than 18 months of follow up. The remaining 31 patients were included in this study.

Preoperative evaluation involved clinical staging of disease by means of separate panendoscopy and/or biopsy procedures with the patient under general anesthesia. Furthermore, CT with contrast or MRI with gadolinium was performed before resection of the primary head and neck lesion. The indication for TORS and SND was a previous biopsy with results confirming OPSCC. Contraindications for SND included 1) presence of stage IVc disease; 2) inability to resect the involved lymph nodes owing to carotid artery encasement, deep neck structure involvement, or skin invasion with dermal metastasis; or 3) invasion of the sternocleidomastoid muscle, jugular vein, or accessory nerve by pathologically involved lymph nodes. Contraindications for TORS included 1) the presence of all American Joint Committee on Cancer (AJCC) TNM T4a disease with the exception of unilateral deep/extrinsic tongue muscle that did not require resection across the midline to achieve a negative margin, 2) the presence of all AJCC TNM T4b stage disease, 3) the presence of cancers that involved more than 50% of the posterior pharyngeal wall, and 4) invasion of the deep tissues

lateral to the constrictor muscles or posterior invasion of the prevertebral fascia, which may be noted radiologically but must be confirmed as fixation laterally or posteriorly on palpation. A small number of non-tumor-related contraindications were present and included 1) retropharyngeal internal carotid artery, in which the artery is located directly behind the tonsillar fossa (this was a contraindication for TORS radical tonsillectomy but not for resection of other oropharyngeal sites), 2) benign causes of trismus or other anatomic findings that preclude transoral access, 3) medical contraindications to transoral surgery in which an open wound heals by secondary intention (i.e., need for chronic anticoagulation), and 4) medical conditions that precluded general anesthesia. A percutaneous endoscopic gastrostomy (PEG) was placed if prolonged dysphagia was anticipated. Preoperative functional status was assessed by using the Karnofsky score, and overall health status was determined by means of the Charlson comorbidity index before treatment. All patients were evaluated preoperatively by speech language pathologists. The operative details of TORS have been described elsewhere.[9,10]

SND was performed in all 38 patients 1 to 3 weeks following TORS. Generally, lymph nodes in levels I through IV were dissected on the ipsilateral side of primary tumor involvement. However, in our series there was some variability in the nodal levels resected; this variability was a reflection of both the diversity of opinion that presently exists in the literature concerning which levels should be resected for oropharyngeal carcinoma, as well as the judgment and discretion of the treating surgeon.[11–15]

Postoperative Adjuvant Therapy

Patients considered to be high risk, based on established criteria, were offered postoperative radiation therapy (RT) and/or chemotherapy.[16–18] The typical high-risk features that warranted adjuvant concurrent chemoradiation with cisplatin included 1) the presence of a positive surgical margin or a close or questionable surgical margin (< 2 mm) at the primary site and 2) the presence of extracapsular extension (ECE). The presence of more than three pathologically positive nodes was not an absolute indication to consider adjuvant concurrent chemoradiation, but this treatment was discussed as an option with the patients who had multiple positive lymph node metastases or suspected ECE. The prescribed dose and schedule of cisplatin was 100 mg/m^2 every 3 weeks administered typically on days 1, 22, and 43 of the radiation schedule. The main indication for neck radiotherapy alone typically was metastatic involvement of more than one node without the presence of ECE.

A coplanar intensity-modulated RT (IMRT) treatment plan using a simultaneous in-field boost prescription has been used in all patients radiated at the Hospital of the University of Pennsylvania since 2003. Technically, the planning target volumes were all encompassed in the IMRT fields, which typically used a coplanar arrangement of six to seven beams. No low anterior neck fields were matched to the IMRT fields. Patients treated postoperatively were typically prescribed 30 daily fractions. Any at-risk areas identified per the operative findings were typically encompassed in the planning target volume (PTV) that was prescribed 54 Gy at 1.8 Gy per day (PTV54). The target volume may have included the contralateral neck or possibly the retropharyngeal lymph nodes if they were deemed to be at risk following surgical and pathologic evaluation. The surgical bed either in the primary site or in the dissected neck was encompassed in the PTV60 that was prescribed at 2 Gy per day. Because the TORS program was just beginning and this was an evolving surgical skill set, postoperative radiotherapy was recommended for all patients, including patients with no pathologic adverse features such as a negative surgical margin

(the institutional definition is >2 mm). If there were pathologic risk factors that deemed the surgical bed to be high risk based on validated risk stratification schemas, the corresponding regions in the surgical bed were encompassed in PTV63 that was prescribed at 2.1 Gy per day. Findings of a positive surgical margin or presence of extracapsular extension including pathologic involvement of the sternocleidomastoid muscle were encompassed in PTV66 that was prescribed at 2.2 Gy per day.[16–18]

Statistical Analysis

Relapse-free survival (RFS), disease-free survival (DFS), and overall survival (OS) were estimated with the Kaplan-Meier method and compared with the log-rank test where indicated. The proportional hazards model was used to adjust for one or more variables simultaneously when assessing RFS. The Fischer exact test was used to compare two groups with respect to a dichotomous endpoint.

RESULTS

Patient Population

Of the 38 subjects eligible and enrolled for this analysis, three patients who were lost to follow up (changed phone numbers and did not respond to letters) and four patients who had no evidence of disease postoperatively but had less than the minimum 18 months of follow up were excluded. Of the remaining 31 patients, the median follow-up time was 24 months (19–44 months) with a minimum of 18 months follow up achieved for all subjects. Patient age, sex, tumor site, and TMN stage are summarized in Table I. Twenty-nine patients had no evidence of disease recurrence at the conclusion of the study. One patient was living with disease, and one died of other causes (multiple myeloma 106 days after TORS). Because there were no deaths related to OPSCC and there was one death from other causes, it was not possible to create a disease-specific or OS curve. The DFS curve reveals three events, one death from other causes, and two cases of recurrence (one of the patients was treated and now has no evidence of disease) (Fig. 1).

TORS

The majority of patients (22 of 31 patients) underwent a separate panendoscopy procedure, and all patients underwent biopsy before TORS. Surgery was successfully performed in all patients; the mean overall operative time for TORS was 2 hours 53 minutes (range, 1 hour 9 minutes to 5 hours 1 minute), including the duration of exposure, robotic positioning, specimen orientation, and frozen section. No surgeries were converted to nonrobotic procedures, and there were no intraoperative complications.

SND and Pathologic Findings

All patients successfully underwent SND. A total of 33 SND procedures were performed in 31 patients with HNSCC. Twenty-nine patients had ipsilateral neck dissection of the primary tumor, and two patients underwent bilateral SND (lymph node levels I–IV were resected, but the sternocleidomastoids (SCM), jugular

TABLE I. Patient Characteristics*	
Characteristic	Patients, No. (%) N = 31
Sex	
Male	29 (93.5)
Female	2 (6.5)
Primary tumor site	
Palate	1 (3.2)
Lateral wall	1 (3.2)
Tonsil	17 (54.8)
Base of tongue	11 (35.5)
Vallecula	1 (3.2)
Clinical tumor classification	
T1	9 (29)
T2	15 (48.4)
T3	7 (22.6)
Clinical neck classification	
N0	6 (19.4)
N1	14 (45.1)
N2b	10 (32.3)
N2c	1 (3.2)
Stage	
I	3 (9.7)
II	2 (6.5)
III	15 (48.4)
IVa	11 (35.5)
Karnofsky score (%)	
0–60	0 (0)
70	0 (0)
80	7 (22.6)
90	15 (48.4)
100	9 (29.0)
Charlson comorbidity index	
0	13 (41.9)
1	13 (41.9)
2	2 (6.5)
3	2 (6.5)
4	1 (3.2)

*Patients ranged in age from 36 to 76 years; median age, 55 years.

veins, and accessory nerves were spared). The majority of patients had levels I through IV dissected (Table II).

Twenty-nine patients had invasive squamous cell carcinoma, and two had basaloid squamous cell carcinoma. Pathologic differentiation level, margins, and extracapsular spread (ECS) are summarized in Table III; 29% of patients had ECE findings in their neck dissection specimen. Table IV contrasts the clinical and the pathologic staging of the neck. With increasing clinical neck stages, there was an increasing rate of pathologic upstaging. The pathologic upstaging for clinical N0 and N1 cancerswas 33% and 43%, respectively. More significantly, 70% of patients with N2b disease had ECE, compared to 14% in the clinical N1 neck group. Moreover, four of 14 clinically N1 neck cases had negative pathologic results.
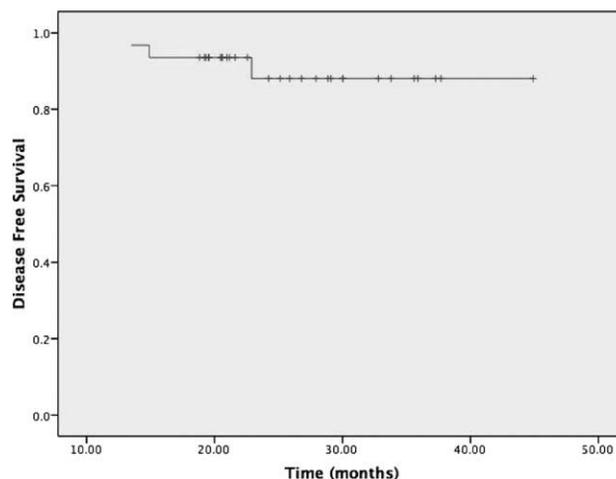

Fig. 1. Disease-free survival Kaplan-Meier curve.

Adjuvant Therapy

Seven patients (four patients with clinical N0 disease, two patients with clinical N1 disease, and one patient with clinical N2b disease) who had negative margins at the primary site and no evidence of ECE received no adjuvant therapy (22.6%). RT was recommended for one patient with clinical T2N0 disease but was found to have two positive neck nodes on the pathology report and for one patient with clinical T3N1 disease who was found to have two positive neck nodes on pathology; however, the two patients refused RT. Another patient with clinical T3N1 disease and negative pathology findings was offered RT, but the patient elected not to have adjuvant therapy. Overall, 24 patients received adjuvant therapy postoperatively with either radiation alone (n = 12, 50%) or concurrent radiation and chemotherapy (n = 12, 50%).

Outcomes

There was one regional recurrence in the contralateral neck which was treated with radiation and not surgery, of a patient who had clinical T2N1 (stage III) disease and underwent SND of node levels I through IV. Although he had negative margins and no evidence of ECS, he was found to have seven positive nodes; therefore, he was pathologically upstaged to N2b. He was also treated with chemoradiation therapy before recurrence. Of note, this patient with the contralateral neck recurrence was found to have a local primary recurrence 6 months from the time of his original TORS that was discovered on PET CT, which had been performed every 3

TABLE II. Selective Neck Dissection (SND).	
SND Combination	Patients, No. (%) N = 31
I–III	4 (12.9)
II–IV	3 (9.7)
I–IV	22 (71)
Bilateral I–IV	2 (6.5)

TABLE III.
Pathologic Findings.

Pathology	Patients, No. (%) N = 31
Differentiation level	
Well	1 (3.2)
Moderate	11 (35.5)
Moderate to poor	6 (19.4)
Poor	12 (38.7)
Unknown	1 (3.2)
Margins	
Negative	31 (100)
Positive	0 (0)
ECS	
No	22 (71)
Yes	9 (29)

Fig. 2. Relapse-free survival Kaplan-Meier curve.

months postoperatively. The local recurrence was treated by means of a laser (scarring and edema precluded a second use of TORS in this case); approximately 3.5 months later, a neck recurrence was found in the contralateral, non-operated neck for which radical neck dissection was performed. Both of these recurrences were within the irradiative prescribed radiation volumes including the contralateral neck.

In addition to the one patient with regional recurrence, one patient was found to have distant recurrence was living with disease at the conclusion of the study. The RFS curve reveals two patients who had OPSCC recurrence and demonstrates disease control (Fig. 2).

Complications

There were no deaths related to surgery, adjuvant radiation, or chemotherapy. There were no intraoperative complications.

TABLE IV.
Contrasting Clinical and Pathologic Neck Findings.

Clinical Neck Stage	Number of Pathologically Positive Nodes Resected	Patients With ECS ECS/Total)
N0	0 (n = 4)	0/6
	2 (n = 1)	
	4 (n = 1)	
N1	0 (n = 4)	2/14
	1 (n = 4)	
	2 (n = 3)	
	3 (n = 1)	
	4 (n = 1)	
	7 (n = 1)	
N2b	2 (n = 3)	7/10
	3 (n = 1)	
	4 (n = 2)	
	5 (n = 2)	
	16 (n = 1)	
	1 large mat at level III (n = 1)	
N2c	1 (n = 1)	0/1
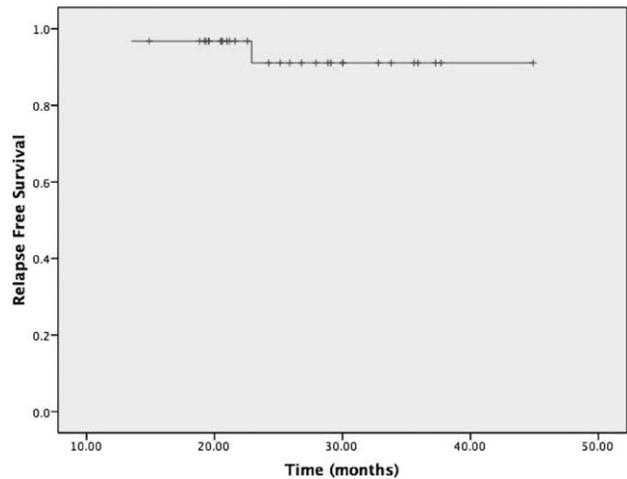
DISCUSSION

The rationale for performing SND is based on the recognition that fascial planes separate the lymphatic structures of the neck from the nonlymphatic structures, such as the muscles, vessels, and nerves. The presence of these planes facilitates the removal of the lymphatics from the rest of the neck in an oncologically sound but function-preserving manner under specific circumstances. In the past, SND was reserved for the N0 neck, but as experience has evolved, increasing numbers of reports have suggested that SND may also be useful for the clinically involved neck under specific circumstances.[5,7,19,20] The use of SND is particularly attractive for the treatment of OPSCC, as the risk of occult level V disease has been reported to be low, especially for N1-2a disease limiting the risk of shoulder complications.[21,22]

In general, the rates relapse for SND are typically in the range of 5% to 29% when combined with postoperative adjuvant radiotherapy.[5,6] Risks of neck recurrence without postoperative radiotherapy may be as high as >20% for pN2 disease and may decrease to approximately 10% with adjuvant postoperative radiation alone, even for pN2/N3 disease and the presence of ECE.[7,23] Previously reported series have not utilized postoperative concurrent chemoradiotherapy. In our series, there was one neck recurrence in the contralateral opposite neck in the one patient with local recurrence. Otherwise, none of the patients with local disease control had failure in the neck; thus the regional control rate following SND was 100%. These results were achieved despite the presence of ECE in 29% of our patients and pN2b neck disease in 61% (19 of 31 patients). We suspect that the high rate of control may also reflect the selective use of concurrent chemotherapy and the consistent dissection of level IV nodes, as well as the fact that there was only one local recurrence. The incremental disease control in the neck following SND that is suggested by these results has not been described in past published experiences.

The criteria for omitting postoperative radiotherapy have not been clearly delineated, although the risk has been reported to be <5% for pN1 disease and for lymph

nodes <3 cm.[7,19] The consensus among experts is that it is unclear whether SND alone is sufficient treatment for limited metastatic nodal disease without extracapsular spread or if the therapeutic efficacy of SND depends on the use of postoperative radiation.[24] Our results do suggest that select patients with clinical low-risk N0-1 disease confirmed pathologically may be observed.

These issues are important considerations in the ongoing efforts to develop risk-adapted therapies, especially deintensified treatment regimens for favorable groups, such as human papilloma virus–associated OPSCC.[25–27] When combined with an effective organ-preserving surgical approach to the primary site such as TORS, the combined pathologic risk stratification allows one to risk-adapt or deintensify the adjuvant therapy. Deintensification of adjuvant radiation or chemoradiation offers the potential benefit of reducing the significant long-term swallowing dysfunction that has been reported with an upfront concurrent chemoradiation approach.[28,29] The results of our subset analysis of the prospective TORS study reported herein demonstrate that a significant proportion of patients benefited from surgical staging of the neck. The use of SND in conjunction with TORS for OPSCC allowed us to determine that 86% of patients with N1 disease and 30% of patients N2 disease did not have ECE and therefore could avoid chemotherapy altogether. Without the benefits of surgical neck staging, concurrent chemotherapy would have been recommended based on the clinical neck staging for all of these patients. In addition, 29% (four of 14) of the N1 patients were able to avoid radiation or any adjuvant therapy. In our TORS and SND treatment paradigm, the ability to provide deintensified postoperative adjuvant therapy may be the key factor in our 2-year PEG dependency rate of 0% (which we have reported elsewhere), despite the potential for advocating a trimodality therapy when an upfront TORS plus SND approach is used for OPSCC.[30] In contrast, the 2-year PEG dependency rate was 9.1% in patients treated at the University of Pennsylvania with an upfront nonsurgical treatment approach using an IMRT technique.[30] Previously, the PEG complication rate was reported to be 14% with nonconformal chemoradiation approaches (University of Pennsylvania series).[31]

The da Vinci robotic surgical system is a master-slave robotic unit in which the surgeon sits at a console and views a high-quality three-dimensional video image; the surgeon controls miniaturized instruments in the pharynx with handheld manipulators on the console. The Federal Drug Administration recently approved the da Vinci Surgical System for use in selected malignancies and all benign lesions of the oral cavity, pharynx, and larynx. There may be several explanations for why a TORS plus SND approach may help successfully reduce the risk of late treatment-related swallowing complications. One reason may be the selective recommendation of concurrent chemotherapy that has been shown to be an independent risk for late swallowing complications.[28,32] Both the volume and dose of irradiation to the pharyngeal constrictor muscles and to the laryngopharynx have also been shown to increase the risk of swallowing complications.[28,29,32] In our TORS and SND treatment

paradigm, we are able to reduce the volume and dose to the oropharynx as per our operative findings and final pathology interpretation. The surgical findings and pathologic information acquired after TORS and SND have allowed us to prescribe risk-appropriate lower doses of radiation to sites as indicated and also selective higher doses given to higher risk limited volumes in the neck. Hence, the surgical staging allows adjuvant therapy deintensification through volume directed irradiation limiting the dose to the swallowing organs. As another potential benefit, the amount of exposed tissue at risk for primary tumor seeding is much reduced when a TORS procedure followed by a staged SND is used as opposed to traditional open primary surgery or concurrent primary resection and neck dissection surgical approaches. Finally, the need for bilateral neck irradiation has also been identified as a risk factor for long-term swallowing dysfunction.[28] The surgical staging of the neck with TORS and SND allows for the possibility of treatment to only one side of the neck.

Although this was a prospective study, the main focus of standardization of technique in the original study was on TORS rather than the type of neck dissection. When a new technique such as TORS is developed, standardization is the norm, but when dealing with a older technique such as neck dissection, it is much harder to gain consensus as to which approach as optimal, even among members of one institution. The decision as to which type of neck dissection to perform was left to the discretion of individual surgeons; given the varying opinions in the literature concerning which lymph node levels are best resected for oropharyngeal carcinoma, it is not surprising that differences existed among our own surgeons as well. It is also our contention that despite the best efforts to achieve accuracy by both surgeon and pathologist, the borders between the various neck levels are somewhat nebulous. Therefore, both during the dissection as well as in the pathology laboratory after the resection, accuracy in labeling the various levels of a neck dissection is subject to variability. Given the potential inconsistency in accurate assessment of the borders between nodal levels and because the highest risk nodal levels for oropharyngeal carcinoma are levels IIa and III, it is reasonable to remove the nodal levels that surround the high-risk levels (levels I, IIb, and IV). This approach makes particular sense for the patients with clinical N0 and N1 disease because the goal may be to perform surgery alone, and the surgeon must have a high degree of confidence that there is no microscopic disease in the surrounding nodal levels. Given the positive findings of our study, as well as the fact that in approximately 90% of patients in our series either level I or level IV lymph nodes resected with low morbidity, there is now greater consensus in our group; our approach has evolved to treating patients with oropharyngeal carcinoma by resecting nodal levels I through IV.

CONCLUSION

In summary, the 100% control rates in TORS patients who underwent SND as well as the 0% 2-year

PEG dependency rate strongly support the idea that a risk-adapted or deintensified adjuvant therapy approach is successful in the management of OPSCC.[30] The selective use of concurrent chemoradiation therapy and the dissection of nodal levels I–IV may further contribute to the absence of any relapses. The new treatment paradigm of TORS and SND followed by deintensified adjuvant therapy holds promise for improving the outcomes of patients with OPSCC and warrants further investigation and expansion to other sites in a multi-institutional study.

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