Olfactory and sinonasal outcomes in endoscopic transsphenoidal skull-base surgery

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Background: Endoscopic anterior skull-base surgery has been previously suggested to cause a significant deterioration in olfactory function. Given the impact on quality of life, the objective of this study was to determine the effect of a unilateral middle-turbinate-sacrificing approach on olfactory function and sinonasal outcome.

Methods: Prospective cohort study comparing olfactory and sinonasal outcomes pre- and post-transsphenoidal skull-base surgery. Olfaction was the primary outcome and was measured prospectively using the University of Pennsylvania Smell Identification Test (SIT). Sinonasal symptoms were assessed subjectively via sinonasal-specific questions from the 22-item Sino-Nasal Outcome Test (SNOT-22), and objectively via the Lund-Kennedy Endoscopic Scoring system (LKES).

Results: Twenty-two patients met study inclusion criteria and completed all data acquisition. The mean preoperative SIT score was 34.8 and the mean postoperative SIT value was 35.1 (p = 0.37). The average change in score (delta) was an increase of 0.3, with changes ranging from −3 to +4.

When examined categorically, 91% of patients maintained their preoperative olfactory function classification. There was no significant difference in mean pre- and postoperative symptom scores. A small increase in the LKES was noted, from a mean of 0.6 to 2.5 (p = 0.001) in the early postoperative period.

Conclusion: Olfactory function, as measured by the SIT test, was preserved with a middle-turbinate-sacrificing skull-base approach. Subjective sinonasal symptom scores were unaffected, but a slight worsening of objective endoscopic appearance was noted. © 2012 ARS-AAOA, LLC.

Key Words: smell; nasal function; skull base; pituitary surgery; endoscopic surgery

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patients and methods

A prospective cohort study was undertaken after Health Research Ethics Board (HREB Protocol #00018598) approval. Patients over the age of 18 years presenting for endoscopic transsphenoidal anterior skull-base surgery were enrolled after informed consent was obtained. Patients were excluded from participation if they were unable to communicate in English, were smokers, had preexisting sinus disease (as evidenced by previous endoscopic sinus surgery, polyposis, or imaging demonstrating chronic rhinosinusitis), or reported significant subjective olfactory dysfunction. The patients’ baseline olfactory function was established by administering the University of Pennsylvania Smell Identification Test (SIT), a validated 40-point scratch-and-sniff questionnaire. The 22-item Sinonasal Outcome Test (SNOT-22) was used to develop an abbreviated questionnaire of 8 questions to establish the patients’ subjective sinonasal symptom status. The abbreviated questionnaire included only the questions related to function and excluded general quality-of-life questions. The rationale for this was to focus specifically on sinonasal function, rather than the overall effect of pituitary surgery on quality of life. Eight questions were asked (Table 1), with a total possible score of 40. Last, the endonasal appearance of the patients’ nasal cavity was graded using the Lund-Kennedy Endoscopic Score (LKES), with a total possible score of 12. Patients were seen back for follow-up 1 to 3 months postsurgery. At follow-up, the SIT was readministered, as were the subjective symptom questionnaire and the LKES. Patients were enrolled in the study from March 2011 to January 2012.

All patients underwent a unilateral middle-turbinate–sacrificing approach to the sella, as described by Kassam et al. The lower one-third to one-half of the ipsilateral superior turbinate was resected if necessary for access, and a face-of-sphenoid flap, which permitted preservation of the posterior septal artery, was developed during the posterior septectomy and sphenoidotomy. Care was taken to preserve the contralateral superior turbinate and a suprior 2-cm strip of septum was preserved at the skull base. If required, a Hadad-Bassagasteguy (HB) nasoseptal flap was elevated on the ipsilateral side prior to the posterior septectomy. In the postoperative period, patients were given instructions to use a nasal saline spray 4 times daily, and were seen at 2 to 3 weeks for debridement. They were given instructions to use saline irrigations and were seen again at 2 to 4 weeks, depending on the status of their sinonasal cavity, for postoperative outcome assessment. Given the great distance that some patients travel for care, some variability was encountered in the postoperative follow-up regimen.

As olfaction was established as the primary outcome, the study was powered accordingly. In order to detect a change in olfaction that would be significant to the patient, a categorical change from normosmia to mild hyposmia would need to be detected. This would require a greater than 5-point change on the SIT, or 12.5%. The pre- and postoperative groups were treated as independent samples and a standard deviation of 5 was assumed. With a power set at 0.8, the total sample size to detect a difference between groups was calculated to be 22. All statistical analysis was performed with SPSS 14.0 (SPSS, Inc., Chicago, IL) using paired t tests and 1-tailed Pearson’s correlation coefficient with an alpha of 0.05 for both for significance.

Results

Thirty patients presented for endoscopic transsphenoidal anterior skull-base surgery during the study period, of whom 22 met study inclusion criteria. The indication for surgery was a nonfunctioning pituitary macroadenoma in 12 patients, a secreting pituitary adenoma in 8 patients (4 adrenocorticotropic hormone, 3 growth hormone, 1 prolactinoma) and a Rathke’s cleft cyst in 2 patients. There were 13 female and 9 male patients enrolled, with ages ranging from 18 to 69 (mean age 49) years. Cerebrospinal fluid (CSF) was encountered intraoperatively in 8 cases, 2 of whom (both adrenocorticotropic hormone

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[ACTH]-secreting tumors) also had a leak in the postoperative period. Two patients had an HB flap for closure during their primary surgery, and an HB flap was raised secondarily for definitive closure in the 2 cases with a postoperative cerebrospinal fluid (CSF) leak. The average time to testing in the postoperative period was 58 days, with a range of 22 to 166 days. Seventeen patients (77%) had postoperative testing completed between 30 and 60 days postsurgery.

The mean SIT score preoperatively was 34.8 ± 2.3, whereas the mean postoperative score was slightly, but not significantly, increased at 35.1 ± 3.0 (p = 0.37). There was no significant difference between males and females (p = 0.89). The range of SIT score change was from a decrease of 3 points (−7%) to an increase of 4 points (+10%), with 10 patients improving, 3 having no change in score, and 9 having a decrease in olfactory function. Twenty patients reported no subjective change in olfaction; the 2 patients who reported a subjective decrease in olfaction actually scored 2 points higher on repeat SIT testing. When examined categorically, 18 patients had no change in olfactory function, 2 patients had improvement from mild hyposmia to normosmia, 1 patient had a slight decrease from normosmia to mild hyposmia, and 1 patient from mild hyposmia to moderate hyposmia; the 2 patients that had a decrease in category only had a decrease of 1 point on SIT testing. All 4 patients who required a HB flap had preservation of function, with an average change in score of 0 and no change in categorical function. Likewise, all 8 patients with secreting adenomas had preservation of olfactory function, with an average increase in SIT score of 1.3 for growth hormone–secreting tumors and 0 for ACTH-secreting tumors; there was no change in categorical function in either group.

The average symptom score preoperatively was 5.9, with no significant change recorded postoperatively (average score 5.3, p = 0.87). No correlation was present between change in SIT score and symptom score (r = −0.191, p = 0.20). All 5 patients (22%) with a preoperative symptom score above 10 had postoperative improvement in subjective sinonasal outcome, with an average 8-point decrease in score. Of the 6 patients (27%) with an increase in score of greater than 1, only 2 patients (9%) had a change of greater than 6 points.

A statistically significant difference was present on LKES, with an average change from 0.6 preoperatively to 2.5 postoperatively (p = 0.001). Again, no correlation was present between LKES and either symptom score (r = −0.02, p = 0.47) or change in SIT score (r = −0.096, p = 0.34).

**Discussion**

This study has successfully demonstrated that olfaction, as measured by the SIT scoring system, can be preserved during endoscopic transsphenoidal surgery using a unilateral middle-turbinate–sacrificing approach. Furthermore, in spite of previous criticisms of this approach, this study also suggests that there is no change in subjective and minimal change in objective assessment of sinonasal outcome.

The amount of olfactory dysfunction in endoscopic endonasal skull-base surgery reported by previous authors is variable. When assessed subjectively, the number of patients reporting significant olfactory dysfunction with endoscopic endonasal approaches varies from 9.7% to 27%. Hart et al. reported no change in mean olfactory function with SIT testing at 3 months with a middle-turbinate–preserving technique, but 3 patients had a greater than 25% increase in postoperative SIT score, potentially confounding the results. Another study examining the effect on olfactory function of routine elevation of an HB flap with a middle-turbinate–preserving demonstrated an average decrease of 16% on SIT testing at 6 months. Although our group of patients with HB flaps was small (n = 4), early postoperative testing demonstrated no change in olfactory function, which may be due to our elevation of the flap without cautery. Another potential reason is that the middle-turbinate–sparing approach often requires resection of part of the superior turbinate bilaterally. Previous cadaveric studies have found that the olfactory neuroepithelium is concentrated in the superior turbinate, superior septum, and some areas of the middle turbinate. It is possible that by completely preserving 1 superior turbinate and the superior 2 cm of septum there is better olfaction postoperatively. The preservation of olfaction may also be due to improved nasal airflow to the remaining olfactory neuroepithelium.

The current study has demonstrated minimal effect on both subjective sinonasal symptoms and objective appearance in endoscopic endonasal transsphenoidal sellar surgery. No significant difference in subjective symptom score was noted postoperatively and the slight increase in LKES, while statistically significant, is likely clinically insignificant in the authors’ opinion. The lack of correlation between increased symptom score and LKES in this study is expected. Previous studies have demonstrated that LKES scores are correlated with performance on subjective health-related quality-of-life surveys, but that the correlation could only explain 25% to 36% of the improvement noted. A possible reason for the lack of correlation in this study is the application of an objective scoring system designed for sinusitis to skull-base surgery. Unfortunately, to our knowledge, no validated tool exists as of yet to quantify the objective endoscopic outcome in skull-base surgery. Likewise, the SNOT-22 questionnaire has been applied in previous studies of endonasal skull-base surgery, but it was not designed for this purpose. However, prospectively applied the SNOT-22 in a heterogeneous group of endoscopic skull-base surgery patients and found that, after a transient worsening, patients actually had a small, but statistically significant, improvement in scores. A tool for assessing the subjective changes in site-specific quality of life after endoscopic transsphenoidal skull-base surgery did not exist when our study commenced; the Anterior Skull Base Nasal Inventory has, however, been recently described in the literature.
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Nyquist et al. directly addressed the issue of middle turbinate preservation during endoscopic endonasal skull-base surgery. They were able to preserve the middle turbinate in 98% of cases; the rationale for middle turbinate preservation was to not hinder endonasal function. Of main concern was the potential risk of frontal sinusitis, hypoplasia, epistaxis, empty nose syndrome, and increased crusting with middle turbinectomy. The literature on frontal sinusitis with middle turbinectomy in the setting of surgery for sinusitis is divided and several authors demonstrate it is, in fact, quite rare in incidence. Our study has demonstrated that olfaction is, in fact, preserved and that whereas the LKES is increased postoperatively, it is only to a slight degree. In the senior author’s experience with over 250 cases of middle-turbinate–sacrificing endonasal skull-base procedures, there is also no increased incidence of epistaxis, nor has there been a single complaint of empty nose syndrome. In fact, in this study, 22% of patients had a substantial improvement in subjective sinonasal symptoms, and 73% of patients reported a stable or improved subjective symptom score. The findings in this study could have been augmented by a larger sample size; however, given the sample size calculation, it was adequately powered to detect a clinically significant difference. Longer follow-up (ie, 6 months postoperatively) could have potentially shown improved subjective and objective sinonasal scoring. In fact, this has been documented by other authors, with an average duration of crusting of 126 &plusmn 87 days in endoscopic endonasal skull-base surgery. The heterogeneity encountered in time to postoperative assessment was secondary to the significant distances patients must travel for care. All attempts possible were made to ensure that patient follow-up with the services involved in their care happened at the same visit, at times either shortening or prolonging the time to follow-up. It is encouraging that even though the majority (77%) of our patients were tested between 30 and 60 days postsurgery, no significant difference was seen on symptom scores.

Conclusion

This is the first study to investigate the olfactory and sinonasal outcomes of unilateral middle-turbinate–sacrificing endoscopic transsphenoidal skull-base surgery. There was no change in olfaction on SIT testing or in subjective assessment of sinonasal symptoms. A slight increase in objective sinonasal scoring was, however, noted in the early postoperative period.

References