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Outcomes of transoral robotic surgery: a preliminary clinical experience

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Abstract

Objective—To report long-term, health-related quality of life (HRQOL) outcomes in patients treated with transoral robotic surgery (TORS).

Study Design—Prospective clinical study on functional and HRQOL outcomes in TORS.

Setting—University tertiary care facility.

Subjects—Patients who underwent TORS at The Ohio State University Medical Center.

Methods—All patients undergoing TORS were asked to complete the Head and Neck Cancer Inventory before treatment, and at 3 weeks, 3, 6, and 12 months postoperatively. Demographic, intraoperative, clinicopathological, and follow-up functional data were collected for each patient.

Results—Sixty four patients who underwent TORS were enrolled with a median age of 56.8years. A total of 113 TORS procedures were performed. Mean follow up time was 16.3 ± 7.49 months (range 6 to 33). Majority of TORS were performed for squamous cell carcinoma (88%). No patients experienced immediate postoperative complications, with all of the patients tolerating an oral diet without any airway compromise on the day of surgery. There was a decrease from baseline in the speech, eating, aesthetic, social, and overall QOL domains immediately after treatment. At the one year follow up, the HRQOL scores in the aesthetic, social, and overall QOL domains were near baseline. Patients with malignant lesions had significantly lower postoperative HRQOL scores in the speech, eating, social, and overall QOL domains ($p<.05$). Forty nine patients (77%) underwent adjuvant radiation therapy (RT), and 61% had chemoradiation (CRT) therapy. Patients who underwent adjuvant XRT or CRT had lower postoperative scores in the eating, social and overall QOL domains, compared to those who did not ($p<.05$).

Conclusion—TORS is a safe procedure with good functional and HRQOL outcomes. Patients who undergo TORS for malignancies and receive adjuvant therapy tend to have lower HRQOL

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outcomes. TORS is a promising future alternative surgical treatment for laryngopharyngeal tumors.

Keywords

Transoral robotic surgery; health-related quality of life; head and neck cancer

Introduction

The gradual trend toward minimally invasive organ and function preserving treatments of oropharyngeal and laryngopharyngeal lesions, paralleled by the evolution of new technologies, has created more surgical options available for the management of head and neck tumors, ranging from transoral CO₂ laser microsurgery, to TORS, and video assisted and robotic surgery for the neck and thyroid.¹ Innovations and refinements in the optic technology and the introduction of the daVinci robot have steadily improved the view, reach, and consequently the effectiveness of the minimally invasive endoscopic transoral robotic techniques. Transoral robotic surgery (TORS) at various sites of the upper aerodigestive tract, ranging from the nasopharynx, oropharynx, to larynx, has been well established, most frequently for the resection of squamous cell carcinoma (SCCA).²⁻⁷

During the last 3 decades chemotherapy and radiation therapy (RT) have been incorporated into oropharyngeal cancer treatment protocols, and have thus led to the development of organ preservation treatment protocols. However the focus recently has shifted to function-preservation treatment modalities, noting that the mere presence of an organ does ensure its function. This has led to reconsideration of the surgical options again, and a shift from radical surgeries to minimally invasive surgeries such as TORS. Previous studies have cited several potential advantages of TORS over traditional treatment options such as avoidance of external incision, preservation of normal surrounding structures, and shorter hospitalizations.⁶⁻⁷

These advantages are associated with improved postoperative function and have been shown to reduce the need for gastrostomy tube (G tube) and tracheostomy tube placement,⁸ compared to more radical surgeries or treatment with primary chemotherapy and radiation therapy. Currently, there is a scarcity of functional status and HRQOL data about patients who have undergone TORS.

The aim of the current study was not only to report long-term, longitudinal HRQOL outcomes in patients treated with transoral robotic surgery (TORS), but also to determine what pretreatment factors effect post-operative functional outcomes and overall QOL. The HRQOL outcomes were also compared with QOL outcomes for other treatment modalities such as chemotherapy and/or RT and other non-TORS surgeries for laryngopharyngeal lesion.

Methods

Institutional review board approval was obtained from The Ohio State University Office of Responsible Research Practices. Patients undergoing TORS were identified from The Ohio State University Medical Center transoral robotic surgery database.

TORS was performed under general anesthesia using the da Vinci Surgical System (Intuitive Surgical Inc, Sunnyvale, CA), and has been previously described.⁹ After complete lesion removal was ensured, the robotic arms and the retractors were removed from the oral cavity and the procedure was completed, or the patient was prepped and draped in a sterile fashion for a unilateral or bilateral concurrent neck dissection.

Clinicopathological data, including age at which TORS was performed, gender, type and site of lesion, intraoperative and postoperative complications, need for adjuvant chemotherapy and/or RT, need for G tube and/or tracheostomy placement, and overall survival were collected. For SCCA T stage, N stage, overall tumor stage, resection margins, human papilloma virus (HPV) status, protein p16INKa (p16) status, lymph node status, extracapsular lymph node spread, lymphovascular invasion were obtained by histopathological review of the specimen by head and neck pathologists at our institution. The indications for postoperative RT alone were presence of high risk features, including: T3 or T4 primary tumor, N2 or N3 nodal disease, nodal disease in level IV or V. An option of concurrent CRT was discussed with patients who had these high risk features. The main indication for postoperative neck RT alone was metastatic involvement of more than one node without the presence of ECE. Need for adjuvant RT and chemotherapy was based on high-risk features including 1) the presence of positive surgical margins or close (<2 mm) surgical margins and 2) the presence of extracapsular extension in the cervical lymph nodes.

HRQOL information was collected via the Head and Cancer Inventory. It is a previously validated and reliable 30-item multidimensional survey that measures head and neck specific outcomes. It comprises 4 domains, including speech, eating, social disruption, and aesthetics. In each domain, the patient's functional (his or her ability to perform certain tasks) and attitudinal (the patient's satisfaction with his or her performance ability) measurements are obtained. The last item on the questionnaire assesses the overall QOL. The items are scored on an ordinal scale ranging from 1 to 5. The total score of each domain is converted to a scale ranging from 0 to 100 to aid in interpreting the results. Based on previous studies,¹⁰⁻¹² the mean domain scores were stratified into 3 groups, representing the highest (score 70-100), intermediate (score 31-69), and lowest (score 0-30) health-related QOL.

Statistical analysis was performed with IBM SPSS 19.0 (Chicago, IL). The number of months of follow-up was defined as the time from the TORS to the time of last follow up and was expressed as mean, and mean $\pm$ standard deviation. Standard descriptive statistics were used to summarize the data. Paired sample t-test and chi square analyses were performed to determine any statistically significant differences between the patient groups, with $p < 0.05$ considered significant.

Results

Between April 2008 and August 2010 a total of 64 patients underwent TORS at our institution. The primary site of the lesion removed with TORS was palatine tonsil in 47 patients (73%), base of tongue in 6 (9%), larynx in 4 (6%), lingual tonsil in 5 (8%), retromolar trigone in 1 (2%), and parapharynx in 1 (2%). Fifty six patients underwent TORS as part of their treatment for head and neck SCCA, and one for melanoma, and 7 for benign lesions (Figure 1). The median age was 56.8 years (range 37 to 81). There were 15 females and 49 males (Table 1). All patients were alive at the time of the current study, with a mean follow up time of 16.3 ± 7.49 months (range 6 to 33).

Negative resection margins were achieved in 50 (93%) cases of SCCA. Among patients with SCCA, 46 tumors were stained for HPV, and 80% were HPV⁺. Fifty four patients with SCCA underwent a unilateral or a bilateral neck dissection in addition to the TORS. The mean number of positive lymph nodes on final histopathological diagnosis was 2.18 ± 4.98 (range 0-37). Forty nine out of 56 patients with SCCA (88%) underwent adjuvant RT, and a total of 61% underwent both chemotherapy and RT. A total of 11 (17%) patients required G tube placement due to dysphagia during RT, with a trend toward higher tumor stage necessitating need for G tube placement compared to an earlier stage. The range of time for G tube placement following TORS was 2-5 months, with a mean of 2.7 ± 1.98 months. Five out of the 34 (15%) patients with HPV+ tumors required a G tube placement for dysphagia during adjuvant RT or CRT, with all but one resuming an oral diet on last follow up visit. None of the TORS patients required tracheostomy tube placement. There was one case of locoregional recurrence of a patient with a tonsil SCCA, who failed to undergo the recommended adjuvant RT. There was one case of distant recurrence after completion of adjuvant CRT in a patient with a tonsillar SCCA.

All 64 patients completed the self-administered HNCI at baseline, with 50, 28, 26, and 18 patients completing the 3 week, 3 months, 6 months, and 1 year questionnaires, respectively (Table 2). There was a decrease from baseline in the speech, eating, aesthetic, social, and overall QOL domains immediately after treatment. At the one year follow up, the health related quality of life (HRQOL) scores in the aesthetic, social, and overall QOL domains were near baseline. The speech and eating domain have decreased at one year from 87.6 to 76.1, and 85.3 to 66.8, respectively. At one year, HRQOL related outcomes were in the high (score 70-100) domains for speech, aesthetics, attitude, and overall QOL, while eating which was in the intermediate (score 31-69) domain.

Table 3 gives the functional and QOL outcomes 3 months after TORS. A 3 month follow up period was chosen because 28 out of 63 patients completed the HRQOL inventory at the 3 months follow up, thus giving a good representation of the overall study population. Patients with malignancies who underwent TORS as part of their overall treatment had significantly lower scores in 4 domains, including the speech, eating, social, as well as overall functional and attitude domains. In addition, their mean overall QOL score was significantly lower than that of patients who underwent TORS for benign lesions. Patients who underwent adjuvant RT or CRT had significantly lower eating scores, social function, and overall function scores, as well as lower overall QOL score, compared with patients who did not undergo

these adjuvant treatments. When comparing the site of the primary lesion, those with tonsillar lesions (n=21) had significantly lower eating outcomes compared to other sites, such as larynx, base of tongue, lingual tonsil, and retromolar trigone. There was no difference in QOL outcomes based on age, gender, or HPV status. However, there was a trend toward higher scores in patients greater than 55 years old in nearly all the domains. Similarly, females tended to report higher QOL outcomes score in majority of the domains.

Discussion

In the last two decades, QOL has been increasingly recognized as an important outcome in the management of head and neck cancer, which has resulted in a significant number of studies which used post-treatment self-assessment surveys to track HRQOL changes following treatment of head and neck cancer.^{11,13-14} To our knowledge the current study is the largest, prospective, longitudinal, single center study evaluating HRQOL profiles for patients who underwent TORS.

The present study demonstrated an initial decrease in the HRQOL scores after treatment with a progressive recovery of the HRQOL in the first year post-treatment. This finding is concordant with other studies which showed similar trends. Bjordal et al, in a longitudinal HRQOL study on patients undergoing treatment for head and neck cancer, reported that there was a general trend toward deterioration in HRQOL during treatment, followed by a slow recovery until a 12-month follow up, with few exceptions including senses, dry mouth, and sexuality.¹⁵ Similarly, in a study of 80 patients with advanced oral and oropharyngeal SCCA treated with resection, free flap microvascular reconstruction, followed by RT, it was determined that most head and neck specific issues deteriorate after treatment but return to pretreatment levels at 12 months, except for senses, opening mouth, sticky saliva, and coughing which remain deteriorated long term.¹⁶ In the current study the only variable that did not return to the high domain in the HNCI was eating function and attitude, which we attribute to the large number of oropharyngeal lesions resected with TORS, a site which is more prone to causing dysphagia following surgery.

Numerous studies in the literature have determined various patient-related factors, such as age, gender, marital status, comorbidity, malnutrition, tumor location, stage, treatment modality, that may contribute to HRQOL outcomes in patients with head and neck cancer.¹⁴⁻¹⁶ In the current series the HRQOL outcomes differed significantly among patients who underwent TORS for a resection of a malignancy compared to those who had a TORS resection of a benign lesion. A similar trend of lower HRQOL in the eating social, overall function, and overall QOL was observed among patients who have undergone adjuvant RT or CRT. It was also noted that patients with tonsillar cancer had significantly lower speech scores, and a trend toward lower eating social, aesthetic and overall QOL scores, than cancers at other sites. Significant HRQOL differences between patients with head and neck tumors in different locations have been reported previously.¹⁹ Among 357 patients with cancer in the oral cavity, pharynx, larynx, nose, sinuses, salivary glands, and neck metastasis Bjordal et al found that patients with pharyngeal tumors have the most problems, followed by patients with oral cancer, then laryngeal cancer, and finally the group of patients with cancer at other sites.¹⁵

Although age was not a significant predictor of the QOL there was a trend toward higher scores in the speech attitude, eating function and attitude, social attitude, aesthetic and overall QOL among patients older than 55 years old, compared to younger patients. It was also noted that younger patients tended to report better pretreatment functional status. When subjected to a surgical intervention in the form of TORS, their perception of HRQOL may have decreased considerably. In contrast, older patients may have more sedentary preoperative lifestyle, and they may have perceived less change from their baseline functional status postoperatively. Age has been inconsistently associated with HRQOL in head and neck cancer. For instance, van der Schroeff et al compared QOL in 24 patients 70 years, and 33 patients 45-60 years old, and found that age had no impact on QOL.²⁰ In contrast, Hammerlid et al found that older patients scored significantly better in emotional and social functioning than younger patients, but significantly worse for physical functioning.²¹

Although the current series did not have a control group, our results parallel those of previous findings by El-Deiry and Funk et al.¹¹ They used the Head and Neck Cancer Inventory to compare QOL in patients receiving chemotherapy and RT with that in patients undergoing surgical resection followed by RT. They found no statistically significant difference between the two groups. Figure 2 compares our HRQOL results for patients that underwent TORS alone, or TORS followed by adjuvant treatment in the form of RT or CRT, to the cohort receiving CRT or surgery followed by RT in the El-Deiry and Funk et al study. Similar to the El-Deiry and Funk et al series, our cohort of patients receiving TORS had mean scores in each domain ranging from intermediate to high QOL. There was a trend toward higher HRQOL outcome scores in each domain for the TORS group, possibly due to the minimally invasive nature of the TORS.

Conclusion

The present study is the largest, prospective, longitudinal, single center study evaluating HRQOL profiles for patients who underwent TORS. TORS is a safe procedure with good functional and HRQOL outcomes. Patients who undergo TORS for malignancies and receive adjuvant therapy tend to have lower HRQOL outcomes. TORS is a promising future, minimally invasive, endoscopic alternative surgical treatment for laryngopharyngeal tumors.

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Figure 1.
Transoral robotic surgery study population.

Figure 2.

HRQOL outcomes in head and neck cancer patients in the current study at 12 months, compared with advanced head and neck cancer at 12 or more months after diagnosis in a study by Funk et al. C=chemotherapy and radiation therapy; SRT=surgery and postoperative radiation therapy; HRQOL=health-related quality of life.

Table 1

Patient demographic and clinical characteristics.

Variable	All TORS Patients (N=64)
Age (years)	56.8 ± 8.96
Gender (F:M)	15:49
Type of lesion (n=64)	
Benign	7 (11%)
Squamous cell carcinoma	56 (88%)
Melanoma	1 (1.0%)
Overall stage (N=54)	
I	7/54 (13%)
II	3/54 (5.6%)
III	7/54 (13%)
IV	37/54 (69%)
HPV Status (n=46)	
HPV ⁺	37 (80%)
HPV ⁻	9 (20%)
P 16 Status (n=45)	
p16 ⁺	38 (84%)
p16 ⁻	7 (16%)
Neck dissection (n=64)	
None	10 (16%)
Unilateral	51 (80%)
Bilateral	3 (4.0%)
Mean number of positive lymph nodes	2.18 ± 4.98
Follow up time (months)	16.3 ± 7.49

Table 2

Quality of life outcomes at baseline, 3 weeks, 3 months, 6 months, and 1 year. Data are given as mean (SD).

HRQOL Score	Baseline N=64	3 weeks N=50	3 months N=28	6 months N=26	1 year N=18
Speech function	90.3 (15.4)	80.4 (21.2)	75.5 (25.1)	76.1 (21.9)	77.4 (23.0)
Speech attitude	85.2 (17.7)	80.8 (20.1)	74.1 (25.9)	76.5 (20.5)	74.7 (24.4)
Eating function	86.3 (17.3)	63.6 (20.6)	71.0 (28.1)	65.5 (24.5)	67.7 (25.3)
Eating attitude	84.3 (20.1)	76.7 (29.1)	60.4 (29.6)	64.4 (23.6)	65.8 (25.9)
Aesthetics	87.3 (25.3)	79.3 (28.8)	86.2 (19.0)	83.2 (25.2)	85.2 (25.7)
Social Function	82.4 (25.6)	61.7 (22.0)	69.9 (28.7)	70.0 (23.4)	79.4 (29.9)
Social attitude	88.1 (16.3)	79.1 (18.6)	80.4 (22.6)	77.4 (21.9)	81.9 (22.6)
Overall QOL	78.7 (21.1)	73.5 (19.8)	67.9 (27.9)	70.2 (20.0)	77.9 (17.4)

Table 3

Patient-related factors and HRQOL outcomes 3 months after TORS.

Variable	N	Speech			Eating			Social		Aesthetics		Overall		Overall QoL
		Function	Attitude		Function	Attitude		Function	Attitude	Attitude		Function	Attitude	
Age (yrs)														
55	13	78 (20)	73 (28)		63 (25)	57 (27)		71 (27)	76 (29)	86 (25)		70.7(21)	68 (24)	65(22)
>55	15	73 (30)	75 (25)		78 (30)	63 (32)		69(31)	84(15)	92(13)		74.3(15)	75(19)	70 (33)
Gender														
Female	7	77 (23)	71 (38)		74 (23)	84(16)		74 (23)	84(16)	91 (12)		75 (22)	78(19)	75 (25)
Male	21	75 (27)	75 (22)		69(31)	79 (24)		69(31)	79 (24)	89(21)		70.1 (25)	70 (22)	65 (29)
Adjuvant treatment														
XRT or CRT	19	70 (26)	70 (27)		68 (29)	52 (25)*		62 (28)*	79(21)	90(16)		66.7(21)*	67(19)	58 (26)*
None	5	88 (24)	83 (24)		86(16)	87 (25)*		92(19)*	90(19)	98 (5.5)		88.7(19)*	88(18)	91 (11)*
Lesion														
Malignancy	25	73 (25)*	71 (26)*		68 (28)	56 (28)*		66 (28)*	79 (23)	89 (20)		70.1 (26)*	69 (20)*	64 (27)*
Benign	3	98 (2.9)*	98 (2.9)*		92(14)	97 (5.0)*		100(0)*	91 (14)	100 (0)		96.1 (8.2)*	95 (5.4)*	100(0)*
HPV status														
HPV positive	17	69 (26)	70 (28)		68 (24)	51 (22)		60 (27)	77 (22)	88(16)		65.7 (25)	66(18)	56 (26)
HPV negative	4	80 (25)	78 (26)		48 (43)	60 (45)		77 (30)	81 (40)	75 (43)		68.5(31)	68 (32)	81 (24)
Site of lesion														
Tonsillar	21	70 (26)*	71 (27)		68(31)	56 (28)		66 (28)	79 (23)	87(21)		68.7 (27)	70(19)	64 (27)
Other	7	91 (16)*	84(19)		80(18)	74 (30)		81 (29)	82 (24)	100 (0)		81.8(19)	78 (27)	78 (30)

* p-value <0.05

Data given as mean (SD)