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Original Research Article

EARLY POSTOPERATIVE COMPLICATIONS OF ENDOSCOPIC ENDONASAL TRANS-SPHENOIDAL SURGERY IN PATIENTS WITH PITUITARY ADENOMA

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ABSTRACT

Background: *Endoscopic endonasal trans-sphenoidal surgery is widely used for the management of pituitary adenomas. While it offers several advantages over traditional approaches, early postoperative complications can affect patient outcomes and recovery.* ***Objective:*** *To determine the frequency of early postoperative complications following endoscopic endonasal transsphenoidal surgery in patients diagnosed with pituitary adenoma.* ***Study Design:*** *A descriptive study.* ***Setting:*** *The study was carried out in a tertiary care center equipped with endoscopic neurosurgical facilities (the Neurosurgery Department of Irfan General Hospital, Peshawar).* ***Duration of Study:*** *Postoperative outcomes were monitored for 30 days following surgery.* ***Methods:*** *Ninety-seven patients with pituitary adenomas confirmed on MRI underwent endoscopic endonasal transsphenoidal surgery. Early postoperative complications assessed within the 30-day postoperative period included hyponatremia (serum sodium <135 mEq/L), diabetes insipidus (characterized by polyuria with low urine specific gravity), hypopituitarism (specifically, growth hormone deficiency), and cerebrospinal fluid (CSF) leak, confirmed via beta-2 transferrin testing. Data were analyzed using descriptive statistics to report complication frequencies.* ***Results:*** *The mean age of patients was 41.03 ± 13.25 years, with a male predominance (55.7%). Among the 97 patients, early postoperative complications were as follows: diabetes insipidus in 10 patients (10.3%), hyponatremia in 8 patients (8.2%), hypopituitarism in 6 patients (6.2%), and CSF leak in 3 patients (3.1%).* ***Conclusion:*** *Endoscopic endonasal transsphenoidal surgery for pituitary adenoma is associated with manageable early postoperative complications. The most frequent were diabetes insipidus and hyponatremia, followed by hypopituitarism and CSF leak. Awareness and prompt management of these complications can improve patient recovery and surgical outcomes.*

Keywords: Pituitary Adenoma, Endoscopic Endonasal Surgery, Transsphenoidal Surgery, Diabetes Insipidus, CSF Leak

INTRODUCTION

Pituitary adenomas (PA) are neoplasms originating from the anterior pituitary gland. The majority of pituitary tumors demonstrate slow growth and are classified as benign. The classification is based on both size and cellular origin. Pituitary adenomas are classified into microadenomas, macroadenomas, and giant tumours according to their size. Microadenoma refers to a tumour measuring smaller than 10 mm, while macroadenoma indicates a tumour exceeding 10 mm in size. Giant pituitary malignancies exceed 40 mm in size. Functioning PAs are defined by cell types that lead to increased secretion of any number of hormones produced by the anterior pituitary. Nonfunctioning adenomas fail to produce hormones; however, they may restrict adjacent regions of the anterior pituitary, which leads to hormonal deficiencies. Patients suspected of PA require assessment by a multidisciplinary team (1-5). The average number of PAs is estimated based on autopsy and radiological data. The incidence of this condition varies significantly across studies and sources of information (6). The average frequency of PAs in a study was 16.7%; autopsy findings suggested 14.4%, while radiological evaluations revealed 22.5% (7).

Endoscopic transsphenoidal surgery lowers trauma, provides clear panoramic views, and facilitates the removal of parasellar extensions that have gone undetected under the microscope for nearly 25 years. PAs were historically removed using microscopic transsphenoidal surgery, but this method has been largely replaced by endoscopic endonasal transsphenoidal excision in recent years. The endoscopic method for excising PAs during surgery exhibits superior safety and efficacy compared to the microscopic technique. The endoscopic excision of PAs was first introduced in the early 20th century. Since that point, microsurgical transsphenoidal surgery has consistently been regarded as the gold standard for managing pituitary tumors (8-13). According to a study, the reported early postoperative complications of endoscopic endonasal transsphenoidal surgery for PAs were hyponatremia (90.8%), Hypopituitarism (7.1%), Cerebrospinal fluid leak (4%), and Diabetes Insipidus (11.2%) (14, 15).

Endoscopic endonasal transsphenoidal surgery is commonly employed for the removal of PAs because it is less invasive, allows for quicker recovery, and eliminates external scarring. As no such study is available on this subject locally, this study aims to determine the frequency of early post-operative complications of endoscopic endonasal transsphenoidal surgery for PA at our hospital setup. By identifying early complications, our medical professionals strive to refine surgical techniques, thereby reducing postoperative morbidity and optimizing patient recovery after undergoing this procedure. This effort ultimately seeks to improve long-term outcomes for individuals with PAs.

METHODOLOGY

This descriptive study was conducted in the Neurosurgery Department of Irfan General Hospital, Peshawar, following approval from the hospital's ethics committee. The duration was from February 16, 2025, to June 16, 2025. We selected 97 patients using a consecutive non-probability sampling method. The sample selection was based on the assumptions of a 4% to 15% incidence of CSF leaks, a 95% confidence level, and a 3.9% margin of error. Patients aged between 18 and 60 years diagnosed with pituitary adenoma via MRI findings (hypointense mass on T1-weighted images and hyperintense on T2-weighted images) and presenting with symptoms such as headaches, visual disturbances, Cushing's syndrome, or acromegaly were

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included. Patients with morbid obesity, pregnancy, bleeding disorders, or chronic liver and kidney disease were dropped out of the study. Each patient gave their consent. Preoperative demographic data, including age, gender, BMI, residence, socioeconomic status, employment, and literacy levels, were recorded. Following standard preoperative preparation, patients were placed in the supine position with the head tilted back at approximately 15 degrees. After administration of general anesthesia with tracheal intubation, the face and nasal cavities were thoroughly disinfected. A cotton pledget soaked in 0.01% epinephrine solution was inserted into the selected nasal cavity for vasoconstriction. Using an endoscope, the sphenoid ostium was first identified. A carefully placed arc-shaped incision was then made approximately 1.0-2.0 cm above the nasal septum mucosa to expose both the posterior septum and the anterior wall of the sphenoid sinus. The anterior wall of the sphenoid sinus and its septations were meticulously drilled and refined to visualize the sellar floor. The extent of sellar floor opening was determined based on preoperative neuroimaging findings. The dura was incised following standard protocols. Tumor removal was performed using either curettes or suction devices, with careful identification of the adenoma margins before resection. In cases where significant defects were present, reconstruction of the sellar floor was accomplished using either artificial dura mater or pedicled nasal mucosa flaps.

Early postoperative complications, including hyponatremia (serum sodium <135 mEq/L with symptoms like nausea or disorientation), hypopituitarism (growth hormone deficiency with clinical manifestations), CSF leaks (confirmed via beta-2 transferrin testing), and diabetes insipidus (polyuria with low urine specific gravity), were monitored for 30 days. All assessments were conducted under the guidance of a consultant with 5 years of experience following a fellowship. Data were recorded on a structured pro forma and analyzed using SPSS v.25. Mean ± SD values were calculated for age, BMI, and disease duration. For demographics and early postop complications, we used frequency and percentages. Early postoperative complications were then stratified by demographics using the chi-square test with a P value notable at ≤ 0.05.

RESULTS

We enrolled 97 patients who underwent endoscopic endonasal transsphenoidal surgery for pituitary adenoma. The mean age was 41.03 ± 13.245 years, with a disease duration of 4.85 ± 2.098 months. The average body mass index (BMI) was 25.2996 ± 1.45110 kg/m².

In terms of demographics, the gender distribution showed a slight predominance of males with 54 (55.7%) compared to 43 (44.3%) females. The remaining demographic distribution is presented in Table 1.

Postoperative complications were analyzed, with hyponatremia observed in 8 (8.2%) patients while the remaining 89 (91.8%) did not develop this condition. Hypopituitarism was reported in 6 (6.2%) cases, with 91 (93.8%) having no such condition. A cerebrospinal fluid leak occurred infrequently, affecting only 3 (3.1%) cases. Diabetes insipidus was noted in 10 (10.3%) patients, with 87 (89.7%) remaining free of this condition (Table 2). Stratifications can be seen from Table No. 3 to Table No. 10.

Table 1: Demographics

Demographics		**n**	**%**
Gender	Male	54	55.7%
	Female	43	44.3%
Socioeconomic status	Low (< 20K Rs/Month)	25	25.8%
	Middle (20 to 50K Rs/Month)	58	59.8%
	High (> 50K Rs/Month)	14	14.4%
Education status	Literate	50	51.5%
	Illiterate	47	48.5%
Employment status	Employed	47	48.5%
	Unemployed	50	51.5%
Residence	Rural	52	53.6%
	Urban	45	46.4%

Table 2: Postop complications

Postop complications		**n**	**%**
Hyponatremia	Yes	8	8.2%
	No	89	91.8%
Hypopituitarism	Yes	6	6.2%
	No	91	93.8%
Cerebrospinal fluid leak	Yes	3	3.1%
	No	94	96.9%
Diabetes insipidus	Yes	10	10.3%
	No	87	89.7%

Table 3: Stratification of postop complications with age

		Age distribution (Years)						**P value**
		18 to 35		**36 to 50**		**> 50**		
		n	%	n	%	n	%	
Hyponatremia	Yes	3	37.5%	1	12.5%	4	50.0%	P > 0.05
	No	34	38.2%	31	34.8%	24	27.0%	
Hypopituitarism	Yes	1	16.7%	1	16.7%	4	66.7%	P > 0.05
	No	36	39.6%	31	34.1%	24	26.4%	
Cerebrospinal fluid leak	Yes	1	33.3%	2	66.7%	0	0.0%	P > 0.05
	No	36	38.3%	30	31.9%	28	29.8%	
Diabetes insipidus	Yes	2	20.0%	3	30.0%	5	50.0%	P > 0.05
	No	35	40.2%	29	33.3%	23	26.4%	

Table 4: Stratification of postop complications by gender

		Gender				**P value**
		Male		**Female**		
		n	%	n	%	
Hyponatremia	Yes	6	75.0%	2	25.0%	P > 0.05
	No	48	53.9%	41	46.1%	
Hypopituitarism	Yes	2	33.3%	4	66.7%	P > 0.05
	No	52	57.1%	39	42.9%	

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Cerebrospinal fluid leak	Yes	2	66.7%	1	33.3%	P > 0.05
	No	52	55.3%	42	44.7%	
Diabetes insipidus	Yes	8	80.0%	2	20.0%	P > 0.05
	No	46	52.9%	41	47.1%	

Table 5: Stratification of postop complications with socioeconomic status

		Socioeconomic status						P value
		Low (< 20K Rs/Month)		Middle (20 to 50K Rs/Month)		High (> 50K Rs/Month)		
		n	%	n	%	n	%	
Hyponatremia	Yes	2	25.0%	5	62.5%	1	12.5%	P > 0.05
	No	23	25.8%	53	59.6%	13	14.6%	
Hypopituitarism	Yes	0	0.0%	5	83.3%	1	16.7%	P > 0.05
	No	25	27.5%	53	58.2%	13	14.3%	
Cerebrospinal fluid leak	Yes	0	0.0%	3	100.0%	0	0.0%	P > 0.05
	No	25	26.6%	55	58.5%	14	14.9%	
Diabetes insipidus	Yes	3	30.0%	5	50.0%	2	20.0%	P > 0.05
	No	22	25.3%	53	60.9%	12	13.8%	

Table 6: Stratification of postop complications with education status

		Education status				P value
		Literate		Illiterate		
		n	%	n	%	
Hyponatremia	Yes	5	62.5%	3	37.5%	P > 0.05
	No	45	50.6%	44	49.4%	
Hypopituitarism	Yes	5	83.3%	1	16.7%	P > 0.05
	No	45	49.5%	46	50.5%	
Cerebrospinal fluid leak	Yes	2	66.7%	1	33.3%	P > 0.05
	No	48	51.1%	46	48.9%	
Diabetes insipidus	Yes	5	50.0%	5	50.0%	P > 0.05
	No	45	51.7%	42	48.3%	

Table 7: Stratification of postop complications with employment status

		Employment status				P value
		Employed		Unemployed		
		n	%	n	%	
Hyponatremia	Yes	3	37.5%	5	62.5%	P > 0.05
	No	44	49.4%	45	50.6%	
Hypopituitarism	Yes	3	50.0%	3	50.0%	P > 0.05
	No	44	48.4%	47	51.6%	
Cerebrospinal fluid leak	Yes	1	33.3%	2	66.7%	P > 0.05
	No	46	48.9%	48	51.1%	
Diabetes insipidus	Yes	5	50.0%	5	50.0%	P > 0.05
	No	42	48.3%	45	51.7%	

Table 8: Stratification of postop complications with residence

		Residence				P value
		Rural				
		n		n	%	
Hyponatremia	Yes	P > 0.05	62.5%	3	37.5%	P > 0.05
	No		52.8%	42	47.2%	
Hypopituitarism	Yes	P > 0.05	50.0%	3	50.0%	P > 0.05
	No		53.8%	42	46.2%	
Cerebrospinal fluid leak	Yes	P > 0.05	66.7%	1	33.3%	P > 0.05
	No		53.2%	44	46.8%	
Diabetes insipidus	Yes	P > 0.05	40.0%	6	60.0%	P > 0.05
	No	48	55.2%	39	44.8%	

Table 9: Stratification of postop complications with BMI

		BMI (Kg/m2)				P value
		18 to 24.9				
		n		n	%	
Hyponatremia	Yes	P > 0.05	50.0%	4	50.0%	P > 0.05
	No		37.1%	56	62.9%	

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Hypopituitarism	Yes	P > 0.05	0.0%	6	100.0%	P > 0.05
	No		40.7%	54	59.3%	
Cerebrospinal fluid leak	Yes	P > 0.05	66.7%	1	33.3%	P > 0.05
	No		37.2%	59	62.8%	
Diabetes insipidus	Yes	P > 0.05	50.0%	5	50.0%	P > 0.05
	No	32	36.8%	55	63.2%	

Table 10: Stratification of postop complications with duration of disease

		Duration of disease (Months				P value
		2 to 5		> 5		
		n	%	n	%	
Hyponatremia	Yes	4	50.0%	4	50.0%	P > 0.05
	No	52	58.4%	37	41.6%	
Hypopituitarism	Yes	1	16.7%	5	83.3%	P > 0.05
	No	55	60.4%	36	39.6%	
Cerebrospinal fluid leak	Yes	1	33.3%	2	66.7%	P > 0.05
	No	55	58.5%	39	41.5%	
Diabetes insipidus	Yes	4	40.0%	6	60.0%	P > 0.05
	No	52	59.8%	35	40.2%	

DISCUSSION

Several studies have documented the complications associated with endoscopic endonasal transsphenoidal surgery (EETS) for pituitary adenomas. Namvar et al. highlighted that the overall complication rate in their cohort of 310 patients was 18.7% with major complications such as cerebrospinal fluid (CSF) leaks and diabetes insipidus (DI) occurring in 9% and 14.1% of cases, respectively. They emphasized that factors like large tumor size, suprasellar extension, and intraoperative arachnoid tearing significantly influenced complication rates (16).

Similarly, Ali et al. (2023) reported an 11.3% incidence of DI and a 2.4% rate of CSF leaks in their study of 124 patients, noting no noteworthy differences in complications based on age or gender.[15] These findings align with Fang et al, which compared endoscopic and microscopic approaches, concluding that endoscopic surgery had lower rates of DI and septal perforation but comparable CSF leak rates (17). Another study reported that they encountered a CSF leak in approximately 11% of patients undergoing EETS for Pituitary Adenoma (18). The consistency in these results underscores the reliability of EETS as a surgical option despite its associated risks.

In our study, we observed that complications following EETS included diabetes insipidus, which was followed in approximately 10.3% of patients, aligning with the findings of Ali et al. and Namvar et al. (15, 16). Hyponatremia was prevalent in 8.2% of patients, and hypopituitarism in 6.2% of cases, which aligns with the findings documented by Ali et al. (15). Our CSF leak rate, 3.1%, is lower than the reported rates by Namvar et al. and Amir et al. (16, 18). The demographic profiles across the studies were relatively uniform, with a slight male predominance and mean ages ranging from 40 to 45 years. For instance, Ali et al. reported 56.5% male participants while Namvar et al. (2023) noted a 46.8% male representation (15, 16). This demographic trend is consistent with the broader literature on pituitary adenomas, which suggests a near-equal gender distribution with a minor male bias.

The most common presenting symptoms of pituitary adenoma reported are headaches, found in 91% of cases in Ali et al.'s study, and visual disturbances, at 62%, reflecting the mass effects of pituitary adenomas on surrounding structures (15).

When comparing the outcomes of EETS with traditional microscopic approaches, the meta-analysis by Fang et al. found no notable differences in CSF leak or meningitis rates. Still, it noted lower incidences of DI and nasal complications with endoscopic surgery (17). This finding aligns with the results of Ali et al. and Behiry et al. (2022), who reported minimal nasal complications, including epistaxis (1.6%) and sinusitis (2.4%) (15, 19). The lower nasal complication rates in endoscopic surgery may be due to the reduced tissue trauma and better visualization afforded by the endoscope. However, the studies also underscore the learning curve associated with EETS as evidenced by Namvar et al.'s observation that complications were more frequent in the initial 155 cases. This suggests that surgical experience and institutional protocols play a critical role in optimizing outcomes (16).

CONCLUSION

From our findings, we conclude that the early postoperative complications of endoscopic endonasal transsphenoidal surgery for pituitary adenoma were diabetes insipidus (10.3%), hyponatremia (8.2%), hypopituitarism (6.2%), and the least prevalent was CSF leak (3.1%).

DECLARATIONS

Data Availability Statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned. (001-2025/AINS-IGH)

Consent for publication

Approved

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Not applicable

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTION

MUHAMMAD ANEEQ (Postgraduate Resident)

Study Design, Review of manuscript, Data Collection, Data Analysis, Manuscript drafting and Manuscript revisions,

MUMTAZ ALI (Professor)

Conception of Study, Development of Research Methodology Design, Critical Input, and Final approval of manuscript.

Data entry, data analysis, and drafting articles.

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