Original Article

Transseptal Versus Endonasal Approaches in Endoscopic Transsphenoidal Surgery for Pituitary Tumors

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ABSTRACT

Background: Currently, transsphenoidal surgery is considered the procedure of choice for treating most sellar lesions. There are two different surgical options for performing the transsphenoidal procedure, the transseptal and the endonasal techniques. Objective: the aim of this study is to compare transseptal and endonasal approaches in endoscopic transsphenoidal surgery for pituitary tumors regarding intraoperative factors and postoperative outcome. Patients and Methods: 40 patients with pituitary adenomas operated upon in the period from 2007 till 2011 were included in the study: the patients were divided into two groups, the 1st group was operated through a transseptal approach using the endoscope and this group included 22 patients. The 2nd group was operated through a direct endonasal approach using the endoscope and this group included 18 patients. Results: Total removal was achieved in 31.8% of the transseptal group and in 33.3% of the endonasal group. Subtotal removal was achieved in 59.1% of the transseptal group and in 61.1% of the endonasal group. Partial tumor removal was achieved in 9.1% of the transseptal group and in 5.6% of the endonasal group.

Conclusion: Endoscopic transseptal technique may be comparable to direct endonasal technique in endoscopic transsphenoidal surgery for pituitary tumors in terms of total tumor resection, operative time, hospital stay, intraoperative factors and postoperative morbidity. Transseptal technique is specially preferred when there is significant nasal septal deviation.

INTRODUCTION

The success of endoscopic paranasal sinus surgery has aroused the interest in the use of endoscopes during pituitary surgery. Currently, transsphenoidal surgery is considered the procedure of choice for treating most sellar lesions. There are two different surgical options for performing the transsphenoidal procedure, the transseptal and the endonasal techniques.

The addition of endoscopic technology has further improved the transseptal method. The main advantages of the endoscopic technique is the angled vision and panoramic view which enable the surgeon to manipulate supra- and parasellar tumors under direct vision rather than the restricted view provided by the operating microscope which only allows blind curettage of tumors extending to these areas. Another important advantage of the endoscopic technique is reducing the need for nasal packing with encouraging postoperative results.

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PATIENTS & METHODS

Retrospective review of the charts of 40 patients with pituitary sellar lesions who were operated in the period from July 2007 till January 2011 at Neurosurgery Department, Zagazig University Hospital was done; all the surgeries were undertaken by a same team approach comprising a rhinologist and a neurosurgeon through a transsphenoidal route with no surgeons’ preference. The patients included in this study were categorized into two groups:
The 1st group was operated through a transseptal approach using the endoscope and this group includes 22 patients during the period from July 2007 to September 2009.

The 2nd group was operated through a direct Endonasal approach using the endoscope and this group includes 18 patients during the period from October 2009 to January 2011.

Each patient was subjected to the following:

- Full History and Clinical examination: including neurological, endocrinological and ophthalmological assessment.
- Radiological evaluation: to determine the tumor size and extensions, optic compression, cavernous sinus invasion and whether the normal pituitary gland is seen or not followed by control images postoperatively.
- Rhinological evaluation: before, during and after surgery including assessment of septal deviations, presence of any nasal pathology and any postoperative sequelae or complications resulting from the surgery. Patients are examined at 1 week, 4 weeks, 8 weeks and 3 months postoperatively and after that on an individual basis (if there is any persisting symptoms or signs).
- Operative data: The method of surgery, intra-operative observations, intra operative localization used degree of tumor resection, sellar reconstruction, nasal packing, operative time and intra-operative difficulties or complications.
- Monitoring for hospital stay and postoperative complications.
- Histopathological evaluation.
- Statistical analysis: qualitative data are presented as number and percentage and chi-square test is used. Fisher exact was recommended when expected value is less than 5; quantitative data are presented by mean and standard deviation and independent t test was used to compare two means; p < 0.05 is considered significant.

RESULTS

This study consisted of 40 patients, 24 males and 16 females. Their ages ranged from 23 to 78 years with a mean of 53 years and 7 months. The follow up ranged from 7 months to 2 years, with a mean of 14 months, the patients were divided into two groups,

- The 1st group was operated through a Transseptal approach using the endoscope and this group includes 22 patients.
- The 2nd group was operated through a direct Endonasal approach using the endoscope and this group includes 18 patients.

Operative data:

- Transsphenoidal retractors: were used in all the cases of transseptal group while it was not used in any of the direct endonasal group.
- Middle turbinate: Not manipulated in any case of transseptal group and in 10 cases of the endonasal group, while unilateral partial turbinectomy in 4 cases and bilateral partial turbinectomy were done in other 4 cases of the endonasal group.
- Intraoperative localization: fluoroscopy was required to ascertain sellar entry in every case of the transseptal group, while it was not used in any case of the direct endonasal group.
- Which side used: the right side was used in 12 cases, while left side was used in the other 10 cases of the transseptal group; the right side was used in 8 cases of the endonasal group, while both sides were used in the other 10 cases of the endonasal group.

There were 32 macroadenomas among the 40 patients, 17 in the transseptal (1st group) and 15 in the endonasal group (2nd group). There were 5 microadenoma among the Transseptal (1st group) patients and 3 among the Endonasal group (2nd group) patients. There were 15 endocrine active adenomas in the two groups, eight in the 1st, (2 GH secreting and 6 prolactinomas), and seven in the 2nd group (1 GH secreting and 6 prolactinomas). There were 25 non-functioning adenomas in the two groups, fourteen in the 1st, and eleven in the 2nd group. There were no significant difference in the distribution of macro- and microadenomas among the 2 groups. Also, there was no significant difference between the histopathological results of the 2 groups.

Rhinological condition of the 2 groups: 9 patients of the transseptal group had significant septal deviation before surgery with some degree of nasal obstruction and this was corrected during surgery. During the follow up, all these 9 patients reported improvement of their nasal airway after surgery. 6 patients of the endonasal group had mild asymptomatic septal deviation before surgery. None of the patients of both groups had clinical or radiological evidence of chronic sinusitis or nasal polyps before surgery. Nasal packs were kept for 48 hours and septal splints for 1 week in the 1st group; while packs were removed after 1 day and no septal splints were used in the 2nd group. Postoperatively, nasal crusting was very minimal and disappeared after 2 weeks in the transseptal group, while it was significant and persisted for a period of at least 1 month in the direct endonasal group especially in cases that required partial middle turbinate resection. Only one patient from each group had postoperative sphenoidal sinusitis which was treated with antibiotics and nasal steroids.

Table (1) shows the mean ages (in years), operative times (in hours), hospital stay (in days) and follow up periods (in months) of the 2 groups.
Table (1): Age, operative time, hospital stay and follow up.

<table>
<thead>
<tr>
<th></th>
<th>Transeptal (22)</th>
<th>Endonasal (18)</th>
<th>t test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Age</td>
<td>50.7</td>
<td>17.0</td>
<td>60.8</td>
</tr>
<tr>
<td>Operative time</td>
<td>2:57</td>
<td>1.0</td>
<td>2:50</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>3.25</td>
<td>1.2</td>
<td>3.23</td>
</tr>
<tr>
<td>Follow up</td>
<td>15.9</td>
<td>6.1</td>
<td>12.5</td>
</tr>
</tbody>
</table>

Table 2: Degree of tumor removal of the two groups

<table>
<thead>
<tr>
<th>Degree of removal</th>
<th>Transeptal (22)</th>
<th>Endonasal (18)</th>
<th>X²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total removal</td>
<td>7</td>
<td>6</td>
<td>0.01</td>
<td>0.91 NS</td>
</tr>
<tr>
<td>Subtotal (&gt;80%)</td>
<td>13</td>
<td>11</td>
<td>0.01</td>
<td>0.89 NS</td>
</tr>
<tr>
<td>Partial (&lt;80%)</td>
<td>2</td>
<td>1</td>
<td>fisher</td>
<td>1.0 NS</td>
</tr>
</tbody>
</table>

NS= non significant

Table 3: Visual function of the two groups.

<table>
<thead>
<tr>
<th></th>
<th>Transeptal (22)</th>
<th>Endonasal (18)</th>
<th>Sn</th>
<th>Dt</th>
<th>Sd</th>
<th>Im</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative</td>
<td>Number</td>
<td>Number</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Postoperative</td>
<td>Sn</td>
<td>Dt</td>
<td>Sd</td>
<td>Im</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>12</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Improved</td>
<td>80% (8 out of 10)</td>
<td>87.5% (7 out of 8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Not improved</td>
<td>20% (2 out of 10)</td>
<td>12.5% (1 out of 8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Deteriorated</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sn= same normal    Dt= deteriorated
Sd= same deteriorated    Im= improved

Table 4: Postoperative complications of the two groups.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Transeptal</th>
<th>Endoscopic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhinosinusitis</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Epistaxis</td>
<td>-</td>
<td>0%</td>
</tr>
<tr>
<td>CSF leak</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Transient DI</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>
DISCUSSION

The direct endonasal transsphenoidal (endoscopic sphenoidotomy) route is the approach done without septal incisions or mucosal elevations. It doesn’t require the use of retractors and is done entirely with the aid of the endoscope.\(^7\)

Jho considered the endoscopic sphenoidotomy approach to be more physiological than the other approaches due to the lack of incisions and also, because it doesn’t utilize middle turbinate resection, ethmoidectomy or sphenoid sinus mucosal stripping. In this way, the normal sinonasal physiological anatomy is well maintained postoperatively\(^{16}\).

Carrau et al. discussed the advantages of the endoscopic sphenoidotomy approach as it doesn’t require nasal mucosal incisions and mucosal dissections and endonasal technique avoids the potential complications resulting from the use of transsphenoidal retractors such as maxillary diastasis or compression injury of the optic nerves.\(^7\)

Cappabianca et al. agreed with Jho and Carrau that the procedure is more physiological than the other procedures to the extent that they called it “functional endoscopic pituitary surgery” or FEPS. In their opinion, the technique provides direct look into the surgical anatomy, with less surgical trauma. It’s a minimally traumatic surgery in respect to inner nose and sellar content. It has an excellent post-operative course with less morbidity. And finally, it seems to be more economical because it minimizes the periods of prolonged hospital stay\(^{2,3}\).
Although there was more significant and prolonged crusting in the endonasal group than the transseptal group in our study, postoperative nasal condition was satisfactory for both groups with no synchia or persistent sinusitis. However, patients of the transseptal group who had septal deviation before surgery showed better nasal airway after surgery and this one of the advantages of the Transseptal surgery. The authors recommend using this route in the presence of significant septal deviation.

Although the mean hospital stay was shorter in the Endonasal group than the Transseptal group in our study, the difference between the two groups was not significant; the authors of this work agree with many authors that the shortened hospital stay is one of the important advantages of endoscopic transsphenoidal surgery as general with no privilege of direct endonasal over transseptal technique.

The choice which side is used in the Endonasal group depends on which side is anatomically wider and the laterality of the tumor. Carrau et al., when 1st described the endoscopic technique in 1996 used a one nostril approach and this was the anatomically wider side, the advantage of the bilateral exposure is providing more working channel so that the endoscope can be introduced through one nostril and the instruments through the other one thus avoiding the difficulty and sometimes the frustration met during inserting both tools through one nostril, especially with narrow nasal passages. This bilateral approach was described and used by some authors while others reported the use of the contralateral side of the lateralized adenoma which, from their standpoint of view, would be more suitable for visualizing and removing these lesions.

In this study, a bilateral (two nostril) approach was used in 10 cases of the direct endonasal group, we agreed with notion that bilateral exposure providing more working space for the endoscope and suction which could introduced through one nostril while the other instruments introduced through the other side.

Both Otori et al. and Thomas et al. described a bilateral endoscopic ethmo-sphenoidal approach to provide wide channel for removing the pituitary lesion in 40 cases. Middle turbinate was partially resected in some of their cases to provide wider exposure. Thomas et al didn’t report any increased incidence of bleeding or infection resulting from this maneuver.

In this work, partial resection of the lower part of the middle turbinate was required unilaterally in 4 patients and bilaterally in another 4 patients of the 2nd group. The indication for that was the presence of large macroadenomas with lateral extension into the cavernous sinus in the presence of hypertrophied middle turbinate. This partial resection is sometimes used to provide more space for instrument manipulation necessary to remove this kind of lesions. Partial turbinectomy was not accompanied by any abnormal postoperative course or complications in these 8 patients. In the rest of the patients, no interference or just lateral displacement of the middle turbinate was enough to expose the sphenoid ostium and provide adequate space for removing the tumor.

Different materials were utilized to reconstruct the sella after completion of the transsphenoidal procedure in the two groups. The choice of these materials depends upon the surgeon’s preference, the condition of the sella at the end of the surgery and whether there are complications (as CSF leak) or not. Various techniques and materials depending on surgeons’ experiences are used for skull base reconstruction to prevent CSF leak. Intradural and/or extradural closure of skull base defect and packing of the sella with or without packing of the sphenoid sinus can be the technical options. The majority of surgeons use a combination of autologous intra-dural grafts (fat, muscle, fascia lata, dermal grafts, lyophilised dura mater), a hemostatic agent (collagen sponge, oxidized cellulose, etc.) and/or some form of rigid/semi-rigid buttressing (nasal septum, sphenoid bone, titanium mesh, biodegradable plates or Foley catheter). Usage of vascularized mucosal flaps, dural substitutes and tissue sealants have also been described. These can be deployed either with or without the assistance of lumbar CSF diversion.

There was no difference in the outcome of the surgery related to any of the materials used for reconstruction. In all of our cases, fat packing was used only if there is CSF leakage or if there is a large sellar dead space after tumor removal, we used gel foam, cartilage, hostacryl, and it’s especially of value if there is CSF leakage; it provides a watertight seal and glues the reconstruction materials together.

Although no significant difference in materials used for sellar reconstruction in both groups, the incidence of CSF leak postoperatively reported in 3 cases in the endonasal group (16.7%), and in only one case of the transseptal group (4.5%); we could explain that septal closure and nasal packing at end of the transseptal technique maintain the reconstruction materials at place and minimize the dead space thus decrease the incidence of postoperative CSF leak; all cases of CSF leak managed conservatively without surgical intervention.

Some authors reported shorter operative times with the endoscopic technique.

In this work; however, although the mean operative time was slightly shorter in the endonasal group than the transseptal group, this was not at all significant. In addition to the technique used, many factors can affect the operative time such as the method of intraoperative localization.

After the traditional transseptal technique, the nose is typically packed for several days. Patients often report that this is the most uncomfortable part of the entire procedure. In this work, nasal packing was used more frequently in the 1st group than the 2nd group and the difference was significant.
Many authors discussed the no or minimal packing with the decreased postoperative discomfort as a unique advantage of the endonasal endoscopic technique.6,16,25,4

Postoperative discomfort is somewhat difficult to measure. Also, it was difficult to compare between the groups regarding this symptom because this requires patients who were operated by the 2 methods (transseptal and endonasal). This is difficult to achieve except after a very long period of time with large flow of patients. In this work, however, the postoperative discomfort was noticed to be much less in the endonasal group than the transseptal group, and it was nearly similar to that experienced after a minimally invasive sinus surgery.

Sheehan et al.23 discussed 3 recurrent patients who experienced much less postoperative discomfort after the 2nd endoscopic procedure than the 1st sublabial procedure. Also, Heilman et al.11 reported the same observation with one of his patients.

There was no statistically significant difference between the 2 groups regarding the degree of tumor resection postoperatively. Total removal was achieved in 31.8% of the transseptal group and in 33.3% of the endonasal group. Subtotal removal was achieved in 59.1% of the transseptal group and in 61.1% of the endonasal group. Partial tumor removal was achieved in 9.1% of the transseptal group and in 5.6% of the endonasal group. Subtotal removal was achieved in 9.1% of the transseptal group and in 5.6% of the endonasal group. Partial tumor removal was achieved in 9.1% of the transseptal group and in 5.6% of the endonasal group. The results of this study compared to these of Sheehan et al. who achieved total resection in 44% of patients with the endoscopic technique.

On the other hand, Cappabianca et al. reported total tumor removal in 62.3%, subtotal removal in 24.7% and partial removal in 13.0%. However, total tumor removal rate of this series of 146 patients’ drops to 56.6% if analysis is restricted to macroadenomas only.4

The relatively lower rate of complete tumor resection in this work can be explained by the smaller sample size, the relatively higher rate of macroadenomas. Moreover, most of the adenomas of our study group are nonfunctioning in an old age group of patients where total removal was not the primary goal of surgery.

In this study, subtotal removal was greater than Cappabianca et al.4 The authors of this work agree with the opinion of Cappabianca et al that a cautious strategy determines the degree of tumor removal, whether partial or total, and not the technique itself. At the same time, the increased vision offered by the endoscope permits removal of the lesion under better visual control, thus contributing to lowering of complication rate.

The distribution of visually impaired patients among the 2 groups was ten and eight patients respectively. The visual outcome in the 2 groups was satisfactory. In the transseptal group, 80% of the patients who showed preoperative visual impairment improved postoperatively and none of the unimpaired patients deteriorated. In the endonasal group, no patient who had unimpaired vision before surgery deteriorated after it. However, one patient of this group who had preoperative visual impairment remained the same after surgery with improvement rate of 87.5%. Tumor removal was partial in that patient who had a large nonfunctioning macroadenoma. Although these results seem to be in favor of the endonasal group, there was no statistically significant difference between the two groups.

These visual outcome results are parallel to those of Sheehan et al.23, who noticed visual improvement in 92% of the endoscopic group and 87% of the conventional microsurgical group.

For the functioning adenomas, all the patients in the two groups showed clinical and laboratory improvement after surgery. Some of the patients required additional treatments in the form of medical and/or radiotherapy treatment to achieve good endocrinologic outcome. Longer follow up is needed to ascertain the achievement of permanent cure in these patients. Analysis of the residual anterior pituitary function (adrenal, thyroid and gonadal) after surgery showed no significant difference between the two groups.

During the surgery, some intraoperative complications occurred in the two groups and were managed without any postoperative squeal. These ranged from nasal or cavernous sinus bleeding to intraoperative CSF leakage. Some of these complications usually arise from the surgeon’s keenness to completely remove the lesion. Any pituitary surgeon should have enough skill to deal with such possible complications. Postoperative complications of the two groups fall within the reported ranges.8 Some authors reported fewer complications with the endoscopic technique because it allows removal of the lesion under full visualization16,4 A comparison between the groups in our work showed no significant difference in the incidence of postoperative complications of the two groups.

CONCLUSION

Endoscopic transseptal technique may be comparable to direct endonasal technique in endoscopic transsphenoidal surgery for pituitary tumors regarding total tumor resection, operative time, hospital stay, intraoperative factors and postoperative morbidity; transseptal technique is specially preferred when there is significant nasal septal deviation.

Larger studies with large number of patient population who share the same tumor characteristics and performed by the same surgeon or surgeons with equal experience with longer follow up are recommended. Such studies can provide data sufficient for making comparisons that may prove the superiority of one type of surgery over the others.
REFERENCES