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INTRA-OCULAR TUMORS.

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CASE 1. Mr. Stubbs, aged 60, of St. Louis, Mo., was first examined in September, 1869, He had observed a few weeks previously that there was some obstruction to his vision in the right eye, at first slight, but it gradually increased. He consulted his family physician, who finding the case somewhat obscure brought him to me for examination.

There was found, on examination, obstruction to vision in the internal portion of the field of vision. With the ophthalmoscope there was also found, in the external portion of the fundus, about the equator, a well defined tumor nearly the size of a large pea. It was dark with some greyish or whitish streaks over its surface. The outlines posteriorly were well defined. The patient was seen a few days later and cursorily examined, receiving at the same time instructions to return again soon.

He was not seen again until about the middle of Jan-

uary, 1870. In the meantime the sight had gradually disappeared from the inner towards the outer side of the field of vision until no objects could be distinguished. There was no pain in the eye, at least not sufficient to cause any inconvenience. The conjunctival and episcleral vessels were somewhat enlarged on the external aspect of the eye. The cornea was clear; the pupil moderately dilated; the lens transparent, not entirely clear, but sufficiently so as to make out the irregular outlines of the dark nodular tumor, with indistinct lines on its surface, which I took to be vessels.

Diagnosis: The age of the patient, the progress of loss of vision in a well defined direction, comparative painlessness of the organ, absence of an injury or of inflammation; also, the ophthalmoscopic appearances—the *color*, the *well defined border* and *nodular* surface; the grey lines on the surface of the tumor; added to these the history of intra-ocular tumors, all pointed clearly to a sarcoma of the choroid, which was the diagnosis given. This was not fully concurred in by others who examined the case at the same time.

The *Prognosis* was given in accordance with the diagnosis—namely, aggravation of all the symptoms of glaucoma, and finally, extension of the disease to the intra-orbital tissues, et cet.

Under clear convictions of the nature of the case, and the dangers arising from extension of the disease in case an operation was postponed, I urged immediate enucleation of the globe. An appointment was made for the next day for farther examination, and arrangements for the operation. The patient did not, however, meet the appointment. Hence, the meagre details of the examination. He received other opinions and advice elsewhere, and I saw nothing more of the case till the morning of the 22d of February, at which time he sent for me to come and remove the eye.

There had been a dull pain in the globe for a week or more; but on the 21st the pain became suddenly so severe

as to deprive him of rest the entire night. The tension of the ball was extreme, T 3, it felt as hard, under the finger, as a marble. The cornea was smoky or hazy; the anterior chamber was shallow, almost obliterated; the iris pushed forwards, of a dull dirty, hazy color; the pupil in medium dilatation; the lens opaque; conjunctival and episcleral vessels enlarged and congested; a bluish perikeratic zone, such as is seen in iritis also existed.

Violent pain existed in the forehead, temple, and cheek, in fact, in the entire surroundings of the orbit. The eye could be touched with comparative impunity.

The case had followed, up to this time, so exactly the course prognosticated, that he was anxious to be relieved of the organ lest the other consequences might also follow.

Accordingly at four o'clock P.M., on the 22d, in presence of Drs. Drake, Gregory, DeCourcillon, Briggs, Allen, Mudd, McCosh, Howard, and others, I enucleated the eye, cutting the muscles close to the sclerotic; and, lest the optic nerve might be affected, after the removal of the globe, I seized the stump of the nerve with forceps, guided by the finger, drew it forwards and cut off another portion. Very little of the orbital contents were removed with the globe, it being almost clear of surrounding tissue.

The hæmorrhage following the operation was slight. Simple dressing of a compress wet with cold water, and a light bandage was all that was applied. The next day a small coagulum was expressed from the cavity; and a day or two later Lister's Carbolic Oil was applied. No unpleasant symptoms followed.

Examination of the Eye. The eye was examined the next day after its removal. A vertical meridianal section was made through the cornea and the sclerotic and anterior portion with the razor, and completed with the scissors. On first entering the eye, a darkish, dirty looking fluid escaped, as it proved afterwards, from between the choroid and retina.

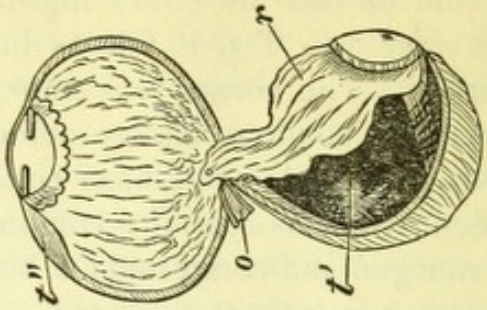

FIG. 1.

a Optic nerve. *t' tt''* Tumor. *r* Folded retina.

The *retina* was detached entirely from the choroid, and was stretched across from the optic papilla posteriorally, to the ora-serrata anteriorally, in the form of a hollow cone containing the remains of the vitreous body. It was opaque, unpigmented and entire. (See Figure 1).

The vitreous body was reduced to one-fourth, or less, its normal quantity, and was contained within the cavity of the retinal funnel.

The cavity of the eye was about two-thirds filled with a black, softish, nodular tumor springing from the external half of the eye, from a few lines posterior to the equator, as far forward as the corpus ciliaris and involving the latter partly. The tumor had a broad base, then a more contracted portion, and again expanded and extended into the main portion or body. The main portion of the tumor was comparatively soft, easily broken down with a needle, and contained many shreds or fibers, which, however, proved to be mainly vessels of a greyish color. The retina was loosely attached to it in several places, and was pushed before it, but could be detached without rupturing either tissue excepting little shreds, probably vessels. It had involved the ciliary body, but not the iris so far as could be observed. That portion directly in contact with the sclerotic and extending to the imperfect pedicle was more firm than the main portion.

The *choroid* was attached to the sclerotic everywhere except where the latter was occupied by the base of the

tumor. The *sclerotic* was entire and apparently unaffected.

Microscopic Examination. The microscopic examination of the tumor was made, partly while it was in a recent state, and also when hardened in alcohol.

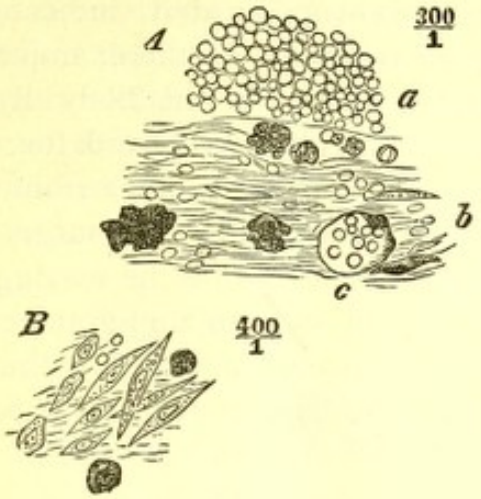

FIG. 2.

A Structure of tumor. *a* Blood globules and pigment clusters. *b* Proper tumor structure. *c* Blood vessel. *B* Variously shaped cells characteristic of the tumor, together with pigment granules and clusters.

The tumor was composed of spindle-shaped cells, mostly finely pigmented, some almost without pigment, with well defined nuclei and nucleoli; also of pigment granules and pigment clusters; and numerous comparatively large vessels filled with blood. There was also fatty degeneration as was shown by the granules and globules of that character. (See Figure 2.)

The hexagonal pigmented epithelium lined the tumor internally in places, and it is fair to presume everywhere, but it had been removed in part by manipulation.

The growth was largely vascular, especially in the central portion; the walls of the vessels were but slightly discolored; there were found occasionally what appeared to be *fresh effusions of blood*, no vessels appearing around them; the globules, red and white, were distinctly defined.

The tumor seemed to have its origin from the choroid (and I am confident from the tunica vasculosa), and extended between the internal coats—the lamina vitrea and

the pigmented epithelium on the the one hand—and the sclerotic on the other. (See Henle.)

I made a large number of sections to determine the exact coat and point whence the growth arose, and demonstrated, it seems to me its exact origin as above indicated; certainly it was in that coat it extended. As the examination extended towards the inner boundary of the body, it became more vascular (telangiectatic), less firm, and the cells were apparently longer. Sections were made from the unaffected parts of the choroid directly into the margin of the tumor. The choroidal epithelium rose on the waving margin over the tumor, and beneath was an unpigmented strip (Basement membrane and the capillary tunic), then followed the pigmented structure of the growth corresponding to the tunica vasculosa Halleri, choroidea propria.

Diagnosis: Melano-sarcoma choroideæ. Cause: The cause is entirely uncertain. He now recalls having had a blow on the eye many years ago, but was not aware of any permanent injury to the eye or the sight resulting from it.

Prognosis, is favorable.*

The patient returned to his occupation in a few days.

Case II. *Primary Glioma of the left Eye.* Joseph Legg, aged two and a half years, was brought to the clinic at the St. Louis (Sisters') Hospital Sept. 24, 1869. The globe was protruding, and the cornea turned upwards and inwards so as to be hidden by the upper lid. A protruding mass existed below the globe, having a somewhat elastic feel. An incision was made into it by way of exploration. The eye and the tumor were then removed by Dr. Pollak, assisted by myself, others also being present.

A partial examination of the tumor was made while the specimen was fresh. After hardening for some time in alcohol, I examined the eye and tumor by making a perpendicular meridianal section. The lens was pushed for-

*Patient had no appearance of any return of the disease in the orbit, but he died in the last of February, 1871, one year and a few days after the operation, with all the symptoms of cancer of the liver. I saw him during his last illness.

wards against the cornea. The cavity was about half filled with the degenerated yellowish, white, granular looking retina. Above, and resting on the retina, there was a reddish uniform substance, probably the remains of a clot; and again, above that and in contact with the sclerotic, another of a deeper red color, the two filling nearly one-third of the cavity. Posteriorly, surrounding the entrance to the optic nerve, extending several lines on each side of it, there was a whitish structure of greater density, corresponding in appearance to the external tumor.

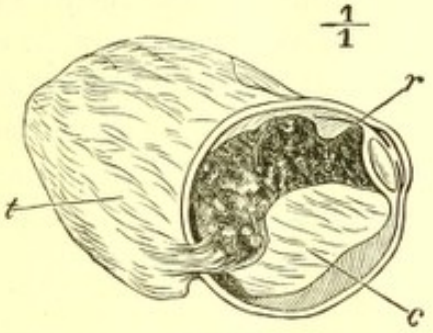

FIG. 3.

r Degenerate retina. *c* Clot. *t* External tumor.

The *sclerotic*, in the parts corresponding to the clots, and the opposite anterior half, was still intact, and lined with the, more or less, degenerated choroid. In the posterior portion, however, it was in parts, very thin and clearly perforated by the gliomatous growth. (See Figure 3.)

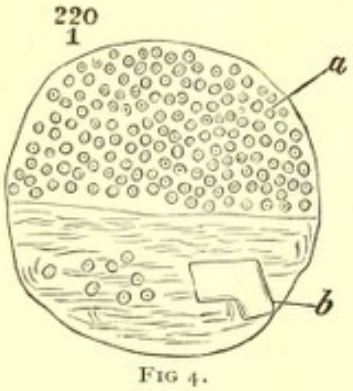

FIG 4.

a Small cells from the external tumor. *b* Cholesterin from the clot.

Internally and externally, the characteristic cells, as shown in Fig. 4, were found on microscopic examination,

the outer portion, however, being more firm, and more resembling in appearance a sarcoma. The case resembles in outline almost exactly Prof. Knapp's Case IV, as described and illustrated by him in his work on "Intra-Ocular Tumors." The cells were from the $\frac{1}{3500}$ to $\frac{1}{3000}$ of an inch in diameter. In the clot was found some crystals of cholesterin.

The child died four months after, of the extension of the disease. Is there any benefit to be derived from operation in these cases? We believe there is, provided the diseased structure has not extended so far as to involve the intra-orbital structures to any very considerable extent; and that in the operation all diseased structures be entirely removed or destroyed. The clearest evidence on this point is Knapp's first case, in which both eyes were affected; the worse one was removed early. The disease extended after a time from the *other eye*, and the child died.

Case III. *White Sarcoma of the Choroid.* A nun, aged nineteen; she had been complaining of failure in the vision of the left eye for some time. I saw the case for the first time with Dr. Pollak, Aug. 5, 1870. On examination with the ophthalmoscope, a tumor of a dirty white color was seen in the outer half of the fundus. The outlines of it could be made out imperfectly, yet irregularities, and darker and lighter shades could be discovered. The Doctor was of the opinion it was a glioma. But from the age of the patient, the appearance of the growth, and the history of intra-ocular tumors, I thought it was a sarcoma of the choroid, and so expressed. The treatment, of course, to be pursued was the same in either case.

On Aug. 6, 1870, Dr. Pollak, assisted by Dr. Hauck, myself and others, removed the eye.

The sclerotic externally posterior to the equator gave way during the operation. After the operation, a light dressing and bandage were applied.

The eye being already opened by rupture, a section of

the sclerotic was made large enough to discover the tumor; and the specimen was put into Müller's fluid (bichromate of potass. 12 grs.; sulphate of sod. 4 grs.; aqua 1 oz.) until a careful examination could be made. Some weeks later the specimen was hardened in alcohol and examined.

A horizontal meridianal section was made with scissors through the sclerotic and completed through the main tumor with a razor. (See Figure 5.)

The retina was attached posteriorly to the optic nerve, to the ora serrata anteriorly, and to the surface of the main tumor at certain points. Otherwise it was detached from the choroid and thrown into folds in the middle of the eye. The choroid lined the sclerotic except at the parts covered by the tumors.

Fig 5. 1/1

FIG. 5.

a Ruptured sclerotic *o* Optic nerve. *r* folded retina. *t* tumors.

The sclerotic was entire except at *a*, Fig. 5, where it was attenuated by the disease and ruptured in the operation. When the corrugated retina (Fig. 5, *r*) was turned aside, three tumors were exposed, (*t*) one large and two smaller ones. The two latter were situated entirely below the section. The large one had about one-third of it removed, and at the anterior and inner part it was attached to the retina. It was attached to the sclerotic by quite a broad base, and had also been, without doubt, at the point of perforation. Its inner boundary was lined with a very thin pigment, the remains of the choroid. There were also traces still of the choroid between it and the sclerotic.

The other two smaller tumors were lined also by a thin imperfect layer of choroidal pigment epithelium, so that they appeared whitish on the most prominent points of the surface. The lens and iris were in situ and intact. The interior of the tumors were uniformly white in color.

Microscopic Examination. The tumors were composed of cells, the outlines of which were generally not well

marked. With a No. 7 lens of Hartnack's system, however, the outlines in very thin sections from the middle of the large tumor could be distinctly made out in some cases. The inter-cellular material was very scanty. The nuclei were well defined and elliptical in form. (See Figure 6.)

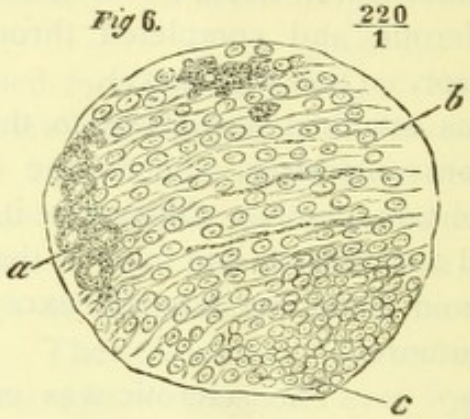

FIG. 6.

a Pigmented epithelium. *b* Rows of lymphoid cells of tumor. *c* Cells of tumor proper.

I saw the case on Nov. 5, three months from the date of operation. From the center of the socket outwards the conjunctiva was red and evidently congested. In the center there was still a little suppuration. There was very little pain. My opinion was and is that the disease will return, and that it would have been better to have removed the contents of the orbit, especially those parts corresponding to the attenuated sclerotic.

P. S. Saw the patient sixteen months after the operation in perfect health; no sign of return of disease.

CASE IV, Mr. —— Thompson, aged 35, of Nashville, Ill. The left (?) eye was operated on in 1861 for cataract unsuccessfully. I presume it was the operation for couching. The present tumor was first discovered by the patient about fifteen months before the removal, as a small hard tumor beneath the upper eyelid. The growth was projecting from the orbit at the time of its removal, which was performed on the 23d of July, 1870. The operation was performed by Dr. J. J. McDowell, who kindly presented me with the specimen the next day. The morbid structure

had extended beyond reach, some portion of it being in all probability within the cranial cavity. The specimen is about two inches in its antero-posterior diameter, of a nodulated surface, and oval form, probably so determined by the orbital walls. The cornea and anterior half of the sclerotic were still mainly entire, but the posterior hemisphere of this latter envelope was entirely gone so far as the unaided eye could discover. I observed no remains of the lens nor of the optic nerve. The eye was filled with the black structure characteristic of the tumor in general.

The tumor was a melano-sarcoma, in all probability arising from the choroid, first filling the eye, then perforating the sclerotic at or near the optic nerve, and later filling the orbit. The exciting cause may have been the operation for cataract (that of couching?) The other eye had been lost years before by rheumatic (?) inflammation.

The anatomical characters were, in general, the same as that of Case I, and had the nature of the case been recognized early and the eye removed before the perforation of the sclerotic capsule, or even soon after, life might have been saved* in this as well as in the case of Mr. Stubbs.

Case v. Daniel Smith, aged 21 months. The patient had had erysipelas of the face the year previous to the removal of the eye. The operation was performed by Dr. Hodgen, in July, 1869. The specimen was sent me sometime afterwards for examination. About one-third of the posterior hemisphere of the sclerotic was destroyed. The diseased structure was composed of small round cells as in Figure 4.

Case vi. Eudora Brescoe, aged two years and eleven months. Brought to St. Luke's Hospital June 7, 1870. A tumor of the left eye, covered with inspissated pus and blood, was projecting largely from the orbit. Assisted Dr. Hodgen remove the tumor, and examined it at his request.

*Died March 25, 1871.

It was composed of a soft whitish brain-like material. The sclerotic and cornea were destroyed in front, and the mass was so much broken up removing it that the parts of the eye could not be readily distinguished except the sclerotic posteriorly. The microscope showed the growth to be composed of small round cells with very soft intercellular structureless material. I have the specimen in my collection, but it is not such as would be sufficiently instructive to warrant illustration.

Case VII. Master Flood, aged five years and ten months. Came to St. Louis (Sisters') Hospital July 29, 1871. There was a protruding tumor of the right eye, covered with dried blood and pus. (See Figure 7.) The appearance of a growth within the eye was discovered about a year previously; and about six months since the eye began to be prominent. I had a photograph taken of the case. Dr. Gregory, assisted by others and myself, removed the tumor. I examined portions of the tumor while recent; and after preserving in Müller's fluid examined it more thoroughly. The tumor measured three-quarters of an inch in the antero-posterior diameter. There were remains of the sclerotic, iris, choroid, and optic nerve still to be recognized. The structure was composed of the small round cells heretofore described. The patient returned home in about a week. A few days since I received the following letter as answer to an inquiry of the case: "The boy in question is dead. For three weeks after he arrived home he did splendidly, eating or sleeping the greater portion of the time. The eye seemingly healed and got all right; but after some time he complained of a pain in his temple and a violent vomiting which terminated in frequent

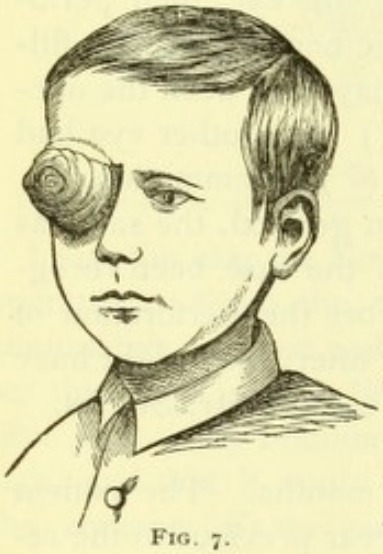

Fig. 7.

spasms and death, which occurred about one month after the operation was performed."

The following is a tabulated statement of the above seven cases:

NO.	VARIETY.	EYE.	AGE.	OPERATION.	RESULT.
1.	Melano Sarcoma.	R. Eye.	60.	Enucleation.	No return in the orbit.
2.	Glioma.	L. Eye.	2½.	Enucleation.	Died in 4 months.
3.	White Sarcoma.	L. Eye.	19.	Enucleation.	No return thus far, 16 mos.
4.	Melano Sarcoma.	———	35.	Removed.	Died 8 months after.
5.	Glioma.	———	2½.	Removed.	Died within 4 months.
6.	Glioma.	L. Eye.	2½.	Removed.	Unknown.
7.	Glioma.	R. Eye.	5.10.	Removed.	Died in 1 month.

General Remarks. It is within a comparatively recent date that the nature of intra-ocular tumors has been understood, or their importance appreciated. Hirchwald, Graefe, Hulke, Virchow, and lastly Knapp, in his work on "Intra-Ocular Tumors," together with cases from others, have given us materials, worked up with so much care and detail, as to form a basis on which certain theories may be built, and from which some conclusions may be arrived at, approaching certainty, in a good degree.

There are very few well authenticated cases of malignant or semi-malignant intra-ocular tumor which cannot be properly referred to glioma of the retina, or to sarcoma of the choroid or ciliary body.

The cases of glioma are not so frequent as those of sarcoma, though in our seven cases there were four of the former, and but three of the latter.

Glioma is a disease of childhood; no well established case, so far as I now recall, of primary glioma having been recorded in grown persons. There are cases of glio-sarcoma, or those in which the retina became involved by the sarcoma, as in our Case III. The only cases with which it may be confounded, after careful examination, are those of white sarcoma of the choroid, which may occur in young persons. But a diagnosis may still be made, by means of the ophthalmoscope, with a strong probability of its being correct. In the early stages of glioma the peculiar ramifications of the retinal vessels may be recognized on the sur-

face of the growth; but in the sarcoma an irregular branching of the vessels is to be seen accompanied frequently with extravasations. Again, glioma in addition to its almost metallic lustre, has generally either an extended surface, or is composed of numerous clusters of various sizes. It is the only tumor of the retina so far as Knapp's examination extends, and my cases correspond.

The prognosis is almost entirely dependent upon the extent of the disease as marked by the sclerotic capsule. If the disease has extended so as to involve the orbital contents to any considerable extent, operative procedures are but palliative. Case VI was certainly benefited by the operation.

The *treatment* is the removal of the globe in the earliest stage, indeed as soon as the nature of the case can be made out. If there is any reason to suspect extension of the disease beyond the sclerotic, or if there is even a doubt about the disease being confined within the sclerotic, give the patient the benefit of the doubt, and remove the orbital contents in proportion to the possibility of the present extension of the disease. If it has perforated the sclerotic capsule and involved the connective tissue, and, perhaps, formed a tumor, causing the ball to protrude, the entire orbital contents should be removed, followed by the application of chloride of zinc paste as recommended by Hulke.

Sarcoma, as defined by Virchow, is in this language: "I understand thereby a formation, the tissue of which, according to the general group, belongs to the connective tissue series, and which is distinguished from the sharply defined species of the connective tissue groups only by the preponderating development of the cellular elements." Vol. II, page 777, Krankhaften Geschwülste. Sir James Paget, in his last edition, page 544, of his Lectures on Surgical Pathology, makes the following remarks: "The term sarcoma has recently been revived by Virchow and other pathologists in Germany, and employed to designate a group of tumors, the tissues forming which belong to the series of

connective substances, but which are distinguished from the tumors formed of the connective tissues by the preponderating development of the cell element." The following varieties of sarcoma have been distinguished: A—Tumors with spindle shaped cells, the fibro-plastic cells of Lebert (spindelzellen sarcoma, recurrent fibroid fibro-plastic). B—Tumors with colossal, many-nucleated or myeloid cells (reisenzellen sarcoma, myeloid tumors). C—Tumors with small round cells, like the lymph or white blood corpuscles, or pus or granulation cells (rundzellen sarcoma, granulations sarcoma, glio- or lympho-sarcoma). D—Tumors with stellate cells and gelatinous, shiny, intercellular substance, not unlike the material found in a myxoma (myxo-sarcoma). E—Tumors with round or variously shaped cells, most of which are of large size, are usually imbedded in a fibrous matrix. In structure no well-defined character distinguishes these tumors from carcinoma. F—Tumors in which the cells contain a considerable proportion of pigment, which is most frequently found in the cells described in the last group, in the tumors with round and with fusiform cells (pigments sarcoma, melanoma). In all these forms an intercellular substance occurs, which may be either homogeneous or fibrous, or which may present a delicate, net-like, or trabecular structure, such as is found in the lymphatic gland. But the tumors classed under the name of sarcoma vary also greatly in their characters, and in the localities in which they grow. Pendulous growths from the gum, soft, fleshy warts in the skin, myeloid tumors of the bones, tumors in muscles and faciæ, tumors in the female breast, clusters of enlarged lymphatic glands, have all been grouped under this head.

"After a careful consideration of the matter, we are inclined to think that the group is too vague, and is made to embrace tumors which are too diverse both in consistence, color, vascularity, structure, mode of growth, seat, course, and effects on the patient, to be included under one common term. We are not prepared, therefore, to em-

ploy the term sarcoma in the classification of tumors; for we believe that the morbid growths which have been ranked under that name, may be more satisfactorily and precisely arranged under one or other of the heads employed in these lectures."

We are strongly inclined to Mr. Paget's views, as expressed in the last paragraph. We have chosen for the present to call cases I, III, and IV sarcoma for the sake of convenience, rather than with a view of adhering strictly to the doctrine set forth in the definition of sarcoma by Virchow.

We may say that a morbid growth, malignant or semi-malignant, may arise in a given tissue and yet not arise from the elements of saidt issue. In other words, the elements of a morbid growth may originate as an infiltration between the natural elements of a healthy tissue.

We may here refer, for a few moments, to opinions as to the origin of glioma of the retina.

Scweigger says, in describing a case, Band VI, part 2, Graefe's Arch., "the glioma probably arose from the inner granular layer of the retina."

Hirchberg reports the examination of eight cases, and concludes that "glioma arises from the round cells of the inner granular layer."

Virchow says, l. c., vol II, 163, "was das reine glioma betrifft so entwickelt es sich zunächst von den Körner- und Zwischenkörnerschichten."

Again, "the boundary of glioma proper is defined, according to my notion, by the size and form of the elements. So long as the nuclei and cells do not surpass in size (or only to a moderate extent) the normal elements of the granular layer, so long can we regard the growth as a simple hyperplasia."

Knapp says in Arch. of Ophthalmology and Otology, vol. 2, No. 1, page 42, in describing a case of glioma of the retina: "The retina, not far from the ora-serrata, was the seat of conspicuous changes. It swelled by multiplication of small cells, *the origin of which* in many places could be *distinctly traced to the inner granular layer.*" Again, page 43: "In the vast majority of the preparations taken from the anterior portions of the retina, where the tumor was located, the *elements of the pseudoplasm originated in the inner granular layer.* Both granular layers, indeed, were blended, and the intergranular layer had disappeared, but the primary clusters of the newly formed elements never occupied the outer layers." Page 44, "All this leaves no *doubt that the inner granular layer was the starting point of the pseudoplasm, although a limited growth* was also observed in the *outer granular layer* and the *inner* (molecular, ganglionic, and nervous) *layers* of the retina." He adds further on this case, page 51, as a "maxim," "extirpate when the tumor is still a local disease, that is, before infection of the system has begun, and life will be saved."

Dr. Francis Delafield, in the examination of five cases of "tumors of the retina" makes the following remarks.—Arch. of Ophthalmology and Otology, vol. 2, No. 1, page 58. In the first case, "The eye, while still warm, was opened by horizontal section"; "the cavity of the globe, posterior to the lens, was filled with a soft, whitish mass, stained red in some places by hemorrhages, and so soft as to be semifluid. The elements of this mass, examined without the addition of any fluid, (Hartnack, No. 9, immers.) were round cells, of very pale, finely granular appearance, exhibiting no nucleus until iodized serum was added, and measuring .0116 mm. ($\frac{1}{2153}$ in.)" "After hardening the eye in Müller's fluid, in sections of that part of the retina which is continuous with the tumor it is found that the rods and cones and membrana limitans externa are everywhere unaltered. In other sections the new growth reaches only to the external intergranular layer." Page

60, "As regards the precise point in the retina which gave rise to the tumor, we can only say with certainty that it was to the inner side of the external intergranular layer. Nearly all authors describe the cells which make up these retinal tumors as if they were identical with the granules of the retina, and formed by hypergenesis from them. The supposition that they are formed by proliferation of the retinal granules seems to be purely hypothetical." He concludes, after the examination of five cases that: 1. "The rule laid down by Hirschberg that retinal tumors grow outward toward the choroid, has many exceptions. 2. The elements of these tumors only resemble the granules of the retina when altered by reagents and seen with low powers. When examined fresh and with high powers, they are seen to be identical with the so-called lymphoid cells which compose so many new growths. 3. If we dismiss from our minds the superficial resemblance between the elements of these tumors and the retinal granules, they at once take their place in the class of round celled medullary sarcoma. 4. The variation in the size of the cell body and in the proportion of stroma in the different parts of these tumors, is almost always found. This variation is the same which we find in most sarcomata, and is no reason why we should speak of a tumor as beginning as a glioma and then becoming sarcomatous. 5. Not only the anatomy, but also the clinical history of retinal tumors corresponds exactly with those of the medullary sarcomata. 6. The development of secondary tumors follows the rule laid down by Virchow for sarcomata, and occurs: (1) by continuous infection of the retina, optic nerve, and, perhaps, the brain; (2) by discontinuous infection, forming the choroidal, scleral, and episcleral tumors; (3) by metastasis proper, forming tumors in the bones, lymphatic glands, and liver."

We give in tabular form the termination of the five cases of retinal glioma examined by Dr. Delafield:

No.	Variety.	Age.	How long discovered before operation.	Result.
1.	Glioma retinæ.	18 mo.....	3 mo.....	No return for 2 months.
2.	"	.. 4 yrs.....	2 yrs.....	Died within a year after operation

3.	Glioma retinæ...	4 yrs.....	8 mo.....	Died within a year.
4.	"	.. 2 yrs.....	1 yr.....	Died within 3 months.
5.	"	.. 2½ yrs....	6 mo.....	Died in 3 months.

Also six cases by Prof. Knapp:

No.	Age.	Period of death after operation.
1.....	18 weeks.....	2 years.
2.....	4 years.....	4 weeks.
3.....	2½ years.....	3 months.
4.....	2 years.....	2½ months.
5.....	2½ years.....	3½ months.
6.....	2½ years.....	Probably died.

These tables exhibit a mortality most discouraging, if no better results can be obtained. Most of the cases—all, indeed, in our own table—were far advanced before the operation, and the details show that in most, if not in all the cases of glioma, the disease returned in or near the original site. May we not, however, hope that, as the means of diagnosis in these cases have been greatly improved within a few years, and as the public have more confidence in the opinions of the profession in this particular department than formerly, the cases will be brought earlier for treatment while yet, perhaps, within the reach of successful operation?

We have seen from the quotations, that authorities differ essentially as to the exact point of origin or coat in the retina, in which glioma arises, some giving the inner, and some the outer coats (körner- und zwischenkörnerschichten) of that complex structure.

Such a difference, of little or no importance in a practical point of view, is not difficult to account for, when we take into account the minute anatomy of the retina. Formerly this membrane was described as being composed of *five* layers, viz., Stratum bacillosum or tunica Jacobi, the granular or nuclear layer, the ganglionary layer, the vesicular layer, and the fibrous expansion of the optic nerve.

Below we give a table of the different strata, with their respective thickness at given distances from the optic papilla. I have reduced this table of Heinrich Müller to

inches (approximately). In it there are seven layers given, and the third is farther divisible:

Distance from margin of the optic papilla.	Layer of rods and cones (Stratum bacillosum)	Granular layer.	Outer fibrous and granulated (Intergranular) layer.	Outer ganglionary layer. (Stratum granulosum.)	Inner granulary layer (finely granular layer.)	Inner ganglionary layer.	Layer of nervous fibers.
$\frac{1}{30}$	$\frac{1}{500}$	$\frac{1}{562}$ to $\frac{1}{430}$	$\frac{1}{833}$ to $\frac{1}{625}$	$\frac{1}{714}$	$\frac{1}{710}$ to $\frac{1}{625}$	$\frac{1}{1666}$	$\frac{1}{125}$
$\frac{1}{25}$	.....	.....	.....	.....	.....	.....	$\frac{1}{260}$
$\frac{2}{25}$	.....	$\frac{1}{697}$ to $\frac{1}{500}$	.....	$\frac{1}{857}$	.....	.....	$\frac{1}{625}$ to $\frac{1}{312}$
$\frac{5}{25}$	.....	.....	.....	.....	.....	$\frac{1}{2083}$	$\frac{1}{1250}$ to $\frac{1}{83}$
$\frac{8}{25}$	$\frac{1}{562}$	.....	.....	.....	.....	$\frac{1}{1000}$ to $\frac{1}{890}$	
$\frac{11}{25}$	.....	.....	$\frac{1}{890}$	$\frac{1}{950}$	$\frac{1}{730}$	$\frac{1}{1250}$	
$\frac{14}{25}$	.....	$\frac{1}{833}$	$\frac{1}{1250}$	$\frac{1}{1250}$	$\frac{1}{833}$		
$\frac{18}{25}$	$\frac{1}{625}$	$\frac{1}{1000}$	$\frac{1}{1850}$	$\frac{1}{1500}$	$\frac{1}{626}$ to $\frac{1}{500}$		

Henle* regards the retina as being composed of two general divisions: the first, the outer, on account of its mosaic (mosaikähnlichen) arrangement, he designates as the *mosaic layer* (musivische schichte); the second, the inner, as the *nervous layer* proper. The whole retina is divided more minutely into the (10) secondary layers, of which the *mosaic layer* comprises the first three: 1, the *layer of rods* and cones (stratum bacillosum); 2, the *membrana limitans externa;* 3, the *granular layer;* between this latter and the *nervous layer*, there is a thin layer, the 4, or *outer fibrous* layer. The nervous layer comprises five (5–9) of the secondary layers, four of which (5–8) belong to the *grey substance*, and one (9) to the *white;* 5, the *outer granulated* layer; 6, the outer *ganglionary* layer; 7, the *inner granulated* layer; 8, the *inner ganglionary* layer; 9, (white substance) inner layer of *nervous fiber* (expansion of the n. opticus). Tenth (10) is the *limiting*

* Eingeweidelehre S. 640.

membrane (limitans hyaloidea) which serves to unite, and, at the same time, to separate the retina and the vitreous body.

Considering the rapid changes that occur in the healthy eye after removal, and our imperfect knowledge of the exact structure of the several granular and ganglionary layers which enter into the structure of the retina, it is not strange, after pathological changes have ensued, that difficulties should arise as to the origin of glioma retinæ.

The growth may commence in any layer of the retina, anterior or posterior. We do not accept as a fact that glioma is nothing more than a hyperplasia of the retinal granules. It may and does arise in, but we do not think from, the retinal granules, otherwise it would seem there should be a nearer resemblance between its elements and those proper to the retina than there is. The difference can be observed in a fresh specimen by using high powers. The granules of the third layer, when examined fresh with high powers, are ellipsoidal in form, the longer axis is from $\frac{1}{4000}$ to $\frac{1}{3500}$ of an inch in length, and placed perpendicularly to the plane of the retina; while the shorter diameter is but little more than half the length. When viewed from the side these granules show delicate parallel markings, which remind one of the striation of muscular fiber*.

If we admit that the granules of the retina may be simply changed by the pathological action and growth, rather than destroyed and replaced, then indeed may we find a partial confirmation of the view which looks upon glioma of the retina as a hyperplasia of some one or more of the retinal layers. But, at present, its exact *manner* of origin is as uncertain as that of any other malignant growth.

The greater number of cases which were in a condition to show the *place* of origin, seem to show the inner granular layer (7th of Henle), or, at least, the inner portion of the retina, as the part in which the growth arose and extended.

* Henle, l. c., p. 648.

We regard glioma of the retina as a local manifestation of a general predisposition or condition, requiring for this local manifestation a favorable condition of both part and system before the development will occur. It generally appears only in one eye; it may appear in both simultaneously. If this be the true view, what benefit can be derived from removal of the local disease?

We answer, it will cut off the main source of constitutional poisoning, and thus, at least, weaken the general or predisposing cause, and, it may be, to such an extent, as to entirely prevent any farther new developments of the disease for a greater or less length of time—*possibly altogether*, though we must confess that observations of cases, so far as they occur to us now, are quite insufficient to establish this latter view as one to be received as established. But we do know that, in many diseases, the removal of the local affection has much to do in diminishing the constitutional force or power for new developments of the disease.

At the least, the operation for retinal glioma, as for many other malignant diseases, is, in most cases, justified and demanded, to give the patient ease and quiet of mind for weeks or months.

Respecting the choroid, the structure is not so delicate nor so difficult to make out. Formerly the choroid was described as being composed of three layers, viz.: the outer, which united the choroid and sclerota, and was called *lamina fusca;* the second, the *vascular layer*, supposed to be composed of an arterial and of a venous portion, the former of which was called the *tunica Ruyschiana;* and the third, the *hexagonal* choroidal epithelium. Now, however, we have, (1) the *membrana suprachoroidea* (lamina fusca), in which is found so freely distributed the *brown stellate cells;* secondly, (2) the layer of *coarser vessels* (*tunica vasculosa Halleri*, or venous vascular lamella of M. J. Weber); thirdly, (3) the *capillary layer* (*tunica Ruyschiana* of Todd and Bowman, or arterial vas-

cular lamella of M. J. Weber), these three being regarded as the (*a*) CHOROID PROPER. Next follows the fourth, (*b*) BASEMENT MEMBRANE or elastic lamella (lamina vitrea choroideæ, Arnold), which lies immediately external to, and sustaining (*c*) the CHOROIDAL or HEXAGONAL PIGMENTED EPITHELIUM (Stratum pigmenti. Tapitum nigrum. Choroidal epithelium of Todd and Bowman).

The origin and development of choroidal sarcomata are questions not definitely settled. We know that in most of the cases, as in our I and III, the growth arises in the choroid proper; that is, in the vascular portion, (second and third layers, especially the former, as we have given them above). Whether the commencement is from morphological elements escaping from vessels and carrying with them a certain pathological impress which determines the form and character of the cells, etc., composing the tumor; or, that amorphous elements of the blood determine changes in the normal structures, we do not positively know, but are inclined to the former view.

The treatment for sarcoma, as for glioma, is entire removal of the diseased part at as early a date as possible.

We here acknowledge our obligations to Prof. E. E. Edwards, of McKendree College, Ill., for accurate pencil sketches from the photograph, for the wood-cut in Case VII.

Not being able to be with the engraver, we observe some inaccuracies made in Fig. 6. The pigmented epithelial cells at *a* should not have been made round, but irregular in outline. "Rows of lymphoid cells of tumor" should have been followed by a note of interrogation (?) and not a period.

P. S. CASE VI. Brescoe, died January 28, 1871, at Capaugris, Mo.

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