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Quality-of-Life Outcomes in Transoral Robotic Surgery

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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, longitudinal, clinical study on functional and HRQOL outcomes in TORS.

Setting—University tertiary care facility.

Subjects and Methods—Patients who underwent TORS were asked to complete a Head and Neck Cancer Inventory before treatment and at 3 weeks and 3, 6, and 12 months postoperatively. Demographic, clinicopathological, and follow-up data were collected.

Results—Sixty-four patients who underwent TORS were enrolled. A total of 113 TORS procedures were performed. The mean follow-up time was 16.3 ± 7.49 months. The HRQOL was assessed at 3 weeks and at 3, 6, and 12 months, with a response rate of 78%, 44%, 41%, and 28%, respectively. TORS was performed most frequently for squamous cell carcinoma (88%). There was a decrease from baseline in the speech, eating, aesthetic, social, and overall QOL domains

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Author Contributions

Agnes M. Hurtuk, corresponding author, acquired data, organized data, analyzed data, helped with interpretation of data, drafted the article, revised manuscript, approved final version to be published; **Anna Marcinow**, acquired data, organized data, helped with data analysis, helped with interpretation of data, helped with drafting and revision of manuscript, approved final version to be published; **Amit Agrawal**, took part in conception and design, acquisition of data, revision of the manuscript, was critically for important intellectual content, provided final approval of the version to be published; **Matthew Old**, took part in conception and design, acquisition of data, revision of the manuscript, was critical for important intellectual content, provided final approval of the version to be published; **Theodoros N. Teknos**, took part in conception and design, acquisition of data, revision of the manuscript, was critical for important intellectual content, provided final approval of the version to be published; **Enver Ozer**, principal investigator on this study, provided substantial contributions to conception and design, acquisition of data, analysis and interpretation of data, took part in drafting of the article, and revised it critically for important intellectual content, provided final approval of the version to be published.

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immediately after treatment. At the 1-year follow-up, the HRQOL scores in the aesthetic, social, and overall QOL domains were in the high domain. Patients with malignant lesions had significantly lower postoperative HRQOL scores in the speech, eating, social, and overall QOL domains ($P < .05$). Patients who underwent adjuvant radiation therapy or chemotherapy and radiation therapy had lower postoperative scores in the eating, social, and overall QOL domains ($P < .05$).

Conclusion—The preliminary data show that patients who undergo TORS for malignancies and receive adjuvant therapy tend to have lower HRQOL outcomes. TORS is a promising, minimally invasive, endoscopic alternative surgical treatment of laryngopharyngeal tumors.

Keywords

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

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 transoral robotic surgery (TORS) to video-assisted and robotic surgery for the neck and thyroid.¹ Innovations and refinements in optic technology and the introduction of the da Vinci robot have steadily improved the view, reach, and consequently the effectiveness of minimally invasive endoscopic transoral robotic techniques. TORS at various sites of the upper aerodigestive tract, ranging from the nasopharynx, to oropharynx, to larynx, has been well established, most frequently for the resection of squamous cell carcinoma (SCCA).^{2–7}

During the past 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 not 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 placement⁸ compared with more radical surgeries or treatment with primary chemotherapy and radiation therapy. Currently, there is a scarcity of functional status and health-related quality-of-life (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 TORS but also to determine what pretreatment factors affect postoperative functional outcomes and overall QOL. The HRQOL outcomes were also compared with QOL outcomes for other treatment modalities such as RT with or without chemotherapy and other non-TORS surgeries for laryngopharyngeal lesions.

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, California) 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 RT with or without chemotherapy, need for G tube and/or tracheostomy placement, and overall survival were collected. 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, and lymphovascular invasion were obtained by histopathological review of the specimen by head and neck pathologists at our institution. HPV status was determined by chromogenic in situ hybridization study for high-risk types of HPV with appropriate controls. Forty-nine patients underwent adjuvant RT (with or without chemotherapy); among those 49 patients, 16 received RT alone and 33 received combined RT and chemotherapy (CRT). Adjuvant treatments in the form of RT or CRT were delivered within 6 weeks following TORS. The indications for postoperative RT alone were the presence of high-risk features, including T3 or T4 primary tumor, N2 or N3 nodal disease, and 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 1 node without the presence of extracapsular lymph node extension. The 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 interpretation of 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) HRQOL.

Statistical analysis was performed with SPSS 19.0 software (SPSS Inc, an IBM company, Chicago, Illinois). 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 the mean and mean $\pm$ standard deviation. Standard descriptive statistics were used to summarize the data. Paired-sample t test and χ^2 analyses were performed to determine any statistically significant differences between the patient groups, with $P < .05$ 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 patients (9%), larynx in 4 patients (6%), lingual tonsil in 5 patients (8%), retromolar trigone in 1 patient (2%), and parapharynx in 1 (2%) patient. Fifty-six patients underwent TORS as part of their treatment of head and neck SCCA, 1 patient for melanoma, and 7 patients for benign lesions. The median age was 56.8 years (range, 37-81 years). There were 15 women and 49 men (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, 6-33 months).

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 TORS. The mean number of positive lymph nodes on final histopathological diagnosis was 2.18 ± 4.98 (range, 0-37). Forty-nine 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 with an earlier stage. The range of time for G tube placement following TORS was 2 to 5 months, with a mean of 2.7 ± 1.98 months. Five of the 34 (15%) patients with HPV⁺ tumors required a G tube placement for dysphagia during adjuvant RT or CRT, with all but 1 patient resuming an oral diet by the last follow-up visit. None of the TORS patients required tracheostomy tube placement. There was 1 case of locoregional recurrence of a patient with a tonsil SCCA, who failed to undergo the recommended adjuvant RT. There was 1 case of distant recurrence after completion of adjuvant CRT in a patient with a tonsillar SCCA.

All 64 patients completed the self-administered Head and Neck Cancer Inventory at baseline, with 50, 28, 26, and 18 patients completing the 3-week, 3-month, 6-month, 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 1-year follow-up, the HRQOL scores in the aesthetic, social, and overall QOL domains were back to the high domain (scores 70-100). The speech and eating domains decreased at 1 year from 87.6 to 76.1 and from 85.3 to 66.8, respectively. At 1 year, HRQOL outcomes were in the high (score 70-100) domains for speech, aesthetics, attitude, and overall QOL, while eating 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 of 63 patients completed the HRQOL inventory at the 3-month follow-up, thus giving a good representation of the overall study population. Among

patients who responded to the HRQOL questionnaires compared with those who did not at 3 months, there was no statistically significant difference in patient age ($P = .48$), tumor site ($P = .62$), stage ($P = 1.0$), or presence or absence of adjuvant therapies ($P = 1.0$). Patients with malignancies who underwent TORS as part of their overall treatment had significantly lower scores in 4 domains, including the speech, eating, social, and overall functional and attitude domains, with scores falling in the intermediate to high 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 scores, 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 speech outcomes compared with other sites, such as larynx, base of tongue, lingual tonsil, and retromolar trigone. The reasons for the lower speech outcomes among patients who underwent TORS for tonsillar lesions are unclear and deserve further investigation. There was no difference in QOL outcomes based on age, gender, or HPV status. However, there was a trend toward higher scores in patients older than 55 years in nearly all the domains. Similarly, women tended to report a higher QOL outcome score in most of the domains.

Discussion

In the past 2 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 using posttreatment 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 after treatment. This finding is concordant with other studies that showed similar trends. Bjordal et al,¹⁵ in a longitudinal HRQOL study on patients undergoing treatment of 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. 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 Head and Neck Cancer Inventory was eating function and attitude, which we attribute to the large number of oropharyngeal lesions resected with TORS, a site that is more prone to causing dysphagia following surgical excision.

Numerous studies in the literature have determined that various patient-related factors, such as age, gender, marital status, comorbidity, malnutrition, tumor location, stage, and

treatment modality, might contribute to HRQOL outcomes in patients with head and neck cancer.^{14–18} In the current series, the HRQOL outcomes differed significantly among patients who underwent TORS for a resection of a malignancy compared with 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 underwent 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 patients with 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 al¹⁵ 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.

Although age was not a significant predictor of the QOL in the present series, 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 compared with 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 a 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 al²⁰ compared QOL in 24 patients aged 70 years and 33 patients aged 45 to 60 years and found that age had no impact on QOL. In contrast, Hammerlid et al²¹ found that older patients scored significantly better in emotional and social functioning than younger patients did but significantly worse for physical functioning.

Although the current series did not have a control group, our results parallel those of previous findings by El-Deiry et al.¹¹ They used the Head and Neck Cancer Inventory to compare HRQOL in patients receiving chemotherapy and RT with that in patients undergoing surgical resection followed by RT. The cancer patients in the present study were similar to the patients in the El-Deiry et al study in terms of age, site of lesion, and stage of disease. They found no statistically significant difference between the two groups. Figure 1 compares our HRQOL results for patients who 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 et al study. Similar to the El-Deiry et al series, our cohort of patients receiving TORS had mean scores in each domain ranging from intermediate to high HRQOL. There was no statistically significant difference between the El-Deiry et al surgery and postoperative radiation therapy (SRT) group versus TORS or the CRT versus TORS group in the speech, aesthetics, social disruption, and overall QOL domains ($P > .5$). Within the eating domain, the TORS group had statistically significant higher outcomes (66.8 vs 37.8 for CRT and 40.8 for SRT, $P = .003$). Overall, 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 minimally invasive, endoscopic alternative surgical treatment of laryngopharyngeal tumors.

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Figure 1.

HRQOL outcomes in head and neck cancer patients in the current study at 12 months compared with patients with advanced head and neck cancer at 12 or more months after diagnosis in a study by El-Deiry et al.¹¹ CRT indicates concurrent chemotherapy and radiation therapy; HRQOL, health-related quality of life; SRT, surgery and postoperative radiation therapy.

Table 1

Patient Demographic and Clinical Characteristics

Variable	All TORS Patients (N = 64]
Age, y	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%)
P16 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 Adjuvant therapy	2.18 ±4.98
Radiation therapy	49/64 (77%)
CRT	33/64 (53%)
Follow-up time, mo	16.3 ± 7.49

Abbreviations: CRT, chemotherapy and radiation therapy; HPV, human papilloma virus; TORS, transoral robotic surgery.

Table 2

Quality-of-Life Outcomes at Baseline, 3 Weeks, 3 Months, 6 Months, and 1 Year, 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 quality of life	78.7 (21.1)	73.5 (19.8)	67.9 (27.9)	70.2 (20.0)	77.9 (17.4)

Abbreviation: HRQOL, health-related quality of life.

Table 3

Patient-Related Factors and HRQOL Outcomes 3 Months after TORS, Mean (SD)

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

Abbreviations: CRT, chemotherapy and radiation therapy; HPV, human papilloma virus; HRQOL, health-related quality of life; QOL, quality of life; RT, radiation therapy; TORS, transoral robotic surgery.

^a $P < .05$.