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Visual Field Improvement After Pituitary Tumor Resection

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Introduction: Optic neuropathy due to chiasmal compressive lesion can affect the visual acuity, color vision, and visual field in both eyes. The most common visual field defect of chiasmal compression is a bitemporal hemianopia. Restoration of visual function is possible following surgical decompression.
Purpose: To report a case of visual field improvement after pituitary tumor resection.
Case Report: A 53 year old woman came with a chief complaint of blurred vision on her left eye since 3 months. Patient visual acuity was 0.25F1 on the right eye and counting fingers at 1 meter on the left eye. Ophthalmologic examination revealed optic disc pallor on both eyes. HVF 30-2 results showed bitemporal hemianopia. Head MRI with contrast showed an pituitary macroadema, size 2.3 x 2.2 x 2.7 cm and pushing the optic chiasm superiorly. Patient diagnosed with bilateral papil atrophy and bitemporal hemianopia caused by pituitary macroadenoma. She underwent endoscopic transsphenoidal tumor resection by a neurosurgeon. Visual function showed an improvement after 6 months follow up. Colour vision and contrast sensitivity were increased in left eye. HVF 30-2 showed visual field improvement in both eyes, especially in right eye.
Conclusion: Pituitary adenoma can lead to visual impairment. Preoperative factors such as retinal nerve fiber layer thickness, severity of the preoperative deficit, duration of visual symptoms, tumor size, extent of resection, and patient age may also serve as predictors of postoperative visual outcomes.
Keywords: Bitemporal Hemianopia, Chiasmal Lession, Pituitary Adenoma

INTRODUCTION

Optic neuropathy caused by chiasmal compressive lesion can affect the visual acuity, color vision, and visual field in both eyes. Pituitary adenoma was one of the causative. Pituitary adenomas are common intracranial neoplasms that represent approximately 15% of primary brain tumors. When growing upward, they can compress the optic chiasm, resulting in visual impairment and a visual field defect (VFD). The most common visual field defect of chiasmal compression is bitemporal hemianopia. These defects may appear relative or complete. They may involve the paracentral temporal field alone, and visual acuity is often unaffected until late. In chiasmal syndromes, the optic nerve heads (ONH) may appear normal initially, even with significant visual field loss, but mild ONH pallor may develop.[1,2,3]

Restoration of visual function is possible following surgical decompression, it can begin within hours to days after surgery and sometimes with full recovery. The amount of visual recovery from chiasmal decompression surgery depends on the degree of both anatomical and physiological damages and how much regeneration of retinal ganglion cells and axons will occur. Postoperative visual recovery in patients with pituitary adenoma can be influenced by the duration of symptoms, age, and tumor volume.[2,4,5] The objective of this case report is to report visual field improvement after pituitary tumor resection.

CASE REPORT

A 53 years old woman came to Neuro Ophthalmology unit, Cicendo Eye Hospital with a chief complaint of blurred vision on her left eye. Her vision had been gradually decreased since 3 months before admission. Patient denied any headache, nausea, vomiting, double vision, painful ocular movement, weight loss, nor loss of appetite as associated symptoms. Patient was already menopause and had history using contraceptive injection for 6 months. She had uncontrolled hypertension,uncontrolled diabetes mellitus, and dyslipidemia. There was no history of trauma, allergies and asthma. She did not wear any spectacle and no medication history for recent complaint or past use of any other drugs.

Figure 1. Ocular Motility in 9 Cardinal Positions

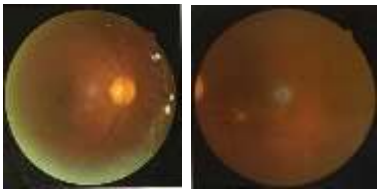

Figure 2. The Fundus Photography of Both Eyes

The general examination and vital signs of patient were within normal limits. Patient visual acuity was 0.25F1 pinhole 0.5 on the right eye (RE) and counting fingers at 1 meter on the left eye (LE). Intraocular pressure measured with non-contact tonometry was 13 on both eyes. Eye movements were full on both eyes. Anterior segment examination showed relative afferent pupillary defect (RAPD) grade I on the left eye and lens opacities with NO2NC3 on both eyes. Funduscopic examination showed an optic disc pallor on both eyes and epiretinal membrane in left eye (figure 2).

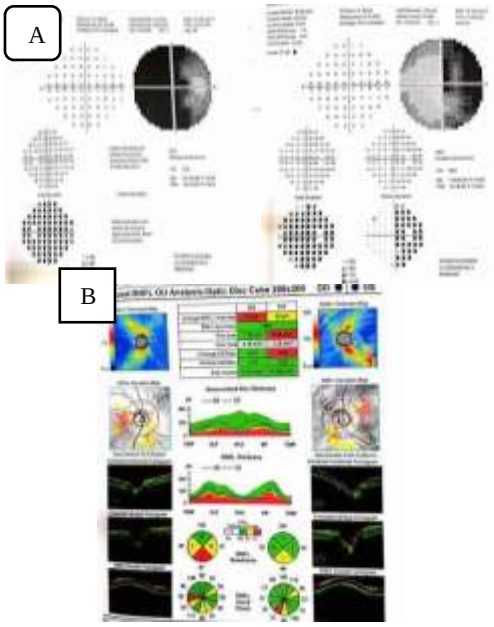

Figure 3. HVF 30-2 and Optic disc OCT Before Endoscopic Transsphenoidal Resection

A. Visual Field Defect on both eyes showed bitemporal hemianopia
B. OCT showed reduction of all quadrants RNFL thickness on both eyes

Patient's color vision tested using Ishihara color plates was 21/21 on the RE and was not applicable on the LE. Amsler grid examination were within normal limits for the RE and not applicable for the LE. Contrast sensitivity test on her RE was measured 1.25% and on her LE was not applicable. Confrontation test was normal on right eye and there was scotoma on the temporal field of left eye. Neurological examination (cranial

nerve and motoric) within normal limit. The laboratory examination showed elevation of total cholesterol (271 mg/dl). HVF examination showed bitemporal hemianopia (figure 3a). Optic disc OCT showed a reduction of all quadrants RNFL thickness on both eyes, with average of RNFL thickness was 72 μm on the right eye and 80 μm on the left eye (figure 3b). Head MRI with contrast was performed (figure 4). There was found an enhancing solid lesion in intrasella that extends to the suprasella which gives a snowman appearance due to pituitary macroadema, size 2.3 x 2.2 x 2.7 cm and pushing the optic chiasm superiorly. The patient was diagnosed with bilateral papil atrophy, bitemporal hemianopia caused by suspect pituitary macroadenoma, senile cataract on both eyes and epiretinal membrane in the left eye. Patient treated with citicoline tablet 1x 1000 mg per day and referred to the neurosurgeon. The patient underwent endoscopic transsphenoidal tumor resection at Gunung Jati Hospital 4 months later by a neurosurgeon. The pathologic anatomy results of the tumor were pituitary adenoma.

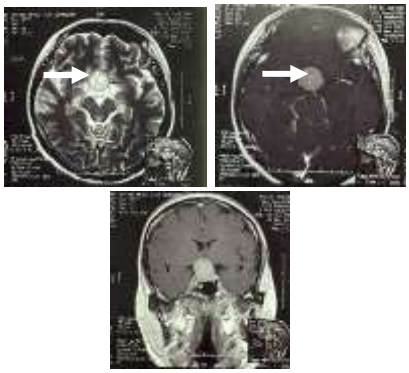

Figure 4 Head MRI With Contrast Before Endoscopic Transsphenoidal Resection Showed Mass In Intrasella That Extends To The Suprasella

On last visit, 6 months after tumor resection, patient's visual acuity was 0.1 pinhole 0.5 on the RE and counting fingers at 1 meter pinhole 0.05 on the LE. Intraocular pressure was 15 on right eye dan 14 on left eye. Eye movements were full on both eyes. Anterior segment examination showed pupillary reflex was decreased on both eyes and opacity lens on both eye. Funduscopy examination showed an optic disc pallor on both eyes and epiretinal membrane in left eye. Patient's color vision was tested using Ishihara color plates, on the RE was 38/38 and LE was 4/38, Amsler grid examination were within normal limit for the RE and there was scotoma in LE. Contrast sensitivity was tested using MARS, on her RE were measured 1,32 and on her LE was 0,32. Humphrey's visual field (HVF) 30-2 (figure 5a) showed improvement in visual field defect, yet there was a slight temporal hemianopia on left eye.

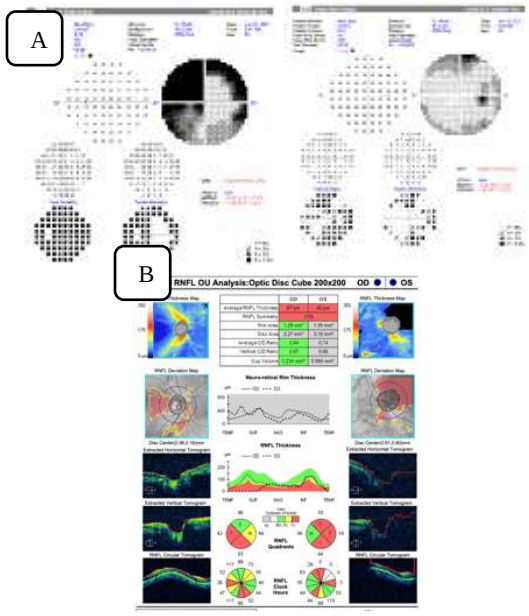

Figure 5. HVF 30-2 And Optic Disc OCT After Endoscopic Transsphenoidal Resection

A. HVF Showed Improvement In Visual Field Defect, Yet There Was A Slight Temporal Hemianopia On Left Eye
B. OCT Showed Reduction Of All Quadrants RNFL Thickness On Both Eyes

Optic disc OCT showed a reduction of all quadrants RNFL thickness on both eyes (figure 5b). Average RNFL thickness was 67 μm on right eye and 40 μm on left eye. Head CT scan with contrast post endoscopic transsphenoidal tumor resection showed solid mass measuring 2.11x1.38x1.72 cm in the sella suprasellar area. Patient diagnosed with bilateral papil atrophy, resolving bitemporal hemianopia caused by pituitary macroadenoma (post tumor resection), senile cataract on both eyes and epiretinal membrane in left eye. Patient treated with citicoline tablet 1x 1000 mg per day and advised to return to the neurosurgeon f or control. The prognosis for this case, quo ad vitam was ad bonam, quo ad functionam was dubia ad bonam, and quo ad sanationam was dubia ad bonam.

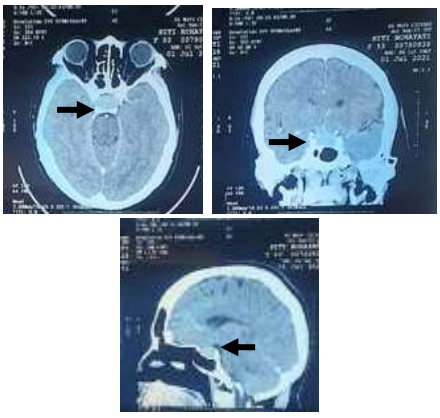

Figure 6. Head CT Scan With Contrast After Endoscopic Transsphenoidal Resection Showed Mass In Intrasella

DISCUSSION

Pituitary adenomas are common intracranial neoplasms that represent approximately 15% of primary brain tumors. Pituitary adenomas usually occur in adults, they rarely occur in childhood. Various articles have reported both male and female predilections. Historically, pituitary adenomas have been described by their size. This is performed radiographically with CT or MRI. Macroadenomas: if the size of tumor ≥10 mm and microadenomas if size of the tumor <10 mm. A broad spectrum of visual symptoms has been reported in the literature, ranging from no alteration to blindness. Visual symptoms may be vague, usually have a gradual onset and may not be noticed by the patient until well established. Visual impairment may comprise a decrease in visual acuity (41%), impaired color vision (56–71%), ocular movement alterations (8%), and visual field disturbances, the last one being the most common, with a reported prevalence from 37 to 96% in different studies. Visual impairment is primarily due to direct tumor compression on the optic nerve with subsequent nerve atrophy and devascularization. [1,3,5,6] In this patient found gradually visual disturbances in both eyes, color disturbances and contrast sensitivity in the left eye.

In chiasmal syndromes, the ONHs may appear normal initially, even with significant visual field loss. With progressive damage, the ONHs show typical atrophy, often in the temporal portion of the ONH. Cupping of the ONH may increase. Optic atrophy refers to the late stage changes that take place in the optic nerve resulting

from axonal degeneration in the pathway between the retina and the lateral geniculate body, manifesting with disturbance in visual function and in the appearance of the optic nerve head. Optic atrophy is present in approximately 50% of cases with field defects. Initially, compression induces axoplasmic flow disorder, blockage of conduction and demyelination, all of which are reversible. Longer or more intense compression induces axonal fibre degeneration and optic atrophy, which are irreversible. When nerve fibre loss is confined to fibres originating in the nasal retina (i.e. nasal to the fovea) only the nasal and temporal aspects of the disc will be involved, resulting in a band or 'bow tie'-shaped atrophy. A tumor compressing the chiasm almost never produces ONH oedema. Para sellar lesions that involve the chiasm whether compressing or infiltrating this area result in gradually progressive, bilateral, often asymmetric vision loss. An affected optic nerve may cause more central vision loss, with impaired visual acuity, dyschromatopsia, and an RAPD on the affected side.[2,6,7,8] The patient had bilateral optic disc atrophy and RAPD gr I in the left eye.

The classic visual disturbance associated with pituitary tumors is a bitemporal hemianopsia in which bilateral temporal visual fields are affected. This pattern occurs when the body of the chiasm (consisting of the crossing nasal fibers of each optic nerve) is severely compressed by a superiorly extending tumor. This defect can be complete (ie, involving the entire hemifield) or partial, typically starting with the superior hemifield (ie, superior temporal quadrantinopsia) and progressing inferiorly. Several different visual field deficit patterns have been reported, and all relate to the position of the growing tumor relative to the optic nerves and chiasm. 'Postfixation blindness' refers to the presence of a non-seeing area distal to the fixation point due to the overlap of two blind hemifields despite the similar terminology, it is not linked to a postfixed chiasm. Patients may complain of difficulty with fine close-up tasks such as threading a needle and cutting fingernails, and near visual acuity measured binocularly may be worse than when measured with each eye individually. Double vision may result from slippage of the two fields with fusional failure ('hemifield slide'); diplopia may also result from cranial nerve palsy. Automated static perimetry or kinetic perimetry are used to formally assess visual fields. In an undiagnosed patient with a history suspicious for pituitary disease, this often confirms the presence of a compressive chiasmal lesion. Visual fields are also commonly documented prior and following neurosurgical intervention.[4,6,9] The patient underwent HVF examination before and after tumor resection. HVF examination before tumor resection showed bitemporal hemianopia. HVF examination after tumor resection showed visual field improvement on both eyes, especially in right eye.

MRI with gadolinium contrast utilizing multiple planes and thin sections demonstrates the relationship between a mass lesion and the chiasm, and is usually the preferred imaging modality. Adenomas are typically hypointense on T1 and hyperintense on T2 images. The pituitary gland is best

seen on coronal sections and normally enhances with contrast. CT scan will demonstrate enlargement or erosion of the sella.[6,10] In this patient, head MRI with contrast was performed. There was found an enhancing solid lesion in intrasella that extends to the suprasella which gives a snowman appearance due to pituitary macroadema, size 2.3 x 2.2 x 2.7 cm and pushing the optic chiasm superiorly.

Management of pituitary adenomas depends on the size of the tumor, its secretory function (as well as what type of hormone is secreted), and its impact on the patient's vision. Goals of treatment include visual recovery/preservation, reversal of hypersecretory syndromes, and control of tumor growth. While some forms of pituitary adenoma can be managed medically, most pituitary adenomas that have demonstrable visual field loss are treated surgically. Medical therapy for pituitary adenomas has a slower effect, taking days to weeks, but also shrinks the tumor and improves visual function in responsive cases. Medical therapy is usually the initial step and consists of the reduction in tumour size and secretion using agents such as dopamine agonists (e.g. cabergoline and the older bromocriptine) and somatostatin analogues such as octreotide, with supplementary hormonal correction as appropriate. The presence of visual abnormalities is one of the main indications for surgical resection and chiasmatic decompression. Surgery consists of tumour debulking rather than complete excision and is usually carried out endoscopically via a trans-sphenoidal approach through a gum incision behind the upper lip. The endoscopic endonasal approach (EEA) is widely accepted as a modality of surgery, as it has proven to be an effective technique in terms of tumor resection and improvement of hormonal disorders and visual defects, with a low surgical morbidity and low mortality rate in high-volume centers. The EEA is particularly effective to correct visual field disturbances, with reported improvement rates that range from 50 to 90%, and less effective for visual acuity, motor ocular involvement, and improving color vision. Radiation therapy (external beam or gamma-knife) is considered a second-line treatment. Medical and surgical management of pituitary adenomas require a multidisciplinary team. Ophthalmology is typically consulted to evaluate the patient's visual fields. Less commonly, ophthalmologists may be the first to detect evidence of a pituitary adenoma. Standard automated perimetry is often utilized by ophthalmologists and pituitary surgeons to document indication and follow progression of visual involvement. Endocrinology is often involved to help evaluate hormonal levels and guide medical management. Surgical debulking of pituitary tumors is often performed by otorhinolaryngology (ENT) or neurosurgeon.[2,3,11,12] In the patient, a mass was found pressing on the optic chiasm, so endoscopic transsphenoidal tumor resection was performed by a neurosurgeon at Gunung Jati Hospital.

Restoration of visual function is not only possible following surgical decompression, but it can begin within hours to days after surgery, sometimes

with full recovery. “Medical decompression” of the optic nerve with bromocriptine in patients with prolactin-secreting pituitary tumors has yielded similar improvements in visual function. Following endoscopic endonasal pituitary surgery, most patients have improvement in visual symptoms such as visual fields or visual acuity. Most visual field recovery occurs within the first 3 to 6 months. Regeneration of axons in the optic nerve in human and nonhuman primates is quite limited and abortive. However, some degree of remyelination does occur after the injury. This remyelination results from the activity of uninjured, injured but surviving, and newly generated oligodendroglia. There is no correlation between the rapidity of visual loss and the rapidity of visual return. Recent studies using optical coherence tomography have demonstrated utility in the use of this technology in terms of visual prognosis following decompression; preoperative RNFL measurements of over 80 microns portend a better prognosis and may be more helpful than features such as degree of optic atrophy, depth of visual field defect, or color vision or acuity measurements. It has been theorized that there are three stages of visual recovery after decompression of the anterior visual pathway: Relief of visual pathway compression is initially followed by rapid recovery of some vision within minutes to hours. This recovery can be likened to the relief of conduction block after an arm or leg “goes to sleep.” This initial recovery is followed by delayed recovery of additional function over weeks to months. This improvement may be related to progressive remyelination of previously compressed demyelinated axons. Finally, there is an even longer period of improvement, taking many months to years. The mechanism by which this late recovery occurs is unknown. Advanced optic atrophy, however, induces decreased vision and visual impairment that can persist even after surgical decompression.[1,4,9] In this case, there was improvement in colour and visual field, although there was no improvement in visual acuity, after endoscopic transsphenoidal tumor resection.

The amount of visual recovery from chiasmal decompression surgery depends on the degree of both anatomical and physiological damages and how much regeneration of retinal ganglion cells and axons will occur. Preoperative factors such as retinal nerve fiber layer thickness, severity of the preoperative deficit, duration of visual symptoms, tumor size, extent of resection, and patient age may also serve as predictors of postoperative visual outcomes. Intraoperative considerations and techniques also important to optimize visual outcomes for safe decompression of the optic chiasm and nerve. Ihsan et al analyzed the correlation of visual recovery with age, duration of symptoms, and tumor volume. Their research reported that prolongation of duration of symptoms can be observed with a decrease in the rate of recovery. When the tumor volume was evaluated, it was observed that the full recovery group showed the lowest tumor volume. When age was assessed, the full recovery group was the youngest and the nonrecovery group was the oldest. Although all

these parameters affected the visual recovery, the most prominent parameter in visual recovery was tumor volume according to their statistical analyses. Better postoperative outcomes when the delay to decompression is shorter. The postoperative first year is the most prominent interval evaluating the prognosis of visual recovery.[1,3,9,11] In this case the tumor size was 2,5x3x2,5 cm. Although in this case there is already bilateral optic atrophy and the size of the tumor has suppressed the optic chiasma but there is still an improvement, indicates that remyelination does occur.

Preoperative retinal nerve fiber layer (RNFL) thickness has been correlated strongly with postoperative visual field defects in various studies on chiasmal compression. Eyes with mean preoperative RNFL thickness < 100 µm were found to have worse postoperative visual outcomes. Danesh-Meyer et al reported the cut-off value for mean preoperative RNFL thickness to be 80 µm in chiasmal compression cases. RNFL thickness is also a useful tool to evaluate tumour severity and prognosis. The degree of reduction in RNFL thickness has been shown to correlate with visual field defects. It can predict the recovery of visual function after decompressive surgery in patients with chiasmal visual field defects caused by compression.[5,13,14] The prognosis for this patient, quo ad vitam was ad bonam, because pathologic anatomy result of the tumor was benign. Quo ad functionam was dubia ad bonam due to bilateral optic atrophy with lower mean RNFL thickness (average of RNFL thickness preoperative was 72 µm on the right eye and 80 µm on the left eye) but there was still an improvement in visual field defect and colour plate test. Quo ad sanationam was dubia ad bonam because there still a mass in the sella region after endoscopic transsphenoidal tumor resection.

CONCLUSION

Pituitary adenoma can lead to visual impairment. Preoperative factors such as retinal nerve fiber layer thickness, severity of the preoperative deficit, duration of visual symptoms, tumor size, extent of resection, and patient age may also serve as predictors of postoperative visual outcomes.

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