

Ophthalmology. — *“On Enlargement of the “Optic Foramen”.* By
Prof. J. VAN DER HOEVE.

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In normal persons the size of the optic foramen shows only very little individual variations. WHITE's anatomic research showed that the diameters of the canalis opticus ranged from 4—6.5 m.m. GOALWIN's averages varied from 4.26 to 4.5 m.m.

My own observations are chiefly based on röntgenograms of the foramen.

The method of photographing the foramen opticum by Röntgen rays has first been suggested by RHESE. This author, who tried to find and actually did find in his method an excellent means to photograph the the accessory nasal cavities, did not realise himself the significance of his invention. It was A. DE KLEYN who pointed to the great use of this procedure for ophthalmology. In collaboration with STENVERS he slightly modified RHESE's method, so that the optic foramen and the fissura orbitalis superior could be observed more distinctly and these authors showed that in cases of accident: fractures, fissures and later on callus formation could be found in the bony environment of these holes.

Since the first announcement of their experience, nine years ago, I had Röntgen photos taken of the foramen opticum as often as opportunity offered. From the results of my rather extensive experience I learnt that at a distance of 75 c.m. from the Röntgentube to the photographic plate the diameter of the foramen varied from 4—6 m.m. A foramen of 6 m.m. looks a bit suspicious, one of more than 6 m.m. I consider to be decidedly too large.

The form of the foramen on the röntgenogram is perfectly circular, oval, or slightly angular. GOALWIN considers them as quadrants.

What we really see on the photographic plate, is not the foramen opticum, but a projection of the lumen of the canalis opticus. Obviously a wrong position of the patient's head may give a projection that is too small but not one that is too large. For this reason greater precaution should be exercised in diagnosing too small a foramen than an abnormally dilated one. If an abnormally large image is found on the röntgenogram, the foramen is certainly too large.

Of late I have given special attention to the possibility of an enlargement of the optic foramen, being convinced that it might occur just as well as an enlargement of the meatus auditivus internus sometimes will occur. Like the optic foramen the meatus is also an opening encircled

on all sides by bone which affords a passage for a nerve; tumours of the auditory nerve or its environment may enlarge this hole. The study of this enlargement on the röntgenogram is of great significance for the identification of these tumours.

The enlargement of the meatus auditivus internus is occasionally observed in RECKLINGHAUSEN'S disease, in which pontile tumours (occurring most often bilaterally in this disease) may occasion deafness and dilatation of the inner auditory canal.

Now considering that this disease may also be attended with blindness or weak eyesight caused by atrophy of the optic nerve, I suspected that this blindness in some case might be attributed to tumours similar to those occurring along the auditory nerve or to diffuse neurofibromatosis of the optic nerve itself. Both processes might possibly engender dilatation of the optic nerve canal to such an extent, that it might be imaged on the röntgenogram.

The first patient that I examined to ascertain this, was blind at the right eye and had a markedly reduced visual acuity at the left eye. The application of Röntgen rays proved that the right optic foramen was far wider than normal, while the left optic foramen was much wider still. (See fig. b^1 and b^2 as compared with the normal optic foramen a).

An acute deterioration of the eyesight necessitated operation. It was performed by Prof. ZAAVER. We then observed that there were no definitely marked tumors in the foramen opticum, but that the two optic nerves were much thicker than normal, which was presumably owing to neurofibromatosis.

Prof. ZAAVER removed the roof of the optic canal and slit the dura mater, so that the optic nerve was relieved of pressure. The result was very satisfactory: visual acuity and field of vision improved considerably, and at the present time, two years after the operation, patient still enjoys a fairly good eyesight.

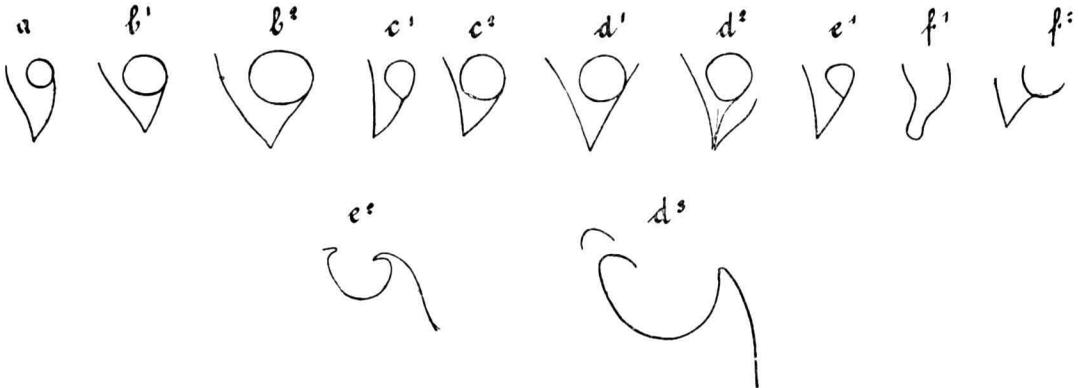
This, then, went to show that a long-continued swelling of the optic nerve can induce a marked widening of the foramina.

In another patient the widening was generated by a tumour growing out from the orbit towards the cranial cavity. When two years old this patient had been brought to me for glioma retinae of the right eye. At the time the parents objected to having the eye enucleated immediately. After ten months the child was brought to me again in a sorry plight; the eye was blind, excessively dilated, while it gave an impression as if there was tumourous mass also in the orbit. Being convinced that the optic nerve was affected, I had photos taken of the foramina. It appeared now that the diameter of the foramen at the diseased side equalled about twice that at the healthy side (fig. c^1 and c^2). Besides this a small portion of the wall of the enlarged foramen opticum had been corroded.

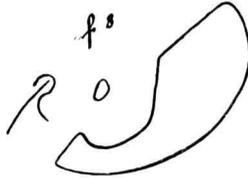
After the whole orbit had been evacuated, it appeared that the optic

nerve had thickened considerably, so that the area of the section equalled about four times the normal surface. This goes to show that in young individuals a thickening of the optic nerve, which has originated from

Röntgen pictures of the Optic Foramen.



Sella Turcica



a. normal; b. enlargement by neurofibromatosis diffusa; c¹ normal and c² diseased side in glioma retinae. d. dilatations in hydrocephalus. e. normal condition in hydrocephalus; f. dilatation and destruction in glioma of the chiasm, all on the same scale.

a tumourous growth, can give rise to enormous dilatation of the optic foramen.

A third case tended to show that also tumours growing out from the cranial cavity towards the orbit can expand and affect the optic foramen. A female patient was brought to me from the neurological ward, because she had lost the visual acuity of both eyes in a short time. The left eye was still slightly sensible to light.

From the ophthalmoscopic picture I learnt that we had to do here with primary atrophy of the optic nerve as well as with choked disk. This led me to make the presumptive diagnosis glioma of the chiasm and the optic nerves, as recently described by MARTIN and CUSHING. In this case I expected a change of the sella turcica and incidentally also of the foramen opticum. As will be seen the röntgenogram really revealed a marked dilatation and an almost complete destruction of the sella turcica (fig. f³), while on the side of the eye that had still retained some perceptive power, the foramen opticum had merged into the fissura orbitalis superior (fig. f¹), and at the blind eye only the lower part of

the wall of the enlarged optic foramen was still present (fig. f^2). The line of the base of the skull was almost completely destroyed, which could also be seen on stereoscopic röntgenograms. During the printing of this article I observed a quite similar case in a less advanced stage.

Since it has been proved by the above that tumours, developed along the optic nerve, can induce dilatation of the foramen opticum, I suspected that mere overpressure in the fluid of the cranial cavity might generate also this dilatation; with a view to this I examined various cases of hydrocephalus.

One of them concerned a patient of 10 years of age. In this case I observed the dilatation, the sella turcica being considerably enlarged (d^3). Figs. d^1 and d^2 illustrate the enlargement of the foramen opticum, while the wall remained smooth.

Figs. e^1 and e^2 present a foramen and sella turcica of normal size in a child of 8 years, also with hydrocephalus. Further investigation will perhaps settle the question in what cases of hydrocephalus enlargement of the foramen opticum occurs and in what cases it does not.

It has been seen that the expansion is easily brought about in young patients. So long as the causative agent is confined to the sheaths of the optic nerve, the wall will retain its smoothness; as soon as the tumour affects also the environment of the optic nerve, there is a chance of the walls of the optic nerve-canal being corroded, as was shown in the cases of glioma retinae and glioma of the chiasm.

Various problems still remain unsolved, i.a. if the enlargement of the foramen opticum will also occur with other affections that cause overpressure in the skull of young patients, e.g. microcephalus through premature closure of the cranial sutures.
