Transoral Robotic Surgery Alone for Oropharyngeal Cancer Quality-of-Life Outcomes

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IMPORTANCE Few studies have examined quality-of-life (QOL) outcomes in patients who undergo transoral robotic surgery (TORS) alone (ie, without adjuvant radiotherapy or chemoradiotherapy).

OBJECTIVE To report QOL outcomes of patients with oropharyngeal squamous cell carcinoma who receive only TORS.

DESIGN, SETTING, AND PARTICIPANTS Medical records for all patients undergoing TORS for treatment of primary oropharyngeal squamous cell carcinoma from May 1, 2010, to March 31, 2014, at a tertiary care academic cancer center were examined from June through September 2014. Thirty-four patients who did not receive adjuvant therapy after TORS were included in the study.

INTERVENTION Primary surgical resection via TORS.

MAIN OUTCOMES AND MEASURES The University of Washington Quality of Life, version 4, questionnaire was completed by patients preoperatively and at 1-, 6-, 12-, and 24-month intervals after TORS. Demographic, clinicopathologic, and follow-up data were collected.

RESULTS Mean follow-up time was 14 months (May 1, 2010, to April 30, 2014). Most patients had T1 (20 [59%]) or T2 (13 [38%]) and N0 (13 [38%]) or N1 (16 [47%]) disease. Statistically significant improvement in QOL outcomes was noted in the following postoperative domains: chewing from 1 month (median, 50 [IQR, 50-100]) to 12 months (100 [IQR, 100-100]; P = .048), swallowing from 1 month (70 [IQR, 30-85]) to 6 months (100 [IQR, 70-100]; P = .047) and 1 to 24 months (100 [IQR, 70-100]; P = .048), pain from 1 month (38 [IQR, 25-75]) to 6 months (88 [IQR, 75-100]; P = .006) and 1 to 12 months after surgery (100 [IQR, 75-100]; P = .01), and activity from 1 month (63 [IQR, 50-88]) to 24 months (100 [IQR, 75-100]; P = .03). Two participants (6%) died during the follow-up period: 1 because of disease and 1 because of a myocardial infarction. Two patients (6%) required temporary gastrostomy tube placement, but none required tracheostomy.

CONCLUSIONS AND RELEVANCE Appropriately selected patients who undergo TORS alone for oropharyngeal squamous cell carcinoma experience acceptable short- and long-term QOL outcomes.

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Large shifts in treatment recommendations for oropharyngeal squamous cell carcinoma (OPSCC) have occurred over the past 3 decades resulting from technological advances in all treatment modalities. The use of primary chemoradiotherapy (CRT) for OPSCC doubled between 1985 and 2001, and use of primary radiotherapy (RT) and primary surgical therapy decreased. However, acute and late tissue toxic effects are a limiting factor for treatment success with RT and CRT. Common adverse effects include mucositis, xerostomia, dysgeusia, and increased risk of oral infections, all of which impair posttreatment quality of life (QOL).

Over the past decade, the use of transoral robotic surgery (TORS) as a treatment option for OPSCC has been increasing. Multiple studies have demonstrated that TORS, with or without adjuvant therapy, offers excellent long-term oncologic and survival outcomes. The use of TORS has been associated with decreased length of hospitalization, tracheostomy tube requirement during treatment, and permanent gastrostomy tube requirement. Faster postoperative recovery after TORS may decrease treatment duration and toxic effects associated with adjuvant RT and CRT. Even so, patients who undergo TORS followed by adjuvant therapy appear to score lower on QOL indexes compared with those who receive TORS alone up to 1 year after treatment, especially in the swallowing and diet domains. Overall, few studies have examined QOL outcomes in patients who undergo TORS alone.

Herein, we report our single-institutional experience with the use of TORS alone for patients with early-stage OPSCC and describe patient-reported QOL outcomes up to 2 years after treatment. We hypothesized that, for select patients with low-risk features, TORS alone would be an effective treatment algorithm that allows for acceptable short- and long-term QOL outcomes in the absence of adjuvant therapy.

Methods

Patient Selection

This retrospective review of medical records was conducted at the University of Pittsburgh Medical Center, a tertiary referral center. Surgical scheduling records were reviewed from June through September 2014 to identify all patients who underwent TORS between May 1, 2010, and March 31, 2014. In total, 172 patients received TORS for oncologic resection during that time. Thirty-four patients met the criteria for inclusion. All patients underwent TORS as the primary treatment modality for OPSCC. At our institution, adjuvant therapy following TORS is generally not recommended if patients lack adverse prognostic pathologic features, such as extracapsular spread, multiple involved lymph nodes, perineural invasion, or positive or close margins. Few patients (11) in the present study were recommended to receive adjuvant therapy following TORS for high-risk pathologic features but refused. We excluded patients who received any postoperative adjuvant therapy including RT or CRT, those who received TORS for an unknown primary tumor or salvage purposes, and those with a primary tumor site other than the oropharynx. Demographic data (ie, age, sex, race, alcohol use, and smoking status), rates of tracheostomy and gastrostomy tube insertion, and oncologic data (ie, tumor markers, tumor staging, extracapsular spread, tumor grade, surgical margin status, histologic characteristics, and tumor recurrence) were collected.

Approval for the study was obtained from the University of Pittsburgh Medical Center Office of Quality and Research. The requirement for informed consent was waived and the data were deidentified.

QOL Assessment

The University of Washington Quality of Life (UW-QOL), version 4, questionnaire is a previously validated 12-item survey that scores pain, appearance, activity, recreation, swallowing, chewing, speech, shoulder function, taste, saliva, mood, and anxiety. The survey also includes 3 global QOL scores. Scores for each domain range from 0 to 100, with 100 being the best functional outcome reported by the patient. El-Deiry et al demonstrated that a 7-point difference in the score on this scale is sensitive to predict for a clinically meaningful difference in QOL.

The UW-QOL questionnaires were routinely completed by patients during clinic visits preoperatively and at 1-month (±1 month), 6-month (±2 months), 12-month (±3 months), and 24-month (±3 months) postoperative visits from the date of TORS (followed up through April 30, 2014). Surveys were pooled by time from TORS into 4 categories (1, 6, 12, and 24 months after surgery) for analysis.

Statistical Analysis

Demographic and clinical oncologic data were summarized with proportions for categorical data and with means (SDs) for continuous data. Medians and interquartile ranges were used to summarize the UW-QOL survey scores. The overall distribution of the UW-QOL scores at 1 month after surgery was compared with that of each subsequent QOL time point with the Wilcoxon Mann-Whitney test. Overall trends in QOL scores over time were assessed with simple linear regression. Individual statistical tests were not adjusted for multiple comparisons. All reported P values are 2-sided, and significance was set at P < .05. Statistical analyses were performed using SAS/STAT, version 9.4 (SAS Institute Inc) and R, version 3.0.1 (R Foundation for Statistical Computing).

Results

Patient and Disease Characteristics

A total of 34 patients were included in this analysis. Patient characteristics are reported in Table 1. The most common oropharyngeal subsite was the tonsil (16 patients [47%]), followed by the base of tongue (15 [44%]). Cancer in most patients was category T1 (20 [59%]) or T2 (13 [38%]) and category N0 (13 [38%]) or N1 (16 [47%]). One patient (3%) had a positive margin, 4 patients (12%) had confirmed nodal extracapsular spread, and 4 individuals (12%) had perineural invasion. A synopsis of disease data can be found in Table 1. Advanced oncologic data analysis from this patient cohort will be included in an upcoming multi-institutional report (not included here to prevent reporting duplication of data).
Follow-up

The follow-up period for overall survival was defined as the number of months from the date of TORS to the date of the last follow-up determined by clinic visit, telephone survey, or death. Mean follow-up for this cohort was 14 months (range, 13 days to 38 months; from May 1, 2010, to April 30, 2014). Two patients (6%) died during the follow-up period: 1 due to disease and 1 due to a myocardial infarction. There were no intraoperative complications. Two patients (6%) required temporary gastrostomy tube placement, but no patients required tracheostomy. Among all the completed UW-QOL forms, 4 forms were completed preoperatively, 8 at 1 month after surgery, 12 at 6 months, 8 at 12 months, and 9 at 24 months.

Quality of Life

The scores for the 3 global QOL survey questions (“health-related QOL compared to 1 month before cancer,” “health-related QOL during the past 7 days,” and “overall QOL including personal well-being over the past 7 days”) showed a tendency to improve throughout follow-up (Figure 1). One interval reached statistically significant improvement (“health-related QOL during the past 7 days” 6 months after surgery) (Figure 1B and Table 2); improvements were observed in several other domains, although these were not statistically significant (Figure 1 and Table 2) compared with 1-month follow-up scores.

Scores for the QOL domains of pain, swallowing, activity, and chewing also tended to improve throughout follow-up (Figure 2). Statistically significant improvement in chewing scores was noted from 1 to 12 months after surgery ($P = .048$) (Figure 2B). A positive trend was observed for chewing scores over time ($P = .05$). Pain scores improved from 1 to 6 months ($P = .006$) and 12 months ($P = .01$) after surgery (Figure 2C). However, there was no evidence that the median pain score continued to improve over time ($P = .10$). Swallowing scores improved from 1 to 6 months ($P = .047$) and 24 months ($P = .048$) after surgery (Figure 2D). There was an overall positive trend in swallowing scores ($P = .01$). In addition, the median activity score improved over time ($P = .03$) (Figure 2A). No other specific symptom domains showed statistical evidence of improvement or deterioration from 1 month after surgery over time (Table 3).

Discussion

Increasing recognition of the adverse effects of CRT and their negative effect on QOL has provided the rationale for TORS as a primary treatment modality option for OPSCC. The present study is especially timely in the current era of human papilloma virus-positive OPSCC, with younger and healthier patients seeking treatment modalities with less long-term treatment-related morbidity. There is, however, a paucity of literature describing the long-term QOL of patients who receive TORS.
alone. To our knowledge, this is the largest study with the longest follow-up period investigating QOL in patients who receive only TORS.

Our study suggests that selected patients with OPSCC treated with TORS alone experience continued improvement in QOL in multiple domains soon after surgery, as well as in the long term. Statistically significant improvements were noted when compared with QOL 1 month after surgery in the following domains: swallowing and pain at 6 months, chewing and pain at 12 months, and activity and swallowing at 24 months (Table 3). No domain demonstrated decreases of QOL that were statistically significant at any time. These findings are in contrast to those of previous studies showing that patients who received adjuvant RT or CRT experienced deterioration in QOL scores to a nadir at approximately 3 months after TORS. Although it is possible that patients have not recovered completely from surgery at the start of adjuvant therapy in these previous studies, it has been suggested that this lack of improvement could be secondary to substantial adjuvant treatment–related toxic effects.

### Table 2. Global QOL Domains

<table>
<thead>
<tr>
<th>QOL Question</th>
<th>Postoperative Months, Median (IQR)</th>
<th>1</th>
<th>6</th>
<th>12</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients, No. (%)</td>
<td>8 (50-50)</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Health-related QOL vs 1 mo before cancer</td>
<td>&gt; .99</td>
<td>.62</td>
<td>.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health-related QOL during the past 7 d</td>
<td>50 (40-60)</td>
<td>80 (60-100)</td>
<td>70 (50-100)</td>
<td>60 (40-80)</td>
<td></td>
</tr>
<tr>
<td>P value</td>
<td>.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.12</td>
<td>.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall QOL during the past 7 d</td>
<td>50 (40-80)</td>
<td>80 (60-80)</td>
<td>80 (50-100)</td>
<td>60 (60-80)</td>
<td></td>
</tr>
<tr>
<td>P value</td>
<td>.12</td>
<td>.18</td>
<td>.33</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: IQR, interquartile range; QOL, quality of life.
<sup>a</sup> Quality-of-life scores were compared with QOL scores at 1 month after baseline using the Wilcoxon Mann-Whitney test.
<sup>b</sup> No adjustments were made for multiple testing.
<sup>c</sup> Statistically significant at P < .05.

### Figure 2. Trends in Symptom-Specific Quality of Life (QOL) Domains

Changes in median scores for activity (A), chewing (B), pain (C), and swallowing (D). Error bars indicate the interquartile range.

<sup>a</sup> P < .05 compared with 1 month after surgery.
It is especially notable in our study that speech function was minimally affected 1 month after surgery, and patients were able to maintain similar levels of function throughout follow-up. A similar result was reported for patients with OPSCC treated with TORS alone by Leonhardt et al,9 although with smaller numbers (\(N = 9\)). This minimal effect on speech only in patients who underwent surgery is not surprising since previous studies\textsuperscript{8-11,16,17} suggested that RT and CRT cause substantial deterioration in short-term and long-term patient-perceived swallowing function, with slow recovery.

To our knowledge, the present study is the first to report a statistically significant improvement in pain in the short term with lasting long-term relief among patients who undergo TORS without adjuvant therapy. Pain scores at 1 month were initially low (mean score, 47), but they improved at 6 months (mean score, 83) (\(P = .048\)) and remained stable at 12 months. This finding is in contrast to that in patients who received adjuvant therapy after TORS and experienced a significant deterioration at 6 months in the bodily pain domain of the Short Form 8 Health Survey.\textsuperscript{9} It appears that the addition of RT or CRT following TORS hampers recovery from pain associated with surgery, but TORS alone is associated with short-term pain and good long-term recovery.

Similarly, patients reported relatively low scores in chewing and swallowing at 1 month following surgery (median score, 50 and 70, respectively). This difficulty was followed by statistically significant recovery to a higher level of function with long-term follow-up (chewing: \(P = .048\) at 12 months; swallowing: \(P = .047\) at 6 months and stable at 24 months; \(P = .048\)), confirming a previous finding in a small number of patients receiving TORS alone.\textsuperscript{9} This recovery is not unexpected; previous studies\textsuperscript{8-11,16,17} suggested that RT and CRT cause substantial deterioration in short-term and long-term patient-perceived swallowing function, with slow recovery.

Our study included 2 patients (6%) who had recurrences, both of whom did not adhere to recommendations for adjuvant therapy. These patients demonstrated high-risk features after TORS (extracapsular spread, positive margin, or perineural invasion); adjuvant therapy was recommended, but the patients declined. At a 2-year follow-up, 1 patient demonstrated regional failure, and 1 had both local and regional failure. None of the 34 patients experienced distant metastasis or failure in the retropharyngeal nodal basin. The patient with local and regional failure showed a sharp decrease of QOL score, but the other patient with regional failure maintained a high QOL score at the time of recurrence. Overall, excluding these 2 patients did not affect the statistical significance of QOL scores found in our original analysis.

Our patients had a good rate of survival throughout the 2-year follow-up period. Based on scores for the 2 global health-related QOL items, patients experienced a trend toward increasing health-related QOL during 2 postoperative years. At the 6-month follow-up evaluation, significant improvement in health-related QOL over the past 7 days was recognized com-

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**Table 3. Symptom-Specific QOL Domains**

<table>
<thead>
<tr>
<th>QOL Domain</th>
<th>Postsurgery QOL Score, Median (IQR)(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Month</td>
</tr>
<tr>
<td>Patients, No.</td>
<td>8</td>
</tr>
<tr>
<td>Activity</td>
<td>63 (50-88)</td>
</tr>
<tr>
<td>P value</td>
<td>.43</td>
</tr>
<tr>
<td>Anxiety</td>
<td>70 (30-70)</td>
</tr>
<tr>
<td>P value</td>
<td>.19</td>
</tr>
<tr>
<td>Appearance</td>
<td>88 (75-100)</td>
</tr>
<tr>
<td>P value</td>
<td>.35</td>
</tr>
<tr>
<td>Chewing</td>
<td>50 (50-100)</td>
</tr>
<tr>
<td>P value</td>
<td>.40</td>
</tr>
<tr>
<td>Mood</td>
<td>75 (75-100)</td>
</tr>
<tr>
<td>P value</td>
<td>.66</td>
</tr>
<tr>
<td>Pain</td>
<td>38 (25-75)</td>
</tr>
<tr>
<td>P value</td>
<td>&lt;.01(^b)</td>
</tr>
<tr>
<td>Recreation</td>
<td>75 (63-100)</td>
</tr>
<tr>
<td>P value</td>
<td>.45</td>
</tr>
<tr>
<td>Saliva</td>
<td>85 (70-100)</td>
</tr>
<tr>
<td>P value</td>
<td>.85</td>
</tr>
<tr>
<td>Shoulder function</td>
<td>85 (70-100)</td>
</tr>
<tr>
<td>P value</td>
<td>.71</td>
</tr>
<tr>
<td>Speech</td>
<td>100 (85-100)</td>
</tr>
<tr>
<td>P value</td>
<td>.25</td>
</tr>
<tr>
<td>Swallowing</td>
<td>70 (30-85)</td>
</tr>
<tr>
<td>P value</td>
<td>.05(^b)</td>
</tr>
<tr>
<td>Taste</td>
<td>100 (50-100)</td>
</tr>
<tr>
<td>P value</td>
<td>.43</td>
</tr>
</tbody>
</table>

Abbreviations: IQR, interquartile range; QOL, quality of life.

\(^a\) Quality-of-life scores were compared with QOL scores at 1 month after baseline using the Wilcoxon Mann-Whitney test. No adjustments were made for multiple testing.

\(^b\) Statistically significant at \(P < .05\).
pared with 1 month after surgery ($P = .01$). No significant decline in QOL was noted at any time during the follow-up period. None of the patients required tracheostomy, and only 2 patients required transient gastrostomy tube at any time point.

Our study has limitations. Although this cohort included 34 patients, fewer individual patients (8-12 patients per time point) provided UW-QOL responses at each postoperative visit. Because of this small cohort and the large number of comparisons, there exists the possibility that some of the statistical significance that was achieved could have been by chance. Similarly, the QOL scores were compared in a pooled fashion and not on an individual basis. There was also no comparison arm for patients who received adjuvant CRT after TORS, which would have allowed direct evaluation of the effect of adjuvant therapy on QOL in patients who undergo TORS. The patients included in our study had early T category (category T1-2; 97%), light nodal burden (category N0-N1; 85%) and few high-risk features (12%, extracapsular spread; 3%, positive margin; and 12%, perineural invasion). Although this cohort was comparable to that reported in a previous review of patients who underwent only TORS, it should be noted that our patients had a much smaller percentage of T3/T4 tumors and N3 disease compared with previously reported CRT series.

Conclusions

Optimizing posttreatment QOL for patients with head and neck cancer is important in early T-stage disease with good prognosis. Our study suggests that appropriately selected patients who undergo TORS alone for OPSCC experience acceptable short- and long-term QOL outcomes.

**ARTICLE INFORMATION**

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**Author Contributions:** Drs Choby and Duvvuri had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Choby, Ferris, Duvvuri.

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Drafting of the manuscript: Choby, J. Kim, Ling, Abberbock, Mandal, Ferris.

Critical revision of the manuscript for important intellectual content: Choby, J. Kim, Ling, Abberbock, Mandal, S. Kim, Ferris.

Statistical analysis: Choby, J. Kim, Abberbock, Ferris.

Obtained funding: Ferris, Duvvuri.

Administrative, technical, or material support: Mandal, S. Kim, Ferris, Duvvuri.

Study supervision: Mandal, Ferris, Duvvuri.

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**REFERENCES**


