A net for extending the optic nerve at enucleation of the eyeball

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SUMMARY A long section of optic nerve can be obtained during enucleation, when the eyeball is caught in a net made specifically for this purpose. The net is knitted from surgical thread and is in the shape of a barrel with two openings: one wide, one narrow. Separate thread is wrapped around the edge of the wide opening. When the eyeball is freed from the extrinsic muscles and Tenon's capsule, it is drawn into the net, and the wide opening is closed round the optic nerve. At the narrow opening there are three slip-knots by which the net is pulled forward and out of the orbit. Then the optic nerve is exposed and the surgeon is able to cut it close to the apex of the orbit. The length of severed optic nerve amounts as a rule to about 15 mm or more, depending on the age of patient.

The indications for enucleation of the eyeball are numerous, and it is an operation which must be performed frequently. In cases of intraocular malignancy enucleation may save the patient's life. In standard procedures the excising of enough length of the optic nerve presents a distinct problem. Often the surgeon cannot judge accurately the length of nerve exposed, and hence cutting is done at random. Grasping the globe by the remnants of one or more extrinsic muscles as well as using various curettes¹ to extend the optic nerve do not give satisfactory results. The eyeball is not sufficiently separated from the adjacent tissues of the orbit by these means and the optic nerve cannot be seen.

In practice I have used all such curettes and slip-knots and tried out slip-knots which I made myself, but the results have not been very successful. Again the globe and adjacent tissues disturbed the final step in the enucleation. To overcome these problems I have developed a net which is capable of enclosing the entire eyeball and allowing accurate excision.

Material and methods

The net is knitted from surgical linen thread (no. 100) with rectangular openings. Its length is about 25 mm and its width at the centre about 35 mm. There are two openings into the net: one with a diameter of 30

mm and one with a diameter of 20 mm. Stronger thread (no. 90) is wrapped round the wider opening. This thread serves to close the net about the optic nerve when the globe is inside. Three slip-knots are tied at the narrow opening to act as a handle, and on pulling them the net with the eyeball inside is pulled out from the orbit (Fig. 1). The dimensions of the net

Fig. 1 The net with thread round the wide opening and slip-knots on the narrow opening.

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Fig. 2 Enucleation of an eye from the cadaver of a 12-month-old child. The eyeball is completely drawn into the net.

are somewhat larger than those of the eyeball and can be varied about 2 mm. If the eye which has to be enucleated is buphthalmic or swollen, lateral canthotomy can be performed so that the work of enucleation is made easier.²

At present the net is not produced commercially.

Fig. 3 A severed optic nerve 17 mm long of an eye with retinoblastoma.

The prototypes have been produced by my wife using an ordinary crochet needle. I am hoping to obtain its commercial production.

Until the severing of the optic nerve the procedure of enucleation is performed in the classical way.² When the eyeball is freed from the extrinsic muscles and the Tenon's capsule, it is drawn into the net through its wider opening. At this point the wider opening is closed through the surgeon stretching and tightening the thread and the globe is caught in the net. In the next step the surgeon catches the slip-knots at the narrow opening and slowly pulls the net forward and temporally (Fig. 2). An assistant with a steel retractor draws the soft tissues of the orbit nasally, and the surgeon can observe part of the optic nerve. The optic nerve is approached from the nasal side because the foramen opticum is situated nasally and a little above the orbital apex. The surgeon now presses the closed enucleation scissors back to the optic foramen, opens the blades, and cuts the nerve at the level of the foramen. As a result of this procedure the enucleated eye generally presents a length of optic nerve of about 15 mm in children and more in adults (Fig. 3).

Discussion

The intraorbital part of the optic nerve amounts to about 17 mm in the newborn infant, and its length increases until the age of 12, so that in adults it reaches 25 to 33 mm.³⁻⁵ At enucleation it is necessary to cut the optic nerve as far behind the globe as possible. This is especially so in cases of intraocular malignancies such as retinoblastoma. This tumour of neural origin travels along the optic nerve, invading intracranial structures and the bones of the skull, and spread of a tumour into the orbit after enucleation mostly comes from the stump of the optic nerve.⁶ Therefore the globe needs to be enucleated together with the orbital part of the optic nerve.

The standard procedures for pulling the globe and putting the optic nerve under tension do not give the best results. The nerve is often cut near the sclera or a few millimetres from it. This is because thickened connective tissue frequently persists round the dural sheath of the optic nerve at its junction with the globe. This has been noted by Havre⁷ and has been my observation too, working on both cadavers and patients. This connective tissue prevents the surgeon from pushing the enucleation scissors back to the apex of the orbit. Furthermore the surgeon may accidentally cut the adjacent orbital tissues instead of the nerve and haemorrhage occurs, which considerably prolongs the operation.

Having used the net, which I have been developing over the past two years, I have found it has effectively

Fig. 4 Enucleation with a net. The optic nerve is enlarged between the sclera and the optic foramen.

eliminated all the difficulties which arise during the standard procedures. Exposing the optic nerve in this way best allows the section to be performed under the control of the surgeon, who can always estimate how much of the nerve's length is being severed. If there is additional connective tissue round the optic nerve, it can be liberated better when the globe is drawn into the net, as the whole of the retrobulbar space can be clearly observed. In such a way the net can be drawn up partially at first and entirely later. Thus the risk of cutting adjacent tissues is diminished, and in this way additional bleeding is prevented. Furthermore, the scissors can be moved up to the apex of the orbit without hindrance.

As well as being used effectively in cases of intraocular malignancy the net proved to be especi-

ally efficient with one of our patients with astrocytoma of the optic nerve. The eye of this girl of 6 was protruded; her visual acuity was no perception of light; and oedema of optic disc could be seen. Examination showed a tumour of the optic nerve, and it was decided to enucleate the eye, with the complete section of the nerve. The net was used, and after the eyeball was pulled the swollen optic nerve could be seen (Fig. 4), which was then cut at the optic foramen. Histological examination showed an astrocytoma of the optic nerve.

I consider that this simple method will find its place in the operating room, making all work on the enucleation of the eye safe.

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