Original Article

Association between duration of visual symptoms and early postoperative visual outcome following pituitary macroadenoma surgery

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ABSTRACT:

Background: *Pituitary tumors represent approximately 10-17% of intracranial tumors. However, they may grow large and extend into surrounding structures, resulting in neurological and hormonal complications, including visual impairment. The duration of visual involvement will help predict visual outcomes after pituitary surgery and will be helpful for patient counseling.*

Methodology: *A prospective observational study was conducted in the neurosurgery department of Bangabandhu Sheikh Mujib Medical University (BSMMU). The patient who fulfilled the selection criteria, which included [specific criteria], was enrolled in this study and was divided into two groups according to the Duration of visual symptoms. A total of 24 patients were selected; 12 presented with visual symptoms with less than six months duration; they were included in the first group, and 12 patients with more than 6 months duration were included in the second group. Patient data were recorded in a predetermined data sheet. An ophthalmologist examined visual status. Data was processed and analyzed using SPSS version 22. An appropriate statistical test for data analysis (Chi-square test and student t-test) was performed. Statistical significance was at P-value <0.05 at a 95% confidence interval level.*

Results: *The age distribution of 24 patients ranged from 17 to 64 years, with a mean ±SD of age of 36.21±13.7. Males had slightly more preponderance than females in this series, with a male-to-female ratio 1.2:1. All patients presented with visual problems (100.0%). The majority (93.3%) patients presented with headache, 6 patients (25.0%) presented with acromegaly, 1 patient (4.2%) presented with hypothyroid, and 3 patients (12.5%) presented with amenorrhea and galactorrhea. Regarding visual acuity symptoms less than 6 months, 58.3% were improved, and 41.7% were not improved. Visual symptoms of more than 6 months duration 25% out of 24 eyes improved and 18(75.0%) did not improve post-operatively; we found that visual symptoms of less than 6 months improved better postoperatively (p-value 0.001).*

Conclusion: *Our study reveals a significant association between the Duration of preoperative visual symptoms and early postoperative visual outcomes in patients with pituitary macroadenoma surgery. Specifically, patients presenting with less than 6 months of visual symptoms showed a marked improvement compared to those with more than six months duration. These findings provide valuable insights for patient counseling and early intervention strategies.*

Key Words:
pituitary macroadenoma,
visual abnormality,
transsphenoidal approach

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Introduction

Pituitary adenomas account for 10-17% of all intracranial tumors [1-4] and often remain undetected because they may be asymptomatic [4]. However, some patients may present with distinct clinical syndromes due to hormonal excess secretion, such as hyperprolactinemia, acromegaly, Cushing's disease, hyperthyroidism, or pituitary dysfunction due to glandular compression [4]. Large tumors with suprasellar and/or parasellar extension can cause severe headaches, visual disturbances, and oculomotor nerve palsies [4,5]. Surgical intervention remains the treatment option for the majority of these tumors and is the gold standard for hormone-inactive adenomas [4]. Most tumors require surgery to relieve visual symptoms and prevent further vision loss [5].

Typically, nonfunctioning tumors present as macroadenomas that cause neurological symptoms due to intracranial mass effect since hormonal activity delays diagnosis compared with functional pituitary adenomas. It has been reported that 96.5% of nonfunctioning adenomas present as macroadenomas and that 67.8% of patients with these tumors experience visual defects. The primary ocular manifestation of pituitary macroadenoma includes visual field defect, visual disturbance, and oculomotor abnormalities[2].

The optic chiasma sits 8–13 mm above the pituitary gland. The point preceding the contralateral optic tract is where each eye's nasal retinal fibers (temporal visual field) cross. Pituitary tumors with an upward growth pattern press against the anterior notch at the lowest aspect of the chiasma. This leads to superior bitemporal hemianopia with increased density. Because tumor growth is frequently asymmetrical, the loss of eye field is also usually asymmetrical and denser in the inferior than in the superior region.[3, 4]

Chaisma comprises three layers. The upper layer contains fibers from the upper retinal quadrant (i.e., subserving the lower visual quadrant) with non-crossing out numbering crossing fibers. The middle layer contains crossing fibers from the upper nasal quadrant, which is a roughly equal portion to noncrossing fibers from the lower nasal retinal quadrant (i.e., subserving the upper temporal visual quadrant), which loop forwards into the opposite optic nerve before turning backward into the optic tract.

The function of the lowest fibers is commonly the first to be interrupted by a tumor compressing the anterior-inferior face of the chiasma, resulting in a peripheral bitemporal upper quadrantic hemianopia. Visual impairment is a significant indication of surgical intervention by the transcranial or transsphenoidal route[4].

A pituitary adenoma may compress the anterior visual pathway, producing vision loss. Transsphenoidal surgical reduction or medical treatment of pituitary adenomas may decompress the anterior visual pathway, leading to visual recovery. Improvement in visual function has occurred in three stages: rapid recovery within minutes, delayed recovery over weeks to months, and late recovery over months to years.[5]

Improvement in vision may occur immediately after surgery and visual evoked potentials have been documented to improve within ten minutes. This initial rapid recovery within the first week after surgery is well established. It has been postulated that the initial improvement results from removing the physiologic conduction block. Further improvement during a stage of delayed recovery is thought to be the result of remyelination of the decompressed optic pathway. Finally, there was a late visual field recovery over the months.[5,7]

It is necessary to define the difference between late and delayed recovery clearly. Preoperative and single postoperative visit visual function have been compared in most investigations to improve visual function following treatment of pituitary tumors compressing the anterior visual pathway. Younger age, shorter duration of symptoms, visual acuity, and lack of disk pallor are preoperative characteristics linked to a better visual prognosis.[7,8]

The quality visual recovery of postoperative results is encouraging, but still, there are 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. The integrity of the vascular supply to the chiasma and optic nerve is the primary prerequisite for postoperative visual improvement.

Some studies in Bangladesh have examined the visual outcome of pituitary adenoma surgery. However, no study has examined the duration of preoperative visual symptoms and early postoperative visual outcomes in

patients with pituitary macroadenoma.

Methodology

This prospective obrvational study was carried out in the Department of Neurosurgery, BSMMU, Dhaka, during the period from September 2016 to April 2018 to evaluate the early post-operative (7 days) visual outcome of pituitary macroadenoma and also to find out any other factor that influences it. 24 cases of pituitary macroadenoma had been included in this study, as well as those who presented with visual symptoms. Pituitary macroadenoma was diagnosed pre-operatively by MRI and, after operation, confirmed by histopathology. The preoperative and postoperative visual status were analyzed and documented. Those patients whose data were not collected after the operation were excluded from this study.

Preoperative and postoperative data on visual status were correlated and compared to determine the early post-operative visual outcome in pituitary macroadenoma. Data were analyzed in SPSS (version 22). The test statistics used to analyze the data were descriptive statistics, the Chi-square probability test, and the significance level set at 0.05.

Results

In this study, the age distribution of 24 patients ranged from 17 to 64 years, with a mean ±SD of age of 36.21±13.7. The patient age distribution shows a peak incidence of Pituitary macroadenoma between 31 and 40 years. Males had a higher preponderance than females in this series, with a male-to-female ratio 1.2:1.

Table-1: Distribution of the study subjects by preoperative visual acuity according to number of total eyes (N=48)

Preoperative visual acuity	Frequency	Percentage (%)
6/6-6/12	21	43.7
6/18-6/36	11	22.9
6/60	16	33.3

Table-2: Distribution of the study subjects by postoperative visual acuity according to number of total eyes (N=48)

Preoperative visual acuity	Frequency	Percentage (%)
6/6-6/12	29	60.4
6/18-6/36	8	16.7
6/60	11	22.9

Table-3: Association of visual acuity preoperative and postoperative according to the number eyes (N=48)

Preoperative visual acuity	Total	Postoperative			
		Improved No. (%)	Stable No.(%)	Deteriorated No. (%)	P value
6/6-6/12	21	5(23.8%)	16 (76.2%)	0(0.0%)	0.021*
6/18-6/36	11	8(72.7%)	1(9.1%)	2(18.2%)	0.200ns
6/60-PR	16	7(43.8%)	9 (56.3%)	0(0.00%)	0.016*

*= Significant, ns= Non-Significant

Table-4: Association with duration of visual symptoms with postoperative visual status

Duration of symptoms	No of eyes	Improved No. (%)	Not improved	P value
< 6 months	24	14(58.3%)	10(41.7%)	<0.001*
> 6 months	24	6(25.0%)	18(75.0%)	<0.001*
Total	48	20(41.7%)	28(58.3%)	

*= Significant

Table-5: Distribution of patients according to postoperative complications (N=24)

Postoperative complications	No of patients	Percentage (%)
Absent	10	41.7
CSF leak	1	4.2
CSF leak, Transient DI	3	12.5
Transient DI	10	41.7
Total	24	100.0

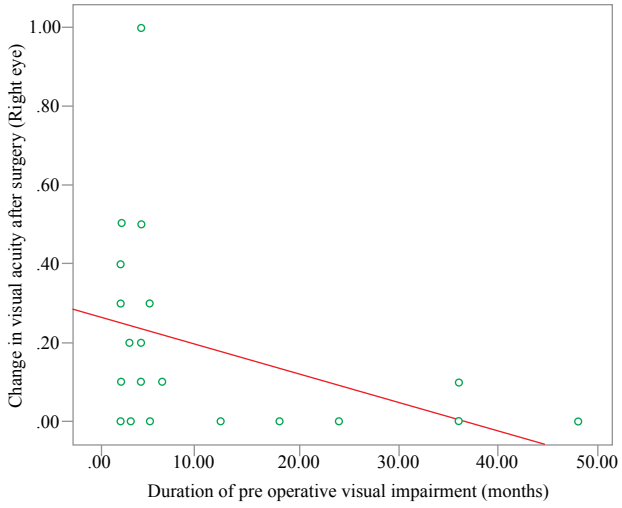

Figure 1: Correlation of duration of pre operative visual impairment with change in visual acuity after surgery (right eye) Pearson's correlation coefficient r= -0.420 and p= 0.041

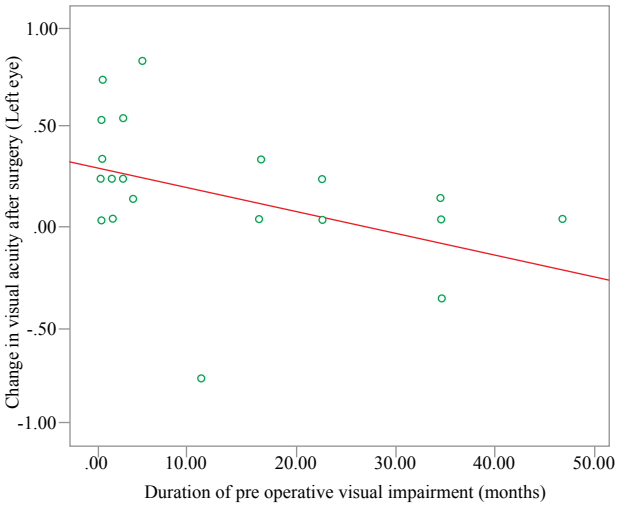

Figure 2: Correlation of duration of pre operative visual impairment with change in visual acuity after surgery (left eye) Pearson's correlation coefficient r= -0.409 and p= 0.047

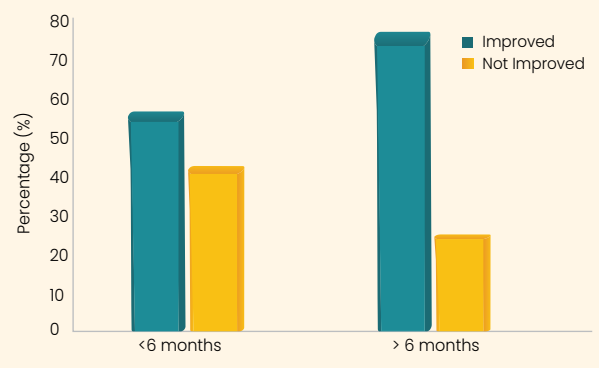

Fig 3: Bar diagram of Improvement and Non-improvement according to pre-operative duration of visual involvement

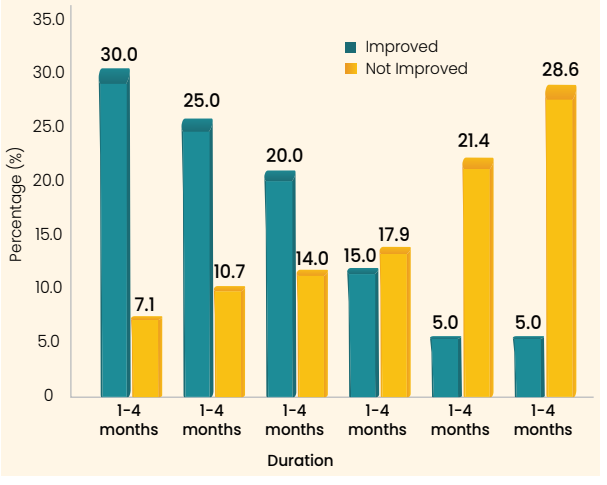

Figure-4: Bar diagram showing duration of visual involvement with improvement and not improvement

All patients presented with visual problems (100.0%). The majority (93.3%) presented with headaches. Six patients (25.0%) presented with acromegaly, 1 patient (4.2%) presented with hypothyroidism, and 3 patients (12.5%) presented with amenorrhea galactorrhoea.

Among 24 patients of pituitary macroadenoma who underwent surgery by transsphenoidal approach, gross total removal was achieved in 11 patients (45.8%) patients, near total -10(41.7%) patients, partial 3(12.5%).

The duration of the symptoms ranged from 2 months to 48 months. The volume of the tumor ranged from 3-136.5 ml; the Majority of the tumors were within 3-20 ml. Post-operative VA VF were collected and documented at 7 days after surgery. They were compared with the pre-operative status.

The pre-operative visual acuity among 24 patients according to the no. of the eyes (n=48). Visual acuity 6/6-6/12 had 21(43.7%) eyes, visual acuity 6/18-6/36 had 11 (22.9%) eyes, and visual acuity 6/60-PR had 16 (33.3%) eyes. (Table 1)

The postoperative visual acuity among 24 patients according to the no of eyes (n=48), visual acuity 6/6-6/12 had 29(60.4%) eyes, visual acuity 6/18- 6/36 had 11(22.9%) eyes, and visual acuity 6/60-PR had 8 (16.7%) eyes.(Table 2)

Regarding visual acuity of less than six months, 14(58.3%) improved, and 10(41.7%) did not improve. Regarding visual acuity of more than six months duration, 6(25%) out of 24 eyes improved, and 18(75.0%) did not improve post-operatively (Table 4); we compared the pre- and post-operative data and found that visual acuity of less than six months duration improved better (statistically significant, p-value 0.001).

Regarding VF Post-operatively, 33.0% of eyes were improved, 58.3% were unchanged or stable, and 8.3% were deteriorated. These were not statistically significant. We discussed why it was not statistically significant. However, it was a good indicator that VF functions improved later on because improving the visual field is a continuous process; up to 2 years, it can improve.

In bivariate analysis, the duration of the symptoms was shown to be a factor influencing the visual outcome (statistically significant, p-value 0.001).

The postoperative complications. The main complications

were transient DI 10 (41.7%), CSF leak, and transient DI in 3(12.5%) patients. 10(41.7%) patients had no complications. CSF leak 1(4.2%) patients had developed post-operatively. Some patients had more than one complication simultaneously.(Table 5)

Discussion

This study was carried out in the Department of Neurosurgery from September 2016 to April 2018, BSMMU, Dhaka, to determine the association between the duration of visual involvement and early post-operative visual outcome following pituitary macroadenoma surgery.

The final study subjects were 24 patients with pituitary macroadenoma; all presented with visual symptoms and were recruited according to the exclusion and inclusion criteria. The visual outcome in this study was analyzed as an improvement over preexisting vision at admission. Successful surgical treatments of pituitary macroadenoma resulted in recovery, and in many cases, normalization of visual functions was found in this series of patients. In our series, we assessed visual status after 7 days of surgery. We compared it with the patient's preoperative status and correlated it with the duration of visual involvement that influenced it. Kerison et al. 2000, observed statistically significant improvement in visual status at surgery to one week; the duration of visual disturbances ranged from 2 months to 48 months with a mean duration of 16.3 months[8].

Post-operatively, VF in 41.7% of eyes improved; it was unchanged or stable in 53.3%, and 5% of eyes deteriorated. These findings are not 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 [8]. This is due to our early visual field assessment of the patient compared to the other authors and the need for long-term follow-up. Improvement of visual field defects is a continuing process for at least 1 year [8,9,10]. Kerrison et al. 2000, showed progressive improvement of visual fields even more than 2 years after surgical decompression of the optic chiasm[8].

Optic atrophy was presented in 30% of eyes in this study series. Optic disc pallor or atrophy was not a good predictive factor for visual outcome. Improvements or even complete regression of visual deficit often occurred in cases with preoperative optic disc pallor or atrophy [11]. In this series, the study showed that preoperative optic atrophy had a worse prognosis for visual outcome post-operatively (statistically significant, p-value 0.0001).

Overall outcome in 24 patients after surgery: 76.7% showed mild to moderate improvement, 16.7% showed unchanged, and 6.7% showed deterioration.

In this series, age, sex, volume of the tumors, suprasellar extension, surgery methods, and tumor resection extent were not analyzed with the visual outcome. Bivariate analysis showed that the duration of visual disturbances is a factor that affected the postoperative visual outcome. Duration under 6 months had a better result than more than 6 months (statistically significant, p-value <0.001).

The improvement of visual dysfunction after surgical treatment is supposed to consist of two or 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 was demonstrated in the first days after surgical treatment. The second phase, i.e., delayed recovery, is pathophysiologically caused by the restoration of axonal transport and remyelination and is based on the remyelination of the optic nerve. This phase of delayed recovery may last for several years [8]. A precise boundary between the end of the fast phase of recovery and the start of the delayed recovery is artificial because these two phases reflect different pathophysiological mechanisms, which may co-exist for a specific period. The contribution of the fast phase of recovery might be more significant [12]. For this reason, in this study series, the visual outcome was analyzed within one week of surgery, which indicates that visual improvement will occur later.

Conclusion

In this study, it was statistically proved that the duration of preoperative visual symptoms is an essential factor for improving postoperative visual outcomes in pituitary macroadenoma; preoperative visual acuity also influences the visual result. Visual acuity 6/18-6/36 has a favorable outcome. Patients who were operated on for pituitary macroadenoma have visual problems, and they consulted with an ophthalmologist first. The index of suspicion among ophthalmologists should be their early referral. Awareness regarding pituitary macroadenoma and the reversibility of vision loss must be increased among the medical community, especially ophthalmologists and physicians, so that timely neurosurgical intervention can occur. A large sample and population-based long-term study is needed

to determine the incidence, factors, treatment modalities, and outcome of pituitary macroadenoma in our country.

Reference

1. Mortini P, Losa M, Barzaghi R, Boari N, Giovanelli M. Results of transsphenoidal surgery in a large series of patients with pituitary adenoma. Neurosurgery. 2005;56(6): 1222–33.
2. Ezzat S, Asa SL, Couldwell WT, Barr CE, DodgeWE, Vance ML, et al. The prevalence of pituitary adenomas: A systematic review. Cancer. 2004;101(3): 613–9.
3. Garibi J, Pomposo I, Villar G, Gaztambide S. Giant pituitary adenomas: clinical characteristicsand surgical results. Br J Neurosurg. 2002;16(2):133–9.
4. Lampropoulos KI, Samonis G, Nomikos P. Factors influencing the outcome of microsurgicaltranssphenoidal surgery for pituitary adenomas: A study on 184 patients. Hormones. 2013;12(2):254–64
5. Fredes F, Undurraga G, Rojas P, Constanzo F, Lazcano C, Pinto J, Schmidt T. Visual Outcomes after Endoscopic Pituitary Surgery in Patients Presenting with Preoperative Visual Deficits. J Neurol Surg B Skull Base. 2017 Dec;78(6):461-465. doi: 10.1055/s-0037-1604169. Epub 2017 Jul 19. PMID: 29134164; PMCID: PMC5680029.
6. Okamoto, Y., Okamoto, F., Hiraoka, T., Yamada, S. and Oshika, T., 2008. Vision-related quality of life in patients with pituitary adenoma. American journal of Ophthalmology, 146(2), pp.318-322.
7. Williams peter, Falconer Murray A., 1968, 'Pattern of visual failure with pituitary tumors. Clinical and radiological correlations' Br J Opthalmol,vol. 52, pp. 94-110.
8. Kerrison, J.B., Lynn, M.J., Baer, C.A., Newman, S.A., Biousse, V. and Newman, N.J., 2000. Stages of improvement in visual fields after pituitary tumor resection. American journal of Ophthalmology, 130(6), pp.813-820.
9. Kristof, R.A., Kirchhofer, D., Handzel, D., Neuloh, G., Schramm, J., Mueller, C.A. and Eter, N., 2011. Pre-existing chiasma syndromes do not entirely remit following transsphenoidal surgery for pituitary adenomas. Acta neurochirurgica, 153(1), pp.26-32.
10. Dekkers, O.M., Hammer, S., De Keizer, R.J.W., Roelfsema, F., Schutte, P.J., Smit, J.W.A., Romijn, J.A. and Pereira, A.M., 2007. The natural course of non-functioning pituitary macroadenomas. European Journal of Endocrinology, 156(2), pp.217-224.
11. Gnanalingham, K.K., Bhattacharjee, S., Pennington, R., Ng, J. and Mendoza, N., 2005. The time course of visual field recovery following transphenoidal surgery for pituitary adenomas: predictive factors for a good outcome. Journal of Neurology, Neurosurgery & Psychiatry, 76(3), pp.415-419.
12. Peter, M. and De Tribolet, N., 1995. Visual outcome after transsphenoidal surgery for pituitary adenomas. British journal of Neurosurgery, 9(2), pp.151-158.