

# Pituitary Adenomas: Patterns Of Visual Presentation And Outcome After Transsphenoidal Surgery - An Institutional Experience

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## Abstract

**Objectives:** The present series reports the patterns of visual presentation and visual outcome of pituitary adenoma in 62 patients treated by transsphenoidal surgery in a single institution.

**Patients and Methods:** A retrospective analysis of 62 cases of pituitary adenomas that had undergone total or subtotal resection performed by transsphenoidal route between January 1995 and December 2004 in King Khalid University Hospital, Riyadh, Saudi Arabia. The patterns of visual assessment before and after surgery were evaluated and correlation between age, duration of symptoms, pre- and post-operative visual acuity, afferent papillary defect, visual field, and funduscopy, were analyzed. Follow up period ranged between six months and 7 years (mean 23 months).

**Results:** 36 females and 26 males, harbored primary pituitary adenoma proved by histology, their age ranged between 14 and 83 years (mean 42 years). Sixty eight eyes (54.8%) of 37 patients presented with visual symptoms ranged from decreased visual acuity and/or visual field defect to complete blindness. The overall improvement in visual symptoms after transsphenoidal surgery was 78%. Visual acuity in 28 out of 48 affected eyes (58.3%) showed significant improvement. Of the improved eyes, 3 were blind and vision in 6 eyes was counting fingers before surgery. Visual field defect recovered in 65.5% of the affected eyes. Ten eyes with affected visual field (18.3%) improved to normal within 6 months from surgery. There was no fatality related to surgery, and the best prognoses were found in patients in whom the duration of symptoms was less than one year and in patients younger than 50 years.

**Conclusion:** This study shows that although eyes with severely affected visual acuity and/or visual field may have remarkable improvement if surgical decompression of the optic apparatus is undertaken early, . However, Transsphenoidal rout is a relatively safe procedure for pituitary adenoma patients with visual impairment. Awareness regarding pituitary adenomas and reversibility of vision loss needs to be increased among the medical community, especially ophthalmologists and physicians, so that timely neurosurgical intervention can occur.

## INTRODUCTION

A variety of visual presentations of pituitary adenomas have been reported, including absence of clinical symptoms or deterioration of visual acuity, visual field affection, and partial or complete ophthalmoplegia. [14] Visual field defects caused by pituitary adenomas are unique, with bitemporal hemianopia being most common, because of the distribution of visual fibers in the chiasm and their anatomic proximity to the sella turcica. However, other types of defects may be

observed and, in fact, visual field examination may remain normal in small pituitary adenomas not causing significant optic compression. [14,16]

At present, some secreting pituitary adenomas are accessible to medical therapy. Other pituitary tumours, and non-functioning pituitary adenomas are not suitable for valid medical treatment and may warrant a surgical strategy. [8] Transsphenoidal access is advocated when surgery can be expected to achieve adequate tumor resection without

damaging the normal pituitary gland. Progressive deterioration of visual fields is often the principle neurological criterion on which surgical management decisions are based. [7]

This report is a single institution series of patients with pituitary adenoma referred over a decade to the department of neurosurgery and underwent transsphenoidal surgery for primary pituitary adenoma. The purpose is to highlight the different patterns of visual presentation and to assess the visual outcome of transsphenoidal decompression of the optic pathway.

**PATIENTS AND METHODS**

Between January 1995 and December 2004, 127 patients were admitted to the neurosurgery unit at King Khalid University Hospital, Riyadh, and underwent transsphenoidal surgery for sellar lesions. Sixty-five cases were excluded when histological examination was other than pituitary adenoma or undergone redo transsphenoidal surgery for recurrent lesions or because of insufficient data regarding formal, pre- and post-operative ophthalmological assessment. Our analysis is thus based on the remaining 62 cases, diagnosed to have primary pituitary adenoma, proved by surgery and histology.

The patients' charts were retrospectively reviewed. Patients with preoperative ophthalmologic assessment, and with at least six months follow up, were included. Information about demographic characteristics, visual symptoms, duration of symptoms at presentation, and radiological findings, based on computed tomography (CT) or magnetic resonance imaging (MRI) scans, were recorded. All patients underwent transsphenoidal resection of pituitary adenomas, using a trans-nasal approach. The extent of resection of the tumour (total or partial) was recorded, based on surgeons' operative notes and as judged on postoperative imaging. The results of histological examination including immunohistochemistry were also recorded.

**VISUAL ASSESSMENT**

All patients underwent independent assessment in the Department of Ophthalmology at this institution, preoperatively and at least in two different occasions (one month, 6 months, and last follow up visit) postoperatively. Visual data were recorded including; visual acuity (VA) (using the Snellen chart), slit lamp examination to anterior segment, afferent pupillary defect (APD), fundus examination for optic disc (disc pallor). Visual fields (VF) of

all patients were also recorded, using the Humphrey field analyzer II (30–2 test; Humphrey Instruments, London, UK). A simple system was used, based on the number of field quadrants affected.

**RESULTS**

The median age at presentation of this series of 62 patients was 42 years (range 14 - 83). Female preponderance was observed in the ratio of 1.4:1. The median duration of symptoms from onset to diagnosis was 135 weeks (range 3 days to 384 weeks).

A total of 68 eyes (54.8%) were affected either by decreased VA and/or change in VF. The main visual presentation in 32 patients was impaired vision (VA= 20/50 or greater) [n=48 eyes (38.7%)], and was found bilateral in 16 patients. In the remaining 76 eyes (61.3%) there was no visual symptoms related to the presence of pituitary adenoma. (Table 1 & 2)

**Figure 1**

Table 1: Visual presentation in 62 patients with pituitary adenoma

	No. of patients	Monocular	Binocular	No of affected eyes	No of unaffected eyes
No visual symptoms	30	0	0	0	60
<u>Affected vision</u>	32	16	16	48	16
<b>Total</b>	<b>62</b>	<b>16</b>	<b>32</b>	<b>48</b> (38.7%)	<b>76</b> (61.3%)

**Figure 2**

Table 2: Patterns of visual acuity in 62 patients with pituitary adenoma, (C.F.: counting fingers, H.M.: hand movement, L.P.: light perception)

Visual Acuity	No of eyes	%
20/50 - 20/20	76	61.3%
20/100 - >20/50	14	11.3%
20/200 - >20/100	6	4.8%
C.F. - >20/200	14	11.3%
C.F - H.M	10	8.1%
No L.P.	4	3.2%
<b>Total</b>	<b>124</b>	<b>100%</b>

Twenty one patients had APD involved 28 eyes (22.6%), four of them had no light perception. Visual field abnormality was detected in 55 eyes of 29 patients (44.4%), and bitemporal hemianopia was the striking abnormal VF in 19 patients (69%). (Table 3) Thirty nine eyes (31.5%) showed abnormal optic disc on fundus examination; 30 eyes of them (77%) with optic disc pallor, eight eyes (6.5%) showed optic atrophy, and in one eye the optic atrophy was secondary to glaucoma.

**Figure 3**

Table 3: Patterns of abnormal visual field in 55 affected eyes. (BTH: bitemporal hemianopia, TFD: temporal field defect)

Visual Field	No. of eyes	%
BTH	38	69%
Upper quadrant TFD	7	13%
Two quadrants TFD	4	7.2%
Three quadrants	2	3.6%
Blind	4	7.2%
<b>Total</b>	<b>55</b>	<b>100%</b>

Disorder of extra-ocular movements was seen in 10 eyes (8%) of 7 patients, and involvement of all three cranial nerves (III, IV, and VI) was a frequent finding, that total or partial ophthalmoplegia was bilateral in three and unilateral in two cases, while isolated sixth nerve palsy was present in two eyes.

Histopathological examination revealed non-functioning adenoma in 31 specimens (50%), and hormone-secreting adenomas in the other half. (Table 4) The main operating surgeons were consultants (n=55) or senior trainees (n=7). Forty two patients (68%) had a gross macroscopic clearance of tumour, while the remaining had significant residual in the postoperative MRI scans.

**Figure 4**

Table 4: Histopathology results of 62 surgically treated pituitary adenomas.

Immunohistochemistry	No.	%
Non-secretory adenomas	31	50%
GH secreting adenomas.	14	23%
Prolactinomas	10	16%
Corticotroph secreting adenomas	5	8%
TSH secreting adenoma	1	1.5%
Gonadotroph secreting adenomas	1	1.5%

**POSTOPERATIVE RESULTS**

Fifty-three out of the affected 68 eyes showed a significant degree of improvement in the V.A. and/or V.F. with an overall improvement rate representing 78%. Visual acuity improved in 58.3% of the affected eyes, about two third of them improved to normal. Of the 4 blind eyes, 2 showed marked improvement and 1 eye recovered to normal. (Table 5) Only one eye deteriorated its V.A. after surgery due to postoperative hematoma collection which gradually improved following a transsphenoidal evacuation of the clot.

**Figure 5**

Table 5: Postoperative visual acuity in 64 affected eyes.

	No of eyes affected	Improved to Normal	Partial improvement	Total improvement	Unchanged
20/100 ->20/50	14	5	4	9	5
20/200 ->20/100	6	0	3	3	3
C.F. -> 20/200	14	1	4	5	9
H.M - C.F	10	3	5	8	2
No L.P.	4	1	2	3	1
Total	48	10	18	28	20
%	100%	(21%)	(37.3%)	58.3%	41.7%

Visual field recovered in 65.5% of the affected eyes. It improved to normal in 10 eyes and significantly improved in 26 eyes out of the 55 affected eyes. (Table 6) Recovery from ophthalmoplegia was very slow and incomplete in all eyes except in one case unilateral partial third nerve palsy recovered to full range of ocular motility. Afferent papillary defect recovered in six eyes (21.4%), and remained unchanged in 22 affected eyes.

**Figure 6**

Table 6: Patterns of Postoperative visual field improvement

Field Defect	Affected eyes	Improved to normal	Improved	Total no of Improved eyes	Unchanged
BTH	38	8	18	26	12
Upper quadrant TFD	7	0	3	3	4
Two quadrants TFD	4	1	2	3	1
Three quadrants	2	0	1	1	1
Blind	4	1	2	3	1
Total	55	10	26	36	19
%	100%	18.2%	47.3%	(65.5%)	34.5%

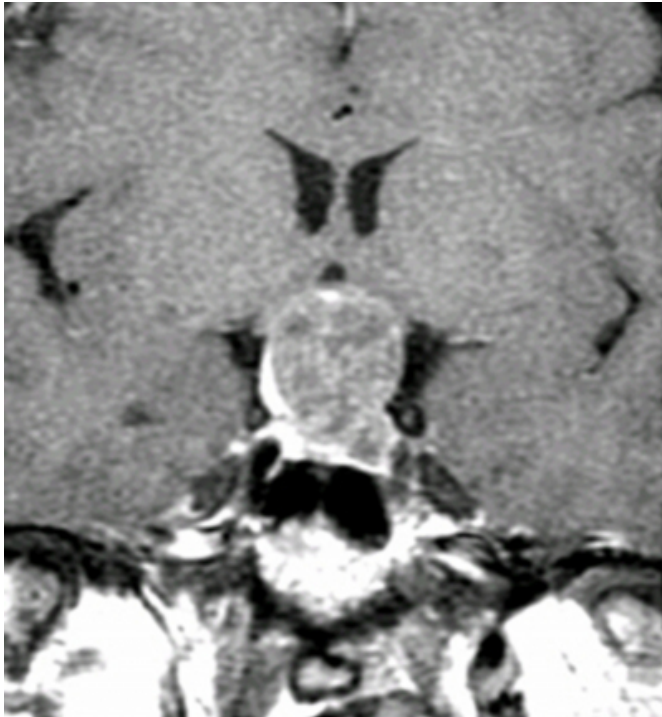
**DISCUSSION**

Pituitary adenomas are typically slow growing, benign neoplasms of epithelial origin. In most circumstances they arise from the adenohypophysis, and are capable of producing both systemic and visual signs. Optic chiasm is approximately 8 to 13 mm above the pituitary gland. The nasal retinal fibers of each eye (temporal visual field) cross at this point, proceeding into the contralateral optic tract. Upwardly growing pituitary tumours, impinge on the anterior notch of the chiasm at its lowest lying aspect. (Figure 1 ) This produces bitemporal hemianopia with increased density superiorly. Since tumor growth is usually asymmetrical, the field loss between two eyes is also typically asymmetrical, and more dense from superior to inferior.

**Figure 7**



**Figure 8**



Visual presentation of pituitary adenoma varies depending on the size of the tumor and its proximity to optic pathway. In addition to bitemporal visual field loss, it may include, colour desaturation, diplopia and partial or complete ophthalmoplegia, when tumours expand into the cavernous sinus. (Figure 2) Progressive deterioration of visual fields is often the principle neurological criterion on which surgical management decisions are based.

Until the 1970s, V.F. defects were reported in up to 90% of patients with pituitary adenomas of all types. [2] Modern neuroimaging techniques have played a major role in decreasing the rate of V.F. abnormalities. [6,17] In this population of patients, 44.3% had a V.F. defect linked to their pituitary adenomas, which was detected at the time of diagnosis in all of them, and before commencing treatment. (Table 3) Field defect was greater in the temporal quadrants, and bilateral in 69 % of the affected eyes (38 patients), half of them had non-functioning pituitary adenomas, this could be explained by the relatively late presentation of non-functioning adenomas. (Table 4)

The funduscopy sign of long-standing chiasmal compression from pituitary macroadenoma is primary optic atrophy (secondary to retrograde axonal degeneration). In this group of patients, optic atrophy was seen clearly in 21 eyes (17%), and all of them noticed to have significantly

affected vision (V.A. 20/100 or worse). This also has reflected on the degree of visual recovery following transsphenoidal decompression.

The visual outcome after a transsphenoidal procedure is usually excellent. Even severe visual defects secondary to optic nerve or chiasm compression can regress or resolve completely. Most of the improvement occurs during the first days or weeks following surgery. Only few cases showed further improvement after 6 months or more from surgery. The majority (78%) of affected eyes showed improvement in vision, which is similar to the figures quoted from other series – 71% [19], 75% [5] and 79% [3].

Although overall VF returned to normal or significantly improved in 56.5% of affected eyes, as per Humphery field analyzer, 90% of the eyes with affected V.F. were asymptomatic during their follow up. Other larger surgical series employing the transsphenoidal approach, have reported postoperative improvement or normalization of VF in 74–95% of patients.[8,9,11,12] This could be explained by the fact that most of those patients were young age at the time of diagnosis. We found also V.F. recovery in the first 6 months after surgery, in particular, was progressive in all quadrants, and this has extended to several years in few cases that showed continuous but slow recovery. On the other hand, patients with severe optic atrophy showed little or no recovery during the course of follow up, suggesting a direct relation between the degree of optic atrophy and visual recovery following surgical decompression of the optic chiasm.

In contrast to the general belief that optic nerves withstand pressure and the subsequent ischemia poorly, the good-to-excellent long term visual outcome attained in our patients points toward the ability of optic nerves to resist ischemia for prolonged periods. Seventy one percent of the severely affected eyes in our study showed good visual outcome, three of them were totally blind for a period ranging from one to 14 days. Out of the 14 eyes with severely affected vision (4 blind and 10 H.M. to C.F.) 11 patients significantly improved. (Table 5) Interestingly, 5 patient of them had improvement in their vision despite that surgical intervention was delayed beyond a week, and this finding is in contrary with previous reports that have shown good visual outcome if optic nerves are decompressed within a week. [1,15]

The transsphenoidal route to access pituitary fossa has been used almost since the beginning of the century, and the

advent of the operating microscope has now made this procedure almost universally favored for pituitary tumour resection. [20] It is widely accepted that transsphenoidal surgical resection of pituitary adenomas is much less frequently responsible for secondary visual symptoms linked to treatment. [2,4,14,17,18] This may explain less than 2% rate of secondary visual deficits linked to treatment, and 71% rate of visual field examination improvement compared favorably with previous studies. [12]

The prevalence of ocular motor palsies among patients with pituitary adenoma ranges from 1% to 14%. [13] In our series, limitation of ocular motility was found in 10 eyes (8%), involvement of the 3 ocular motility cranial nerves was frequent, and isolated third cranial nerve palsy was the most frequent. [21] In a large series of patients, Hollenhorst and Younge [8] reviewed 1,000 cases of pituitary adenoma and found 59 patients (5.9%) with cranial nerve palsies. Mechanisms proposed to explain the preference of third nerve involvement include pressure transmitted to the cavernous sinus by the growing or invading tumor and compression of the third nerve between the tumor and the interclinoid ligament. Sixth nerve palsies, although much less frequent, also have been reported. A proposed mechanism for isolated sixth nerve palsy is extension of the tumor backward along the Dorello canal, containing the sixth nerve along with the inferior petrosal sinus, or secondary to increased intracranial pressure by significantly large adenomas or obstructive hydrocephalus. [10]

## CONCLUSION

Transsphenoidal adenomectomy and decompression of the optic apparatus continues to be a safe and effective method, suitable for a large number of patients, however, there is still a very small risk of postoperative visual deterioration. Therefore, all patients with pituitary adenoma should undergo if possible, formal visual assessment, rather than bed-side visual examination, before and after surgery, not only those who have pituitary macroadenomas with suprasellar extension or patients present with visual symptoms.

Computerized visual fields analyzer (Humphrey's) is useful even if there appears to be no contact between the optic pathways and pituitary mass. Visual symptoms could be due to previous impingement, potential vascular shunting, or displacement of the chiasm following decompression. [21]

Even eyes with severely affected visual acuity and/or visual

field may have remarkable improvement if surgical decompression of the optic apparatus is undertaken early. Awareness regarding pituitary adenoma and reversibility of vision loss needs to be increased among the medical community, especially ophthalmologists and physicians, so that timely neurosurgical intervention can occur.

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