

which will develop into an addiction from the slightest exciting cause in after years.

SECONDARY GLAUCOMA.

A CLINICAL AND PATHOLOGIC REPORT OF THREE CASES, REPRESENTING DIFFERENT TYPES OF THE DISEASE.*

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Secondary glaucoma may be defined as being that variety of glaucoma which occurs as a result of some pre-existing disease of the eye which has caused an increase in the intraocular tension by obstructing the angle of the anterior chamber. It is not the purpose of the writers to enumerate the conditions which may effect this closure, but merely to give a detailed report of three cases which occurred in their practice, in all of which such an occlusion was found, and in addition, to call especial attention to conditions which existed in two of the eyes.

CASE 1.—J. E. G., male, aged 39 years, first consulted Dr. Posey about his eyes three years ago. His primary ocular affection dated back four years, and was said by the patient to be characterized by pain, redness and dimness of vision in both eyes, though he thought that the inflammation was more severe in the right eye. He was treated for this attack over a period of some months by the late Dr. Keyser, and recovered with good vision in each eye. Shortly after the inflammation in the eyes had subsided, however, transient attacks of redness in his right eye occurred, which were associated with pain that was most severe in the temple, but sometimes radiated into the nose; vision also began to deteriorate. The left eye occasioned him no trouble. Instead of consulting an ophthalmologist, he applied domestic remedies of different kinds to the affected eye, and continued them for several years, as he found that he succeeded in reducing the acute symptoms by these measures fairly well.

As he noticed several months prior to consultation that the attacks of inflammation recurred more often, and that the remedies which he employed were no longer so successful in causing their subsidence, and as his vision had become much reduced, and the pain was at times almost unbearable, he decided to seek proper surgical aid.

At the time of the first examination it was ascertained that the right globe was in an advanced stage of secondary glaucoma; there was intense ciliary injection, with engorgement of the peri-corneal veins; the cornea was hazy and presented a needle-stuck appearance; the anterior chamber was almost obliterated; the iris was discolored and thickened; the pupil was 3 mm. in size and was immobile to light. Tension was +2. No view could be had of the fundus by the direct method of ophthalmoscopic examination on account of the corneal haze, but with the indirect method a deep glaucomatous excavation with dilatation of the retinal veins could be clearly seen. Vision equaled 3/50. The left eye was quiet, though a faint annular stippling of pigment upon the anterior capsule of the lens evidenced a previous iritis in that eye also. The fundus was plainly seen, and showed no gross pathologic change other than a diffuse perivasculitis of the retinal vessels, which was most pronounced in the large arterial streams. The field of vision was reduced to a small triangle, the apex of which corresponded to the fixation point, and the base

to a segment in the temporal field about twenty degrees broad. Central and peripheral vision in the left eye was normal.

As the patient admitted having had a primary sore some eighteen months previously, he was at once placed on a dram of mercurial inunction twice daily. Two drops of salicylate of eserin—gr. 1/8 to the ounce—and five drops of muriate of cocain—gr. 4 to the ounce—were ordered to be instilled into the eye five or six times daily, and his bowels were freely opened by salts in the mornings. After two weeks of this active treatment, the eye had improved to such an extent that the vision now equaled 5/15, the cornea was practically clear and all the details of the fundus could be seen with the direct method, the head of the nerve being found to be excavated both above and below and to the nasal side though but slightly to the temporal side. Two weeks later, one month after the installation of the inunctions, vision was brought to normal by +1.5 Sph. +3 cyl. ax. 20°; the field of vision, however, remained as before.

About one week later the patient returned acknowledging that he had relaxed some of the details of the treatment, and complained of intense pain and poor vision in the affected eye. The ciliary injection, which had entirely subsided, had recurred with great intensity, and the cornea was now exceedingly hazy. The iris was congested, and, at a point to the nasal side corresponding to the minor circle of the iris, there was a small yellow spot with marked engorgement of the vessels in this position. A small hypopion had also formed at the bottom of the anterior chamber. The patient was at once admitted to the Howard Hospital, his temple leached, and ice compresses applied to the eye almost constantly, and cocain—gr. 4 to the ounce—instilled every two hours, the eserin being withdrawn. The bowels were freely opened by rochelle salts and the mercury continued. After a few days of this treatment the eye again whitened, and at the end of two weeks he was discharged from the hospital, corrected vision equaling 5/6.

For several months after this the eye did uniformly well, although the patient was compelled to be extremely cautious regarding his manner of living, and most assiduous in the care which he gave to his eyes. After an interval of several weeks' absence from the office, and following some indiscretions in his manner of living, another glaucomatous attack supervened; light perception was abolished, and the eye was so painful that enucleation was advised and willingly consented to. The patient was re-admitted to the Howard Hospital, and the globe removed under ether narcosis. The socket healed rapidly after the operation and an artificial eye was inserted several weeks later. The patient was seen after the lapse of a year, and found to be using his remaining eye without any discomfort. Vision equaled 5/5 with the proper lenses and the eye was entirely free from inflammation.

The eyeball was placed in Mueller's solution at the time of operation, and was subsequently frozen in a mixture of ice and salt, and cut into halves by a horizontal section passing through the optic nerve and the center of the cornea. One-half was mounted in glycerin jelly for macroscopic demonstration while the other was carefully dehydrated in alcohol and embedded in celloidin. The sections obtained for the celloidin-mounts varied in thickness from 1.15 to 1.25 mm., and were stained in hematoxylin-eosin, Van Gieson, and by Weigert's nerve-sheath method. The other two eyeballs were treated in the same manner.

*Read before the Ophthalmological Section of the College of Physicians of Philadelphia, April 17, 1900.

Pathologic Findings.—Macroscopically, the globe measured 22 mm. in the antero-posterior diameter, and 23.5 mm. in the horizontal diameter. Retina was in place; anterior chamber shallow at the periphery; nerve atrophic and nerve-head pathologically excavated.

Microscopically, the cornea is normal, except for distension of the vessels at the limbus. The base of the iris is adherent for a short distance anterior to the canal of Schlemm, and the distance between the iris and cornea anteriorly is very much reduced. The iris shows changes due to low-grade chronic inflammation, as indicated by an increase of the cellular elements, moderate condensation of tissue, decided thickening of the vessel-walls, and some heaping of pigment, especially in the region of the sphincter. There is one small posterior synechia above, inside the pupillary area. The lens shows nothing abnormal. The nerve is reduced in volume and the connective-tissue septa are hypertrophied.

little trace remaining of the neuroglia cells and investing pial sheath. Elsewhere there is complete atrophy of the entire nerve except for a few peripheral fibers on both nasal and temporal sides. There is, however, no disappearance of the investing sheaths as in the cavity described above. The intervaginal space is widely distended. The retina was artificially detached in hardening, but the layer of rods and cones and the nuclear layers all seem to be well preserved, while the ganglion cells appear to be much reduced in number and their nuclei stain poorly, but as the specimen was hardened in Mueller's fluid the Nissl stain was refused and their exact condition can not be determined. The pigment layer is normal, there being no proliferation of the cells, or pigmentation of the retina. The choroidal vessels are distended but otherwise this tunic and the sclera are entirely normal.

Diagnosis.—Chronic iritis, blocking of anterior cham-

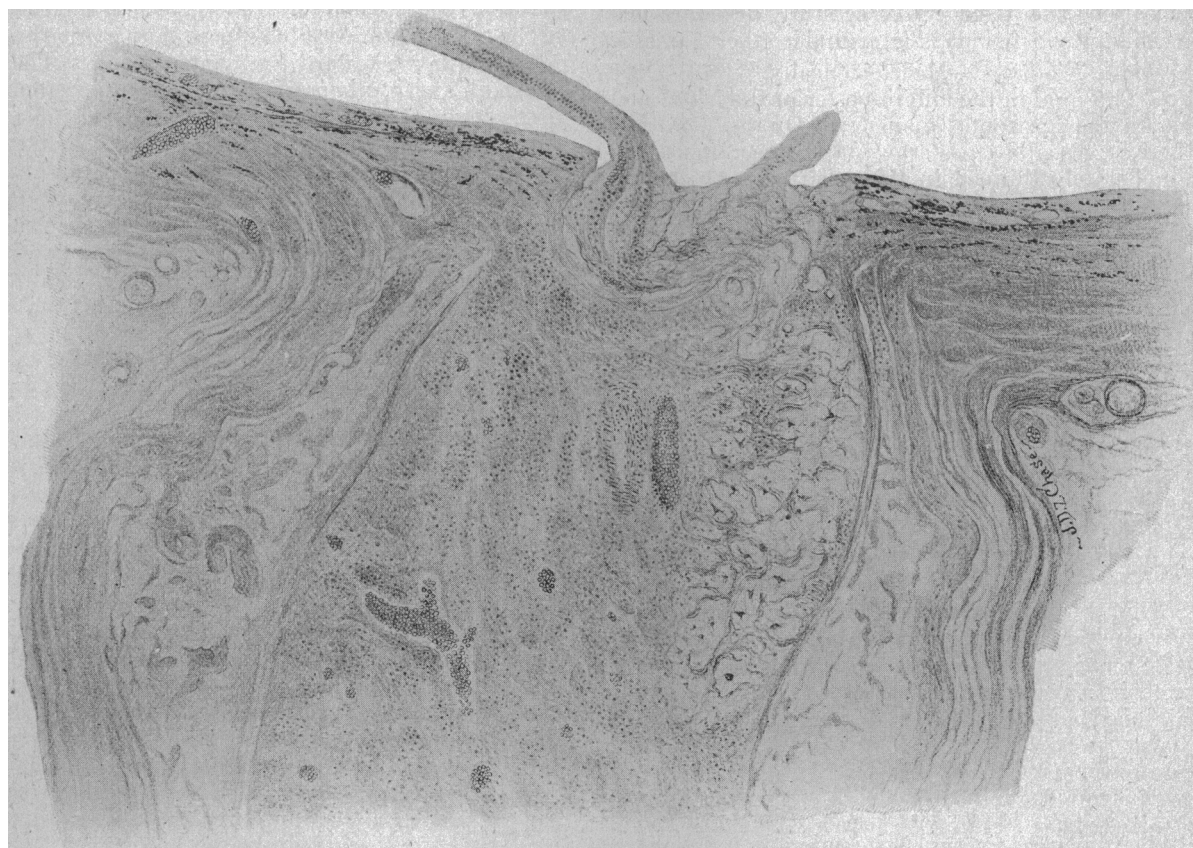


Plate 1.—Sketch of optic nerve entrance, showing area of rarefaction.

The excavation in the nerve-head is .75 mm. deep, with very steep edges, especially on the nasal side; it involves the entire papilla, and is partially filled with a mass of loose-meshed connective tissue—neuroglia fibers—but the nerve fibers are pressed to one side. The fibers of the lamina cribrosa bend backward in a sharp curve. On the temporal side of the nerve, beginning at the level of the excavation, and extending backward a distance of 2 mm. from the bottom of the excavation, there is a cyst-like space, reaching from the external sheath of the nerve, almost to the central vessels. (Plate I.) At this position there is a marked atrophy of the connective-tissue bundles; the fibers being reduced in size and widely separated, leaving gaps in the tissue. Except at the margin of this cavity, where a few of the nerve-fibers retain the Weigert stain, the nerve bundles have not only become atrophic but have absolutely disappeared, but

ber; secondary glaucoma, with excavation of nerve-head, and nearly complete atrophy of the nerve. Complete disappearance of the nerve-fibers and investing tissue in one portion of the nerve. Beginning atrophy of the retina.

CASE 2.—B. McK., female, aged 30 years, presented herself at the ophthalmologic clinic of the Howard Hospital eighteen months ago with a history of having sustained a fall on the ice five years previously, as a result of which she had received a severe blow in the right temple. The eyelids of this side of the head were swollen to such a degree that leeching was necessitated. After the swelling in the temporal region had subsided, she noticed that the right eye, which had always been near-sighted, was now almost blind. She made no effort however, to have the vision in the eye improved, nor to obtain relief from transient attacks of pain and redness, which

manifested themselves in the eye at frequent intervals for several years after the accident. Finally, however, the pain became so acute that she decided to seek professional advice, although she now despaired of anything being done to restore the sight, as the eye had been quite blind for five months.

At the first examination, the tarsal and ciliary injection in the right eye were seen to be intense; the anterior chamber was shallowed at the periphery, though the iris was bombé and its pupillary edge in-drawn, especially below. The lens was densely cataractous and emitted a yellowish reflex. Tension could not be determined, on account of the intense degree of ciliary tenderness. The left eye was quiet, and presented no changes other than are usual in a myopic eye of 16 D. Vision in the right eye was reduced to perception of light eccentrically to the temporal side; vision in the left eye equaled 5/20.

Enucleation was advised and successfully accomplished by Dr. Shumway a few days later under ether narcosis.

Pathologic Findings.—Macroscopically, the globe measures 24.5 mm. in the antero-posterior diameter, and 24 mm. in the horizontal diameter. On the temporal side there is a shallow posterior staphyloma, the sclera being moderately thinned in this position. The retina is totally detached, and the subretinal space filled with a homogeneous exudate. The anterior chamber is shallow at the periphery, but quite deep at the center, and the lens and iris are imbedded in a mass of exudate.

Microscopically, the cornea shows a moderate infiltration with round cells at the periphery and the vessels at the limbus are distended with blood. Descemet's membrane is normal at the center, but on each side has been ruptured, and remains adherent to the anterior surface of the iris, to which it is attached by a layer of partially organized exudate, showing that during life the iris was pressed against the cornea. The filtration angle is blocked and on the nasal side the canal of Schlemm is surrounded by infiltrated cells containing pigment, evidently derived from the iris and ciliary body. The iris shows evidence of chronic inflammation, being covered anteriorly with an exudate containing but few cells. The stroma is much condensed, having been converted into dense connective tissue; the vessel-walls are thickened and their lumen is nearly obliterated in places, but everywhere filled with blood. The pigment is deposited in irregular clumps and in certain areas is much proliferated. It is attached to the lens capsule in several places by an organized exudate, and the lens capsule is covered with a similar though thinner membrane in the pupillary area. All communication between anterior and posterior chambers is thus abolished. On the nasal side, the attachment between the iris and lens is nearly complete, and where this has occurred the lens shows several small capsular cataractous formations between the capsule and its lining epithelium. The lens is imbedded in an exudate which contains but few cells on the temporal side, but which is organized on the nasal side where it is connected with the dense adhesions between the iris and the lens capsule. Here the ciliary processes are drawn inward, and the pigment epithelium on their inner surface is very markedly proliferated. The ciliary processes are becoming atrophic, and there is beginning detachment of the entire ciliary body, the fibers being pulled apart and the interstices filled with fluid. The lens, in addition to the capsular cataracts noted above, shows a splitting up of the fibers, and their conversion into irregularly round masses, especially at the posterior pole, and at the equator. No laceration

of the capsule can be seen. The choroid is thin and atrophic, the fibers composing the stroma being widely separated, probably by the shrinking of the subretinal exudate during the artificial hardening of the globe. The retina is totally detached, and extends as a folded and twisted membrane from the nerve entrance almost to the lens, and then turns abruptly to its attachment at the ora serrata. It is partially disorganized; the rods and cones have entirely disappeared; the molecular layers are fairly regular, but the nerve-fiber layer is very much thickened, being converted into dense connective tissue, and the ganglion cells have disappeared. The nerve shows an increase in the cellular elements. On superficial examination, the fibers appear to retain the Weigert stain remarkably well, but under high power the myelin sheaths are seen to be broken down in places into fine drops. The degeneration is probably acute and does not involve the majority of the fibers. The nerve entrance is oblique, and there is a moderate distension of the supra-vaginal space, but no marked pulling of the nerve toward the temporal side. The sclera is normal, and at the position of the shallow staphyloma on the temporal side, shows a thickness of .55 mm. in contradistinction to a thickness of .95 mm. at the corresponding point on the nasal side of the nerve.

Diagnosis.—Detachment and secondary fibroid degeneration of retina; plastic iritis with posterior and anterior synechiae; occlusion of pupil; anterior capsular and posterior cortical cataracts; blocking of angle of anterior chamber, and secondary glaucoma in myopic eye.

CASE 3.—L. W., aged 61 years, said that her left eye had become blind ten years previously from an ulcer for which she had been treated at another hospital. No history of traumatism could be elicited, and as she was in apparent good health, the cause of the ulceration had been attributed to "catching cold." Although the eye had remained quiet for a time after the primary inflammation had been combated, she had suffered repeatedly from attacks of pain and redness in the eye, from which she obtained only partial relief by the persistent use of drops which she obtained from various clinics.

At the time of the first consultation at the Howard Hospital, both tarsal and ciliary congestion of extreme degree were noted as occurring in the left eye. The cornea was hazy throughout its entire structure, but at its center there was an irregular denser area of scar tissue. There were two similar narrow bands to the nasal side. The anterior chamber appeared to be very deep, the plane of the iris being drawn backward. A yellow reflex was obtained from the pupil, but no red glare could be detected. Tension was elevated, but it was impossible to ascertain to what degree on account of the extreme sensitiveness of the eye. The right eye was slightly hypermetropic, but presented no other changes, its vision equaling 5/9. Sight in the left eye was totally obliterated.

Enucleation was advised and successfully performed by Dr. Shumway under ether narcosis.

Pathologic Findings.—Macroscopically, the eye measures in the antero-posterior diameter 20 mm. and 20.5 mm. in the horizontal diameter. The anterior chamber is very deep, and the cornea is conical, 8 mm. in diameter, the periphery being drawn inward and backward. On the nasal side, just posterior to the ora serrata, the sclera is also drawn inward. No portion of the nerve appears. The retina is detached and degenerate, the vitreous cavity being filled with a mass of exudate and blood.

Microscopically, the corneal epithelium is thickened and everywhere separated from Bowman's membrane by a round-cell infiltration, and by minute blood-vessels. This round-cell infiltration is densest at the limbus, where the epithelium is widely separated from the cornea. In the substantia propria there is a moderate extension of round cells between the deeper layers. At the central part of the cornea Bowman's membrane is interrupted, and directly beneath this the laminae are replaced by dense scar tissue. The cornea is thinned in this area, and Descemet's membrane absent, a sharp notch appearing in the posterior surface of the cornea, which is partly filled with degenerate cells partially pigmented and with pigment clumps. This apparently indicates the point of perforation of the cornea, with attachment of the iris. Descemet's membrane is intact elsewhere.

being drawn inward by the shrinking exudate, and the cavities thus formed are filled with a homogeneous fluid. Just posterior to the ora serrata, the retina is detached and bends sharply forward and merges into the mass of exudation posterior to the lens, becoming completely degenerated. All of its elements have disappeared, and its situation can be recognized best macroscopically by an indistinct bluish line, extending backward from the lens, which under higher power is seen to be composed of a mass of granular debris, red blood-cells, and a few partially staining nuclei imbedded in a fine-meshed reticulum. The pigment epithelium of the retina in places is fairly regular, but in others it has disappeared. The choroid is thickened to several times its normal size, and shows numerous irregularly circular masses of fresh round-celled infiltration. The meshes of the choroidal stroma are widely separated. The surface of the choroid

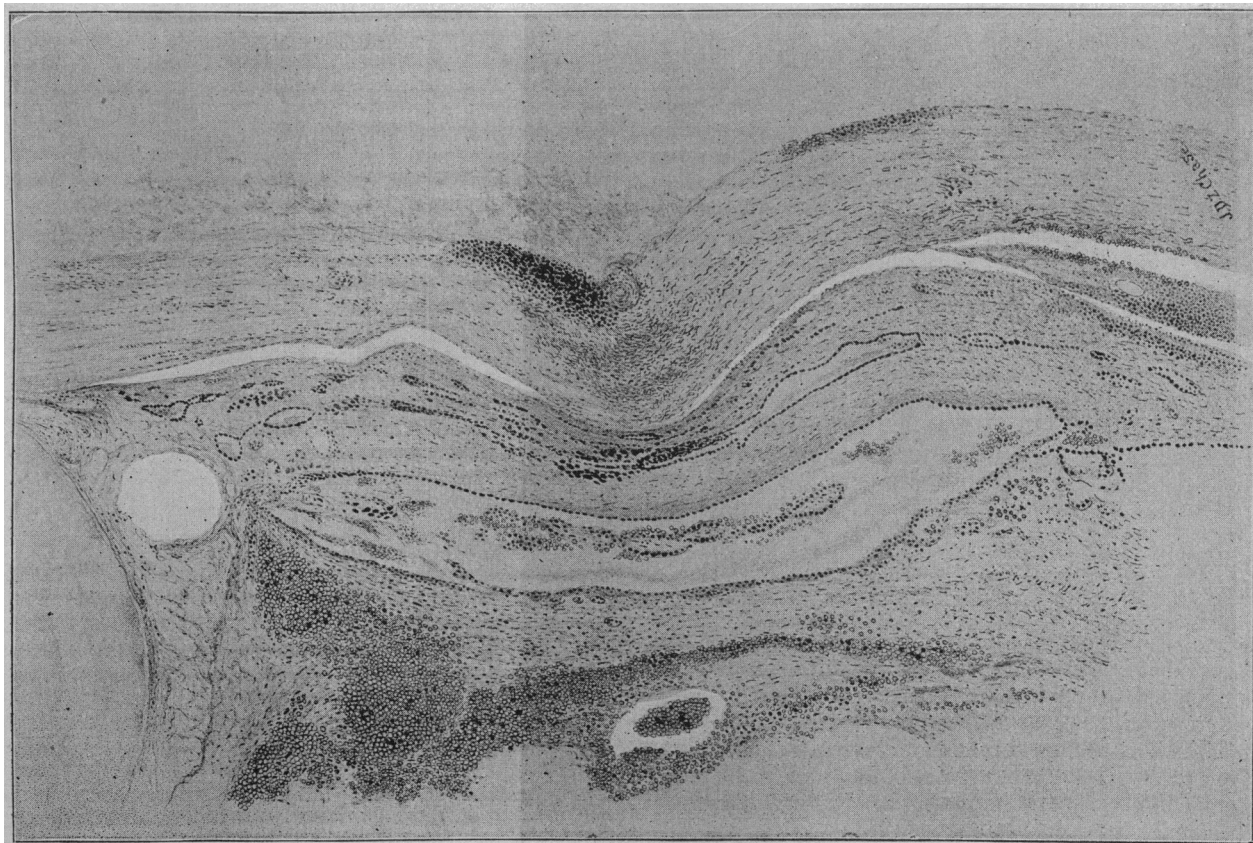


Plate 2.—Exudate on choroid, showing cavities lined with pigment epithelium.

The iris is firmly attached to the posterior surface of the cornea, at the periphery, and is completely atrophic, being reduced to a thin connective-tissue layer. There is a beginning intercalary staphyloma. The anterior chamber is partially filled with blood and a homogeneous exudate. The lens is surrounded by a mass of exudate which is firmly organized anteriorly, forming a dense membrane extending between the margins of the iris, and completely occluding the pupil. This exudate is less firmly organized posteriorly, and fills up the remnants of the vitreous cavity between the ciliary processes, lens, and detached retina as a layer of loose connective tissue, with numerous round cells, and minute capillaries, which spring from the retina at the ora serrata. The ciliary muscle is atrophic, infiltrated, and the processes drawn inward and forward by the exudate. Its pigment layer is markedly proliferated. The retina anterior to the ora serrata is cystic, the supporting fibers

is covered with a firmly organized layer of exudate which on the temporal side is over one mm. in thickness, into which the proliferated pigment epithelium extends. This exudate shows wide spaces anteriorly lined with flat pigmented cells and partially composed of red corpuscles and leucocytes. The exudate is chiefly composed of spindle cells and fine fibrillary tissue, and contains a large amount of light-colored pigment in clumps, probably of hematic origin, numerous round cells and freshly extravasated red blood-corpuscles. The space between it and the detached retina is filled with a mixture of fresh blood and of a homogeneous exudate, staining pink with the eosin. Near the nerve entrance on the temporal side there is an area of calcification in the exudate.

The sclera and episcleral tissue in the ciliary region are infiltrated with round cells on the nasal side. Just posterior to the ora, the sclera is drawn sharply inward and at this point shows an increase in the cellular in-

filtration. At a corresponding point in the choroid, there are a series of circular areas of complete cell-necrosis, containing a fine granular debris measuring about one mm. in diameter. There is, however no proliferation process surrounding them, and they probably represent previously deposited masses of round cells. The lens is cataractous and shows several areas of calcification. Unfortunately, the nerve was not included in the sections. It would certainly have shown complete atrophy.

Diagnosis.—Irido-choroiditis following perforation of the cornea. Secondary cataract. Occlusion of filtration angle of anterior chamber, secondary hemorrhagic glaucoma. Detachment and complete degeneration of the retina. Beginning atrophy of the globe.

It is of interest to note, in connection with these cases, that all exhibited a greater or less degree of blocking of the angle of the anterior chamber, and that it was, as a consequence of the impediment which was offered to the escape of the intraocular fluid through the lymph-channels in this position, that the glaucomatous symptoms supervened. In Cases 2 and 3 there was in addition, occlusion of the pupil and interference with the communication between the anterior and posterior chambers. Coinciding with the relapses which were manifested clinically all three eyes showed changes, the result of different stages of inflammatory action.

Case 1 is of peculiar interest from the fact that despite the very severe clinical manifestations in the anterior segment of the eye, the microscopic changes in the iris ciliary body are remarkably slight. The writers wish to call especial attention, however, to the peculiar cavity in the optic nerve of this eye, as a careful search through the ophthalmologic literature has failed to discover any similar condition. No less an authority on nervous tissue than Dr. William G. Spiller, to whom the sections were shown, states also that so far as he is aware, such a condition has not been described in the central nervous system. When the cavity is subjected to the close scrutiny of the highest power of the microscope, fine fibers which have the appearance of typical neuroglia fibers are seen to cross it. The few cells present are of this latter type also, but much larger than normal, showing numerous branching processes proceeding from a central area of protoplasm which includes the deeply stained nucleus. The nerve-fibers themselves are seen to have not only become atrophic, but to have absolutely disappeared, whereas in other parts of the nerve they can still be traced between the fibrous septa. Although the anatomic structure of the cavity is evident, its explanation is extremely difficult. Both Dr. Spiller and the writers, however, concur that it is probable that the area involved is one of rarefaction of tissue, in which for some unknown reason the atrophic process was not accompanied by the usual sclerosis of the connective-tissue fibers, whether of pial or neuroglial origin, and that, perhaps, to some extent the separation of the fibers, with the open spaces between, was increased by the process of hardening and imbedding the eye. It is possible that the interfering process was a local edema, although the cavity does not present the appearance of a cyst. There are no traces of any previously existing exudate or hemorrhage to account for it, and the writers can only present the specimen as a unique condition without attempting further explanation.

In the second case, the absence of decided atrophy of the nerve, in conjunction with such extensive changes in the retina, is rather remarkable, but doubtless indicates that the detachment of this membrane was of recent origin.

In the third case, the point of greatest interest is the formation, in the old exudate, on the surface of the choroid, of the large cavities, which are lined with a single layer of cells. (Plate II.) These cavities vary greatly in size, the largest being 2 and 3 mm. long, and 1 mm. wide. On casual examination, they appear like enlarged lymph-spaces, lined with endothelium. More careful study, however, shows that these lining cells are pigmented, and that the pigment granules are in the form of the minute rods which are typical of the retinal pigment cells. Such cavities have been previously described and discussed by Krueckmann¹ in his article on pigment changes following ligation of the choroidal vessels. He thinks that they are due to the union of two separate processes of the proliferating pigment epithelium. The writers, however, believe that the method of their formation was different in this case. By studying a series of sections, it is possible to follow the process, from its inception to the formation of the largest cavities. As in every case of exudation on the surface of the choroid there has been a marked proliferation of the retinal pigment cells. These can be traced as single and double lines of cells, extending through the newly formed tissue. In places, the cells composing the double lines are separated by a narrow space containing a few blood-cells. Between these small spaces and the large cavities there are cavities of intermediate size, all of which are lined with pigment cells, while many contain loosely coagulated fluid, with a few red corpuscles and the leucocytes. From the subsequent shrinking of the tissue the process may be outlined as follows: Proliferation of the pigment cells, at first in a single layer, later in double layers. As a consequence of the subsequent shrinking of the exudate, these layers are pulled apart and interstices are formed in which fluid collects, and as the contraction of the exudate advances, and more fluid is forced into the laminae, the latter become more and more distended and form the cavities which have been described. In their complete form, it is possible that they may act as true lymph-spaces, although lined with epithelium instead of endothelium.

THE THERAPEUTIC PROPERTIES OF THE SUPRARENAL CAPSULE.*

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The curative action of the suprarenal extract, dealing with all inflammations of the body and with those diseases which are affected by changes in blood-pressure, covers a wide area of therapeutic application. If we are to use this drug, which is so rapid that its maximum effect is reached in less than one minute, and so potent that some obstinate cases of chronic keratitis have been cured in one treatment, it is imperative that we should know what effect the suprarenal extract, absorbed from its local use in the eye or ear, will have on other organs, since the patient may also have serious lesions of the heart, kidneys or other tissue. To obtain this necessary knowledge, I had at my command my own clinical observations, my laboratory experiments, and the experiences of physicians whose work lies in other fields. The conclusion drawn from these data is that no condition of organic disease contraindicates the use of suprarenal, non-septic solutions being absolutely harmless. Its constitutional action may be briefly described as a muscle tonic, restoring the power of contractility to all muscle

¹Archiv. f. Ophthalm. xlviii, 2.

*Read before the New County Medical Association, May 21, 1900.