



Original Article

Surgical Outcome of Pure Endonasal Transsphenoidal Approach for Pituitary Tumors

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ABSTRACT

Objective: To determine the frequency of complete tumor excision by endoscopic skull base (transsphenoidal) approach in pituitary adenoma patients presenting to a neurosurgical department.

Materials & Methods: This descriptive case series was conducted at the Department of Neurosurgery Unit II, Lahore General Hospital Lahore from May 2019 to November 2019. The study included 60 patients with pituitary adenoma from the outpatient department who qualified for the inclusion criteria. All patients went through the endoscopic binarial transsphenoidal approach for pituitary adenectomy. All patients were treated according to the department protocols and were followed for 6 weeks to determine the outcome i.e. no residual tumor left as determined by Magnetic Resonance Imaging.

Results: The mean age of pituitary adenoma patients studied was 50.02 ± 8.2 years. 43 patients (71.7%) were male. 56 patients (93.3%) showed complete resection on MRI using the endoscopic binarial transsphenoidal approach. The outcome was not affected by patients' gender and age. Tumor size significantly affected the outcome i.e. complete resection.

Conclusion: It is concluded that the endoscopic skull base (transsphenoidal) approach for excision of pituitary adenomas gives desirable results as depicted by 93.3% success rate in terms of complete resection of the tumor. We did not observe a significant effect of patients' gender and age on the clinical outcome in the studied sample of the population.

Keywords: Endoscopic Binarial Transsphenoidal Approach, Resection, Pituitary Adenoma, Giant Adenoma, Sellar Mass.

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Date of Submission: 31-05-2021
Date of Revision: 05-09-2021
Date of Acceptance: 17-09-2021
Date of Online Publishing: 30-09-2021
Date of Print: 30-09-2021

DOI: 10.36552/pjns.v25i3.551

INTRODUCTION

Pituitary adenomas are among the most frequently reported tumors of sella turcica. Approximately 10% of all brain tumors comprise pituitary adenomas.^{1,2} A study in England reported a four times higher prevalence of pituitary adenomas when compared with previous

estimates.³ Herman Schloffer first introduced trans sphenoidal method for resection of pituitary adenoma about 100 years ago.⁴ The excision of pituitary tumors is modified after the introduction of a transnasal endoscopic approach to the sellaturcica.⁴ The endoscope provides a better view of the sella turcica. The endoscopic approach provides an exceptional panoramic visualization when compared with the conventional conical outlook of the microscopic view.^{5,6} The complete excision of the tumor is important to optimize the integrity of the neural structure by releasing the pressure effects.⁷ Other techniques for tumor resection include the microscopic endonasal transsphenoidal approach and microscopic sublabial transsphenoidal approach.

We are currently using the endoscopic binaural transsphenoidal approach in our hospital. In this approach, an endoscope is used to open the floor of sella turcica and incise the dural sheath to expose the adenoma. The tumor is extracted piecemeal and after tumor removal, the sellar floor is repaired.⁷ Different studies reported different results in terms of complete resection of tumor after endoscopic binarial transsphenoidal resection of pituitary adenoma. It can even be used for the removal of leftover tumors. Study results showed that the success rate of gross tumor excision was 78% (95% CI 67 – 89%).⁸ In another Canadian study complete excision was achieved in 98% of tumors confined to sella turcica whereas total excision was possible in 96% of tumors with extra-sellar invasion.⁹ Excision of functioning pituitary tumors was achieved in 75.6% of patients who had undergone an endoscopic trans-sphenoidal method of surgical treatment.⁴

Endoscopy is increasingly used in pituitary adenoma surgery with promising results and lesser complications. Rates of success are different in different populations. This study aimed to determine the frequency of complete resection of pituitary adenoma possible with binarial transsphenoidal endoscopic approach.

There is no local study available while the available evidence is quite different from one setting to other. Results of this study will help to improve our technique and reduce morbidity and mortality as it may help critically audit the surgical technique. The outcome of this study will help us to know the differences in treatment success and complications between ours and other national and international hospitals. Later comparison will help the patients to enjoy better care.

MATERIALS AND METHODS

Study Design & Setting

A descriptive case series was conducted at the Department of Neurosurgery Unit II, Lahore General Hospital, Lahore from May 2019 to November 2019. The study was conducted after approval of the ethical committee and taking informed consent from patients.

Sample Size & Sampling Technique

Non-probability consecutive sampling was considered. The calculated sample size was 60 cases with an 11% margin of error and 95% confidence level taking expected complete resection about 75.6%.

Inclusion Criteria

Patients of both genders were included who were age from 15 to 65 years. Patients included who were with the diagnosis of pituitary adenoma by Magnetic Resonance Imaging (MRI). All sizes of adenomas were included i.e., small (< 2 cm), medium (2 – 4 cm), and large (> 4 cm).

Exclusion Criteria

Those patients excluded who were having previous surgery or intervention for any pituitary problems determined by history. Diabetic patients were excluded who were determined by history and random blood sugar. Cases excluded who

were with any history of systemic mesenchymal disorders e.g. rheumatoid arthritis and systemic lupus erythematosus.

Surgical Technique

A uniform protocol of surgery i.e., endoscopic binarial transsphenoidal approach was adopted for pituitary adenectomy. The standard procedure was as follows: Patient in general anesthesia, kept in supine position with head turned towards the right to face surgeon. A 4mm or 2.7 mm endoscope was used to visualize the sphenoidal recess. The bilateral Sphenoid Ostia were entered. The posterior nasal septum and anterior wall of the sphenoid were resected. The floor of sella turcica was opened and the dura was incised to expose the adenoma. Intracapsular or extra-capsular tumor debulking was done. The tumor was extracted piecemeal. After tumor removal, the sellar floor was repaired using fascia, fat, bone, cartilage, or prosthesis. Sphenoid sinus was packed with Surgicel or fat. The nasal trumpet was placed overnight. Patients will be followed for 6weeks to determine the outcome i.e. no residual tumor left as determined by magnetic resonance imaging. Adenoma size will be treated as an effect modifier and data will be stratified subsequently.

Data Collection & Analysis

Data was collected by the researcher himself on a pre-designed structured proforma. Adenoma size was treated as an effect modifier and data was stratified subsequently. All patients were treated according to department protocols and followed for 6 weeks to determine the outcome i.e. no residual tumor left as determined by MRI. Data analysis was done in the SPSS version 25. Descriptive statistics were used to project the results. For example, continuous variables like age and percentages were projected as mean and standard deviation whereas categorical variables like gender and complete resection of tumor were

presented as frequency. Data was stratified for age, gender, and tumor size. Post-stratification Fischer exact test or chi-square test was used. A p-value \leq of 0.05 was considered significant.

RESULTS

In this study, 60 patients were studied for 6 weeks after treatment. The overall success rate was 93.3%.

Demographics

The mean ages of patients were 50.02 ± 8.298 ranging from 25 to 60 years of age (Table 1). 2 patients (3.3%) were less than 30 years old whereas 25 patients (41.7%) were between 31 to 50 years and 33 patients (55%) were 50 years or more (Table 1). 43 patients (71.7%) were male whereas 17 (28.3%) were female (Table 1). Tumor size was < 1 cm in 34 patients (56.7%), 1 to 4 cm in 11 patients (18.3%) and > 4 cm in 15 patients (25%) (Table 1). 56 patients (93.3%) showed complete resection on MRI (Table 1).

Table 1: Frequency Distribution of Sampled Population by Age Groups, Gender, Tumor Size & Complete Resection.

	Sub-groups	Frequency	Percent
Age Group (in Years)	< 30	2	3.3
	31 – 50	25	41.7
	\geq 50	33	55.0
Gender	Male	43	71.7
	Female	17	28.3
Tumor Size (in cm)	< 1	34	56.7
	1 – 4	11	18.3
	> 4	15	25
Complete Resection	No	4	6.7
	Yes	56	93.3
Total		60	100.0

Distribution of Tumor Resection

When we cross-tabulated gender with complete resection results was non-significant on using the Pearson chi-square test ($p = 0.878$) which depicts

complete resection was equally distributed among males and females (Table 2). On cross-tabulating tumor size with complete resection, results were statistically significant ($p = 0.042$) which means complete resection was unequally distributed among different tumor sizes (Table 2). Cross-tabulation of age group with complete resection gave us non-significant results using the Pearson chi-square test ($p = 0.691$) which means complete resection was equally distributed among different age groups (Table 2).

Table 2: Cross Tabulation between Complete Resection & Gender, Tumor Size and Age Groups.

		Complete Resection			P-value
		No	Yes	Total	
Gender	Male	3	40	43	0.878 (insignificant)
	Female	1	16	17	
	Total	4	56	60	
Tumor Size (in cm)	< 1	0	34	34	0.042 (significant)
	1 – 4	2	9	11	
	> 4	2	13	15	
	Total	4	56	60	
Age Groups (in years)	< 30	0	2	2	0.691 (insignificant)
	31 – 50	1	24	25	
	≥ 50	3	30	33	
	Total	4	56	60	

DISCUSSION

The complete excision of pituitary tumors is important to optimize the integrity of the neural structure by releasing the pressure effects.⁷ Currently we are using the endoscopic transsphenoidal procedure for excision of pituitary adenomas in our hospital. Endoscopy is increasingly used in pituitary adenoma surgery with promising results and lesser complications. Rates of success are different in different populations. The frequency of re-growth of residual adenoma tissue varies but is more likely when surgery is not combined with radiotherapy. In one report of 91 patients who were treated for

nonfunctioning pituitary tumors with surgery alone, tumor re-growth was seen in 10 percent of patients over approximately six years. In contrast, two series of 491 and 159 patients had higher recurrence rates of 19 and 34 percent, respectively.¹⁰

Another study concluded that recurrence risk was 19.2% in patients with complete tumor resection by surgery alone and 18.4% in patients who had residual tumor after surgery and received radiotherapy. While 58.4% recurrence was observed in patients who had residual tumor after surgery and did not receive radiotherapy.¹¹

In our study, 56 patients (93.3%) showed complete resection on MRI. These results are following another previous research, which concluded that gross removal of the tumor was 78%.⁶ In another Canadian study complete excision was achieved in 98% of tumors confined to sella turcica whereas total excision was possible in 96% of tumors with extrasellar invasion.⁹ In another study of pituitary tumors, complete excision was achieved in 75.6% of all subjects treated with the same approach.⁴

A study on patients with Cushing's disease who underwent an endoscopic transsphenoidal approach concluded a remission rate of 87% after the first surgery. Three patients required redo surgery due to persistently raised cortisol levels. Diabetes insipidus was the common complication that was transient in 33% and permanent in 23% of patients. One patient had recurrence after surgery over approximately 2 years (4 – 79 months).¹²

The endoscopic transsphenoidal approach has also shown promising results in the treatment of acromegaly as evidenced by a success rate of 74.6%.¹³ Another similar study conducted on 33 patients who had intrasellar adenoma showed remission of disease in 84.84% of patients after surgery.¹⁴ A comparison of two techniques showed that the endoscopic transsphenoidal approach for removal of functional pituitary adenomas has a better endocrine outcome as

compared to the conventional microsurgical technique. The success rate in terms of improvement in hormonal over-production was 63% in endoscopic procedures and 50% in traditional microsurgery.¹⁵

A 15 years' study supports that endoscopic trans sphenoidal technique is better than traditional microscopic approach. The risk of complications was determined by age of patient ($p = 0.047$), adenoma size ($P = 0.003$), and extrasellar extension ($P < 0.001$). Disease progression was reported in 27.8% patients after surgery during next 68.5 months. Recurrence of tumor was determined by adenoma size ($P = 0.021$), extent of surgical removal ($p = 0.012$), MIB – 1 index ($P = 0.019$) and Knosp classification ($P = 0.002$).¹⁶

In our study complete resection was equally distributed among different age groups. Complete resection was unequally distributed among different tumor sizes i.e. greater the size, more chances of leftover adenoma. The limitation of this study is the non-probability sampling technique.

CONCLUSION

It is concluded that the endoscopic skull base (trans-sphenoidal) approach for excision of pituitary adenomas gives desirable results as depicted by 93.3% success rate in terms of complete resection of the tumor. We did not observe a significant effect of patients' gender and age on the clinical outcome in the studied sample of the population.

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Additional Information

Disclosures: Authors report no conflict of interest.

Ethical Review Board Approval: The study was conformed to the ethical review board requirements.

Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHORS CONTRIBUTIONS

Sr. #	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Abu Bakar Yasin	Study design and methodology.
2.	Abu Bakar Yasin	Paper writing and data calculations.
3.	Rizwan Ahmed Khan	Data collection and calculations.
4.	Rizwan Ahmed Khan	Analysis of data and interpretation of results etc.
5.	Khalid Mehmood	Literature review and referencing.
6.	Talha Abbass	Analysis of data and quality insurer.
7.	Rizwan Ahmed Khan	Response sheet.