Osteoma of the orbit has long been known to ophthalmic surgeons and rhinologists for its effects, as it slowly expands, upon the eyeball and its nerves, and upon the ethmoidal sinuses. More recently this tumour has become of interest to neurological surgeons, for the experiences of Cushing\(^1\) have shown that in the course of its expansion it may project through the floor of the anterior fossa and become adherent to and finally penetrate the dura. It may then give rise to such serious complications as cerebro-spinal rhinorrhoea, intra-cerebral aerocle and meningitis; and in some cases, when the osteoma is small and does not produce much proptosis, one or more of these complications may initiate the illness. This fact has been responsible for the development of an intracranial method of operating on these tumours and the question now arises.

\[\text{Fig. 1.}\]

Patient before operation, showing forward and lateral displacement of left eyeball.
as to whether this route of attack should supersede older methods. The following case is reported on account of its bearing on this problem.

**History.**—R. No. 22418, 1930. Laura D., a single woman, aged 26 years, was admitted to the London Hospital on June 16, 1930, complaining of bulging of the left eyeball. She had only noticed this four months before admission, but her relations said they had been aware of it for two or three years. The eye had gradually become more prominent so that it finally became uncomfortable, and one month before admission she found that she could not read with the left eye alone. There had been no double vision, no nasal discharge or epistaxis, and in other respects her health had been good.

**Examination.**—The left eyeball was displaced forwards and outwards to a considerable degree (Fig. 1.) The movements of the eyeball were quite unaffected, though there was an apparent defect of inward movement due to lateral displacement of the eyeball. Visual acuity was reduced in the left eye (uncorrected vision: right, 6/12; left, 6/36 partly) and there was moderate swelling of the left optic disc (2 dioptres), enlargement of the blind spot, and constriction of the upper field in the smaller isopters (Fig. 2a.) There was slight swelling and engorgement of the lids of the left eye. On firm backward pressure in the region of the left inner canthus a hard nodular mass could be felt. It was not movable and was only slightly tender.

General physical and neurological examination revealed no other abnormality. X-rays (Fig. 3) showed a sharply defined osteoma in the region of the inner wall of the left orbit.

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**Left visual field (a) before operation. (b) Twelve weeks after operation. 10/2000, 5/2000, 1/2000 white.**
Comment.—This was clearly a case of orbital osteoma. Cushing's experiences leave no doubt as to the potential dangers of a tumour of this type when one of its outlying nodules has projected through the floor of the anterior fossa and attached itself to the dura. In our case, therefore, skiagrams were taken in several planes to determine whether there was any intracranial projection of the tumour, and we agreed that if this were found the tumour should be removed by the transfrontal route. The roof of the orbit appeared to be intact.

Considerable controversy arose as to the best method of operative approach, and no agreement was reached; nor, indeed, has
any agreement been reached at the time of writing this paper. Our respective views are set out in the discussion that follows the conclusion of the case report. While we were considering the best method of treatment the patient was shown to a group of visiting neurological surgeons and they unanimously advised that the tumour should be attacked by the transfrontal route.

**Operation.—(N.P.) Removal of Osteoma by Naso-orbital Route. July 16, 1930.** An incision was made along the inner half of the left eyebrow and down on to the left side of the nose as far as the level of the inner canthus. After the soft tissues had been reflected portions of the frontal process of the left superior maxilla, nasal and lacrimal bones were removed. Some of the anterior ethmoidal cells were opened and the anterior portion of the osteoma was exposed. The eyeball was now retracted outwards and the periosteum was separated from the accessible part of the tumour, which was gently rocked in a lateral direction. It was thus loosened and soon its anterior
projection could be grasped by bone forceps, and slowly pulled forwards. Several mucoceles were encountered during this dissection. Finally, it was possible to tilt the osteoma out of its cavity. It was then seen that the tumour had been in contact with the roof of the orbit in one place where there were several small areas of erosion on an otherwise smooth surface. As soon as the tumour had been removed the eyeball receded. The lateral wall of the left side of the nose was pierced and through drainage was effected by a tube passing from the incision, through the cavity of the tumour and out of the left nostril. The skin incision was then completely closed.

*Pathology.*—S.D. 1645, 1930. The tumour (Fig. 4) measured 4·0 by 3·4 by 2·5 cms. Its outer surface was nodular. One part was covered by mucous membrane, measuring 2·0 by 1·0 cm., and 0·05 cm. thick, and on the membrane there were several pink and yellow gelatinous collections. On another part of the tumour there was a small fragment of shell-like bone, and accompanying the specimen was a larger fragment of similar bone (1·0 by 1·0 by 0·05 cms.) These fragments were evidently parts of the thinned orbital plate of the ethmoid. On section the tumour was found to be composed, for the most part, of dense yellow ivory bone, but in places it was slightly spongy and one area (1·5 by 0·6 cms.) in the centre consisted of spongy bone and pink marrow.

Films and cultures of the mucus attached to the tumour failed to reveal any organisms.

*Subsequent Course.*—Convalescence from operation was uninterrupted. The proptosis disappeared immediately the tumour was removed and did not recur. There was now some limitation of the movements of the left eyeball and the patient complained of double vision, especially on looking downwards and to the left. She was rather depressed about the appearance of her face, though, apart from a sinus
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FIG. 5.
Photograph of the patient 12 weeks after operation.

at the inner angle of the orbit, the wound healed by first intention and was not very conspicuous (Fig. 5.)

 Twelve weeks after operation there was still slight weakness of upward and outward movement of the left eyeball with diplopia and slight enophthalmos and a convergent squint. The visual acuity of the left eye measured 6/60, and the upper visual field showed further restriction in the small isopters. The blind spot, however, was smaller. (Fig. 2b.) At this time there was still a small area of granulation in the central part of the incision. The patient was last heard from six months after operation, but she refused to come up for further examination.

Discussion

Osteomata of the orbit are of importance as a cause of proptosis and they are a source of danger on account of the intracranial complications, which occur when the tumour destroys the floor of the anterior fossa of the skull and becomes adherent to the dura. In this particular case the main interest centres on the route by which the tumour should have been removed. The case as reported above shows what can be achieved by the orbital method of approach. We are still in disagreement as to the best method of attacking these tumours and, while the ultimate solution of this diversity of opinion must await further experience we feel that it is desirable to set out the various reasons that have so far influenced each of us in our views. In these days of specialism osteoma of the orbit is a
lesion that may fall to the lot of the ophthalmologist, the aural surgeon or the neurological surgeon. It would, indeed, be regrettable if, contrary to the best interests of the patient, treatment were conditioned by the specialistic bias of any one concerned. It is, therefore, all the more important that the treatment of this lesion should be made the subject of frank discussion.

(I) In favour of the orbital approach (N.P.)

I would suggest the best method of approach in tumours which from X-ray study appear not to have penetrated the floor of the anterior fossa to be the one adopted in this case and described above. Sufficient bone must be removed to allow of free exposure and subsequent delivery of the tumour. Before operation it would probably be possible to ascertain the more important relationships of the tumour and to gauge its size. It would be an easy matter to obtain more room for delivery by removing a large part of the nasal bone, the nasal septum, and if necessary, a portion of the floor of the frontal sinus. I should not anticipate any special difficulty in removing the bony mass by this method, and it would not entail opening the cranial cavity or interfering with the olfactory nerves or their meningeal coverings. There would be no external deformity, and the scar would scarcely be noticeable. It seems to me that there is a potential source of danger in the transfrontal route in the event of subsequent sinus suppuration, especially ethmoiditis with polypoid formations.

(II) In favour of the transfrontal approach (H.C.)

The transfrontal approach consists in turning back on the temporal muscle an osteoplastic flap that corresponds approximately to one side of the forehead. The frontal lobe, protected by unopened dura, is then raised so as to expose the roof of the orbit. This is a method in common use for exposure of the suprasellar region but I have adopted the modification of my former chief, Mr. H. S. Souttar, which consists of reflecting a coronal skin flap forward over the forehead and then fashioning the usual unilateral flap of bone and turning it outwards on the temporal muscle. With this modification the transfrontal operation is easier to perform, the incision is wholly inside the hair line (Fig. 6), and there is probably less danger of post-operative extra-dural haematoma than when the classical skin incision is employed.

When X-rays show that an orbital osteoma has an intracranial extension there can be no question but that the transfrontal is the correct method of approach. Only by this route is it possible to
deal adequately with tears or holes in the dura covering the intracranial extension of tumour, and so to prevent cerebro-spinal rhinorrhoea and meningitis. The method employed is to close such holes by grafts of fascia lata, or by interrupted silk sutures. In the case now under discussion we were for some time in doubt as to whether the tumour had an intracranial projection and several stereoscopic radiograms, taken in different positions, were

necessary before we finally concluded, and as it transpired correctly, that the tumour still lay entirely within the orbit. It is not unlikely that cases will be encountered in which it is impossible to be certain from radiographic examination whether the tumour has actually penetrated the roof of the orbit or not. In such cases, I believe that the correct method of approach is by the transfrontal route.

When the osteoma is limited to the orbit the indications for the transfrontal method of approach are no longer imperative. They are concerned rather with the effect of operation upon the corresponding eye-ball and its nerves, and with the cosmetic result. The
cosmetic advantages of an incision within the hair line have already been considered. Which method of approach will best avoid injury or stretching of the optic and oculomotor nerves, and undue pressure on the eyeball? It is clear that no fixed rule can be formulated, for, though prone to arise at or near the fronto-ethmoidal suture, osteomata of the orbit will doubtless vary in position and, consequently, in their accessibility by various routes. Each case must be considered separately after careful radiographic study. But in the case now under discussion I think that the transfrontal route would have been the better method: by removal of part of the roof of the orbit a large exposure of the upper surface of the tumour could have been obtained and the tumour could then have been removed under direct vision, with less likelihood of tension and traction on the nerves of the orbit. That damage was done to these nerves by the operation actually carried out is evident from the facts that after operation the visual acuity did not improve, the visual field was slightly more restricted than it had been before, and the patient developed double vision.

The only other case within my experience was one operated on by Dr. Cushing (1, Case 4) while I was his Assistant Resident Surgeon. In that case the tumour was removed by the transfrontal route. After operation there was occasional diplopia for a few days but vision of the affected eye, which was 10/100 before operation, was 20/20 when the patient left hospital 18 days after operation.

I do not believe that there would be any more danger of intracranial infection in an operation by the transfrontal route than in operation by the orbital route. In the transfrontal method the approach to the tumour is through the inner half of the roof of the orbit. It is not necessary to strip the dura from the cribiform plate and everyone who has tried to carry out this manoeuvre on the cadaver will agree that, owing to the firmness with which it is attached, it would be very difficult to detach the dura from the cribiform plate inadvertently while stripping it for exposure of the roof of the orbit. The accurate studies of Logan Turner and Reynolds have clearly shown the danger of opening the perineural sheaths of the olfactory nerves in the presence of chronic sepsis of the ethmoidal sinuses, but it is equally clear that the transfrontal route does not impose any greater danger of this happening than does the orbital route. Provided the dura is preserved intact the mere opening of the skull does not increase the likelihood of intradural sepsis.

After the transfrontal operation for pituitary and juxta-pituitary tumours, sense of smell is almost invariably impaired on the side of operation. This is not due to injury of the olfactory nerves themselves, but to pressure and tension on the olfactory tract and it
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occurs after the dura has been opened, during retraction of the frontal lobe in order to gain free access to the sella turcica. In the transfrontal operation for orbital osteoma where the dura is not opened there would be no likelihood of injury to the olfactory bulb. In the case of orbital osteoma mentioned above smell was found to be normal after operation by the transfrontal route even though in that case the dura was of necessity opened for removal of the intracranial projection of the osteoma.

It is clear that decision on the problems of orbital osteoma which we have presented must await further experience. We would urge, however, that in cases of this nature all relevant methods of treatment should receive a careful trial. It is indeed regrettable that any disease, such as this, should lie, through divisions and specialization of modern medicine, on the border line of three specialities. The only way to correct this state of affairs is to achieve the closest co-operation and to make combined studies of the type that we have attempted in this case.

BIBLIOGRAPHY.

EMBOLISM OF THE ARTERIA CENTRALIS RETINAE

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In August, 1930, I published in The British Journal of Ophthalmology (Vol. XIV, p. 402) an article on Spasm of the Central Artery. I have had the opportunity since of studying a case of embolism of the same artery. The purpose of this second communication is to compare the symptomatology of these two affections.

The most striking symptom of embolism of the central artery is sudden and complete blindness* of the eye in which the occlusion has occurred. If one examines such an eye immediately after the accident, one finds all the signs of a complete anaemia of the retina.