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Asymptomatic Radiographic Sinonasal Inflammation Does Not Affect Pituitary Surgery Outcomes

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Objective: Chronic rhinosinusitis (CRS) is a proposed risk factor for meningitis and other intracranial complications following the endoscopic endonasal transsphenoidal approach (TSA). Some have recommended staging TSA following surgery for CRS; however, delaying TSA has important ramifications. The objective of this study is to determine whether asymptomatic sinonasal inflammation (RSNI) on preoperative computed tomography scans, without clinical CRS, is associated with postoperative complications following TSA.

Methods: All consecutive TSA cases performed at a single tertiary care institution from January 1, 2009, to December 31, 2017, were reviewed for patient demographics, prior surgery, presence of RSNI on preoperative computed tomography scan based on Lund-Mackay (LM) score, intraoperative cerebrospinal fluid (CSF) leak, and postoperative complications (postoperative CSF leak, bleeding, infection). The association between preoperative RSNI and postoperative complications was analyzed via multivariate logistic regression.

Results: One hundred seventy-one cases of TSA were included with mean patient age of 52.6 years, 42.7% males, 18.1% revision cases, and mean LM score of 1.9 ± 2.7. Complications were identified in 9.9% of patients at the following rates: 5.3% postoperative CSF leak, 2.9% bleeding, and 1.8% infection (all sinusitis, no episodes of meningitis). Neither total LM score nor LM score >5 (representative of clinically significant radiographic CRS) were predictors of any postoperative complication (both P > 0.05). Age, sex, revision status, intraoperative CSF leak, and total LM score were not independent predictors of any postoperative complication on multivariate analysis (all P > 0.05).

Conclusion: In asymptomatic patients, radiographic evidence of sinonasal inflammation is not associated with increased risk of complications following TSA.

Key Words: Pituitary surgery, infections, outcomes, chronic sinusitis, radiography.

Level of Evidence: 4

INTRODUCTION

Pituitary tumors, most commonly adenomas, are very common neoplasms, with more than 10 thousand cases diagnosed annually. As they become symptomatic, surgery remains the mainstay of treatment, with endoscopic transsphenoidal approaches (TSA) gaining in favor over traditional transcranial and microscopic techniques. These procedures are now commonly performed through the joint efforts of an otolaryngologist/rhinologist and neurosurgeon. Although rare, feared complications following TSA include postoperative/delayed cerebrospinal fluid (CSF) leak and intracranial infection (i.e., meningitis). Chronic rhinosinusitis (CRS) is also highly prevalent and is often associated with radiographic evidence of sinonasal inflammation (RSNI) as diagnosed on computed tomography (CT) scans. However, it is important to distinguish clinically significant sinusitis (i.e., those with symptoms) from RSNI, which may or may not suggest actual sinusitis. Early reports of TSA have identified the presence of sinusitis as a potential risk factor for developing meningitis postoperatively. Thus, pre-TSA treatment of any active sinusitis has been traditionally advocated, and TSA should be deferred until the sinusitis is under control. However, delaying TSA in the setting of a symptomatic pituitary lesion, which can present with headaches, vision changes, or endocrinopathies, may also have a significant impact on health status for these patients. The objective of this study is to determine whether the presence of asymptomatic radiographic inflammation affects post-TSA infectious, reconstructive, and bleeding outcomes.

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MATERIALS AND METHODS

Institutional review board approval was obtained for this study. All consecutive TSA cases performed at a single tertiary care institution from January 1, 2009, to December 31, 2017, were reviewed. The technique for TSA involved either a uninostril or bиноstril approach, including routine resection of one middle turbinate, removal of the sphenoid rostrum, and creation of a wide bilateral sphenoidotomy with partial posterior ethmoidectomy—sparing the olfactory strip—with preservation of the contralateral nasal septal mucosa. If an intraoperative CSF leak was encountered, either a nasoseptal flap or free mucosal graft was used for closure of the leak; otherwise, a free mucosal graft taken from the resected middle turbinate was used to cover the sella. Specifically, data including patient demographics (age and sex), primary versus revision surgery or prior history of sinonasal surgery, presence of RSNI on preoperative CT scan based on Lund-Mackay Scores of the Study Cohort, and presence of intraoperative CSF leak were collected. The primary outcome variables included the presence of postoperative complications (postoperative CSF leak, bleeding, infection sinonasal in nature, and/or meningitis). Patients with active sinonasal infection with symptoms (e.g., acute rhinosinusitis), odontogenic sinusitis, fungal ball, or frank nasal polyposis were excluded from the analysis and were treated first for their active infectious/inflammatory condition, with pituitary surgery staged at a later time. All patients, both those included and excluded from the analysis, were evaluated and diagnosed based on a combination of clinical symptoms, nasal endoscopy, and preoperative imaging.

The association between preoperative RSNI and postoperative complications was analyzed first via univariate regression to identify significant correlations between factors and outcome variables. This was then followed by multivariate logistic regression to determine independent predictors of a given outcome. All statistical testing was performed using SPSS 21 (IBM Corp., Armonk, NY). A significance level of 0.05 was used for all comparisons.

RESULTS

A total of 171 cases of TSA were included in the analysis. The mean patient age of 52.6 ± 17.4 years. There were 73 (42.7%) males. Of those, 31 (18.1%) patients had a history of prior nasal, sinus, or pituitary surgery. Seventy (40.9%) cases developed an intraoperative CSF leak; all were repaired at the time of surgery. The mean total LM score was 1.87 ± 2.65 (range 0–14), and 15 (8.8%) patients had total LM score >5, which is representative of clinically significant radiographic sinusitis.3 Sinus-specific LM scores are summarized in Table I.

Postoperative complications were identified in 17 (9.9%) patients. Specifically, nine (5.3%) patients developed a postoperative CSF leak; five (2.9%) developed postoperative bleeding/epistaxis; and three (1.8%) developed postoperative infections. All infections involved the sinonasal cavity only, with no patients developing meningitis, and were treated with systemic antibiotics without consequence. No patients with total LM >5 developed complications.

Table II summarizes the regression analysis results. Total LM score was not a predictor of any postoperative complication. Age, sex, revision status, intraoperative CSF leak, and total LM score were not independent predictors of any postoperative complication or any specific complications on multivariate analysis.

DISCUSSION

Endoscopic pituitary surgery is now frequently performed and has gradually become the approach of choice for most pituitary tumors. Most patients who undergo pituitary surgery do not have concurrent sinusitis, and traditional teaching dictates that patients with active sinus infections should delay elective pituitary surgery until the infection is treated or resolves in order to prevent intracranial spread of infection.4 Furthermore, there is generally a low risk of intracranial infection during endoscopic skull base surgery, especially with perioperative antibiotic usage.5 Despite its increasing utilization and relative safety and efficacy, little is known about whether preoperative radiographic sinonasal inflammation affects pituitary surgery outcomes. This study is the first of its kind to systematically evaluate all consecutive cases of endonasal endoscopic transsphenoidal surgery for preoperative RSNI and how sinonasal inflammation impacts pituitary surgery outcomes.

In our large series experience, we found there was no correlation between positive LM scores in the setting of nonpolypoid inflammatory disease (as reflective of low levels of RSNI) and the presence of any TSA-related complication, including postoperative CSF leak, epistaxis, or infection (both sinonasal or intracranial). This is consistent with, although larger in scale than, several prior studies that have examined this population of patients. Schaberg et al. described 14 patients who underwent concomitant transsphenoidal surgery for anterior skull base lesions and functional endoscopic sinus surgery to address preoperative sinusitis.6 All patients in this cohort had a clinical diagnosis of CRS based on preoperative symptoms. They found that no patient developed any intracranial complications, including no postoperative CSF leaks or meningitis. The same group then expanded their series to 35 patients with dual diagnoses of skull base lesion and CRS, including patients with nasal polyposis and noninvasive fungal sinusitis, and once again found
that no intracranial complications occurred in their cohort.⁷ Another case series of 11 patients by Heo and Park found that no intracranial complications were noted following concurrent TSA and endoscopic sinus surgery for sinusitis.⁸ Min et al. found no association between radiographic sinusitis and postoperative intracranial infections in 107 patients undergoing TSA.⁹ Finally, Bae et al. reported an experience involving 26 patients who all had some degree of radiographic inflammation; all were treated with either antibiotics or surgery and stabilized prior to addressing the pituitary lesion, with no reports of intracranial infection following pituitary surgery.¹⁰ Taken together, the prior studies provide evidence that the presence of sinonasal inflammation, at least at low levels observed radiographically, does not increase the risk of infectious sequelae.⁷

Although not always correlated with the presence of sinonasal inflammation, sinonasal infection has been proposed as a risk factor for failure of skull base reconstruction. Kim et al., in a series of 33 patients, found that postoperative sinus infection was associated with nasoseptal flap failure.¹⁵ Chabot et al. described the phenomenon of nasoseptal flap necrosis, occurring in approximately 1% of cases, which appears to be linked with the development of postoperative meningitis as a causative factor as opposed to primary flap failure leading to intracranial infection.¹¹ Even with these rare occurrences reported in the literature, the current study found no increased risk of skull base reconstruction failure with radiographic inflammation, although as stated above, patients with active infection were excluded from the analysis. In fact, accounting for only those cases with clinically significant radiographic sinusitis, none of these patients developed a postoperative CSF leak.

There has been some debate regarding solely using radiographic evidence of inflammation for the diagnosis of CRS. Ashraf and Bhattacharyya, in examining 199 patients with sinus scans but without clinically significant sinusitis, defined a normal range of LM scores as being between 0 through 5.³ Nazri et al., in examining patients who underwent CT and magnetic resonance imaging, including cuts through the sinuses, found that more than 15% of patients may have incidental positive LM scores and that the mean LM score for nonsinusitis patients was 2.2 (compared to 6.2 for sinusitis patients).¹² Rudmik et al. further defined “high-stage” radiographic sinusitis based on scanning as total LM score greater than 3.¹³ In the current study, we defined clinically significant radiographic sinusitis based on the Ashraf and Bhattacharyya criteria, which uses the highest value out of the above three proposed cutoffs and therefore carries the greatest sensitivity.

There are several limitations to the current study. First, the main determinant of possible sinusitis in the current study was the presence of radiographic mucosal inflammation, and not all patients may have had symptoms characteristic of CRS. Patients were included in the analysis if they had “clinically eliminated, radiographically positive sinusitis.” Despite this, the mere presence of inflammation likely suggests that there is altered function of the sinonasal mucosa due to primary inflammation, a reaction to the environment, and/or an infectious etiology, and that it likely would function differently from noninflamed mucosa. Second, we utilized mainly technical risk factors and did not account for preoperative medical conditions that may predispose to adverse outcomes (e.g., diabetes, smoking). This may impact the strength of the regression analysis, although the presence of preoperative radiographic sinusitis is likely independent of these factors. Third, we did not account for differences in reconstruction technique due to surgeon preference, and CSF leaks were closed with either free mucosal grafting or nasoseptal flap. Nevertheless, we found no obvious influence upon reconstructive outcomes based on radiographic inflammation.

**CONCLUSION**

In asymptomatic patients, radiographic evidence of sinonasal inflammation, even when clinically significant by scoring criteria, is not associated with increased risk of postoperative complications following TSA. The transsphenoidal approach remains safe to perform in the absence of active sinonasal infection. Even with imaging suggesting asymptomatic sinonasal inflammation, there is no apparent increased risk of intracranial infection.

**BIBLIOGRAPHY**

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**TABLE II.**

Univariate and Multivariate Regression Analysis for Predictors of Postoperative Complications.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Outcome</th>
<th>OR (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Univariate</td>
<td>Any postoperative complication</td>
<td>0.76 (0.54–1.07)</td>
<td>0.114</td>
</tr>
<tr>
<td></td>
<td>Postoperative CSF leak</td>
<td>0.61 (0.32–1.17)</td>
<td>0.135</td>
</tr>
<tr>
<td></td>
<td>Postoperative bleeding</td>
<td>0.96 (0.65–1.40)</td>
<td>0.816</td>
</tr>
<tr>
<td></td>
<td>Postoperative infection</td>
<td>0.68 (0.26–1.80)</td>
<td>0.436</td>
</tr>
<tr>
<td>Multivariate</td>
<td>Any postoperative complication</td>
<td>0.72 (0.50–1.06)</td>
<td>0.093</td>
</tr>
<tr>
<td>Controlling for</td>
<td>Postoperative CSF leak</td>
<td>0.56 (0.26–1.17)</td>
<td>0.123</td>
</tr>
<tr>
<td>age, sex, primary</td>
<td>Postoperative bleeding</td>
<td>0.94 (0.62–1.41)</td>
<td>0.757</td>
</tr>
<tr>
<td>surgery status, intraoperative</td>
<td>Postoperative infection</td>
<td>0.57 (0.17–1.87)</td>
<td>0.351</td>
</tr>
</tbody>
</table>

CI = confidence interval; CSF = cerebrospinal fluid; LM = Lund-Mackay; OR = odds ratio.


