(1) EPIBULAR CARCINOMA NINE YEARS AFTER REMOVAL OF A PAPILOMA OF THE CORNEOSCLERAL MARGIN; (2) SMALL, SPINDLE-CELLED HEMANGIOSARCOMA OF THE EYELID OF A CHILD AGED FIVE MONTHS, EXCISION FOLLOWED BY RADIUM TREATMENT; (3) PATHOLOGIC HISTOLOGY OF A CONCUSSIONED EYE FOLLOWING GUN-SHOT WOUND OF ORBIT.

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This paper reports especially the significant microscopic findings throwing light on the pathologic history of these cases. It was read at the meeting of the American Ophthalmological Society, June, 1920.

The object of this communication is to present the clinical histories of the cases described in the title, as well as the pathologic examinations of the specimens, without analysis of the literature, or reference to similar lesions and growths, except in incidental mention.

CASE I. *Epibulbar Carcinoma*. J. R., laborer, male, white, aged eighty, was admitted to the Eye Ward of the University Hospital December 2, 1919, for the treatment of an epibulbar growth of the left eye of large size.

Medical and Family History: Except for repeated attacks of rheumatism, one attack six years ago being especially severe, the patient's medical history is unimportant. The causes of the death of his father and mother are unknown; his wife died of tuberculosis; there is no family history of carcinoma.

Eye History and Examinations: In October, 1910, or nine years prior to his second admission to the hospital, he had applied for treatment of a small tumor at the corneoscleral junction.

The uncorrected vision of the right eye at this time was 6/22, and it revealed no pathologic condition. The uncorrected vision of the left eye was 6/45. The growth referred to, somewhat crescentic in shape, was situated along the inner border of the corneo-scleral junction, and extended from the center of the upper corneal border around its inner margin to the center of its lower border. Directly in its middle, on a line with the internal rectus, the growth was depressed, owing to the presence of a small pterygium. It appeared to arise in two portions above and below it. The

neoplasm was attached by a broad base, which encroached for 4 mm. on the corneal surface and about 6 mm. on the bulbar conjunctiva. It was smooth on its surface, and of a reddish-yellow color; a number of injected conjunctival vessels surrounded its margins (Fig. 1).

The patient maintained with positiveness that the growth had begun to appear after his eye had been injured by coming in contact with the fin of a sunfish, which struck him violently in the corner of the eye, and occasioned primarily a stubborn traumatic conjunctivitis. Exactly how long a time elapsed between the date of the injury and the development of the tumor as it appeared at the time of examination is not known. According to the patient's statements, it was between three and five years. The tumor was excised, and the gap produced by the dissection covered with conjunctival flaps. Healing was uneventful, and the patient left the hospital at the end of a week.

To the microscope the growth revealed the following characteristics: Externally there was a layer of stratified squamous epithelium arranged in a papilliform manner, while between the papillae there was a rather dense connective tissue growth. This layer of epithelium surrounded an area consisting for the greater part of dilated capillaries and arterioles filled with blood-cells. The remainder of the growth was composed of myxomatous and connective tissue. The epithelial elements were in no sense infiltrated, and had a definite relation to the basement membrane. Many of the cells showed distinct chro-

matin filaments in their nuclei, and in one spot there was an appearance suggesting pearly body formation.

Physical Examination: At the time of the patient's second admission to the hospital (December 2, 1919), nine years after the removal of the epibulbar papilloma which has been described, the

Fig. 1.—Papilloma of the corneo-scleral border, followed nine years after its removal by an epibulbar carcinoma.

physical examination revealed the following conditions: Lungs negative; heart slightly enlarged to the left, with weak muscle sounds and a loud systolic murmur over the aorta and at the mitral area; rhythm good, and no evidence of decompensation; no dyspnea or edema.

The urine was without sediment, free from albumin and sugar, and contained neither casts, cylindroids, nor crystals. Blood count: Erythrocytes, 3,820,000; leukocytes, 6,000; hemoglobin, 70 per cent. Blood pressure, systolic, 155; diastolic, 95.

Eye Examinations: R. E.: Negative except for a few striae in the lens. L. E.: Protruding between the lids there was a

large, fungus-looking mass, approximately 2 cm. in height, arising from the upper corneo-scleral region, overhanging and partly adherent to the cornea in front, and extending backward along the scleral expanse for 2 or 3 cm., and apparently involving the tissues more posteriorly in the orbital cavity. The fundus could not be seen, owing to the haziness of the uncovered part of the cornea. The growth bled easily, was of a dirty grayish color, and the patient suffered considerable pain deep in the orbit and in the periorbital region.

Operation: Removal of the eyeball, and, if necessary, removal of the orbital contents, was advised, and on December 5, 1919, this procedure was adopted:

Fig. 2.—Epibulbar Carcinoma and adjacent orbital tissue.

The contents of the orbit, together with the eyeball, were exenterated in the usual manner, and the bleeding controlled by packing and pressing against the apex of the orbit some surgical wax. The cavity was loosely packed, and directly in the center of the packing two radium bullets were placed, each containing 30 mgm. of radium element, which remained in position for eighteen hours. Convalescence proceeded without complications, and the patient was discharged four weeks after the operation, the orbital cavity being free from suppuration and markedly contracted, the only dressing required being a small

ball of surgical gauze. Up to the present time no report has been received from the patient indicating any return of the growth, altho he has not actually been examined in the hospital since January 14, 1920.

Gross Appearance of the Specimen:
Glycerin-jelly mount of half of the eye-

there is a punched out, central ulcer. The lens has been slightly dislocated backward, and there is extensive detachment of the retina, but no gross signs of exudation, inflammation, or neoplastic tissue within the eyeball, which is of normal size (Fig. 2).

Microscopic Appearances of the

Fig. 4.—Nests of cancer cells in a delicate connective tissue stroma. (High power, b. Low power, a.)

ball, including a mushroom shaped tumor, which arises from the conjunctiva of the corneo-scleral junction and extends posteriorly, together with the adjacent orbital tissue. The growth is in close contact with the sclera, but does not penetrate it. The tumor included in the specimen, about 1 x 1.5 x 2 cm., is circumscribed, nonencapsulated, and has a lobular exterior. The cut surface of the growth is of a dirty white color, surrounded by a marginal zone of varying thickness. A lobule of the neoplasm has encroached upon the upper cornea for a distance of about half a centimeter. The cornea is hazy, and

Specimen: The tumor is composed of small, squamous epithelial cells, and has originated in the conjunctiva, at or just posterior to the limbus, or, in other words, at the position occupied by the upper part of the papilloma removed nine years previously. The growth is entirely extraocular; the bloodvessels underlying it in the limbic zone are engorged, with marked perivascular round celled infiltration. The sclera is without special pathologic features, and the cornea shows only the evidence of pressure edema and the lesions of the central ulcer before noted. Both retina and choroid

are largely detached. Distributed along the choroid posteriorly, and between it and the sclera there is a moderate amount of deeply eosin stained, vacuolated exudation of blood origin. There are no evidences of inflammation (Figs. 3 and 4).

Fragments of the deeper orbital tis-

years after its removal (the exact period is not known), an epibulbar, squamous celled carcinoma, taking its origin at the upper part of the area from which the original growth was removed.

The probable relation of an injury to the development of a papilloma of the limbus, as in the present case, is inter-

Fig. 4.—Nests of cancer cells in a delicate connective tissue stroma. (High power, b. Low power, a.)

sue are composed of normal areolar fatty tissue, bloodvessels, nerves, and voluntary muscle. Sections of the tissue of the orbit adjacent to the growth are composed of the normal structure of this region, save only for considerable infiltration, which suggests chiefly the effects of traumatic hemorrhage, but does not definitely exhibit neoplastic tissue.

Comment.—After an injury from violent contact with the spines of the fin of a fish, followed by a prolonged period of traumatic conjunctivitis, in turn succeeded, about three years later, by the development of a papilloma at the corneo-scleral junction, there originated, several

esting and well known. The invasion of the cornea is usually a later process. That recurrence in the form of an epithelioma may follow removal of a papilloma in this situation has been noted in not a few instances, and it is suggestive that the microscopic examination of the original growth revealed in one spot an appearance resembling pearly body formation. When this papilloma was excised, radium treatment of such a neoplasm was practically unknown, nor was the method of electric desiccation available. I think it likely that such a technic in the treatment of a growth of this description offers a better chance of avoid-

ing a recurrence in a malignant form than excision.

Of practical importance in connection with epibulbar carcinomas is invasion of the interior of the eyeball, which in the present instance did not take place. Shumway and I, discussing this question in a paper before this Society in 1913,¹ have quoted some opinions and statistics which are here reproduced: Some authors, for example, Axenfeld, Greeff, Wintersteiner, and Saemisch, consider that epibulbar carcinomas rarely penetrate the globe, while Ginsberg and Parsons express an opposite opinion. In 53 eyeballs with epibulbar carcinoma, the records of which we found in the literature, perforation occurred in 20, or 37.6 per cent. Hence, altho the cornea and sclera offer a considerable resistance to the growth of the tumor, especially if Bowman's membrane is intact, it is evident that perforation occurs in a considerable number of cases, especially if the neoplasm has been present for a long period of time. Naturally, this percentage is relatively too high, because the eyes examined were those in which the lesion had assumed serious proportions demanding enucleation.

Frequency of perforation depends largely upon the site of the tumor. It has been found that those growths which are situated at the corneal limbus are much more apt to penetrate the globe than those placed at a distance from it, and, as is well known, the region of the penetrating ciliary vessels presents a feeble resistance to a growing carcinoma, because its cells invade the tissue along the perivascular lymphsheaths.

As the microscopic examinations of the orbital tissue adjacent to the tumor did not definitely reveal neoplastic tissue, it may be questioned whether exenteration of the orbit was necessary, and yet only three months after the enucleation of an eye with the epibulbar carcinoma, reported by Shumway and myself, altho exploration of the orbit failed to reveal suspicious tissue, there was a large recurrence requiring a complete exenteration of the orbital contents. With this case in mind, and because of the apparent involvement of some of the orbital

tissue close to the tumor, removal of the entire orbital contents was justified.

The use of radium after the operation requires no comment, save only to point out that it lessens the danger of recurrence, seems to enhance the rapidity of the healing process, and undoubtedly ameliorates postoperative pain and discomfort.

CASE 2.—Small, Spindlecelled Hemangiosarcoma of the Lower Eyelid of a Child Aged Five Months.—F. K., a white female infant of five months, was admitted to the Eye Ward of the University Hospital on November 24, 1919, because of a tumor of the right lower eyelid.

History: Ten weeks prior to admission the child's mother first noted a "blue mark" along the eyelid. This rapidly increased in size until the whole lid was involved. The child, a first baby, has always been healthy, was exceedingly well nourished, and the general physical examination was entirely negative.

Ocular Examination: Both eyes were normal in all respects, and the conjunctival surfaces healthy. Extending practically the entire length of the right lower lid, there was an oblong swelling of bluish color, slightly lobulated to the touch, with which were associated a series of cords assumed to be distended vessels. The skin surface appeared to be normal, the integument was not adherent to the underlying tissue. The tumor became turgid, purplish in color, and seemed to increase in size when the child cried. A tentative diagnosis of cavernous angioma was made and its removal advised.

Operation: An operation was performed on November 27, 1919, and the growth dissected from its bed. On exposure it was found to be covered with a delicate, translucent tissue, which evidently was not adherent to the growth, from which it was easily stripped. On the surface of the tumor were a number of large veins of bluish color. The neoplastic tissue was of a slightly reddish-gray color, and apparently took its chief point of origin from the outer end of the lid. The wound was closed with interrupted silk sutures, leaving at the

outer end a small orifice thru which a radium tube (dosage, 15 mgm.) was inserted beneath the suture line along the length of the incision, and allowed to remain in place for ten hours. Very little reaction followed this procedure, and at the end of four days the child was discharged, the wound being completely healed.

cells. Some of the bloodspaces show a characteristic "combing" of the cells which form their walls. Areas of hemorrhage are visible in the interstitial areolar tissue. There is no melanotic pigmentation. The growth, therefore, is a small, spindlecelled hemangiosarcoma (Fig. 5, *a* and *b*).

Comment.—A goodly number of cases

Fig. 5.—Small spindle celled hamangiosarcoma tumor lobule made up of spindle-cells and blood sinuses. (Low power, A.) Blood channel walls formed of tumor cells which show characteristic "combing". (High power, B.)

Microscopic Examination: The growth, nonencapsulated and irregular in outline, is composed of variously sized round and oval islands of tissue, separated one from another by areolar fatty and fibrous connective tissue. These islands are all similar in structure, and are composed of numerous blood channels supported by densely packed and irregularly arranged spindle cells of the young connective tissue type. A few of the largest bloodspaces have poorly developed walls, chiefly made up of connective tissue, but the walls of all of the capillary spaces and many of the larger blood sinuses are composed of tumor

of sarcoma of the eyelid are on record, and in this country statistical information in this regard has been published by Wilmer (1895), Veasey (1899), Alling (1907), and Shumway and myself (1911). At the time of the last named report at least 80 cases had been described, and since then others have been reported. In the collection made by Shumway and myself² in 43 per cent of the cases the sarcoma was roundcelled, in 40 per cent spindlecelled, while in the remainder the cellular type was mixed. Between 30 and 40 per cent of these lid tumors are pigmented. Parsons records 11 per cent of myxosarcomas. Angio-

sarcomas and cylindromas are said to occur more frequently than myxosarcomas. Some of the reported cases of roundcell sarcoma were probably lymphomas.

In Wilmer's list the age of the patients affected varied between ten months and seventy-six years. I have removed a sarcoma from the lid of a negress aged eighty-one. Five months, the age of the subject of this paper, must place this patient among the very youngest of those whose histories have been published.

Altho often small at the time of their removal, some of these tumors reach unusual size, especially the myxosarcomas. I have recorded one such growth which attained a weight of 247 grams; its size was 10 by 8 by 6 cm.

Up to a month ago there was no evidence of recurrence of the tumor described in this communication, but quite recently (June, 1920) the child was examined, and below the line of incision, at the outer end of the lid, a distinct bluish color is visible, altho no growth can be detected on palpating this area. This coloration, however, is certainly suggestive, and the child will be under constant observation and, if required, radium treatment.

CASE 3.—Concussioned Eye Following Revolver-shot Wound of Orbit; Microscopic Examination of the Enucleated Globe.—J. C., a colored man aged thirty, was admitted to the Eye Ward of the University Hospital on September 10, 1919, within one hour after he had been shot thru the right orbit with a 45-caliber revolver, held at close range.

Physical Examination: The patient, a well nourished adult, was badly shocked and rallied rather slowly under antishock treatment. General physical examination failed to reveal any abnormal condition other than that produced by the injury. The bullet had entered the left side of the nose on a level with the eyes, had traversed the ethmoid (as shown by the X-rays), crossed the orbit, and was lodged in a region outside of its walls to the right and below the apex.

Ocular Examination: Except for a few powder burns of the lid, the left eye was normal and had normal vision.

The right eye was markedly proptosed, the conjunctiva intensely chemotic and ecchymotic, the lids swollen and containing extravasated blood. The cornea was clear, the shape of the eyeball apparently unchanged, and the ophthalmoscope revealed in typical profusion the lesions which Colonel Lister has described as those peculiar to the "grossly concussioned fundus."

Everywhere there were sheets and clouds of hemorrhage; the disc was only dimly made out, being partly covered with blood, and completely surrounded by widespread areas of hemorrhage. Here and there were white patches. Some of the blood was apparently pre-retinal in situation, but there was no free hemorrhage in the vitreous. The eye was entirely blind. The tension, as far as it was possible to measure it, was neither elevated nor lowered. The patient suffered much pain. Within twelve hours the cornea was too steamy to allow further study of the fundus, and a small, yellowish infiltration began to appear slightly below its center. The exophthalmos and the pain had markedly increased.

The eyeball was therefore enucleated, and showed no sign of rupture, altho carefully inspected. The tissues of the orbit were infiltrated with blood, and the wound of exit thru the outer orbital wall far posteriorly was explored without detecting the bullet. About 10 mm. of the orbital nerve was secured, and its coats were intact, altho evidently bruised, but it had not been jerked from its entrance point into the globe. The patient made an uncomplicated recovery, and was discharged from the hospital one week after admission.

Microscopic Examination of the Eyeball and Optic Nerve: A large number of sections of the eyeball (22) and of the optic nerve (39), were prepared. The cornea is somewhat conical in shape, and contains no lesions other than those which were clinically evident. At the limbic region of the cornea there are vascular engorgement, interstitial hemorrhage, and lymphocytic and polymorphonuclear infiltration.

The anterior chamber is deep and free

from exudate. The lens occupies its normal position and shows no pathologic changes. The iris and ciliary body are congested and markedly edematous. The vitreous is negative.

The retina is widely detached on one side (Fig. 6, *a*), and everywhere is the seat of extensive areas of hemorrhage,

leukocytes. The lamina cribrosa stands out sharply, and is accentuated by an almost total destruction of the optic nerve-fibers. The nerve fibers which remain exhibit edema, hydropic degeneration, and are infiltrated with lymphocytes and polynuclears. The fibrous septa are also thickly infiltrated.

Fig. 6.—(a) Separation of retina on one side and position from which section of retina, choroid and sclera was made. (b) Section of retina, choroid and sclera showing distribution of hemorrhage as noted in text.

most marked in the layers of the rods and cones. In all its layers are the evidences of cellular distortion due to co-existing edema.

Thruout the choroid there are numerous and extensive interstitial hemorrhages. Except for the presence of superficial areas of hemorrhage, the sclera exhibits no lesions (Fig. 6, *b*).

Examination of a number of serial sections (1-13) of the optic nerve (retrobulbar and transversely cut) reveals the following conditions: The central vessels contain a few red cells and many

Between the pial and dural portions of the optic nerve sheath there is an area of hemorrhage which circumscribes the nerve. The extradural lesions included in these sections are the seat of interstitial hemorrhage, edema, and lymphocytic and polynuclear infiltration (Fig. 7).

The sections of the optic nerve as it enters the globe (27-37) indicate considerable swelling of the nervehead. The fibers are degenerated, finely vacuolated, and thickly infiltrated with lymphocytes; an occasional polymorphonuclear is vis-

ible. The cause of this swelling of the nervehead appears to be an acute inflammatory condition. Special tangential sections of the posterior pole of the eyeball, not including the optic nerve, show, in so far as the retina and choroid are concerned, the hemorrhagic lesions already described.

Comment.—Many concussioned eye-

cussion had produced the ophthalmoscopic lesions which have been described, added to which are those evident within the sheath of the optic nerve. These lesions antedate by a considerable time those which occur secondarily, the most important being atrophic chorioretinitis (spots of atrophy, exposed scleral areas and pigment distribution, heaping and

Fig. 7.—Transverse section of optic nerve. Atrophy of fibers, perineural hemorrhage, fibrosis of dura with intradural hemorrhage and perivascular (melanotic?) pigmentation.

balls, both in early and late stages, have been examined ophthalmoscopically and microscopically during the late war; and we are indebted especially to Colonel Lister, to Lagrange, and to v. Szily for information in this regard. Some of these data, as well as some of my own observations, I have summarized in a paper entitled "Concerning Concussion and Contusion Injuries of the Eyes in Warfare."³

Evidently the case in question belongs to that group in which the concussion results are produced by the passage of a missile thru the orbit behind without rupture of the globe. Its chief interest resides in the fact that the eye was secured very early after the effects of the con-

fringing) and proliferating chorioretinitis. This secondary chorioretinitis proliferans is essentially a cicatricial process, with organization of hemorrhages. But this is of less importance than the irritating effect of the hemorrhages, already noticeable in specimens, on the connective tissue of the retinochoroidal layers inciting them to active proliferation and the formation of tracts, areas, and masses of fibrous tissue. The whole process and picture differ materially from the so-called proliferating retinitis of recurring hemorrhages in the vitreous, especially in young subjects, often noted in civilian life. Of marked interest are the extensive degeneration of the optic nerve fibers and the lymphocytic and polynuclear infiltration, as well as the

hemorrhages in the optic nervesheath which have many times been noted in eyes examined after concussion injuries during warfare. Evidently in this case the missile, passing thru the orbit, bruised but did not penetrate the eyeball, and caused the extensive hemorrhagic lesions of the retina and choroid; bruised but

did not cut across the optic nerve, and caused a rapid destruction and hydropic degeneration of most of its fibers and a hematoma of the sheath. These conditions also explain the marked papilledema, microscopically evident, which was beginning to take on the lesions of an acute inflammatory edema.

REFERENCES.

1. Schweinitz, G. E. de., and Shumway, E. A. Arch. of Ophth. v. 43, 1913.
2. Schweinitz, G. E. de., and Shumway, E. A. Tr. Ophth. Sec. College of Physicians of Philadelphia, 1911.
3. Schweinitz, G. E. de. Amer. Jour. Ophth. v. 2, p. 313.