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surgical treatment

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ABSTRACT

Background: In the past, there were studies done to assess visual outcomes like visual acuity, fundoscopic findings and visual field mainly in pediatric patients with posterior fossa tumours (PFT). We assessed the above parameters pre- and post-operatively in all age group patients including both extra and intra-axial PFT. We also assessed visual outcome in patients with or without hydrocephalus.

Objectives: To analyze “visual outcomes in patients with posterior fossa tumours undergoing surgical treatment”. The effect of hydrocephalus on the visual outcome was also analyzed.

Materials and Methods: This prospective study including 107 patients with PFT undergoing definitive surgery was conducted in the Department of Neurosurgery at Dr Rmlims, Lucknow. Pre-op and post-op (six weeks after tumour resection) visual examinations were done and compared.

Results: A shifting trend towards normalization of visual acuity (VA) was seen post-surgery in all age groups. Overall improvement was seen in the majority of cases having pupil normal size sluggish reactive (NSSR) after surgery. Papilledema improved in the majority of patients in all age groups and patients having hydrocephalus. Colour vision and night vision also improved in the majority. The field of vision cut was not improved postoperatively in the majority.

Conclusion: Visual parameters like visual acuity, pupil size and reactivity to light; colour vision and night vision were improved significantly after surgery whereas cut field of vision did not improve. All fundoscopic findings like papilledema, retinal venous dilation and retinal splinters haemorrhage disappeared in a significant number of patients post-operatively. In cases with obstructive hydrocephalus, these parameters also improved significantly after Ventriculo-peritoneal shunt/ ETV or definitive surgery.

INTRODUCTION

Posterior fossa tumors (PFT) cause symptoms due to compression over brainstem, cerebellum and raised intracranial pressure (ICP),^[1,2,3,4]. This can lead to obstructive hydrocephalus and papilledema leading to secondary optic nerve atrophy and permanent vision loss.^[5] Hydrocephalus may cause Abducens palsy leading esotropia, and

Keywords
posterior fossa tumors,
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horizontal diplopia. Trochlear nerve palsy may cause vertical/oblique diplopia, with hypertropia. These tumors may disrupt visual fixation and vestibular and/or gaze-stabilization mechanisms, resulting in nystagmus, skew deviation, and complex gaze palsies. Vth and VIth nerve palsy may lead to corneal damage.^[6] In children, cerebellar mutism may result after surgery.^[7] Specially pediatric PFT with ophthalmic complications need more attention.^[8]

This study was done to prospectively analyze visual outcome after surgery in PFT (extra-axial/intra-axial) patients in all age groups.

AIMS

To analyze “visual outcomes in patients with posterior fossa tumors undergoing surgical treatment” and also to analyze the effect of hydrocephalus on the visual outcome.

MATERIALS AND METHODS

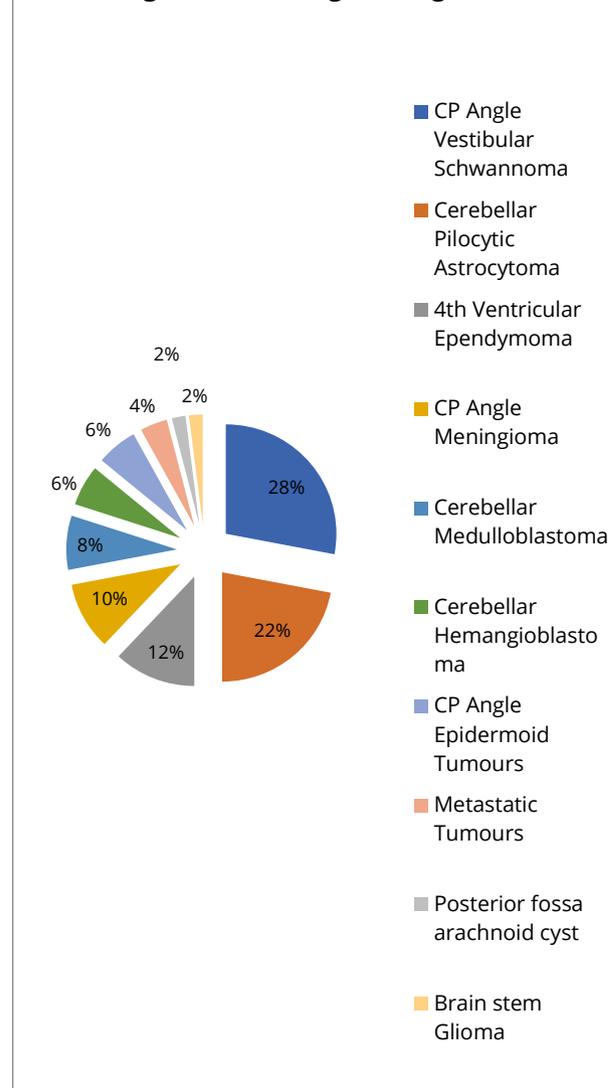
This prospective study included 107 patients was conducted in the department of Neurosurgery Dr.RMLIMS Lucknow. Those patients presenting with symptoms of hydrocephalus underwent cerebrospinal fluid (CSF) diversion procedure e.g. ventriculo-peritoneal (VP) shunt/endoscopic third ventriculostomy (ETV) as emergency procedure. Inclusion criteria were PFTs with or without hydrocephalus. Exclusion criteria were patients with recurrent PFT, visual and ocular motor dysfunction unrelated to their tumor, patients undergoing primary radiotherapy treatment, non-co-operative and not following commands. Most common procedures performed for definitive surgery were retro-sigmoid sub-occipital craniotomy/craniectomy or midline suboccipital craniotomy/craniectomy with gross total resection or subtotal resection of tumor. Pre-op and post-op (after six weeks of tumor resection) visual acuity on Snellen chart, pupillary function (size, reactivity), color vision on Ishihara test (present/absent), night vision (present /absent), visual field by confrontation test, fundoscopy, papilledema grade (modified Frisen scale), retinal findings (venous dilatation and splinter hemorrhage present/absent) were examined. Hydrocephalus (present/absent), CSF diversion procedure in the form of VP shunt/ETV done or not, were also examined. Visual acuity outcomes of various age groups, extra-axial and intra-axial posterior fossa tumors and patients with or without hydrocephalus

compared with Wilcoxon signed-rank test. Analysis was performed on STATA software.

RESULTS

Sample size was 107, out of which 3 patients died due to brainstem injury, infarction and edema. Four cases lost follow up due to unknown reasons. Total 100 patients were followed up to 6 months. 46 (46%) patients were found to be having extra-axial tumors and 54 (54%) intra-axial tumors (Figure 1). Total 20 (20%) patients having PFTs were found in pediatric age (<20years) group, 70 (70%) patients in middle (20-50 years) age group and remaining 10 (10%) in old age group (>50 years). Out of 100, 74 (74%) with obstructive hydrocephalus underwent VP shunt/ETV in emergency.

Figure 1: Pathological Diagnosis

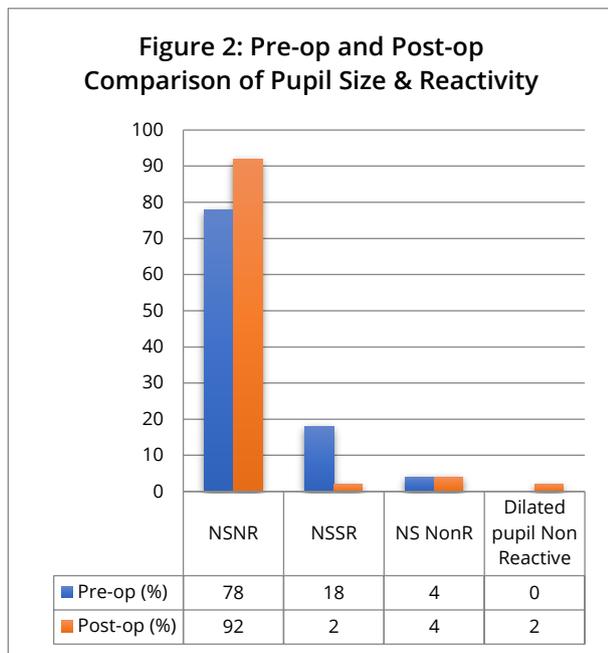


Visual acuity was categorized arbitrarily as normal (6/6), good (6/9 to 6/12 in both eyes), moderate (6/18 to 6/60 in at least one eye), and poor (<6/60 in at least one eye) (Table 1). Using Wilcoxon signed-rank test assessed VA outcomes in patients with extra-axial, intra-axial tumor, with/without hydrocephalus and in different age group.

S. No.	Visual Acuity Category	Pre-op		Post-op	
		No. of Cases	%	No. of Cases	%
1.	Normal Vision (6/6)	48	48	66	66
2.	Good Vision (6/9 to 6/12)	22	22	10	10
3.	Moderate Vision (6/18 to 6/60)	12	12	10	10
4.	Poor Vision (<6/60)	18	18	14	14
Total		100	100	100	100

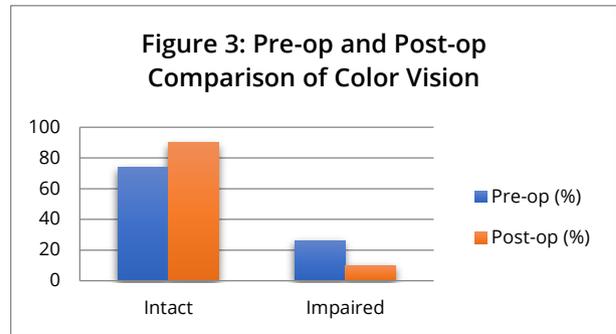
Table 1. Pre-op and post-op comparison of visual acuity.

Pupil size and reactivity measured as normal size of pupil and normal reactivity (NSNR), normal size sluggish reactive (NSSR), normal size nonreactive (NSNoR) and dilated pupil (Figure.2) and outcome analysed. Overall improvement was seen in majority of cases having pupil NSSR post-surgery.

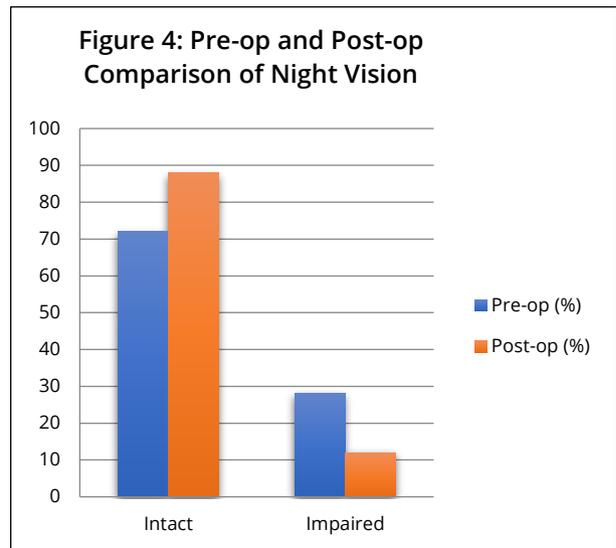


Out of 100, 26(26%) patients had impaired color vision on pre-op examination, which decreased to

10(10%) after surgery. Total number of cases having normal color vision was increased to 90(90%) after surgery but remain impaired or absent in 10(10%) cases. (Figure.3)



Total 72 (72%) patients were found to have normal night vision pre-operatively. Patients having normal night vision were increased to 88(88%), after surgery. Remaining 12(12%) patients did not improve even after surgery (Figure 4).

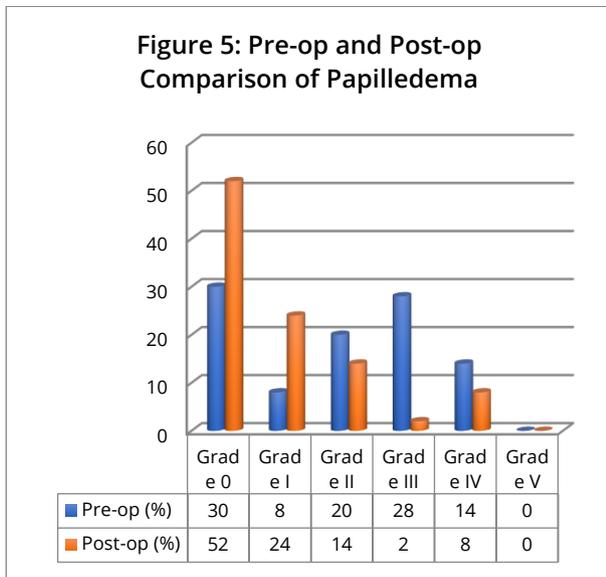


Vision field by confrontation outcome is given in Table 2.

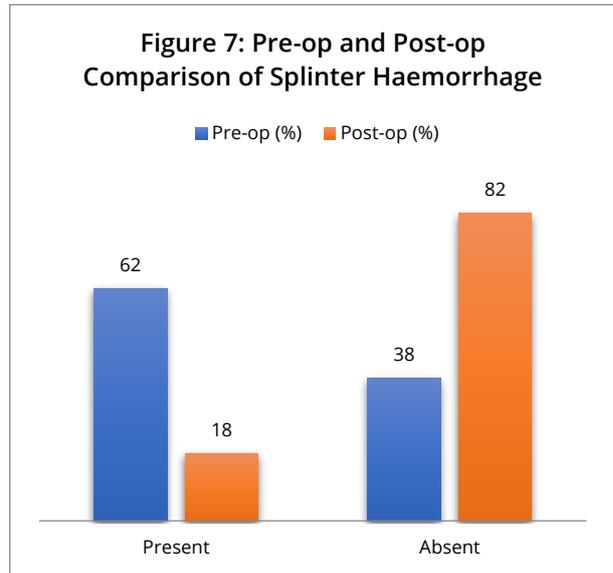
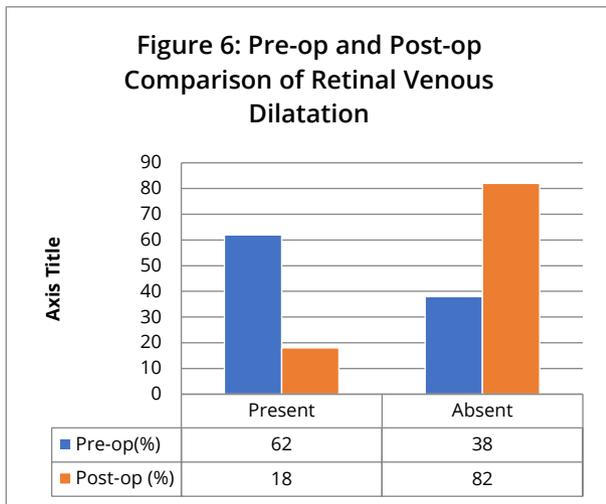
S. No.	Vision Field	Pre-op		Post-op	
		No. of Cases	Percentage	No. of Cases	Percentage
1.	Intact	96	96	96	96
2.	Impaired	4	4	4	4
Total		100	100	100	100

Table 2. Pre-op and post-op comparison of vision field by confrontation.

Out of 100 patients, 30(30%) patients were found to have normal fundoscopic findings (Grade 0), which increased to 52(52%) on post op examination. Grade IV papilledema was found in 14(14%) patients on pre-op examination which decreased to 8(8%) after surgery. Total no of patients having grade III papilledema was 28(28%) on pre-op examination which decreased to one after surgery(Figure.5). Likewise total number of patients with grade II papilledema decreased post operatively. However in 12(12%) patients, either in one or in both eye, optic atrophy was seen on follow up examination.



Retinal venous dilation and splinter hemorrhage examined on fundoscopy and outcome given in figure 6 and 7 respectively. After surgery one case was complicated with IIIrd nerve palsy.



DISCUSSION

Clinical profile and presentation: Total 100 patients were followed up in this study out of which 20 (20%) patients having PFTs were found in pediatric age (<20years) group, 70(70%) patients were in middle (20-50 years) age group and remaining 10(10%) patients were in the age group of >50 years. Most common extra-axial tumor was cerebellopontine angle vestibular schwannoma whereas most common intra- axial tumor was cerebellar pilocytic astrocytoma. Extra-axial tumors were diagnosed pathologically as cerebellopontine angle vestibular nerve schwannoma (28%) patients, cerebellopontine angle meningioma (10%) patients, cerebellopontine epidermoid tumors (6%) patients and posterior fossa arachnoid cyst (2%) patients. Intra-axial tumors were diagnosed pathologically as cerebellar pilocytic astrocytoma (22%) and fourth ventricular ependymoma (12%) cerebellar medulloblastoma (8%) cerebellar hemangioblastoma (6%) cerebellar metastatic tumors (4%) and brainstem glioma in one patient (Figure 1). Most common symptoms were headache (80%), nausea or vomiting (69%), ataxia (61%), ophthalmologic symptoms (31%) hearing loss (28%) and other cranial nerve involvement. Visual and oculomotor disturbance was the fourth most common symptoms (27%), which is similar to a study done by Nisha Gadgilet al. [8] Patients with hydrocephalus (75%) underwent CSF diversion procedure, either VP shunt or ETV in emergency followed by definitive surgery. Patients with persistent ophthalmological complications were consulted 6 weeks post-surgery.

Visual acuity outcome: In our study 48% cases had normal vision (6/6) in both eyes pre-operatively which increased to 66% post surgery. Poor visual acuity (<6/60) was observed in 18% patients in pre-op examination, which decreased post-operatively to 14%. Good visual (6/9 to 6/12) acuity was found in 22% patients pre-operatively, which decreased to 10% after surgery. The sum total of patients having normal visual acuity and good visual acuity was found to be 76% after surgery. Likewise, total no of cases having moderate visual acuity (6/18 to 6/60) was also decreased from 12% to 10% post-surgery. Over all shifting trend towards normalization of visual acuity was seen in majority, post-surgery. According to Peeler *et al* (2017) VA was good in 82.8%, fair in 9.8%, and poor in 7.4%. 9.4% cases had optic atrophy on follow up.^[9] However, this study was done only in pediatric patients having PFT.

Recently Nisha Gadgil *et al* (2018) concluded that 88% had good visual acuity; 5% had moderate and 5% had poor visual acuity. Optic atrophy due to prior hydrocephalus was noted in 13% cases but this resulted in persistent loss of visual acuity only in 2% cases.^[8]

In those patients presenting with obstructive hydrocephalus, urgent neurosurgical intervention was needed to decrease intracranial pressure for saving vision. Patients with poor visual acuity pre-operatively, having long duration of raised ICP improved little or none after surgery.

The median pre-op visual acuity in patients with extra-axial tumors (6/9; IQR 6/6 – 6/12) was better than patients with intra-axial tumors (6/12; IQR 6/6 – 6/24), but statistically non-significant difference was observed with KW test ($p=0.376$). Similarly, no statistical difference ($p=0.182$) was observed in the median post-op visual acuity in patients with extra-axial tumors (6/6; IQR 6/6 – 6/9) and patients with intra-axial tumors (6/6; IQR 6/6 – 6/36). Wilcoxon signed-rank test revealed statistically significant improvement in visual acuity after surgery in extra-axial tumors ($p=0.001$) and intra-axial tumors ($p=0.005$).

The median pre-op VA in patients without pre-op hydrocephalus (6/6; IQR 6/6 – 6/6) was better than patients with pre-op hydrocephalus (6/12; IQR 6/6 – 6/60), and this difference in visual acuity was found to be statistically significant with KW test ($p=0.000$). Similarly, statistically significant difference ($p=0.004$) was observed in the median post-op visual acuity in

patients without pre-op hydrocephalus (6/6; IQR 6/6 – 6/6) and patients with pre-op hydrocephalus (6/6; IQR 6/6 – 6/24). Wilcoxon signed-rank test revealed statistically significant improvement in visual acuity after surgery in patients with pre-op hydrocephalus ($p=0.000$) and patients without hydrocephalus already had normal median visual acuity.

The median pre-op visual acuity in patients aged <20 yrs., 20 to <50 yrs. and ≥ 50 yrs. was 6/6 (IQR 6/6 – 6/12), 6/9 (IQR 6/6 – 6/60) and 6/24 (IQR 6/36 – 6/12), but this difference in visual acuity by age was found to be statistically non-significant with KW test ($p=0.153$). Similarly, the median post-op visual acuity in patients aged <20 yrs., 20 to <50 yrs. and ≥ 50 yrs. was 6/6 (IQR 6/6 – 6/6), 6/6 (IQR 6/6 – 6/24) and 6/12 (IQR 6/6 – 6/12), and this difference in visual acuities by age too was found to be statistically non-significant with KW test ($p=0.200$). Wilcoxon signed-rank test revealed statistically significant improvement in visual acuity after surgery in patients of all age groups (' p ' values for <20 yrs., 20 to <50 yrs. and ≥ 50 yrs. are 0.047, 0.001 and 0.046 respectively).

Pupil size and reactivity to light: On pre-op examination NSNR to light was found in 78% cases, which increased to 92% after surgery. NSSR was seen in 18% cases pre-operatively, which decreased to 4% post surgery. However, 4% cases having NSNoR did not improve even after surgery. One case with NSNoR, complicated with third nerve palsy with dilated pupil (Figure 2).

Color vision: 26% patients were found to be having impaired color vision on pre-op examination, which decreased to 10% after surgery. Total no. of cases having normal color vision increased to 90% after surgery. In remaining 10% cases color vision was either impaired or absent even after surgery (Figure 3).

Night vision: 72% patients were found to have normal night vision pre-operatively. After surgery, total number of patients having normal night vision increased to 88%. Improvement was observed in majority of cases with impaired night vision (Figure 4).

Vision field by confrontation: On pre-op examination 4% patients were found to have field vision cut, which did not improve even after surgery.

All patients with field vision cut had visual acuity PL-ve preoperatively.

Similarly field cut was observed in 2.7% patients in study done by Nisha Gadgil et al.^[8] In our study defect in field vision was due to optic atrophy. The limitation of this study was inability to report on visual field outcomes in all pediatric patients, because quantitative subjective visual field testing could not consistently be performed and better method of measurement of vision field like perimetry could not be done.

Papilledema: According to study done by M.S. Girwan et al papilledema was observed in 94.2% in their experience. ^[10] In our study, on pre-op examination 30% patients were found to have normal fundoscopic findings (Grade 0) while 70% patients were having papilledema (Modified Frisen Scale). The number of patients having normal fundoscopic findings increased to 52% on post op examination. Grade IV papilledema was found in 14% patients on pre-op examination which decreased to 8% on post op examination. Total no of patients having grade III papilledema was 28 (28%) on pre-op examination, which decreased to two after surgery. Likewise total number of patients with grade II papilledema decreased post operatively. The trends toward normalization were seen in majority of patients. However in 12(12%) patients, either in one or both eyes, optic atrophy was seen on follow up examinations (Figure5).

Retinal venous dilation: On pre-op fundoscopic examination retinal venous dilation was seen in 62% cases, which decreased to 18% after surgery (Figure 6). Better outcome was observed in patients who underwent earlier neurosurgical intervention.

Splinter hemorrhage: Total number of patients having retinal splinter hemorrhage was 62(62%), which decreased to 18(18%) after surgery. Splinter hemorrhage disappeared in 44% patients after neurosurgical intervention (Figure 7)

CONCLUSION

Conclusively, visual parameters like visual acuity,

pupil size and reactivity to light; color vision and night vision were improved significantly after surgery whereas cut field of vision did not improve. Significant improvement in the visual acuity and papilledema in patients with pre-op hydrocephalus, irrespective of extra or intra axial location of tumor, age group, were observed after surgery. Other fundoscopic findings like retinal venous dilation and retinal splinters hemorrhage disappeared in significant number of patients post-operatively.

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