

# Early Post-operative Visual Outcome in Patient with Pituitary Adenoma

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## Abstract:

**Background:** Pituitary adenoma, which accounts for 17.4% of all brain tumors, is the third most frequently diagnosed brain tumor, following intracranial glioma and meningioma. The visual disturbance in pituitary adenoma ranged from blurring of vision with or without headache to total loss of vision. In patients with visual field defects, bitemporal hemianopia was the commonest visual field defect. Early improvement of visual function is one of the major indication surgery. **Objective:** The purpose of this study was to comparison between the pre and post-operative visual parameters and to find out the value in assessment of the prognosis of early postoperative visual function and also to find out the factor which influence the early post-operative visual outcome. **Methods:** A prospective study was done from September 2010 to April 2012 in the department of neurosurgery, Bangabandhu Sheikh Mujib Medical University, 30 cases of pituitary adenoma had been included in this study of those who were presented with visual symptoms. Visual assessment was done before the operation and outcome was analyzed at discharged from hospital. **Results:** Within 60 eyes, 13 (43.3%) patients presented with blindness of one or both eyes. 10 (33.3%) presented with uniocular and 3 (10.0%) presented with binocular blindness. Duration of the symptoms ranged from 2 months to 48 months. Patients underwent either transcranial or transsphenoidal tumor decompression. At discharge out of 30 patients, 23 (76.7%) showed improvement, 2 (6.6%) patients were deteriorated post-operatively. *P* value was <0.001, in z 'test',  $Z=91.5$ , which was highly significant. Post-operative visual status was analyzed with age, sex, duration of symptoms, suprasellar extension, and methods of surgery and extent of tumor resection to find out that any other factor influenced the visual outcome. In bivariate analysis it was shown that only duration of the symptoms only other factor that influenced the visual outcome (statistically significant, *p* value 0.017). **Conclusion:** With this study it was statistically proved that pre-operative visual status is the main factor for improvement of early post-operative visual outcome in pituitary adenoma and duration of symptoms had also influence the early post-operative visual outcome. Duration less than 12 months had a favorable outcome.

**Key words:** Pituitary Adenoma, Visual Acuity, Visual Field, Bitemporal Hemianopia, Optic atrophy

**Abbreviation:** VF ( visual field), FA(visual aquity)

## Introduction:

Pituitary adenoma, which accounts for 17.4% of all brain tumors, is the third most frequently diagnosed brain tumor, following intracranial glioma and meningioma<sup>1</sup>. They are more common in adults, comprising 2% of all adenomas in children<sup>2</sup>. Inappropriate pituitary hormone secretion and

visual field deficits are the most characteristic presenting features of pituitary adenomas. Less specific symptoms such as headache, and subtle signs of pituitary hormone deficiency with peripheral endocrine organ hypofunction characterized by amenorrhea, loss of libido, and lethargy, are also common<sup>3</sup>. The visual disturbance in pituitary

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adenoma ranged from blurring of vision with or without headache to total loss of vision. In patients with visual field defects, bitemporal hemianopia was the commonest visual field defect. The reason for such a wide range of visual problems lies in the anatomical variation in the location of optic chiasma and due to the special arrangement of optic nerve fibers in the chiasma<sup>4</sup>. Visual impairment is a major indication for surgical intervention, by the transcranial or transphenoidal route<sup>5</sup>. The quality of postoperative results is encouraging, but there are still too many patients whose vision does not return to normal. Postoperative visual recovery is greatly influenced by the degree of preoperative visual loss, the duration of visual symptoms and suprasellar extension of the tumor. Integrity of the vascular supply to the chiasm and optic nerves is probably the primary prerequisite for visual recovery<sup>6</sup>. Improvement in visual function has been postulated to occur in three stages: rapid recovery within minutes to a couple of days, delayed recovery over weeks to months, and late recovery over months to years. Improvement in vision may take place immediately after decompression, and visual evoked potentials have been documented to improve within 10 minutes of decompression. It has been postulated that the initial improvement is the result of the removal of a physiologic conduction block. Further improvement during a stage of delayed recovery is thought to be the result of remyelination of the decompressed optic pathways. Finally, late recovery of visual field over months to years has not been well studied. Most studies of improvement of visual function after treatment of pituitary tumors compressing the anterior visual pathways have compared pre-operative visual function with visual function at a single postoperative visit. Some studies have reported improvement in visual function using kinetic perimetry between the first week of surgery and a later visit<sup>7</sup>.

This study was done, with the comparison between pre and post-operative visual parameters to find value in assessment of the prognosis of postoperative visual function and also to find out the factor which influence the visual outcome. An assessment of pre-operative visual acuity, field scores, age of the patient, presence or absence of optic atrophy,

duration of the symptoms and size or volume of the tumour with the help of neuro-imaging, methods of surgery, presence of pituitary apoplexy, extent of tumour resection to ascertain correlation with the post-operative visual outcome will also be made.

#### **Materials and Methods:**

Between September 2010 to May 2012, 30 patients (60 eyes) were selected in the department of Neurosurgery, BSM Medical University, who were diagnosed as pituitary adenoma by imaging presented with visual symptoms and underwent surgery either transcranial or transphenoidal approach according to the inclusion and exclusion criteria.

#### **Inclusion criteria**

Patients with neuro-images suggesting pituitary adenoma. Patient with pituitary adenoma who had visual impairment and requiring surgery for it. Patient who had post-operative histological confirmation of pituitary adenoma.

#### **Exclusion criteria**

Patients who had concomitant intra-ocular disease making visual assessment difficult. Systemic disorders other than pituitary adenoma that affected visual function. Presence of any other intracranial pathology

All cases were confirmed as pituitary adenoma by surgery and histopathology. Pre-operative and post-operative visual status were analyzed and documented. Post-operative visual status was analyzed at discharged from hospital. Those patients whose data were not collected after operation had been excluded in this study. Data regarding age; sex; duration of symptoms; mode of presentation; and visual acuity and visual field status at admission and at discharge from hospital were documented. Visual acuity was recorded using the Snellen chart. Visual field charting was performed using Octopus or Humphrey visual field analyzer and fundus examination by ophthalmoscope were done and documented.

The multifactorial effect of variables such as age, sex, duration of visual decline, duration of blindness, imaging characteristics of sellar or parasellar extension, extent of resection was studied on the visual outcome.

Data were analyzed in SPSS (version 17). The test statistics used to analyze the data were descriptive statistics and Chi-square probability test and the level of significance was set at 0.05.

**Results:**

**Table-I**  
Showing the age distribution of the patients (n=30)

Age group in year	Number of patients	Percentage
11-20	2	6.7
21-30	12	40.0
31-40	8	26.7
41-50	4	13.3
51-60	2	6.7
>60	2	6.7
Mean ±SD	36.2±13.7	
Range (Min-Max)	(16-70)	

30 cases of pituitary adenoma had been included in this study those who were presented with visual symptoms. Pituitary adenoma was diagnosed pre-operatively by MRI and after operation confirmed by histopathology. The age distribution of 30 patients ranged from 16-70 years with a mean ±SD of age was 36.2±13.7. The patient age distribution shows a peak incidence between 26– 40 years for pituitary adenoma. Male had slightly preponderance than female in this series with male to female ratio 1.1:1 (Table I).

All patients presented with visual problems (100.0%). Majority (93.3%) patients presented with

headache, 5 patients (16.7%) presented with acromegaly, 1 patient (3.3%) presented with gigantism, 5 patients (16.7%) presented with amenorrhea and 2 patients (6.7%) presented with gynaecomastia and erectile dysfunction, only 1 patient (3.3) presented with diabetes insipidus.

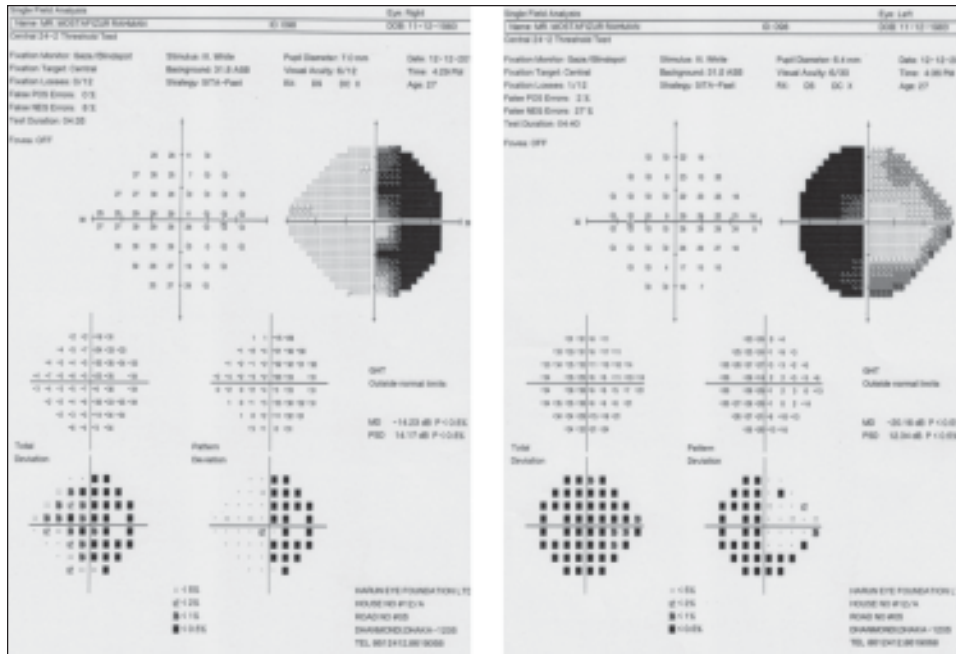
**Table-II**  
Distribution of visual symptoms among 30 patients (n=30)

Visual symptoms	Frequency (n=30)	Percentage (n=30)
Blurred vision	17	56.7
Vision loss	13	43.3
i) One eye	10	33.3
ii) Both eyes	3	10.0

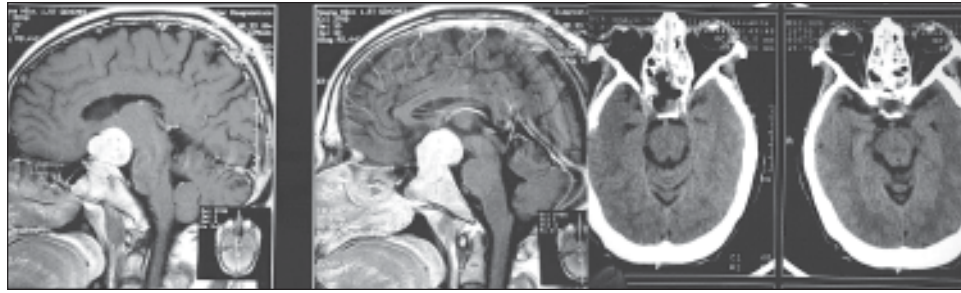
Among 30 patients 17 presented with blurred vision (56.7%). 13 (43.3%) patients presented with loss of vision, among them 10 (33.3%) presented with loss of vision on one eye and 3 (10.0%) patients presented with loss of vision on both eyes (Table II).

Duration of the symptoms ranged from 2months to 48 months. Majority (40%) had more than 12 months duration. Mean duration of symptoms were ±SD 16.3±16.0 (months).

Volume of the tumour ranged from 3-136.5 ml with a mean±SD was 28.4±33.4. Majority of the tumor were within 3-10 ml.



**Fig.-1:** Visual field (VF) by Humphrey visual field analyzer showing bitemporal hemianopia.



**Fig.-2:** Showing a pituitary adenoma before and after surgery (Where gross total excision was achieved with pure endoscopic surgery)

Pre-operative visual status were taken and documented. Regarding visual acuity - majority of the patients are within 6/6-6/36. Regarding VF majority were presented as bi-temporal hemianopia. 30% of eyes had optic atrophy (Figure 1).

Patient were underwent surgery by both transcranial and transsphenoidal route as surgeon's choice and also due to extension of tumor. 7 (23.3%) patients

were underwent transcranial and 23 (76.7%) patients were underwent transsphenoidal approach. Gross total removal was achieved in 13 (43.3%) patients, near total in 14 (46.7%) patients and partial in 3 (10.0%) (Figure 2).

**Visual Outcome**

Post-operative VA, VF, status of the fundus and status of the colour vision of the eye were collected

**Table-III**  
Correlation between pre-operative and post-operative visual acuity according to the no. of the eyes (n=60)

Pre-operative visual acuity (VA)	Total	Post-operative visual acuity						p-value
		Improved		Stable		Deteriorated		
		No.	%	No.	%	No.	%	
6/6-6/12	22	6		27.3	16	72.7	1	4.6
6/18-6/36	15	12	80.0	2	13.3	1	6.7	0.005
6/60-NPL	23	7	30.4	15	65.3	1	4.3	
Total	60	24	40.0	33	55.0	3	5.0	

$\chi^2= 14.707$ , df=4, P value reached from chi square test

**Table-IV**  
Correlation between pre-operative and postoperative visual field according to the no. of the eyes (n=60)

Pre-operative visual field (VF)	Total	Post-operative visual field						p-value
		Improved		Stable		Deteriorated		
		No.	%	No.	%	No.	%	
Normal Field	2	-	-	2	100.0	-	-	0.413
Quadrantanopia	3	3	100.0	-	-	-	-	
Hemianopia	27	10	37.0	14	51.9	3	11.1	
Three quadrant field defect	23	9	39.1	14	60.9	-	0.0	
Atypical field defect	5	3	60.0	2		40.0	-	-
Total	60	25	41.7	32	53.3	3	5.0	

$\chi^2= 8.211$ , df=8, NS=Not significant, P value reached from chi square test



at discharge from hospital and were documented. It was compared with the pre-operative status.

Regarding visual acuity 24 (40%) eyes out of 60 eyes improved post-operatively, including 8 eyes whose vision were normal pre-operatively, 33 (55%) eyes remained stable, and 3 (5%) eyes deteriorated post-operatively. We compared the pre and post-operative data and found that visual acuity less than 6/36 improved better (statistically significant, p value 0.005) (Table III).

Regarding VF post-operatively, 41.7% eyes were improved; unchanged or stable were 53.3% and 5% of eyes were deteriorated. These were not statistically significant. We discussed why it was not statistically significant. But it was a good indicator that VF functions improved later on, because improvement of visual field is a continuous process, up to 2 years it can improve (Table IV).

In this study series, optic atrophy was presented in 30% of eyes. Optic disc pallor or atrophy was not a good predictive factor for visual outcome. Improvement or even complete regression of visual deficit often occurred in cases with preoperative optic disc pallor or atrophy. In this series, the study showed that pre-operative optic atrophy had a worse prognosis for visual outcome post-operatively (statistically significant, p value 0 .0001).

**Table-V**  
*Post-operative visual status of 30 patients (n=30)*

	No. of the patients(n=30)	Percentage (n=30)
Improved	23	76.6
Stable	5	16.7
Deteriorated	2	6.7

p <0.001, in z 'test' (highly significant) Z=91.5

Post-operative visual status categorized into improvement, stable and deteriorated. Improvement means improved any of the VA, VF, and fundus or colour vision. Deterioration means deteriorated of any of the VA, VF, and fundus or colour vision. Stable means those who didn't improve any of the VA, VF, fundus or colour vision. Out of 30 patients, 23 (76.7%) showed

improvement, 2 (6.6%) patients were deteriorated post-operatively. P value <0.001, in z 'test', Z=91.5, which is highly significant (Table V).

We analyzed the post-operative visual status with age, sex, duration of symptoms, suprasellar extension, and methods of surgery and extent of tumor resection to find out that any other factor influenced the visual outcome. In bivariate analysis it was shown that only duration of the symptoms only other factor that influenced the visual outcome (statistically significant, p value 0.017).

So with this study it was statistically proved that pre-operative visual status is the main factor for improvement of post-operative visual outcome in pituitary adenoma, duration of symptoms has also influence the visual outcome. Duration less than 12 months have a favorable outcome.

**Discussion:**

The final study subjects were 30 patients of pituitary adenoma all of them presented with visual symptoms and was recruited according to the exclusion and inclusion criteria. The visual outcome in this study was analyzed as improvement over preexisting vision at admission. Successful surgical treatments of pituitary adenomas resulting in recovery and in many cases normalization of visual functions were found in this series of patients. In our series we assessed visual status after 7 days of surgery and compared with the pre-operative status of the patients and also correlated with other factors that influenced it. Kerison et al. 2000<sup>7</sup> observed statistically significant improvement in visual status at surgery to one week, Marcus et al. 1991<sup>8</sup> also observed significant improvement of visual function within one week of surgery.

All patients presenting with visual symptoms of pituitary adenoma were included in this study. 13 (43.3%) presented with blindness of one or both eyes. 10 (33.3%) patients presented with unocular and 3 (10.0%) patients presented with binocular blindness. Ebersold et al. 1986<sup>9</sup> found 72 patients out of 100 presented with loss of vision, another series Elgamal et al. 2007<sup>10</sup> found 17% eyes presented with loss of vision due to pituitary adenomas.

Duration of visual disturbances ranged from 2 months to 48 months with a mean duration 16.3 months.

The easiest and most reproducible method of evaluation and follow-up of visual function is corrected VA and VF. In our series we evaluated the pre-operative visual acuity and compare with the post-operative results. 8 eyes had normal visual acuity before operation and they didn't deteriorated after operation. 24 (40%) eyes out of 60 eyes improved post-operatively, including 8 eyes whose vision were normal pre-operatively, 33 (55%) eyes remained stable, and 3 (5%) eyes deteriorated post-operatively. We compared the pre and post-operative data and found that visual acuity less than 6/36 improved better (statistically significant, p value 0.005). These findings are consistent with those of other authors, reporting post-operative improvement of VA in 32–81% of the patients, and no improvement or worsening in 18–68% of the patients <sup>11</sup>.

Post-operatively, VF in 41.7% eyes improved; was unchanged or stable in 53.3% and 5% of eyes deteriorated. These findings are not in accordance with those of other authors reporting postoperative improvement of VF in 75–92% and no improvement or worsening of VF in 8–19% of the patients<sup>11</sup>. This is due to our early visual field assessment of the patient than the other authors and needs of long term follow-up. Improvement of visual field defects is a continuing process for at least 1 year <sup>12, 5, 7</sup>. Kerrison et al. 2000<sup>7</sup>, showed progressive improvement of visual fields even more than 2 years after surgical decompression of the optic chiasm. Jacob et al. 2009<sup>13</sup> found that their initial VF defects after surgery did not reach statistical significance. But this is a good indicator to show that the improvement of VF function will occur later on.

In this study series, optic atrophy was presented in 30% of eyes. Optic disc pallor or atrophy was not a good predictive factor for visual outcome. Improvement or even complete regression of visual deficit often occurred in cases with preoperative optic disc pallor or atrophy<sup>14</sup>. In this series, the study showed that pre-operative optic atrophy had a worse prognosis for visual outcome post-operatively (statistically significant, p value 0.0001).

Overall outcome in 30 patients after surgery 76.7% showed mild to moderate improvement, 16.7% showed unchanged and 2 patients (6.7%) showed deterioration. This was compared with other studies (table VI) and the result was the same as others.

**Table-VI**

*Summary of the results of pituitary macroadenoma surgery reported in the literature*

Authors and year	No. of the patients	Improved (%)	Not improved (%)
Fahlbusch et al. 2001 <sup>15</sup>	44	92	8
Mortini et al 2005 <sup>16</sup>	289	92	8
Nimsky et al. 2006 <sup>17</sup>	106	64	36
Dehdashti 2008 <sup>18</sup>	80	89	11
Anik et al 2011 <sup>19</sup>	72	80	20
Current series	30	76.7	23.3

A variety of prognostic factors have been studied in patients with compressive pituitary adenomas. Gnanalingham et al. 2005<sup>5</sup> stated that age, optic disc pallor and duration of symptoms were found to be predictive of the visual outcome. Marcus et al. 1991<sup>8</sup> stated that age and optic disc pallor were found to be predictive of the post-operative visual outcome. Nakao and Itakura 2011<sup>20</sup> found that only duration of visual disturbance significantly affected the visual outcome. Messerer et al. 2011<sup>21</sup> didn't find any predictive factor that significantly affected the outcome. In this series age, sex, duration of symptoms, volume of the tumours, suprasellar extension, methods of surgery, extent of tumor resection were analyzed with the visual outcome. Bivariate analysis showed that only duration of visual disturbances was the only other factor that affected the post-operative visual outcome. Duration less than 12 months had a better outcome than duration more than 12 months (statistically significant, p value <0.017).

The improvement of visual dysfunction after surgical treatment is supposed to consist of two, or probably even three, phases. There is an early phase, comprising the first hours and days after surgery. In this early fast phase, the improvement is caused by decompression of the visual pathways, leading to a restoration of signal conduction. Visual recovery has been demonstrated in the first days after surgical treatment. The second phase, i.e., delayed recovery, is pathophysiologically caused by restoration of axonal transport and remyelination,

and based on remyelination of the optic nerve. This phase of delayed recovery may last for several years<sup>7</sup>. A precise boundary between the end of the fast phase of recovery and the start of the delayed recovery seems to be artificial, because these two phases reflect different pathophysiological mechanisms, which may co-exist for a certain time-period. The contribution of the fast phase of recovery might be larger<sup>5</sup>. For this reason in this study series visual outcome was analyzed within one week of surgery, which is a good indicator that visual improvement will occur later on.

### Conclusion:

In this study we have found that the better pre-operative visual status is the main parameter for visual outcome in patient with pituitary adenoma. If patient's ophthalmological status is better pre-operatively his visual outcome will be better after surgery in pituitary adenoma. We also found that duration of symptoms influence the visual outcome. Duration less than 12 months have a favorable outcome.

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