A clinical and microscopical study of two cases of glaucoma associated with intra-ocular hemorrhages : read before the American Ophthalmic Society, May 31, 1894, at the Third Triennial Meeting of the Congress of American Physicians and Surgeons / by Charles A. Oliver.

A CLINICAL AND MICROSCOPICAL STUDY

OF

TWO CASES OF GLAUCOMA ASSOCIATED WITH INTRA-OCULAR HEMORRHAGES.

Read before the American Ophthalmological Society, May 31, 1894, at the Third Triennial Meeting of the Congress of American Physicians and Surgeons.

BY

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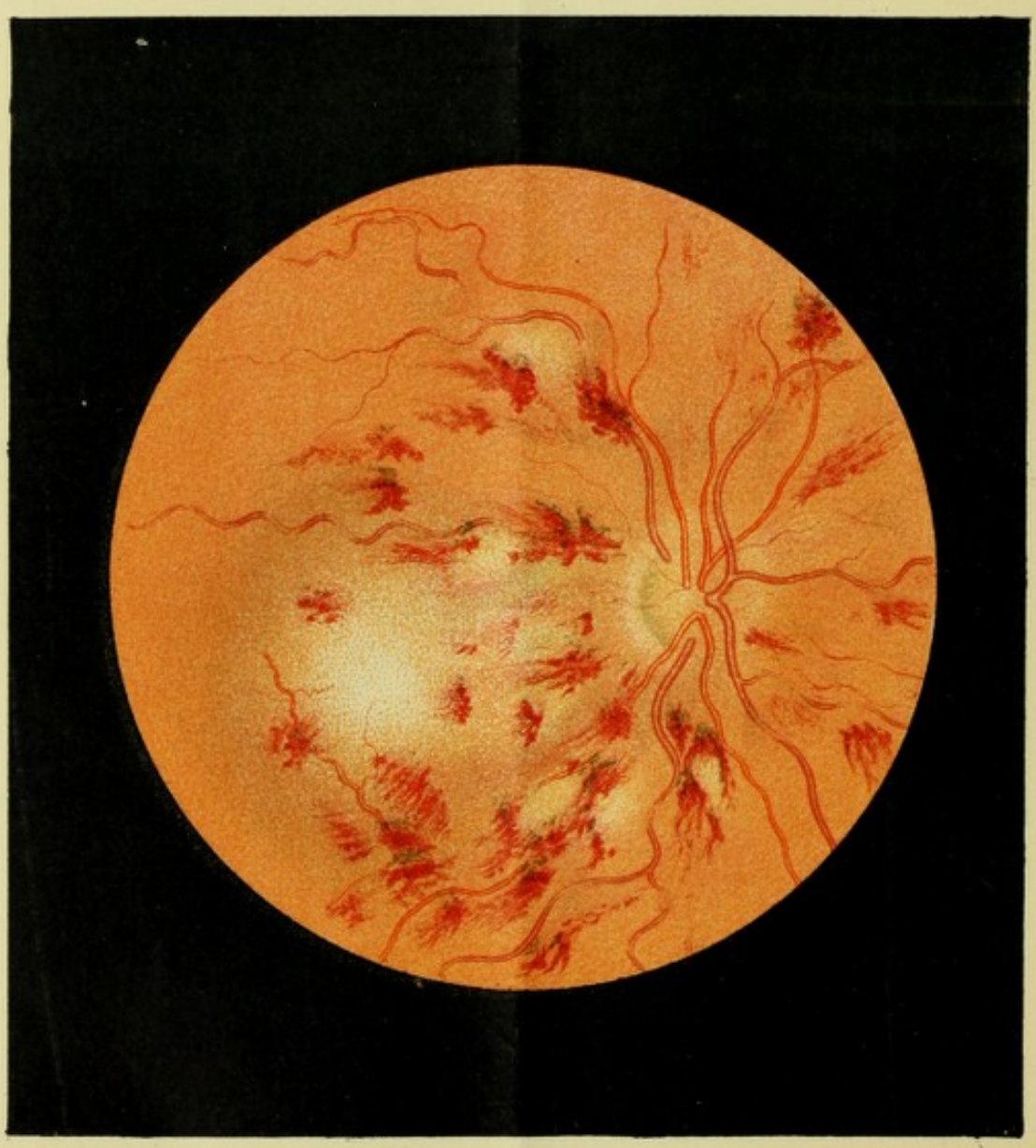
PLATE I.



F. Moran lith. Chicago

RIGHT EYE.

A CLINICAL AND MICROSCOPICAL STUDY OF TWO CASES OF GLAUCOMA ASSOCIATED WITH INTRA-OCULAR HEMORRHAGES.

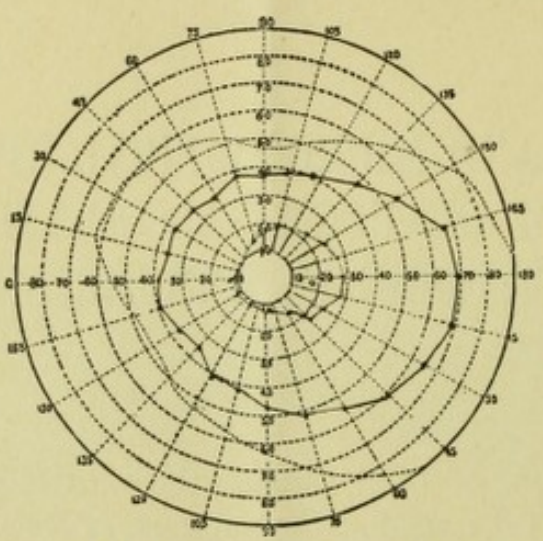
In the early spring of 1890, through the courtesy of Dr. Isaac Barton, of Philadelphia, S. T. C., aged sixty-two years, of New York City, was seen for the first time. The patient, a cultured and well-informed man, though with all the physical appearances of chronic alcoholic abuse and excess, stated that during the previous summer he had had a sudden, though temporary, attack of dimness in the right eye, as if he "saw through holes, especially up and out, with a smoky area directly ahead." This peculiar symptom repeating itself about four weeks before his first visit, and having persistently remained, induced him to apply for relief.

At the time of the primary examination, the right vision was reduced to one-fiftieth of normal; this amount of acuity being best obtained when the test-type was placed excentrically down and out. Uncorrected left vision equalled $\frac{5}{10}$, which could be brought to $\frac{5}{5}$ by the employment of + S. 0.62 D. ⌓ + C. 0.25 D. ax. 90°. Accommodative action in each eye seemed to be normal for age and refractive condition; that in the right eye being studied objectively by means of a retinoscope.

As shown in the accompanying sketches (Plates I. and II.), kindly made by Miss Margaretta Washington, of Philadelphia, the ophthalmoscope revealed a well-marked perivasculitis with numerous hemorrhagic extravasations, especially in and around the macular region, scattered throughout the right eye-ground. In addition, there were swelling, œdema, and extreme pallor over a large retinal area just below and in the macular region of the same eye. Both nerves, though, of course, better seen in the left eye, were slightly, though glaucomatically cupped. The right field of vision, as here shown in Fig. 1, was somewhat limited to the nasal side, and gave evidence of a faint negative dimming throughout the green-field area. The left field of vision, as here reproduced in the four miniature sheets 2, 3, 4, and 5, proved to be quite interesting. Contracted, and with a large central absolute scotoma for both form and color, it seemed filled with innumerable small, irregular areas of faultily-named colorations. Thus, for instance, the red field was broken into numerous "brownish spots" on a red ground. Green

was seen at many points as a dim "blue," whilst blue and yellow at times, especially in the lower outer quadrant, appeared "faded and bleached."[1]

FIG. 1.



Right field for white and green.

Examination with worsteds, while evidencing a slight green blindness with the left eye, showed some very interesting peculiarities of color-sense in the right eye. Whilst being absolutely unable to see any object placed in the position of the positive central scotoma, he could, at times, when the wools were situated peripherally, make color differentiation between yellow and blue, though he was always able to grade the entire series into a system of intensities of tint that was remarkably correct.

Upon monocular exposure, the left pupil was found to be somewhat the larger; the irides, especially the right, responding freely and promptly to light-stimulus, accommodative impulse, and efforts for convergence. Extra-ocular motion, both separately and combinedly tried, was intact in all directions. Intra-ocular tension was not apparently increased, though the scleras were somewhat rigid.

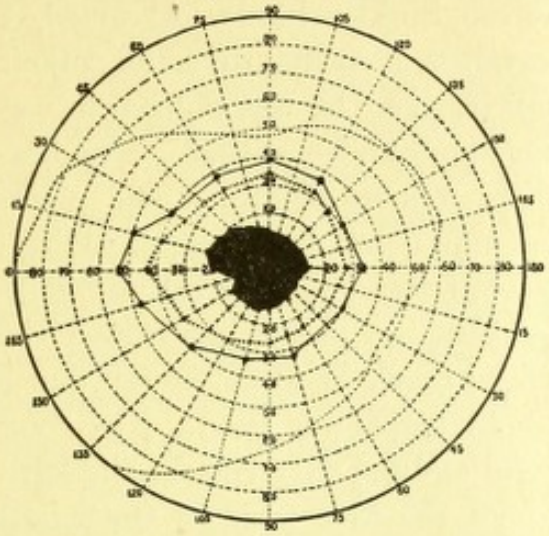
On the following day, our fellow-member, Dr. B. Alex. Randall, kindly made a series of rough pencil sketches upon prepared backgrounds, from which, with reference to an extended verbal description made at that time, the present water-color drawings of the fundus-lesions have been evolved.

Careful repeated chemical analysis and microscopical examination of the urine failed to reveal the existence of any gross morbid animal or mineral deposit.

A systematic and extended physical exploration by my friend, Dr. J. P. Crozer Griffith, showed the want of any gross organic lesion, except a moderate degree of aortic regurgitation without discernible aortic stenosis; a faint systolic murmur that was present, being possibly organic, though without evidence of any considerable degree of mitral regurgitation. The

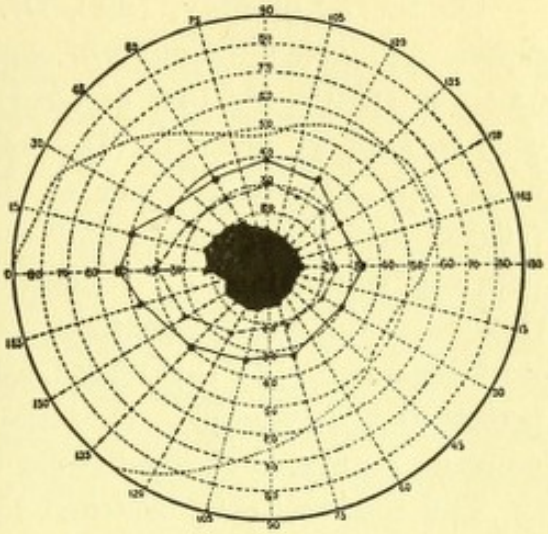
[1] Patient states that he has always had difficulty in differentiating between purple and blue.

FIG. 2.



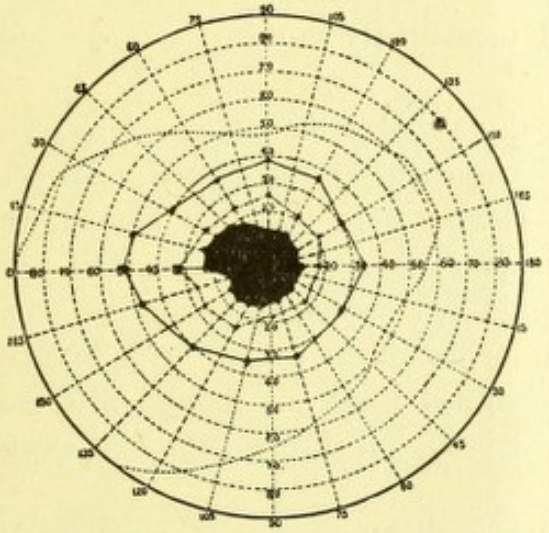
Left field for white and yellow.

FIG. 3.



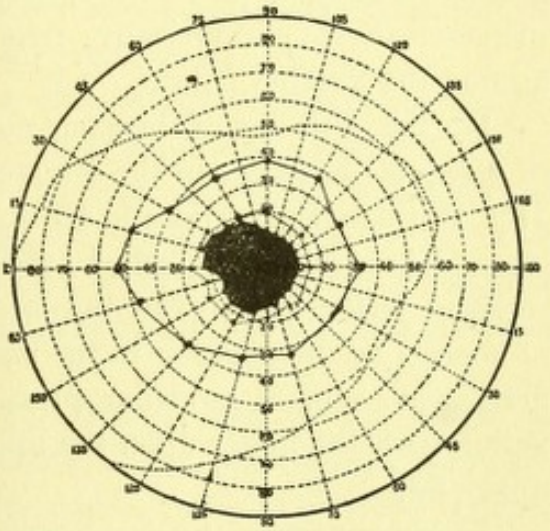
Left field for white and blue.

FIG. 4.



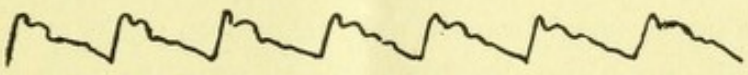
Left field for white and red.

FIG. 5.

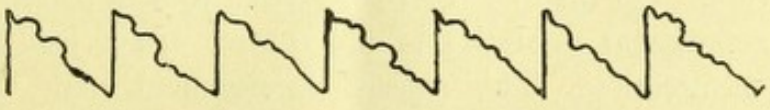


Left field for white and green.

FIG. 6.



A



B

Sphygmographic tracings: A, hand at rest on knee; B, hand above shoulder.
Tracings taken May 8, 1890.

accompanying sphygmographic tracing (Fig. 6) shows the effect of the cardiac disturbance upon the radial pulse.

On the 3d of May, 1890, Dr. Wharton Sinkler kindly examined the patient and gave a diagnosis of chronic myelitis. At that time, the patient's gait was spastic, his toes dragged in walking, and he was obliged to use a cane to support himself. Loss of muscle-power also existed. The knee-jerks were greatly exaggerated, but there was no clonus. The plantar reflexes were exaggerated, and the front-tap reflex was present. Girdle-pain was complained of. Sensation in both feet was so greatly impaired that he could not differentiate compass points no matter how widely they were separated. In this region, a superficial touch could not be felt, but he perceived a deep prick. Sensation in both hands was good. The dynamometer registered eighty-five for the right and but fifty-two for the left.

The case was daily watched throughout the first weeks of the month, the hemorrhages slowly absorbing, the edges of the nerve-head becoming more and more visible, and the original shallow cupping, which at first, by reason of the slight neuritis, was only seen to the temporal side of the disk, gradually, though perceptibly, deepening and broadening. Vision, which increased to $\frac{3}{50}$ excentrically, remained persistently lost in the large area around the fixation point.

On the 27th day of the same month, there appeared such a curious series of irregular beadings in the temporal distributions of the retinal veins that Drs. William F. Norris and George C. Harlan were asked to look at the case. These beadings, which were spontaneous and slowly-moving by a series of jerks towards the disk-head, could be stopped, and a similar series of mobile beadings given to the nasal branches of the retinal veins by artificial increase of intra-ocular pressure obtained by slight though firm palpation with the finger upon the upper ciliary region through the half-closed upper lid.

In each instance, the impulse of the "beads" appeared to be synchronous with the heart's action. At this visit, the right radial pulse seemed to be the stronger and the firmer.

Two days later, the beaded currents in the entire venous series, with the exception of the upper nasal branch, were in motion; this current becoming broken and mobile upon the slightest external pressure upon the globe.

On the following day, the hemorrhages were almost gone and the swollen retina in the macular region seemed to have regained its proper level. The disk-surface was sunken and the nerve had become greenish-gray in tint to the temporal side. A spontaneous beaded current was visible in the upper nasal vein. On the disk there appeared to be a small, though well-pronounced aneurismal dilatation of the central artery just before its primary retinal bifurcation. This arterial enlargement could be thrown into a violently pulsating mass by artificial pressure. The arterial currents, though narrow, could not be broken by any degree of pressure that was compatible with visibility of the eye-ground. The perivascular thickenings

and opacifications of the lymph-sheath walls seemed to have become perceptibly broader and denser during the time that the patient was under observation.

Careful attention to the general condition of the patient, the best of hygienic care, and entire rest to the eyes, kept him perfectly comfortable until the 16th of September of the same year, when he returned with the statement of immediate loss of sight and sudden pain in and around the same eye upon the previous day. He was now in a state of acute hemorrhagic glaucoma. Numerous hemorrhages into the vitreous chamber hiding the entire fundus could be seen through the semidilated pupil. The cornea was anæsthetic, and there was marked increase of intra-ocular tension. The eye appeared to be absolutely blind. Eserine, localized heat, and morphine, with immediate recourse to enucleation should iridectomy fail to relieve the neuralgia, were ordered and agreed to.

Two days later, there being sufficient anterior chamber though the eye remaining quite hard, a broad, clean-cut iridectomy was safely accomplished without any accident or apparent rupture of blood-vessel by a bent keratome; precaution being taken to remove the instrument slowly and deliberately so as to allow a gradual escape of the aqueous humor.

The wound healed rapidly, the pain immediately ameliorated, and tension fell to normal. This continued for six weeks, when, without apparent increase of tension, a slight but fresh hemorrhage was found in the anterior chamber, only to daily increase, causing the eye to grow more and more painful until the 20th of the month, when, after the greatest persuasion, the patient was finally induced to be relieved of the painful and irritating organ by an enucleation.

Exercising the greatest care of the patient's general health, which unfortunately has become more and more shattered, until now he has been compelled to abandon all active pursuits, and to rest and be cared for both at the seashore in summer and at his own home during the winter months, the left eye, which has been seen within a few weeks, has been kept in excellent working condition.

The specimen was carefully prepared and cut into a series of sections by Dr. Mary Morey, of Philadelphia. Examination of this showed in a great number of irregularly broken and unsequentially mounted sections, all the evidences of old perivasculitis and retinal disintegration mostly limited to the inner layers at the posterior pole and around the optic nerve entrance. No thrombotic or embolic remains could be found, though carefully searched for over many specimens. Sequelæ of both old and new hemorrhagic extravasations were found both in the larger cavities and thrust in between the more compact tissues. The ciliary bodies, folds, and muscles were markedly engorged, and the remnants of loose fresh blood-clots in and around the vessels could be seen. The angle of the chamber seemed to be open though choked, as in the second case, with pigment *débris* and pigment corpuscles. The colobomatous edges of the iris were clean,

though laden with pigment. The iris stump, as far as could be determined by the association of several small pieces of separately mounted contiguous tissue, was quite short and evenly edged. The corneal wound was coapted throughout, without any apparent overriding of its extremities, and the track of the incision was smooth and even.

The second case is of much greater clinical interest.

On the 9th of March, 1892, through the recommendation of my friend Dr. George H. Halberstadt, of Pottsville, Pennsylvania, H. McG., an apparently healthy man, without any family history of eye-trouble, came to my service at Wills' Eye Hospital. The patient, aged forty years, an engineer by occupation, stated that the sight of the left eye had been gradually growing increasingly "misty" for three years' time, this being accompanied by attacks of inflammation and pain in and around the organ. A slowly-increasing failure of the right vision, which had become primarily noticeable in December of 1891, and which, in spite of both local and general medication, had been associated with intense localized neuralgias, especially in the temporal region, had caused his physician to seek for further advice. At the time of the examination, both corneæ were hazy and quite anæsthetic, with a few fine deep-seated infiltration-areas. The iris-tissue appeared degenerate and discolored. Both pupils were irregularly dilated. The media in the right eye were so hazy that it was impossible to obtain any view of the fundus, either with the direct or with the indirect image, whilst the ground of the left eye could be but dimly seen, showing a deeply-cupped disk. Intra-ocular tension was markedly increased, this being the more pronounced in the right eye. There was intense engorgement of the episcleral veins, giving the globes a bluish-purple tint. The anterior chambers were almost annihilated. Vision was reduced to perception of light in the area shown in the sketch No. 7. The left eye was absolutely blind.

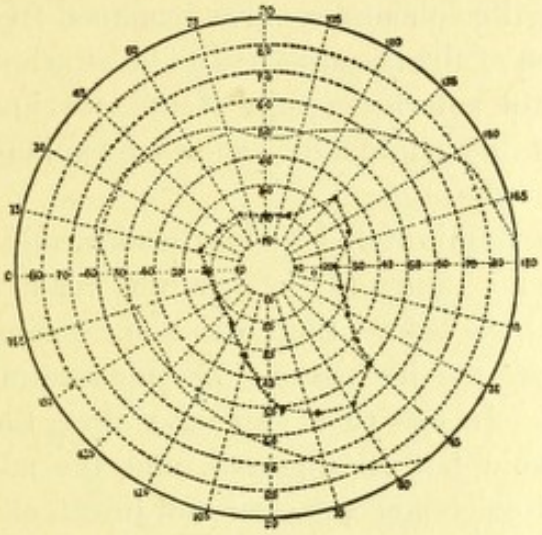
As the patient stated that he could plainly differentiate large objects with the right eye up to within a few days, and as the necessities for prompt radical interference seemed so urgent, an immediate broad upward iridectomy was made, without any unfavorable complication except a slight oozing of blood from the enlarged vessels of the iris stroma. Next day the wound had healed.

Forty-eight hours later, the eye was perfectly quiet. There was a large, broad, clean-cut peripheral coloboma. The cornea was much clearer, the anterior chamber was re-established, and the hemorrhage had almost disappeared. The patient could readily count fingers at six metres' distance, and voluntarily asserted that his field of vision had become larger. Pain had almost gone, and he was enabled to enjoy his night's rest.

Both the local and general conditions steadily improved under appropriate treatment until the 25th of the month, when he was enabled to see the fifty diopter type at one metre's distance, and he had regained the fields taken on the 11th of the month, as shown in Fig. 8. Intra-ocular tension had now fallen to normal.

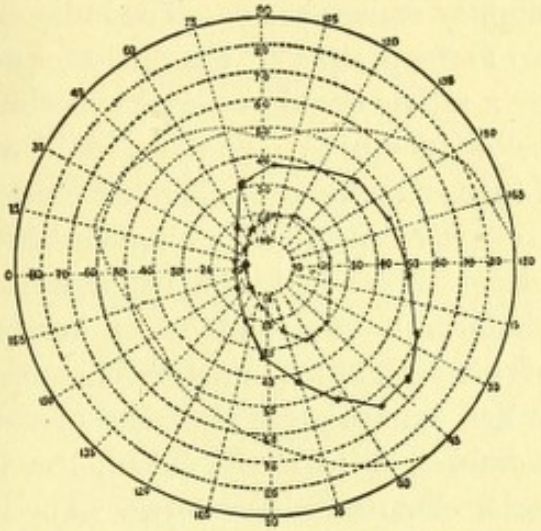
On the 18th of April, with a central vision of $\frac{2}{50}$ which could not be bettered by lenses, a large central field for red and white, no pain, and a

FIG. 7.



Right candle-field when patient first seen.

FIG. 8.



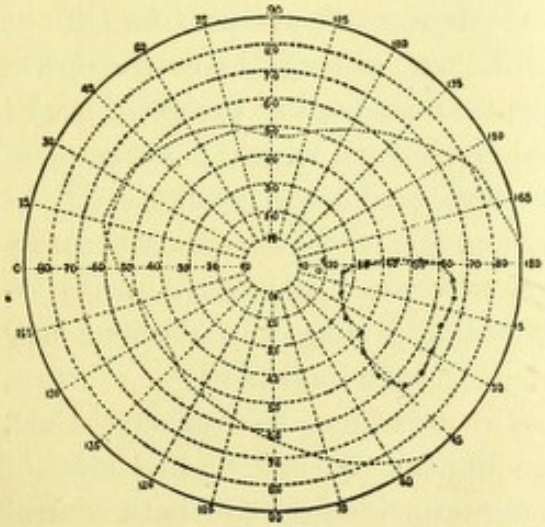
Right white and red fields after first iridectomy.

quiet, properly-toned eye, he was sent back to his physician with directions for the local employment of eserine, etc.

Under this treatment he did well all summer. In the early fall, however, he found that the right vision began again to persistently fail until he was only able to distinguish light.

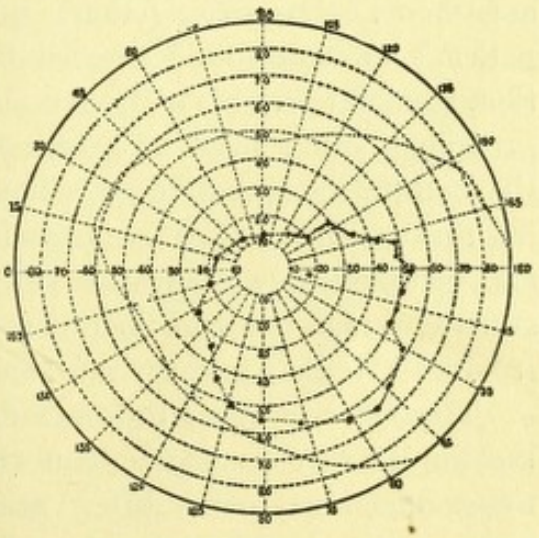
On the 16th of November of the same year, he was again brought to the hospital. The appearance of the eyes had materially changed. Though still blind in the left eye, the right field of vision was reduced, as shown in Fig. 9, to a small heart-shaped area of faint light-perception in the lower

FIG. 9.



Right candle-field before second iridectomy.

FIG. 10.



Right candle-field after second iridectomy.

outer periphery. The left pupil was irregularly dilated to at least seven millimetres' width in its longest diameter. The episcleral veins were en-

gorged. The lens had become partially opaque and greenish in tint. The iris tissue continued degenerate and the corneal haze seemed to be the greatest slightly down and in from the summit of the membrane. Intra-ocular tension had become raised to + 1, that of the right eye seeming to be slightly supernormal. The large artificial colobomatous area remained free up to the periphery, but the lower portion of the iris appeared to be attached by a rather broad posterior synechia to the anterior capsule of the lens just below its centre. The lens itself was milky white and somewhat swollen. Little or no anterior chamber existed.

After consultation, an anæsthetic was administered and a diametrically-placed broad and free iridectomy without injury to the lens was readily obtained by means of a bent keratome. As before, there was some oozing of blood into the anterior chamber from the iris tissue. Eserine was instilled immediately after the operation. In less than two days' time, the wound had perfectly closed, the hypemia had disappeared, and the anterior chamber was restored. The lower coloboma was clear and broad, extending directly up to the lower inner angle of the chamber. This, with some broken remnants of a few synechia upon the anterior capsule of the lens with the original iridectomized area, made a broad hour-glass-like pupil. The lens was undisturbed and intra-ocular tension had fallen to normal.

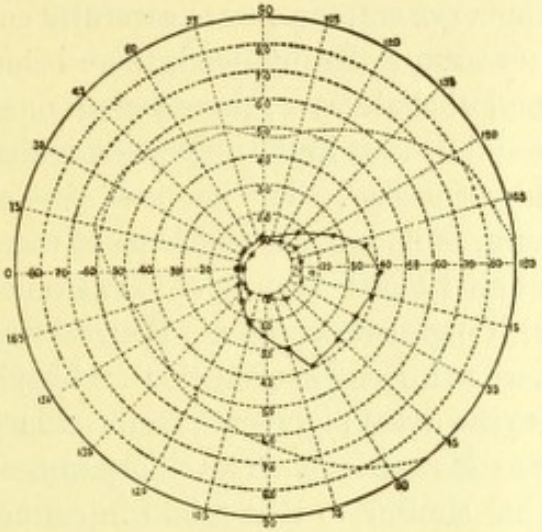
One week after the operation, the patient could count fingers at twenty centimetres' distance, and the field of light-perception, which included the fixation object, was enlarged to the size shown in Fig. 10. Intra-ocular tension remained normal.

In consultation with Dr. Norris, it was then decided to wait a few weeks, to continue the local and general treatment, and to endeavor to extract the right lens. This was done on the 15th of February, 1893, without any difficulty, whilst the patient was under the influence of a general anæsthetic. The drug (ether), curious to state, even at the time of the patient's most profound insensibility and, in fact, during the entire operation, seemed to set his entire muscular apparatus, including the extra-ocular groupings, into a series of gross and rapid clonicisms, which made some of the steps of the operative procedure rather awkward of performance. During this condition, after free capsular division, the lens was delivered safely and completely, without the loss of any vitreous, through a superiorly-situated broad corneal incison; the synechia giving way without any trouble. Neither primary nor seconary hemorrhage took place.

The recovery from the operation was uneventful. In five days' time, the pupil was clear throughout the large upper coloboma and in most of the smaller lower one. After various changes in the degree of both central and peripheral vision, showing $\frac{3}{50}$, by the use of a + S. 10. D. ⌓ + C. 2.50 D. ax. 180°, a series of form and color fields (the one here chosen (Fig. 11) taken nine days after the operation) were obtained, which again embraced central fixation.

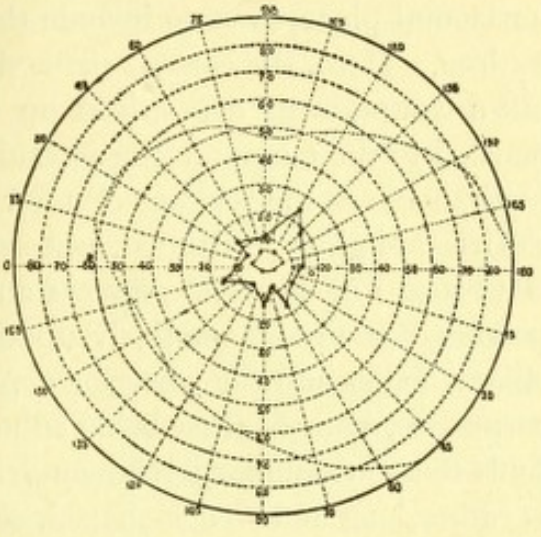
With the above correction, the picture of a deep and an almost complete glaucomatous cupping with a marked green-gray degeneration of the optic-nerve-head tissues, and marks of old blood extravasation into the deeper-

FIG. 11.



Right white and red fields after extraction of lens.

FIG. 12.



Right white and red fields.

lying tissues of the retina, with diminution of retinal vessel calibre, could be plainly seen.

Eight months later, after a quiet and comfortable summer, during which time the patient voluntarily more or less discontinued the use of eserine, he returned with the statement that his blind eye had become suddenly painful a few days previously, and that he desired its removal. Examination showed a stony-hard globe that was almost violaceous in tint, the shallowed anterior chamber being half filled with freshly extravasated blood. The next day, enucleation was done under ether, the patient having the same peculiar muscle-tremor as before. Vision in the right eye taken by a different chart, and practically under the same conditions as before, had now increased to nearly $\frac{4}{50}$. The eye was quiet and the field of vision, though slightly more irregular in outline, remained central and about the same size as before.

The patient was lost sight of until one month ago, when through the kindness of Dr. Wendell Reber, of Pottsville, one of my former assistants at the hospital, into whose hands the patient fell, he was again referred to me to decide whether any further operative measure might be necessary.

A consultation with Drs. Norris and Harlan decided in the negative. At that time, his local condition was practically unchanged. The fields of vision, charts of which were carefully taken by Dr. Reber, but which unfortunately have been misplaced, presented a much greater diminution in area, with quite a zigzag periphery, though here as before central fixation was preserved as when taken in November last. This is well shown in Fig. 12, which is a copy of the field as taken at this time by one of my assistants,

Dr. Krause. The intra-ocular tension was normal and the eye was painless.

After the specimen had been properly hardened and cleaned by Dr. Samuel S. Kneass, of Philadelphia, Adjunct Professor of Bacteriology in the Philadelphia Polyclinic, antero-posterior sections through the median horizontal plane, so as to include the optic-nerve entrance, were carefully cut by him. Here, the corneal tissue does not seem to be involved, there being but a few pigment depositions on the endothelial layer, these being most marked to the temporal side and thickest and densest in the angle,—at which place there are the remains of a few blood-corpuscles. The temporal side of the iris is slightly infiltrated, especially towards its base, at which point there is a broad line of blood pigment and scattered blood-corpuscles. The nasal portion of the iris is similarly studded with pigment deposits. Between the ciliary bodies and the posterior angle there is a large aggregation of blood-corpuscles, many of these being adherent to the uveal pigment. In the ciliary folds there are similar fresh hemorrhagic extravasations. The ciliary muscle is rather long and wedge-shaped, somewhat similar to that found in emmetropia. In the body of the muscle itself and in the overlying sclerotic, there are numerous engorged blood-vessels. In the region of the ora serrata there are numerous blood-corpuscles situated on the retinal tissue next to the vitreous. The larger retinal vessels themselves are engorged with blood. In many instances, the surrounding lymph-channel walls are thickened and the lymph-spaces are enormously dilated at places and engorged with pigment *débris*.

Between the limiting membrane of the retina and the inner granular layer, there are numerous alveoli; these, which increase in size and become more and more aggregated as they approach the nerve-head, break through the internal nuclear layer at points and distribute the nuclei between them. Near the disk, the innermost layer of the retina turns in towards the vitreous to turn abruptly back again. The retinal fibres themselves at this point are forced out against the choroid and the sclerotic to again incurve and pass into an enlarged degenerate mass representing the nerve-head, where they are soon lost in the degenerate tissue. A second projecting mass of nerve-fibres, passing more deeply into the nerve-head tissue, also turns abruptly backward and is lost. A third, though somewhat smaller portion, passes directly backward without much distortion and interruption. The involution of the second series corresponds in position with a depression in the summit of the enlarged nerve-head. The temporal fibres of the retina thus irregularly squeezed into an extremely narrow area, produce a small external depression which mainly affects the external and the bacillary layers of the membrane. These two series of projections tend to produce a large triangular area in the temporal portion of the enlarged nerve-head mass.

The fibres to the nasal side of the retina seem more compact and are less degenerate until they reach the nerve-head, at which point a few are allowed

to pass irregularly into the tissue of the nerve-head itself. These, which are at the extreme edge, pass outward far into the optic nerve as a narrow wedge.

The entire intervening portion of the nerve-head, between the temporal and the nasal series, is occupied by a grouping of irregular whorls and cavities that are densely pigmented in places, and at the centre show the remains of the central artery of the retina.

In the central and most degenerate portion of the optic nerve itself, numerous hemorrhagic areas are distributed.

Remarks.—These brief histories and the results of the post-mortem findings have not only been of great interest to the writer, but have served to teach him a most important lesson. With this latter fact in view, he has brought them before the Society, hoping by the striking contrast between the two cases to offer an extremely rare type of the disease, in which some hope may be vouchsafed to the patient for deferring at least the almost universal fatal issue.

The first, a well-cared-for though dissipated man, suffering from grave nerve-disease, suddenly evidences a right-sided thrombotic and embolic process in an eye that has evidently been the subject of retinal hemorrhage, and already shown signs of increased intra-ocular pressure. In him, we find a victim of pronounced vascular disease, both cardiac and peripheral, in whom the renewed breakages of vessel-wall and the consequent extravasation of blood have been most sudden and violent. Here, each hemorrhage, as shown by the specimens, did not confine itself to the larger lymph-stream channels, but actually forced its way into the interstices of important nerve and nutrient structures. Here, the disastrous pressure with probable disintegration of contiguous tissue by the presence of disorganizing and possibly irritating blood and lymph material, soon rendered the structures of the organ not only increasingly weaker in their physiological acts, but progressively less able to cope with the constantly-augmenting vascular disorder.

Unable at last to withstand the exquisite neuralgia, which was temporarily relieved by a carefully-performed and uncomplicated iridectomy, the entire nidus of pain had to be removed for both the patient's comfort and safety.

How different, however, is the second case. Here, an apparently healthy middle-aged man, without any other evidences of gross organic vascular lesion or general disturbance of the secretory or excretory system, gradually develops, during the course of three years' time, a comparatively painful blindness in the left eye, with an almost complete annihilation of vision on the more neuralgic right side. Brought to necessary operation by an acute exacerbation of pain, the procedure is safely accomplished upon a degenerate and, fortunately, probably but slightly vascular tissue, from which there was but little hemorrhage. Relieved for several months' time, another attack with its necessary accompaniment of lowered functional power only

appeared as the result of indiscretion. By a similar uncomplicated operation, again the process was checked, care being taken this time to keep the patient's general regimen, diet, etc., under the strictest surveillance. The eye then being quiet and all visible hemorrhage having been absorbed, the last hope for useful sight was given to him by the extraction of a cataractous and swollen lens. Safely accomplished, with no accident of any nature, central vision was brought to a higher acuity than during the entire time that he was seen. This degree of visual power has been held in an eye whose tonus is seldom, if ever, above normal; an eye, however, that too surely is showing the slow, steady, and irregular contraction of the field, as seen in the increasing pathological excavation of simple and chronic glaucoma.

The question may be asked, and properly too: Does the second case strictly belong to the category of secondary glaucoma dependent upon intra-ocular hemorrhagic extravasations? That it does can hardly be doubted when it is considered not only that distinctive marks of past retinal hemorrhage could be seen in the right eye after the media had become clearer and the opaque lens had been removed, but that the method of termination of the fellow blind eye was occasioned by a marked intra-ocular hemorrhage. Again, the microscopical study of the enucleated organ, where not only loose hemorrhagic aggregations in the large fluid cavities and vascular infarcta in the tunics of the organ could be seen, but where clump-like masses were to be found interposed throughout the interstices of the more loosely-meshed portions of the ocular coats, furnishes similar evidence. Further, the pictures of vessel-wall thickening and commencing disintegration, both point towards chronic vascular disturbance.

The comparative youth of the patient, however; the relatively better condition of the vascular coats in this case as compared with that of the more advanced stage of the disease in the other older subject; the method pursued during the operative interference; and the careful regimen instituted whilst the patient was under control, all show why here the local disease has been so long stayed in its downward progress.[1]

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[1] The same question may be as consistently asked of the first case. Here most observers, with much less study and without post-mortem verification, could have easily asserted from the first clinical findings and the later history of the case with its fatality, that it belonged to the category of glaucoma that is secondary to retinal hemorrhage; but how, in the absence of any certain traces of past disturbance, could it be certain that the retinal hemorrhages preceded the glaucomatic process, except that absolute dependence be placed upon the patient's assertion in giving but one of the characteristic subjective expressions of previons retinal extravasation? So, in most of the recorded instances, there has been an element of uncertainty as to which was the initiative factor. The first stages of so-called glaucoma are so complex, so evanescent, and in many instances so unlike the latter degenerative ones, that many observers might be led astray and deny the presence of the glaucomatic process. In reality, the main question simply resolves itself into the compensatory powers of the globe in its resistance to a certain morbific process. Granted that this process

Unfortunately, as a rule, the generality of such cases are seen when the vascular degeneration is more advanced and the ocular tissues are more congested. Here any form of operative interference, when vascular structure is divided, is dangerous, and recuperation from the most successful procedure is at times apt to be slow and tedious.

That a few rare examples do exist where the usual function may be usefully prolonged for varying periods of time, there can, from the teachings of the second case, be but little doubt.

As expressive of this almost isolated grouping,[1] the conclusion resolves itself into the fact that in some extremely rare case of glaucoma that is secondary to slight recurrent attacks of intra-ocular hemorrhage, especially in young and comparatively sthenic subjects in whom the vascular system is not greatly involved, the organ may be kept for much longer periods of time than ordinary in such cases in a condition of usefulness by appropriate hygienic and general therapeutic measures; care being taken to slowly perform operative procedures whenever there is urgent necessity to relieve increased intra-ocular pressure by rendering patulous the most important outlets for the intra-ocular fluids.[2]

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practically consists in a primary disturbance in the vascular system from disordered nutrition with extravasation of a foreign and irritative substance into the contiguous delicate structure of the eye, the work of mischief to the free circulation of the intra-ocular fluids has begun. Each attack, proportionately greater by reason of increasing vascular trouble and diminished resistant force of the gradually weakening ocular structures, at last allows as one of the most important and terrible results, the soft neural tissues at the posterior pole of the eye to lose their vitality and thus to render the organ hopelessly blind. Still continuing, ruptures of vessel structure in a more and more degenerate organ in association with all the pathological changes that are produced by tissue cicatrization continue and at last produce such violent outbursts of pain that finally it becomes absolutely necessary to remove the organ.

[1] Out of some eight thousand cases of eye-disease personally seen by the writer, in both public and private practice, during the past four years, this is the only one out of eight that have been confirmed by autopsy, where the patient (this the youngest of all in the series) so persistently retained this modicum of vision.

[2] Since writing this paper, Dr. George E. de Schweinitz has kindly given me the following history of a most interesting and instructive case in the person of J. M., aged fifty-seven, residing in Newark, Delaware. The patient, who was a native of America, applied for treatment on the 8th of April, 1893, with the following history: He is a night-watchman, losing much sleep. Has always had trouble with the left eye, owing to obstruction of the lachrymal duct, which was opened eighteen years ago, but from which a slight purulent discharge has never ceased to flow. Five weeks ago he noticed a red spot before this eye, which gradually increased in size, and was followed by violent pain. Consultation at that time with some one in his own neighborhood is said to have shown hemorrhages in the retina. The violent pain in the eye increased and was succeeded by inflammation, and in about five days the sight is said to have entirely disappeared. He has had various drops for his eyes, and within the last few days has been using a solution of eserine prescribed by Dr. William F. Norris at Wills' Hospital. He is a short, rather dark-skinned man, with grayish hair, of reasonably good habits, and without severe illness since his youth, except chronic dyspepsia. He has had rheumatism, but never severely. The arteries are perhaps

a little stiffer than normal at his age of life, and the facial and neck veins somewhat turgid. There is no cardiac murmur. The urine is practically normal, the specific gravity being, however, rather high, 1030; no albumin, no sugar, no casts, and no sediment of importance.

Right Eye.—The pupil is small, the anterior chamber normal, the lens strongly reflecting, the disk an irregular vertical oval of good color, without cup, the nasal edges of the disk being veiled. The general fundus of good condition, and the retinal vessels of normal size and carrying normally-tinted blood. V = $\frac{6}{6}$ with 1. D.

Left Eye.—No reflex from the fundus; the anterior chamber shallow but not obliterated; the cornea steamy; the iris atrophic, discolored, its stromal vessels enlarged, and the pupillary margin firmly bound to the lens capsule. There is intense injection of the eyeball and a special violaceous color depending upon the congested perforating and non-perforating episcleral veins. There was practically no perception of light, except a faint shimmer detected in the lower and outer quadrant when a ray was condensed upon this portion of the eye with a two-inch lens. T. + 2. The field of the opposite eye was entirely normal.

The patient was treated by the local application of eserine and cocaine, free leeching from the temple, iodide and bromide of potassium, full doses of chloral, ergot, and hop compresses, and up to the 20th of the month was remarkably relieved. Then the pain was renewed, the tension which had somewhat diminished became + 3, and the pain was so excruciating that the patient begged for enucleation. This was performed on the 24th of the month without accident, except that there was a good deal of ecchymosis of the cellular tissue of the lids for several days after the removal of the eyeball. One month later an artificial eye was ordered, and there has never been any trouble since, so far as known.

Microscopic specimens of the eye presented the following lesions: Numerous hemorrhages in the deeper retinal layers and small, irregularly-disturbed ones in other parts of the tunics. Iritic angle closed and infiltrated. Nerve-head shrunken and excavated. Retinal tissue degenerated in many places, and the middle third of the iris markedly atrophic.