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Rationale of Optic Nerve Decompression in Optic Nerve Injury

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Abstract : Optic nerve injury following closed head injury is uncommon and reported in 1-5% cases. Interestingly, incidences as high as 44% was reported by Crompton, among them 20% had bilateral pathologies. Surprisingly only few large series has been published in the World literature. Most of the published series are retrospective analysis of smaller number of cases. We at AIIMS have prospectively analyzed a large number of patients with optic nerve injury over the last 2 decades & rationalized the protocol, based on our experience including indications for optic nerve decompression. Thus this publication is based on the experience of 800 patients of optic nerve injury, treated between 1983-2002.

Keywords : Optic nerve injury, Head injury, Rationale of optic nerve decompression, outcome.

Introduction

Optic nerve injury is a rare condition[1-3] and only few large series are available in the literature[4-7]. The pathogenesis is not clear and management continues to be controvertial[1,2,8,9]. The role of steroid and diagnostic value of VEP is some what[11-14] recognised, however, there is considerable controversy in surgical management of optic nerve injury[1,2,15,16]. (Table 1). In this publication we have reported our experience in 800 cases of optic nerve injury, rationalized our management protocol and indications for optic nerve decompression.

Table 1. Outcome of Optic Nerve Injury Conservative VS Surgical Treatment

(A) Conservative Management			
Authors	**Year**	**No. of Cases**	**% Recovery**
- Hooper	1951	17	29.0
- Matsuzaki et al	1982	33	58.8
- Fuzitani et al	1986	108	55.0
- Mahapatra et al	1989	100	57.0
- Mahapatra et al	1997	530	58.5
(B) Result of Optic canal decompression			
- Impachi	1968	61	70.4
- Fukado	1981	300	40.0
- Matsuzaki et al	1982	11	39.8
- Karnik	1986	37	20.0

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Material and Methods

Eight hundred cases of optic nerve injury patients were managed by Department of Neurosurgery, All India Institute of Medical Sciences (AIIMS), New Delhi, between 1983 and 2002. Patients were managed prospectively following our protocol, after arriving at our hospital (Table 2). In all the patients steroid was started either by intravenous injection or oral route, depending on patient conscious state, time lapse between the injury and arrival at our hospital. VEPs were performed at regular intervals and patients were followed up regularly at our out patients. Only selective number of patients (95 cases) were subjected to optic canal decompression. Ninety patients had transethmoidal decompression of optic nerve, while remaining 5 had intracranial surgical decompression. Following decompression patients were regularly followed up at Neurosurgery out patients department, to establish the long term outcome.

Table 2. Our Management of Protocol (Mahapatra's Criteria)

(a)	Detailed clinical, radiological evaluation
(b)	Initial VEP and Rpt VEP every 3-5 days time
(c)	I/V steroid 2-3 days followed by oral steroid 3-4 weeks
(d)	Repeated follow up
(e)	Patients showing marginal visual improvement following steroid, thereafter remaining static subjected to optic nerve decompression.

Observations and Results

Ninety percent patients had immediate visual loss and 85% had unilateral visual involvement. X'Ray skull revealed skull fracture in 35% and PNS opacity in C.T.

scan in 15% patients. Only in 12% patients an optic canal fracture was noticed. Optic sheath hematoma was recorded in 3% patients only (Table-3). Temporal field cut was the most frequent finding, noticed in 14% cases and nasal field defect in 5% cases. Either upper or lower field defect was recorded in 5% cases.

Table 3. Radiological Findings

	%
- Skull fracture	35
- PNS opacity in CT	15
- Optic canal fracture in CT	12
- Orbital haematoma	6
- Optic sheath haematoma	3

VEPs were performed repeatedly. In 30% cases initial and subsequent VEPs were normal, in 55% cases initial VEP was absent and remaining 15% had abnormal VEPs. Among the 55% those who had initial negative VEP, 13% develop recognizable VEP waves subsequently. Thus in 42% patients VEPs were repeatedly negative.

Visual Outcome (Table-4) – Overall in 58% patients vision improved and 42% had permanent visual loss. Only 10% patients had a complete visual recovery, while 48% had partial recovery. Interestingly, complete recovery was recorded only in conservatively managed group. None of the patients with preop negative PL showed improved (28 patients) following surgery. All the 67 patients with positive preop vision showed postoperative improvement in visual acuity. Thus, optic nerve decompression only helped the patients in whom vision slightly improved preoperatively, but remained static for several weeks prior to surgical decompression. Interestingly, none of the patient subjected to optic canal decompression had a complete recovery.

Table 4. Visual Outcome

(A) Overall Outcome	**%**
(i) Complete recovery	10
(ii) Partial recovery	48
(iii) No recovery	42
(B) Transphenoid Surgery	90 patients
- Transcranial surgery	5
(C) Preop Positive Vision	67 All had some improvement
- Preop PL (-) ve	28 No one improved

Factors Influencing the Outcome (Table 5)

Large number of factors in our study influenced the outcome. Significant factors in recovery of vision were (a) Presence of vision, (b) Presence or absence of VEP wave, (c) Age of the patients and (d) mode of injury. Surprisingly, in our observation following factors were not significant, (a) optic canal fracture; (b) X'ray finding, (c) and time gap between the accident and surgery. Overall, the patients with bilateral injury had a higher incidence of visual improvement, as compared to unilateral optic nerve injury. Children had worse out come compared to adults and blast or missile injury had worse prognosis than blunt injury.

Table 5. Factors Influencing the Visual Outcome

(A) Significant Factors	**(B) Factors not Significant**
- Presence of vision	- Optic canal fracture
- Nature of injury	- X'Ray finding
- VEP findings	- Timing of surgery
- Age of the patient	- Unilateral or bilateral injury

DISCUSSION

Surgical decompression of optic nerve for indirect of optic nerve injury still remains a controversial issue[2,3,5,14]. There are equal number of publications in favour and against the optic canal decompression. Like any others nerve injury, there is good chance of spontaneous recovery, in cases where nerve is not permanently damaged. The chance of spontaneous recovery ranges from 20-80% in various reports[6-11,14,15,18,19]. The result of optic nerve decompression, on the other hand is not significantly different, reporting improvement in 20-70% cases[2,5,14,15,20-24]. Thus, it is not clear cut whether to operate or not. Moreover the timing and indications for surgery are unclear.

Prior to our study there was no prospective study analyzing the visual outcome and role of VEPs in the management of optic nerve injury[6,7,10,12,16,17,21]. In a publication, Matsuzaki et al, in 1982[14] published the result of surgery and conservatively managed cases and compared the result of one with the other. However, they did not study the role of evoked potential and rationalize the timing of surgery. Fuzitani et al[15], in 1986 had studied result of nonoperated case and operated cases. They reported better results in nonoperated cases. In their study, they somewhat rationalized the indications for surgery. All our publications in last 15 years have focused on the role of VEP, indication and timing of surgery[6,7,16,17,21,24]. Thus, we have concluded that a small subgroup of patients need surgery, those who after slight improvement on conservative management remained static. We also proved that there was chance of delayed recovery both in conservative[25-27] and surgical[16,21,24] groups. Thaker et al[24], in 2003 published the results of delayed decompression of the optic nerve following optic

nerve injury. Thus, we have always maintained that timing of surgery is not a significant factor in determining the results of optic canal decompression. This was very much evident from the study by Fukado, in 1981[5] (Table 6). His result in 700 cases of optic canal decompression, carried out at various length of time, after optic nerve injury were not significantly different. In his report, 54 patients were operated within a week and recovery was observed in 43% as compared to 35% in 77 patients operated between 31st and 90th day and in 39% patients operated after 3 months.

Table 6. Results of Surgery in 300 Patients Fukado 1981

Timing of Surgery	No. of Cases	% Recovery
Less than 7 days	54	43
8th - 15 day	60	43
16th 30th day	73	42
31st 90th day	77	35
91st day or more	36	39
Total Cases	**300**	**29.5.04**

Large number of factors influence the outcome (Table 5). Few among them are age of the patients[27,28], type of injury and positive or negative VEP[10,12,14,15,16,21]. Surprisingly, we found no correlation between the optic canal fracture and the oucome[16,21,23,24]. VEP is an important factor determining the outcome[7,10-12], also helps in deciding optic nerve decompression. In our experience, patients with repeatedly negative VEPs and PL negative do not benefit from optic canal decompression. Thus, there is no justification to subject above subgroup of patients to surgery. In another study Agarwal and Mahapatra[29] reported 23% recovery in patients who had initial PL negative, however, VEP become positive subsequently and some of them did improve in their vision.

Bilaterality is not uncommon in optic nerve injury. 10-20% patients may have bilateral visual involvement[1,7,16]. We found better visual recovery in patients with bilateral injury as compared to patients with unilateral blindness[30].

CONCLUSION

Optic nerve injury is a rare condition in closed head injury, with uncertain pathogenesis. Equal number of patients do improve either on conservative or following surgical decompression. VEP does help in diagnosis and predicting the outcome. Small subgroup of patients merit optic canal decompression. If operated with proper indication recovery % is significantly high. We found optic canal fracture and timing of surgery has no bearing on visual outcome. Hence, immediate or early optic nerve decompression is not justified.

REFERENCES

1. Crompton MR. Visual lesion in head injury. *Brain* 1970, 93: 785-92.
2. Gijerris F. Traumatic lesions of the visual pathway. In : Vinken PJ and Bruyn GW (Eds). Handbook of Clinical Neurology. North Holland Publishing Company, Amsterdam 1976, 24: 27-57.
3. Walsh FB, Hoyt WF. Involvement of optic nerve in closed head injury. In: Clinical Neuropathology 3rd (ed) Baltimore, William and Wilkin Publishing Company 1969, 3: 2375-80.
4. Fukado Y. Result of 400 cases of decompression of the optic nerve. *Mod Prob Ophthalmol*, 1975, 114: 474-81.
5. Fukado Y. Microsurgical transethmoidal optic nerve decompression. Experience with 700 cases. In: The Cranial Nerve. M.Samii. P.Jenetta (eds) Springer Verlag. 1981, 125-128.
6. Mahapatra AK, Tandon DA. Optic nerve injury. A prospective study of 250 patients. In: Skull Base Anatomy, Radiology And Treatment. M.Samii (Eds) S.Karger, Basel,1994 pp 305-309.
7. Mahapatra AK. Optic nerve injury. A study of 530 cases. *Clin Neurol Neurosurg* 1997, (Abstract)
8. Hughes B. Indirect injury to the optic nerve and chiasma. *Bull John Hopkin Hosp*. 1962, 111: 98-126.
9. Hedge TR, Gragondes E.S. Traumatic anterior ischemic optic neuropathy. *Ann Ophthalmol,* 1981, 13: 625-628.
10. Mahapatra AK, Bhatia R. Predictive value of visual evoked potential in unilateral optic nerve injury. *Surg Neurol* 1989, 31: 339-342.
11. Nau HE, Gerhard L, Foerster M, Nacher HCH, et al. Optic nerve trauma clinical, electrophysiological and histological remarks. *Acta Neurochir (Wien)* 1987, 89: 16-27.
12. Mahapatra AK. Visual evoked potentials in optic nerve injury. Does it merit a mention? *Acta Neurochir (Wien*) 1991, 112: 47-49.
13. Anderson DP, Frod M. Visual abnormality after severe head injury. *Can J Surg* 1981, 23: 163-165.
14. Matsuzaki H, Kunita M, Kawai K. Optic nerve damage in head trauma. Clinical and experimental studies. *Jpn J Ophthalmol* 1982, 26: 447-461.
15. Fuzitani T, Inoue K, Takahashi T, et al. Indirect optic neuropathy. Visual outcome in operated and nonoperated cases. *Jpn J. Ophthalmol* 1986, 30: 125-134.
16. Mahapatra AK. Current managemnt of optic nerve injury. In: Progress in Clinical neurosciences. S. Venkatraman & B.K. Misra (eds); Mediworld Publishing, Delhi, 1997, 12: 241-254.
17. Mahapatra AK. Does optic nerve injury require decompression? *J Ind Med Assoc* 1990, 88: 822-84.

18. Hooper RS. Orbital complication of head injury. *Br J Surg* 1951, 39: 126-138.

19. Bodian M. Transient loss of vision following head trauma. *New York State J Med* 1969, 64: 607-610.

20. Imachi J, Inouek, Takahashi T. Clinical ophthalmological investigations of optic nerve lesion in cases of head injuries. *Jpn J Ophthalmol* 1968, 12: 70-85.

21. Tandon DA, Thakar A, Mahapatra AK, Ghosh P. Transethmoidal optic nerve decompression. *Clin Otolaryngol* 1994, 19: 98-104.

22. Niho S, Niho M, Niho K. Decompression of optic canal by the transethmoid route and decompression of superior orbital fissure. *Can J Ophthalmol* 1970, 5: 22-40.

23. Joseph MP, Lessell S, Rizzo J, et al. Extracranial optic nerve decompression for traumatic optic neuropathy. *Arch Ophthalmol* 1990, 108: 1091-93.

24. Thakar A, Mahapatra AK, Tandon DA. Delayed decompression of optic nerve for indirect optic nerve injury. *Laryngoscope* 2003, 113: 112-19.

25. Mahapatra AK. Delayed recovery from optic nerve injury. Report of two cases. *J. Neurosurg Sci* 1992, 36.

26. Shaked A, Hadani M, Fensod M. CT and VER follow up of reversible vision with fracture optic canal. *Acta Neurochir (Wien)* 1982, 62: 91-94.

27. Mahapatra AK. Indirect optic nerve injury in children – A study of 35 cases. *J. Neurosurg Sci*, 1992, 36: 79-84.

28. Mahapatra AK, Tandon DA. Traumatic optic Neuropathy in children. A study of 50 patients. *Pediatric Neurosurgery* 1993; 19: 34-39.

29. Agarwal A, Mahapatra AK. Outcome of patient with optic nerve injury with initial PL negative. *Ind J Ophthal* 1999, 46: 47-50.

30. Mahapatra AK. Bilateral optic nerve injury. *Neurology India* 1999, 47: 92-93.