SUMMARY

561 subjects were examined on the synoptophore and variable prism stereoscope, and their horizontal ductions were compared from the point of view of age and 2 types of target. The effects of age and of both types of target were found to be slight.

Difference in the results obtained on the two instruments are described and analysed.

The above investigation was carried out with the aid of a grant from the Spencer Research Fund. I have to thank Dr. R. A. Robb, of the Mathematics Department of the University of Glasgow, for the statistical work.

REFERENCES

- ABRAHAM, S. V. (1943).—*Amer. J. Ophthalm.*, **26**, 271.
 — (1943).—*Ibid.*, **26**, 400.
 BERENS, LOSEY and HARDY (1927).—*Ibid.*, **10**, 910.
 DOBSON, M. (1941).—*Brit. J. Ophthalm.*, **25**, 66.
 — (1942).—*Binocular Imbalance*. London.
 GILES, G. H. (1941).—*The Practice of Orthoptics*. London.
 GRAEF, A. (1931).—*Arch. f. Augenheilk.*, **105**, 187.
 LYLE and JACKSON (1940).—*Practical Orthoptics in the Treatment of Squint*. London.
 PETER, L. C. (1941).—*The Extra-ocular Muscles*. London.
 SHEARD, C. (1926).—*Amer. J. Phys. Optics*, **6**, 585.
 STUTTERHEIM, N. A. (1937).—*Eyestrain and Convergence*. London.
 WEYMOUTH, BRUST and GOBAR (1925).—*Amer. J. Phys. Optics*, **6**, 184.
 MAXWELL, J. (1937).—*Outline of Ocular Refraction*. Omaha, Nebraska. P. 189.
 BIELSCHOWSKY, A. (1940). *Lectures on Motor Anomalies*. Dartmouth College Publications.
 SCOBEE, R. G. (1947).—*The Oculorotary Muscles*. London.
 — (1944).—*A.A.F. School of Av. Med.*, Project 139, Report No. 1.
 SCOBEE, R. G. and GREEN, E. L. (1947).—*Amer. J. Ophthalm.*, **30**, 436.
 — (1948).—*Ibid.*, **31**, 427.

ADENO-CARCINOMA (MIXED TUMOUR) OF THE LACRIMAL GLAND*

BY

NORMAN FLEMING, LONDON

THE total number of "mixed" tumours of the lacrimal gland hitherto reported appears to be less than three hundred, so any new case is still of importance. The case here described presents certain special features not without interest.

The commonest story is that of a patient complaining of a lump under the outer part of the upper lid, over which the skin is freely moveable. This may or may not be accompanied by exophthalmos, diplopia and loss of vision. Treatment consists of local removal, and in the majority of cases there is no recurrence.

Such tumours sometimes show local malignancy, and may bring about the death of the patient after repeated operation or extirpation of the orbit. A fatal termination may also be due to direct spread, in one case to the meninges and involving the cervical glands (Jack and Verhoeff). Lane found metastasis in seven out

* Received for publication, April 13, 1949.

of ninety-five cases, and Godtfredsen found metastasis in lymphatic glands in three out of ten cases. Mr. Dickson Wright tells me that he knows of five or six cases in which general dissemination, especially involving the liver, has taken place.

Now that the elements suggesting mesodermal origin are explained as arising from the metaplasia of epithelial cells, and that this explanation has been accepted, all the varied nomenclature and varieties based on the presence of mesodermal tissues become inaccurate and outdated. They will, however, continue to serve to stress the degree to which metaplasia is possible.

The tumour removed from the case here recorded has been examined and described by Mr. T. H. C. Benians, and his report is published herewith. He has also supplied some excellent microphotographs, two of which show a mass of tumour cells being squeezed into a cone with blood from a ruptured capillary, and lying free in a gland compartment (Figs. 4 and 5). This, we consider, might provide both explanation and cause of dissemination by the blood stream.

A healthy-looking girl, aged nineteen years, came to my out-patients on September 4, 1946. She was suffering from marked proptosis of the left eye, and she gave a history that this had first been noticed two years ago, but had increased materially during the past four months. The protrusion amounted to about a fifth of an inch. There was no divergence, but, as the photograph suggests, the depression usually found in a proptosed eye, may have been somewhat greater than usual; there was no diplopia, no suggestion of conjunctival or other inflammation or congestion, and, apart from the prominence of the eye and pain for the last two days, the patient had no complaints.

Vision of the right eye was 6/5, and of the left 6/9, and there was no field defect. Vision with the left eye later became subject to fatigue with intermittent blurring. Both eyes were slightly and similarly hypermetropic, but correcting lenses made no difference to the visual acuity. The pupils were equal and active, the media clear, and the only abnormality within the eye was slight left papilloedema without any haemorrhages. Palpation around the globe revealed no resistance, but it seemed evident that a tumour must be present, presumably within the cone of muscles, and a provisional diagnosis of meningioma of the optic nerve was made.

An X-ray picture taken by Dr. Cochrane Shanks to show the optic foramina, indicates no disparity. Other photographs show no sign of the tumour. I referred the case to Mr. Eugene Wolff for his opinion, and he agreed with me in thinking that a meningioma of the optic nerve was the most likely diagnosis. The outward appearances are well shown in the accompanying photographs (Figs. 1, 2, 3).

She was admitted to hospital and I asked Mr. Dickson Wright to see her with a view to operation; it was decided that the orbit should be explored from above, after a left frontal craniotomy.

Mr. Dickson Wright has given me the following description of the operation:

December 12, 1946. "Lt. frontal craniotomy (Mr. Dickson Wright). G.A. (Dr. Cave).

1. Trotter flap—Burrs and Gigli saw. Hinged on temporalis muscle.
2. Orbital roof thinned—removed.
3. Whole supraorbital ridge resected in one piece with Gigli saw and restored to its place after the removal of tumour.
4. Resection of tumour of lacrimal gland which extended backward to apex of orbital cavity. Removed intact with surrounding tissue. Levator palpebrae muscle and possibly its nerve-supply damaged.
5. Closure in layers. Dural hitch sutures to avoid epidural clot. Small temporal drainage tube.

FIG. 1.
Full face.

FIG. 2.
Side view of affected eye.

FIG. 3.

Side view of unaffected eye.

December 21, 1946. Stitches and tube removed."

Mr. Dickson Wright did not see the normal gland separately and considers that a tumour of this size would have obliterated it.

X-ray treatment was carried out by Mr. Anthony Green, who makes the following comments:—

"In view of the fact that similar tumours in the parotid gland had proved sensitive to irradiation in many instances, it was considered well worth while giving treatment, provided the eye could be adequately screened.

"A plaster-cast model of the head was made, and a wax mould fitting to the face so that the X-ray beams were carefully directed to the site of the growth. A small protective piece of lead rubber was built in to the wax so that direct irradiation to the globe was avoided as far as possible.

"Tissue dose calculated at the lacrimal gland 4,783r. in 4 weeks.

"The eye was slightly sore after the treatment, but the reaction cleared up quickly, and the oedema of the eye settled down."

Mr. T. H. C. Benians reports as follows:—

A rounded flattened tumour $3\frac{1}{2} \times 1\frac{1}{2}$ cm. with a thin fibrous capsule and irregular bossy surface. It is firm and elastic, showing on section an opaque yellowish-white mottled surface with occasional fibrous strands and apparently very scanty blood-supply, though a few small subcapsular haemorrhages are present. The lacrimal gland was not identified. Without entering into the discussion on origin and nomenclature that has for many years centred on growths of similar type arising mainly in the salivary glands, one can say that the microscopic picture is that of an adenoma with patches of "mucoid" degeneration (Cystic basalioma of Godtfredsen; Pleomorphic adenoma, Willis). Structurally it shows some large

parenchymatous areas in which the cells have either a solid acinar or a cribriform arrangement (Fig. 4), the latter showing few or many pseudotubular or acinar spaces filled with a palely staining eosinophilic hyaline substance. Other areas are composed of small cysts or dilated acini similarly filled. Elsewhere single or grouped tubules lined by radially arranged cells, sometimes in two layers, form separate entities of more normal anatomical type. The tumour-cells are moderately uniform in size and pale, with a round nucleus of relatively large size which shows a well marked chromatin network and one or more nucleoli. Some cells contain small droplets of hyaline material, and a small proportion are of giant size hugely distended with hyaline droplets. The latter are found only in the more anaplastic parts of the growth.

Vascular spaces are abundant in some areas, and mostly contain blood. They lie in the stroma usually close to the gland element, and are formed of a single layer

FIG. 4.

Showing general adenomatous structure of growth with torsion effects ($\times 75$).

of fine endothelial cells; a few large, better formed vessels traverse the structure of the gland.

The intimate stroma is of denser bands of collagen than the capsule, and tends to divide the parenchyma up into more or less regular large or small compartments. In the larger masses of cells the collagenous supporting structure is entirely absent. The "mixed" element of the tumour is rather scanty, and consists of irregular patches of hyaline material in which scattered epithelial cells can still be recognised. This material blends with and may ablate both the cellular and collagenous elements of the growth.

The capsule, or more probably false capsule, is thin and made up of collagen fibrils with here and there intercalated compressed tumour-tissue. The part of the gland examined close to the capsule shows in several places the effect of torsion or pressure on the tumour cells, which have assumed a spindle-shape and stain densely. A block of such cells is seen forced into a cone and lying free mixed with blood in an adjacent compartment (Fig. 5).

Sections of the tumour show a remarkable amount of this cell distortion, some of it in small patches deeper in, as though force had been exerted through a band of stroma traversing the region. Tearing of the thin-walled vascular spaces was observed. If these changes occur during operation, dissemination by the blood

FIG. 5.

Higher power picture of same ($\times 300$).

stream would no doubt be possible, and since the growth was removed by free exposure after raising the orbital roof and presumably without undue trauma, it seems that the cells of this tumour may be of a very soft, almost diffuent character.

From the strictly histological standpoint, and judging by the usual criteria, this tumour would appear to be benign, but it is clear from Godtfredsen's paper that growth behaviour in this group is not consistent with microscopical structure, and that these tumours must be regarded as essentially malignant.

In Fuchs' Diseases of the eye, one finds the statement: "New growths of the lacrimal gland are mostly mixed tumours in which the connective tissue of the gland as well as the epithelial portion participates. As indeed the one or the other part predominates in the histological pictures one speaks of fibroma, myxoma, lymphoma, sarcoma or of adenoma, carcinoma or cylindroma."

Morax in his Pathology stresses the slight vascularity and small amount of protoplasm, also the hardness, due to great development of supporting tissue, encapsulation and yellow colour of the tumour.

Seen again in October, 1947, the patient appeared to be in excellent health. Her only complaint was that the left eyebrow, which had been shaved, had failed to grow again. The left eyelid drooped somewhat, but not enough to cover the pupil. She had no diplopia and no pain, and it is interesting to note that she had not suffered from dryness of the eye, even in the hottest weather. The left eye had developed some hypermetropic astigmatism (+2.50 D.S. with +1.75 D.C. Axis 70), but when this was corrected, vision proved to be 6/9 as before operation. The fundus was normal. There was no sign of secondary growths in glands or liver.

I saw her again on May 23, 1949, and found that she had been practically bedridden for six months. She keeps her bed partly because of weakness but chiefly because any form of exertion causes her to be sick. She is very thin.

The left eye is exophthalmic, the lower two-thirds of the cornea being keratinised, vascular and opaque, and the fundus can be seen only dimly through the remaining part. It was possible to make out that the disc was swollen. The orbit is evidently filled with a recurrence which projects forwards above the eye, where it is very hard and tender. The eye has been immobilised for some time past, presumably through involvement of the nerves at the back of the orbit, and during the last month the right eye has been similarly involved, but the optic disc is normal, and there is no evident loss of vision. The lid droops, the pupil is semi-dilated, and the eye cannot be moved in any direction. There is no evidence of any secondary growth, but the abdominal wall was found to be somewhat rigid. Her doctor tells me that she eats very little and it is evident that her weakness is progressive.

REFERENCES

- COLLEY, T. (1931).—*Brit. J. Ophthalm.*, 15, 35.
 FUCHS, E. (1933).—*Diseases of the Eye*. Tenth Edition, p. 137. Philadelphia and London.
 GODTFREDSEN, E. (1948).—*Brit. J. Ophthalm.*, 32, 171.
 GREEVES, R. A. (1914).—*Ophthalm. Hosp. Rep.*, 19, 237.
 JACK, E. E. (1910).—*Trans. Amer. Ophthalm.*, 12, 414.
 MORAX, V. (1929).—*Pathologie Oculaire*. Paris. P. 69.
 WILLIS, R. A. (1948).—*Pathology of Tumours*. London.

THYROIDECTOMY AND THYROTROPIC EXOPHTHALMOS (EXOPHTHALMIC OPHTHALMOPLEGIA)*

A Review of 1001 Thyroidectomies

BY

HUGH RYAN

*Registrar-Tutor, Institute of
Ophthalmology, London*

It has been noted since the early days of thyroid surgery that the exophthalmos of primary thyrotoxicosis (Graves' disease) did not always subside following an otherwise successful thyroidectomy, but that in certain cases it even progressed. Benedict and Knight (1923) of the Mayo Clinic described a case of progressive exophthalmos following thyroidectomy performed six months previously, and there are now many other reports in the literature of this sequence of events. Zimmerman (1929) recorded 11 cases in which this condition followed thyroidectomy, and in Russell Brain's (1944-45) series of 61 cases there were 11 which were post-operative. Mann (1946) in a series of 18 cases observed during the war years, reported 7 post-thyroidectomy cases. Robertson (1945) reported 9 similar cases with the loss of both eyes in two cases and the loss of one eye in two other cases. With similar cases being reported in increasing numbers, it began to appear that thyroidectomy was associated with a definite risk of thyrotropic exophthalmos. Robertson (1945) states that he does not

* Received for publication, August 23, 1949.