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Optic nerve decompression in head injuries*

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Abstract

DIMINUTION of vision arising from head injuries involving the optic foramen can be treated by transethmoidal decompression of the optic nerve. Early surgery is associated with good recovery of function. In this paper, the surgical procedure is discussed, with the results in 10 cases.

Introduction

Transethmoidal surgical decompression of the optic nerve for fractures involving the optic foramen due to head injuries, was first advocated in 1967 by Miwa and Fukado (1967). In 1973, Fukado, a Japanese ophthalmologist, published his results of 400 cases of surgical decompression of the optic nerve. It was noted that the earlier the surgery was performed, the better was the prognosis. It has been the general experience that such injuries to the optic nerve, with immediate onset of blindness, almost never recover spontaneously. Transethmoidal surgical decompression, being totally extracranial, is safe and devoid of any serious complications. Considering the above points we feel that it is worthwhile decompressing the optic nerves as early as possible and thus offering the patient the best possible chance of recovery of vision.

Surgical Anatomy

The optic nerve is considered to be a direct prolongation of brain tissue sheathed with all three meningeal layers. It is 40 mm. long and is directed backwards and medially through the optic canal into the cranial cavity to join the optic chiasma. Infero-lateral to the nerve lies the ophthalmic artery, while the nerve itself is a close medial relation of the posterior ethmoidal and sphenoidal sinuses. The optic foramen, the proposed site of decompression, is situated 45 to 50 mm. deep to the inner canthus of the eye, and it lies in a straight line joining the anterior and posterior ethmoidal foramina in the medial wall of the orbit (Fig. 1).

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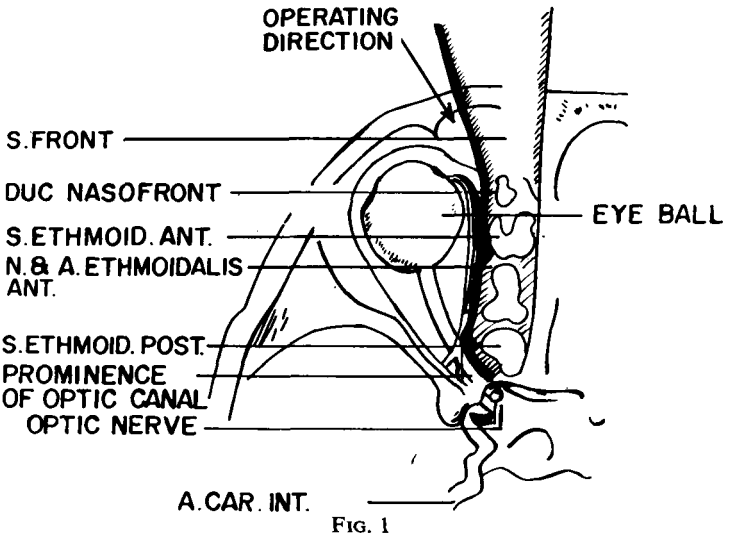


FIG. 1

Relations of the optic nerve.

Pathophysiology

Loss of vision following fractures in the region of the optic foramen is often caused by compression of the optic nerve by oedema, haemorrhage, or bony fragments impinging on the optic nerve. The nerve lesion due to these causes is in the nature of either neuropraxia or axontomesis. The sheath of the optic nerve being intact in either of the above lesions, an early decompression of the nerve should restore visual function. If decompression is not carried out early enough after the injury, the chances of functional recovery diminish (Strohm, 1979). This is probably due to progressive ischaemic intraneural fibrosis as a result of persistent compression by the offending agent.

In some instances, as was found in one of our cases, there is a severence of the optic nerve itself, precluding any chance of recovery.

Diagnosis

The diagnosis of an optic foramen fracture is suggested clinically by the presence of an injury in the temporal region, with associated epistaxis, and an absent or sluggish direct pupillary reflex (Miwa and Fukado, 1967; Fukado, 1973). A consensual pupillary reflex elicited by stimulation of the opposite eye is usually present. The vision may be completely lost, or perception of light may be present in one or more of the quadrants. Plain X-rays delineating the optic foramen may show the fracture; however, tomograms may sometimes be necessary. At times a fracture may be missed even on tomography and the only certain way to detect the fracture is at surgery.

It is our contention that, in view of the relative safety of the operative

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procedure and the improbability of spontaneous recovery, suspected cases should be subjected to decompression of the optic foramen, even in the absence of positive radiological findings.

Material and Methods

Eleven cases of post-traumatic blindness with suspected compression in the region of the optic foramen were seen by us over a two-year period from 1977 to 1979. All the patients were male, the youngest being 10 years old, and the oldest 45 years old. The 10 cases which were explored had suffered the injuries in vehicular accidents while the eleventh patient, who refused surgery, had a direct penetrating injury to the ethmoids by an umbrella strut just medial to the medial canthus of the left eye. Each of these cases had unilateral involvement only, the other eye being unaffected.

Radiologically, a fracture of the optic foramen could only be demonstrated in 4 cases. Eight cases showed a haziness in the ethmoids on the affected side, three of them showing a fracture involving the ethmoids and the medial wall of the orbit.

Of the 10 patients who underwent surgery, only three were seen within one week of the injury and, of these three, only one was seen within 72 hours.

Three cases were seen within one month of the injury while four cases came more than a month after injury. All of them were examined in detail by an ophthalmologist before being referred to us.

Operative Procedure

The operation is performed under general anaesthesia (Strohm, 1979). An incision is made which extends from 0·5 cm. medial to the medial canthus of the eye, and then curves laterally, parallel to and about 0·5 cm. below the eyebrow. The medial palpebral ligament is exposed and divided and the underlying periosteum of the medial wall of the orbit is elevated as widely as possible. The superior oblique muscle is displaced off the trochlea. The eyeball is gently retracted laterally. Sometimes, when needed, a Killian's long-bladed self-retaining nasal speculum may be used to achieve this retraction. The anterior and posterior ethmoidal vessels are diathermized and divided. Adrenaline-soaked gauze strips are packed into the depth of the dissection, as required, to achieve haemostasis during the procedure. At a depth of about 4·5 cm. to 5 cm., in the same straight line as the anterior and posterior ethmoidal vessels, the prominence of the medial margin of the optic foramen is seen (see Fig. 1).

For better visualization and greater clarity we use the operating microscope with a 300 mm. objective lens. The microscope is brought into use once the ethmoidal vessels are visualized. From here onwards all dissection is done under microscopic vision. The last step, *viz.* decompression of the optic nerve, is achieved by removing any fractured

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fragments of bone. Further decompression may be achieved by removing the medial lip of the optic foramen with the help of a curette or a small gouge and hammer. The sheath of the optic nerve is never opened. A soft rubber drain is retained for 48 hours. The periosteum of the maxillary and nasal bones and the medial palpebral ligament are sutured together with 3–0 catgut. The skin is sutured with prolene. A padded eye-dressing is applied. The patient is prescribed antibiotics post-operatively for one week, and the sutures are removed on the 5th post-operative day.

Results

We have operated on 10 cases during the past two years and our results are as follows:

Duration between head injury and operation	Cases	Recovery of vision
Less than a week	3	1
Less than a month	3	1
More than a month	4	Nil
One patient refused operation		

None of the patients had any post-operative complications.

Illustrative Cases

Case 1

A man aged 38 years was seen within 72 hours of a vehicular accident wherein he sustained an immediate loss of vision in the left eye.

His X-rays showed a fracture involving the medial wall of the orbit with haziness in the ethmoids indicating haemorrhage. No fracture was seen at the optic foramen.

At operation, the periosteum of the medial wall of the orbit was seen to be lifted off by a haematoma in the region of the posterior ethmoids. Loose fractured pieces of the walls of the ethmoidal air cells were seen to be embedded in the haematoma and the posterior ethmoidal artery was lacerated but not bleeding actively.

After evacuation of the haematoma and loose bony fragments, the optic foramen was clearly visualized and found to be intact and hence was not interfered with. The optic nerve emerging from the foramen was also apparently normal. A small rubber drain was left in place to drain any subsequent collection before closing the wound. The drain was removed after 24 hours as no such collection of blood was evident.

When tested 72 hours after the operation the patient had regained near-normal vision.

Case 2

This was a 26-year-old man, whose clinical and operative findings are almost identical to those of Case 1, except that the fracture of the ethmoid region had

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extended to involve the medial lip of the optic foramen. This fractured fragment of the medial lip of the optic foramen was removed to decompress the optic nerve adequately. The recovery of vision, when tested after 72 hours, was satisfactory.

Case 3

A male patient was seen 8 days after a vehicular accident wherein he had sustained a complete loss of vision in the right eye. His X-rays showed a fracture involving the optic foramen and he was subjected to surgery without delay.

At operation a triangular fragment of bone from the medial wall of the optic foramen was found to have been driven into the optic nerve. On removal of this fragment, the optic nerve was found to be completely transected. The patient had no recovery of function post-operatively.

Discussion

Fukado (1973), who reported 400 cases of surgical decompression of the optic nerve, found a remarkably high incidence of recovery of vision especially in those patients who were operated upon very early. He followed up these patients for a period of one year without any deterioration in the vision regained. This prompted us to operate on the cases of traumatic blindness referred to us by our ophthalmologist colleagues who from past experience felt that spontaneous recovery was unlikely.

The operation of optic nerve decompression has in the past been performed by the neurosurgeon *via* a frontal craniotomy. The exposure was limited and the results unsatisfactory. The operation carried the risks associated with a craniotomy and hence the procedure is not often practised.

The transethmoidal route as described by Fukado is totally extra-cranial and therefore devoid of any complications. The area of operation, *viz.* the posterior ethmoidal region, is familiar to the oto-rhino-laryngologist and the use of an operating microscope ensures good illumination and adequate visualization of the various structures in that area.

The radiographic demonstration of a fracture in the optic foramen is not an absolute pre-requisite to surgery. As a matter of fact, one of our cases that showed complete recovery of function had a fracture in the posterior ethmoid region without any fracture in the optic foramen. Evacuation of the posterior ethmoidal haematoma which was pressing on the optic nerve led to complete recovery.

On the other hand, fragments from the fractured margin of the optic foramen tend to lacerate the nerve and thus worsen the prognosis. This makes us feel that the cases which carry the best prognosis are those with haematomas without fractures of the optic foramen.

One point that required deliberation was whether the sheath of the nerve should be incised as for the facial nerve in Bell's paralysis.

Theoretically, an intraneural haematoma or oedema would be decompressed by such a manoeuvre. However, as the nerve sheath in this

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region consists of the layers of the meninges and the pia mater carries the vascular supply to the nerve (which is considered to be an extension of the brain itself), incising the sheath would jeopardize the blood supply to the nerve. Hence we desist from incising the sheath.

Conclusion

Blindness following injury around the eye may result from compression of the optic nerve in its canal. A transethmoidal approach to this region allows an easy and satisfactory decompression of the nerve. Since it is the general experience that such traumatic blindness almost never recovers spontaneously, surgery seems to be the only answer.

Surgery in this region is not new to the oto-rhino-laryngologist and his familiarity with the operative field, coupled with the use of an operating microscope, make the procedure very safe.

Though in our series of 10 operated cases only two showed recovery of vision, we strongly advocate surgery in such cases as the procedure is safe and spontaneous recovery unlikely.

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REFERENCES

FUKADO, Y. (1973) *Proceedings of the 2nd International Symposium on Orbital disorders, Amsterdam, 1973,* Vol. 14, pp. 474–484, (Karger, Basel, 1975).

MIWA, T., and FUKADO, Y. (1967) *Industrial Health* (Japan), **5**, 50.

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