

SUDDEN OBSTRUCTION OF THE CENTRAL ARTERY
OF THE RETINA, BEING A CLINICAL
RECORD OF FIVE CASES.

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The record of the phenomena of central retinal artery-block, always interesting, may, even in the absence of opportunity for their study from the pathological standpoint, help our interpretation of the signs of this affection. Hence we report the following five cases, and will make special reference to (*a*) large central scotoma as an onset-symptom with smaller central scotoma as a permanent end-product; (*b*) extensive vasculitis and perivasculitis as the ultimate outcome of the original obstruction; (*c*) long periods of prodromal visual disturbances, in one instance in the form of recurring vertical hemianopsia; (*d*) the possible relation of spasm of the central vessels to the condition under consideration; (*e*) the presence of a small area of functioning retina surrounding the optic nerve entrance; (*f*) the temporary presence of a scotoma in the visual field closely corresponding to the position of this retinal zone around the nerve-head, which in some cases is ultimately the only area which retains visual perception; and (*g*) the therapeutic value of deep ocular massage, and the exhibition of nitro-glycerin.

CASE I. F. B., male, aged 52, college professor, was first seen in consultation with Dr. T. F. Branson, April 14, 1907.

Family History.—This contains nothing of importance, except that the patient's father died of some form of Bright's disease.

Personal History.—The patient has had the usual diseases of childhood, but in general terms has been healthy throughout his life; his habits have been perfectly good; syphilis and tuber-

culosis may be definitely eliminated. The patient has led an extremely active life from the literary standpoint, and has been an incessant worker in his college and devoted to his literary labors. In these respects he has been far from temperate, and is in consequence high-strung and in general terms "nervous."

On April 1, 1907, feeling the need of general examination, he consulted Dr. T. F. Branson, whose examinations demonstrated the presence of slight cardiac dilatation, with a systolic murmur at the base of the heart, rather soft in character. There were no palpable signs of sclerosis. The urine was light amber in color, had a specific gravity of 1010, contained some uric acid crystals, a trace of indican, a trace of albumin, and three epithelial, four granular and twenty hyalin casts in each 15 c. c. of fluid. One week later the trace of albumin continued, and there was decided increase in the number of casts.

Five years prior to the patient's present discomforts, his eyes were examined for the purpose of ascertaining whether or not glasses were required. They had never been used during his long and active literary career. The results were as follows:

O. D. — .50 c axis 165, 6/5

O. S. — .25 c axis 180, 6/5

To these cylinders suitable convex lenses were added for reading; there were no anomalies of the ocular muscles. Each disc was a vertical oval, rather gray in its deeper layers, with sharply marked scleral ring; the veins were fuller than normal; there were no pressure signs, but the light streaks on the retinal arteries were more distinct than normal.

Additional History.— On the 12th of April, 1907, after a period of proofreading persistently pursued for many hours at a time, the patient noted several complete obscurations of the vision of the right eye, lasting for a few seconds, which were attributed to "a disordered stomach." On the following day, toward its close, a similar obscuration of vision occurred which did not pass away, and for which on the following morning his physician

was summoned, who in turn asked one of us (Dr. de Schweinitz) to see the patient, about eighteen or twenty hours after the occurrence of the obscuration.

Examination of the eyes revealed the following conditions:

O. D. vision reduced to hand movements in the periphery of the lower field, the center of which was occupied by a large central scotoma, extending 20 degrees in all directions around the fixing point, and which merged into a complete loss of the upper field. The disc was slightly congested, the veins dark and uneven, and the lower temporal artery markedly uneven. A bank of fog (retinal edema) occupied the entire center of the eyeground, extending from the disc in all directions toward the periphery, and in the center exactly at the macula, was a typical, although not very brightly colored, cherry spot. There was no cilio-retinal vessel. The light reflex of the pupil was faintly preserved.

O. S. vision was normal, the veins were somewhat overfilled and slightly uneven, and near the nasal side of the disc there was a rather large, yellowish-white exudate.

The patient was put to bed, pilocarpin solution (gr. ss. $\frac{3}{1}$) instilled in each eye, and systematic finger massage instituted over the right eye.

At the expiration of sixteen days, when the next eye-examination was made, the vision of the right eye, excentric, was 1/100, the surface congestion of the disc had subsided, and all vessels were now small, but apparently carrying normally tinted blood and with no break in the blood columns, nor had there been any such breaks at the original examination. The bank of fog was somewhat thinner, but still plainly visible, as was also the cherry spot at the macula. The field of vision was somewhat concentrically contracted,—in other words, there had been a partial restoration of the lost upper field. The central scotoma, now about 10 degrees in diameter, was absolute (see Fig. 1). The vision of the left eye was normal, and the area of exudation at the nasal side of the disc had disappeared.

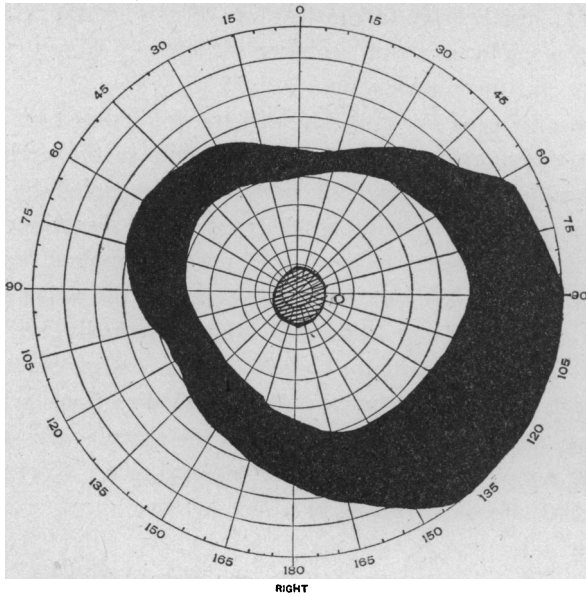


FIG. 1.

Case 1. Central scotoma sixteen days after obstruction of central artery; originally it had been just twice this size.

On the 17th of May the vision of the right eye had risen to $1/45$, the disc was extremely pallid, and there was one small exudate at its outer margin. The general retinal edema had disappeared, but some fine macular changes were beginning to be visible. The central scotoma persisted.

On the 11th of June, vision had risen to $4/150$, the head being turned slightly to the left, and the patient, to use his own expression, saw through the scotoma as if it had holes in it. All retinal vessels were shrunken, especially those on the disc surface, but no definite plug or obstruction could be detected in any one of them. In the macula there was an oval area of erosion and a few small white dots.

Five months later, when the next examination of the eyes

was made, namely, on the 15th of November, 1907, the nerve-head was entirely atrophic, all vessels were shrunken, especially those on the disc, and a faint thickening of the perivascular lymph-sheaths was evident. The field of vision was similar to that already described, and which is pictured in Fig. 1.

General examinations made shortly after the lodgment of the obstruction in the central retinal vessel, yielded the following results:

May 2, 1907: The cardiac sound had distinctly increased in harshness over the base, but there was a moderate improvement in the urine, which still contained a trace of albumin, but only three or four casts in each 15 c.c. of the fluid.

Three weeks later, namely, May 30, 1907, an examination of the cardio-vascular system was made by Dr. Alfred Stengel, who writes as follows:

"I find rather suggestive indications of arterio-sclerosis in the patient's complexion and the beginning whiteness of hair. There is moderate thickening of the peripheral retinal vessels, especially the brachial, and examination of the heart discloses a slight enlargement of the left side, that is, the left border is a little beyond the mid-clavicular line. The systolic sound is heavy and prolonged, and over the base and aortic area there is a harsh murmur, followed by an accentuated second aortic sound. The blood pressure is systolic, 135, and diastolic, 100. The condition seems to me to be one of moderate arterio-sclerosis, with probable involvement of the cerebral vessels rather in advance of the peripheral."

Additional notes as to the physical condition of the patient are furnished by his physician, Dr. Branson, as follows:

June 12, 1907: Specific gravity of the urine 1020; increased number of casts; entire absence of albumin.

June 26, 1907: Physical examination showed decided improvement in all respects; the cardiac area had decreased in size, the murmur was softer, and the urine about negative.

October 14, 1907: Cardiac area about normal, murmur very

soft, and patient apparently in excellent condition; no signs of progression in the vascular or cardiac conditions; urine the same as at last report.

The next and *last eye examinations*, made respectively April 27, 1908, and May 14, 1908, after the patient had made a most injudicious tramp which included rather extensive mountain climbing, showed that the vision of the right eye was 6/60 eccentric, the scotoma persisted, the disc was atrophic, with beginning shallow cup; all branches of the central vessels were small, but somewhat larger just as they left the disc than either on the disc itself or in the peripheral distribution. The vision of the left eye was normal, and there were faint signs of pressure, that is to say, indentation of underlying veins by the arteries.

As the result of this mountain climbing, there was for a time distinct cardiac dilatation, Dr. Branson reporting that the apex beat was diffuse and throbbing, and one half inch to axillary side of nipple and extending down to sixth rib. The sounds over the heart base were exaggerated and harsh, and the heart was missing every fifth beat. There was, however, no recurrence of either albumin or casts. Absolute rest in bed and appropriate medicines produced rapid and marked improvement. The blood pressure measured at this time was systolic 135, diastolic 90. The patient was commanded to take a complete rest, and has for the time given up most of his literary duties.

Summary.— Briefly summarized, the conditions in Case I may be stated as follows: Moderate arterio-sclerosis, with probable involvement of the cerebral vessels rather in advance of the peripheral; slight enlargement of the left side of the heart, with a harsh murmur over the apex and aortic area and accentuation of the second aortic sound; probably a certain amount of secondary nephritis, indicated by the presence of small amounts of albumin in the urine, which was of low specific gravity and contained also granular and hyalin casts; immoderate use of the eyes in literary labors; symptoms indicating sudden obstruction of the central

artery of the retina with most of its classical signs, followed by a partial restoration of vision, 6/60, in spite of the ophthalmoscopic appearances of optic nerve atrophy with shrunken vessels; preceding the onset of blindness, several obscurations of vision. The unusual symptom in the case was the presence from the beginning of a large central scotoma, which gradually shrank in size, but persists in the form of moderately produced central scotoma.

CASE 2. F. H., female, aged 32, colored, married, came to the Dispensary for Diseases of the Eye in the Hospital of the University of Pennsylvania, on May 24, 1907.

Family History.—The patient's mother is dead, the cause of death being unknown. Her father is living and well. She has four living children, who are in good health. There is no history of miscarriages.

Personal History.—The patient had measles in childhood, rheumatism twenty years ago, and malaria three years ago. For several months there has been some edema of the legs. The patient at times has suffered from slight dizziness, but has no flatulence, nausea or gastric pain; the bowels are regular. There has been no pain in the head, cough or dyspnoea; the appetite is good and sleep is regular; there is moderate leucorrhœa.

On May 20th, or four days prior to the patient's entrance into the hospital, she retired "with the sight of each eye as good as ever"; when she awoke on the morning of the 21st, the left eye was completely blind.

General examination revealed an enlarged hard, freely movable gland at the angle of the right jaw, one that had broken down at the angle of the left jaw, and one that was discharging in front of the left ear. There were numerous other enlarged glands on the left side of the neck. The lungs were negative. The heart was enlarged; the apex beat was in the fifth interspace outside of the nipple line; there was a mitral regurgitant murmur, and the second sound was decidedly accentuated; pulse 92; temperature 98; weight 111 pounds. There was a slight

pretibial edema, which, as already noted in the past medical history, had been more marked. Urine: specific gravity 1026; no albumin; no sugar, casts or crystals.

Examination of the Eyes.—O. D. V.= 6/6; the media were clear, the disc a vertical oval and surrounded by choroidal changes, spreading out into a wide area of absorption above, with some pigmentation at its borders, and two patches of choroidal atrophy on the nasal side. The whole fundus was slightly stippled.

O. S. V. = no light perception; the media were clear, on the disc surface the arteries were normal in size, but at its margin became much reduced in caliber. The veins were enlarged, dark in color and slightly tortuous. There were a few hemorrhages along the course of a venous twig coming from the macular region. The whole retina was edematous, and at the macula there was a small, round, dark red spot, the so-called cherry spot, although, as is usual in the colored races, dark in color. The direct light reflex of the pupil was lost; the indirect reflex preserved.

On the 8th of June, 1907, or nineteen days after the loss of vision, the edema was much less marked and chiefly produced along the vessels, the smaller branches of which were sheathed in white lines. The macular spot had become brownish-red in color and was mottled with fine, pin-point white dots. One week later the edema of the retina was still less marked, although present particularly in the central area, while small streaks of it were apparent along the vessels. The white spots in the macula had become larger, had coalesced and were more or less angular in shape. Two weeks later the edema had entirely disappeared, except near the disc along the upper and inner vessels. A marked perivasculitis was evident, and a granular mottling of the posterior pole of the eye was present on the nasal side, while through the macular region a number of small cholesterol crystals were noticeable, and the white dots in the region of the cherry spot were more pronounced than at previous examinations. One

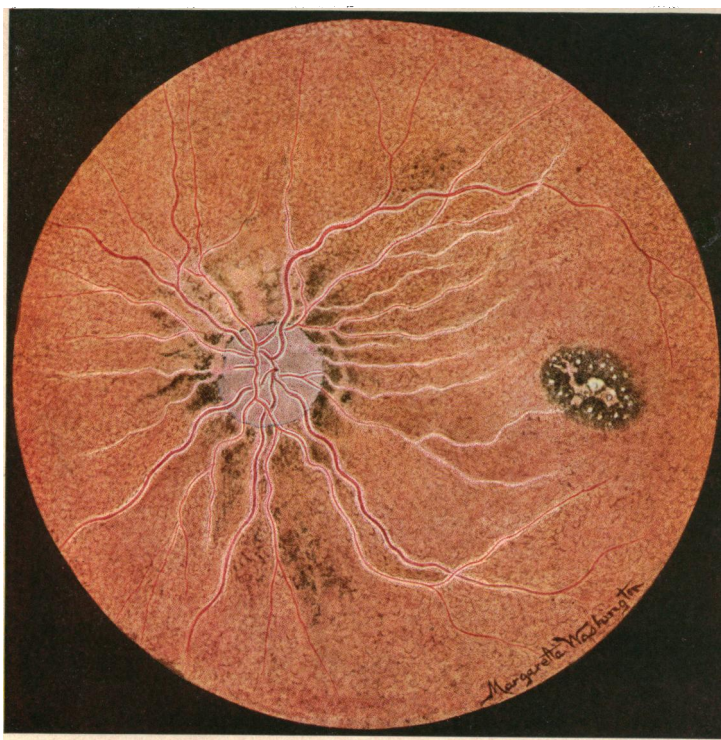
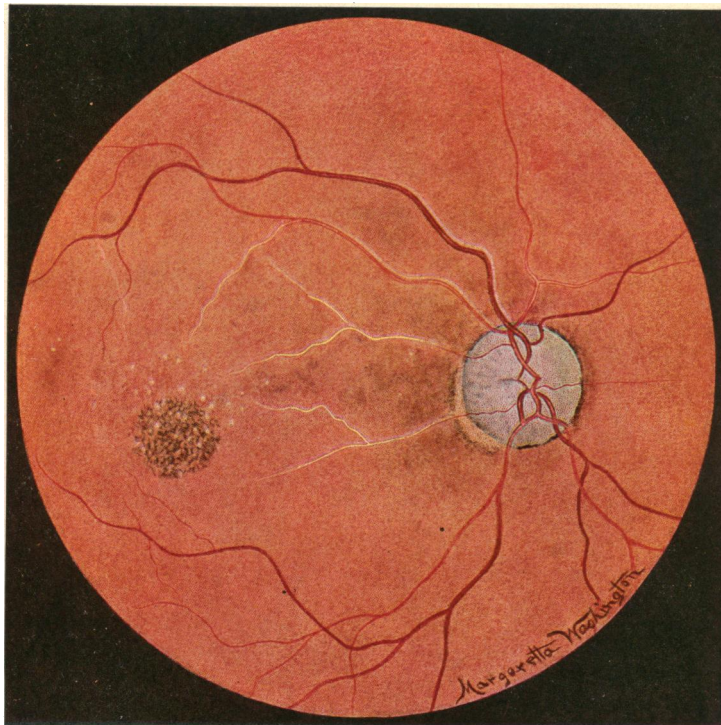


FIG. 2. Extensive perivasculitis following obstruction of central retinal artery.



week later, misty patches remained along the upper vessels, while all of the vessels at the disc were accompanied by white lines which were most apparent along the smaller branches, especially a horizontal branch which passed to the nasal side, and a smaller branch running down and out and passing upward toward the macula. This vessel about a disc's diameter from the disc could not be recognized as such, but was represented simply by a white line. The white dots in the cherry-spot-region were still larger, and the whole posterior pole of the eye was mottled.

Four weeks later the dark mottled spot in the macular region continued to have much the same appearance as has already been described, but its edges were less defined. There was decided increase of the perivasculitis, and along one moderate sized artery running down and out the white lines could be traced far out into the periphery. The mottling of the fundus seemed to be more marked than ever, and resembled somewhat the appearances occasionally seen in hereditary syphilis. The disc was white and atrophic.

One week later the accompanying water color (Fig. 2, colored plate) was made by Miss Washington. As will be seen, the disc is paper-white in color and shows advanced atrophy. It is surrounded by irregular pigmentation, and all of the vessels of the fundus are encased in white lines, those running out toward the macula having been converted entirely into white cords. In the macular region there is an oval, pigmented area dotted with white points, which have coalesced in the center into an irregular whitish mass. The general fundus is pigmented and mottled.

Summary.— Briefly summarized, the conditions in Case 2 may be stated as follows: Enlargement of the heart with disease of the mitral valve and accentuation of the second sound; adenitis, possibly tubercular, of the cervical lymphatic glands; suggestion of syphilis, but no definite proof of its presence; sudden loss of vision of the left side without prodromal symptoms, and with most of the typical signs of obstruction of the retinal artery; complete loss of vision from the beginning without the slightest

return of light perception; ultimately complete atrophy of the optic nerve; and as an unusual sequel most extensive vasculitis and perivasculitis of the retinal vessels, the macular branches being practically converted into a series of white lines.

CASE 3.—M. T., female, aged 32, unmarried, masseuse, was admitted to the medical ward of the University Hospital, September 15, 1906.

Family History.—The patient's father and mother are living and in good health; one brother died of hip disease, one sister of tuberculosis of the lungs, and another sister in infancy; two brothers and one sister are living and are in good health.

Personal History.—The patient has been in poor health most of her life. She had the usual diseases of childhood, as well as several attacks of gastritis. She has had three attacks of acute rheumatism, the first when she was 14 years old, the second when she was 16, and the third when she was 29, and the duration of these attacks was from two weeks to three months. During the intervening periods, there were several slight attacks of chorea. The patient has always been subject to attacks of palpitation, and to other attacks which are described as "smothering," during which breathing was performed with great difficulty. Two years prior to her entrance into the hospital, following unusual exertion, she had a slight hemorrhage from the lungs lasting for two hours. Examination at that time by Dr. Stanton demonstrated an area of dullness in her right lung, but the hemorrhage was attributed to congestion and not to ruptured vessels.

The patient has been myopic since childhood, and the tendency to myopia is inherited through the mother's line; one sister wore glasses for short-sightedness. Twelve years ago the patient was stricken with sudden blindness while walking home from school. It is maintained that this blindness was absolute in both eyes, although she appears to have managed to walk several squares alone, and then waited for schoolmates, with whom she finished the walk without betraying the blindness. This attack lasted half an hour, and disappeared as suddenly.

as it had come. For the past five or six years, she has had frequent attacks of haziness of vision of the left eye, but never of the right. These periods of hazy vision lasted for a few seconds.

Additional History.—On the 12th of September, 1906, the patient was admitted to the wards of the University Hospital, with the statement that on the 7th of that month, or five days prior to her admission, while giving massage, she became suddenly blind in the left eye. There were no immediate premonitory symptoms and no hemianopsia, or any other form of half vision, although, as previously stated, for some time, and particularly for a year prior to this loss of sight, there were brief periods of filmy vision. In addition to the blindness of the left eye, the patient had marked gastric distress, gaseous distention of the stomach, dyspnoea, and edematous ankles.

Physical examination at that time by Dr. Morehead, the resident physician, gave the following results: The patient was a well-nourished woman, with good bony and fair muscular development, and considerable panniculus adiposus, especially over the abdomen. The skin was clear and gave evidences of moderate anemia. There was no cyanosis or jaundice. The right pupil reacted promptly to light and accommodation; the left pupil was semi-dilated and fixed; there was lateral nystagmus. A slight lateral curvature of the spine was evident. Examination of the lungs revealed no notable lesions. The deep cardiac dullness on the right side extended $\frac{3}{4}$ inch to the right of the sternum, above to the third rib, and on the left side nearly to the anterior axillary line. In the fourth interspace $1\frac{1}{4}$ inches from the left margin of the sternum there was a rough, presystolic murmur, a loud first sound, a faint blowing systolic murmur and a long rumbling diastolic murmur. At the apex there was a loud first sound and a faint systolic murmur. A systolic murmur, loud and blowing in character, was well heard in the second interspace just to the left of the sternum, and here the second sound was markedly accentuated and reduplicated; at times the cardiac action was quite irregular. There was

some impairment of resonance and prolongation of the expiration below the right apex. The liver dullness extended from the level of the fifth rib to the costal margin in the mid-clavicular line. The organ was not palpable; the lower border of the stomach, not inflated, was half an inch above the level of the umbilicus. Examination of the blood revealed hemaglobin 73, red blood cells 4,200,000, white blood cells 6,960.

Examination of the Eyes.—V. of O. D. with — 3 sph. C — 3 cyl., axis 15, 6/12; pupil reactions normal; visual field for form and colors practically normal. The disc was a vertical oval, of good color, the retinal blood vessels of normal size and carrying normally tinted blood. There was lateral nystagmus.

V. of O. S. possibly faint light perception in the upper field. The ophthalmoscope revealed the usual appearances of stoppage of the central artery of the retina, namely, markedly contracted vessels, wide-spread edema of the retina, and a cherry spot in the macula. The disc was pallid, its margins cloudy, and shrinking of the arteries in all directions was most pronounced.

The patient was not again seen until April 25, 1908, when an ocular examination in the Dispensary for Diseases of the Eye, revealed the following conditions: Corrected vision of O. D. 6/12. There was practical absence of ophthalmoscopic lesions except a general rarefaction of the choroid coat.

V. of O. S. entirely absent. The media were clear, the disc in the stage of advanced white atrophy, both sets of vessels being markedly contracted in their entire distribution, no one set more contracted than the other, and no spot indicating any local obstruction. There were slight evidences of perivasculitis along the vessels on the disc.

Summary.—Briefly summarized, the conditions in Case 3 may be stated as follows: History of acute rheumatism and chorea; one attack of pulmonary hemorrhage; no tuberculosis demonstrated; enlargement of the heart, with systolic and pre-systolic murmurs, and accentuation of the second sound; sudden loss of vision of the left eye with no immediate premonitory

symptoms, but with a history that twelve years prior to its occurrence, there was one temporary period of absolute blindness in both eyes, lasting for half an hour, and during five or six years prior to the ultimate loss of vision there were many brief attacks, lasting but a few seconds, of hazy vision of the left eye, which had been particularly marked in the year before the final loss of vision developed; characteristic signs of obstruction of the central artery of the retina with at first faint light perception in the upper field, but within a short time complete blindness, which has remained permanent; final ophthalmoscopic atrophy of the optic nerve, marked contraction of both sets of vessels, and faint perivasculitis.

CASE 4. O. W., male, aged 65, broker, was first seen in consultation with Dr. Morris J. Lewis, May 27, 1907.

Family History.—The patient's father died suddenly of heart disease at the age of 71, his mother lived to the age of 80, and in general terms, the family history is good.

Personal History.—This is exceptionally good. As a child and as a young man the patient was always healthy. During service in the Civil War, he suffered from diarrhoea and occasionally from chills and fever. Recently he has had attacks of dizziness while walking, and he has always been a great walker, and in general terms devoted to outdoor exercises. There was no history of specific taint. The patient was accustomed to take six ounces of alcohol daily in the form of whiskey. On the 27th of May, while reading index cards which were rather hard to decipher, the vision of the right eye was suddenly obliterated. On the preceding day he had had one short period of blurred sight, to which no attention was paid.

General Examination.—The patient is a tall, finely formed, vigorous man. The pulse beat was 60 per minute, and there was no marked atheroma noticeable in the peripheral vessels, no clang of the second sound, but there was a soft apex systolic murmur. The liver dullness extended below the ribs, and there was some edema of the legs. The urine was amber-colored, clear, with

acid reaction and a specific gravity of 1012. It contained a faint trace of albumin, but no sugar. With the microscope a few epithelial cells, some leucocytes, cylindroids and mucous threads were detected.

Examination of the Eyes.—This was made thirty minutes after the loss of vision recorded in the preceding paragraph, and revealed the following conditions: V. of O. D. described by the patient as “inability to see a thing”; he probably had faint light perception. Pupil reacted slightly to direct illumination. There was complete obliteration of the entire arterial tree, all of the

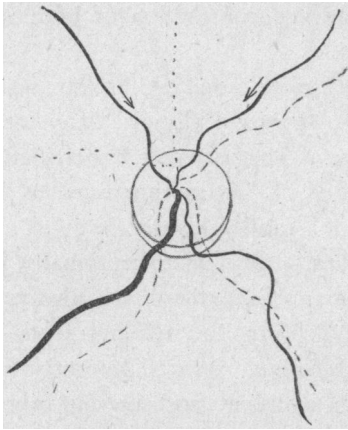


FIG. 3.

Case 4. Complete obliteration of entire arterial tree; reversal of blood in upper veins; distension of lower temporal vein.

branches being emptied of blood. The lower temporal vein was somewhat distended with dark blood; all other veins were shrunk, and in the veins above the disc the current was reversed and the blood columns broken by bubble-like interspaces (Fig. 3). The vision of the left eye was 6/9, and with his reading glass + 3 C + .50 c axis 45 0.50 was read at 30cm. With the exception of some distention of the retinal veins and a little tendency to indentation by overlying arteries, there were no lesions.

The patient was immediately placed in a recumbent posture and deep massage of the eye practiced for ten minutes. At the expiration of this time there was practically a complete restoration of the blood current in all the previously emptied vessels, except one artery which passed directly upward between two branches of the temporal vein, and one vessel which passed directly outward (Fig. 4). There was not at this time, nor sub-

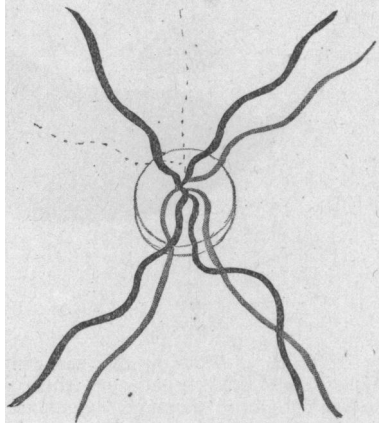


FIG. 4.

Case 4. Restoration of arterial circulation after 10 minutes of massage, except in arteries marked by dotted lines.

sequently, any edema of the retina, nor the formation of a cherry spot at the macula. Three hours later, the massage having been continued at intervals and pilocarpin having been instilled into the eye, the retinal vessels were even fuller than has just been described, except in the upper vessel already named. The peripheral field was normal above, contracted below, and contained two wedge-shaped scotomas, one directly below the fixing point, and one upward and outward from the blind spot (see Fig. 5). Four days later the conditions described were similar, except that the lower scotoma was somewhat smaller and the contraction of

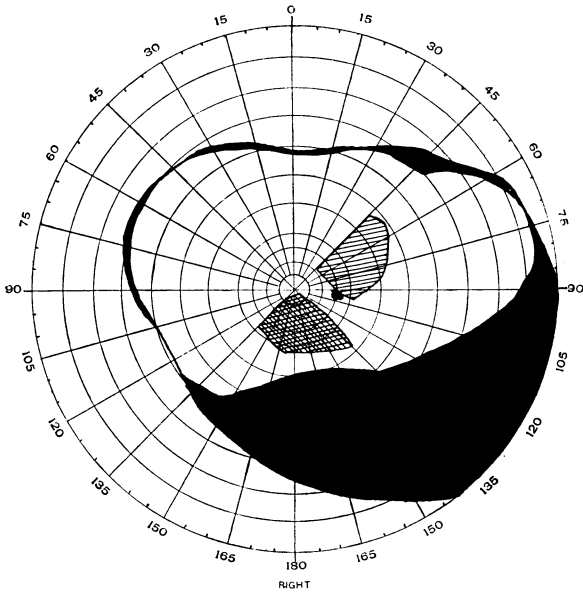


FIG. 5.

Right field of Case 4, showing the paracentral scotomas and contraction of lower field three hours after partial restoration of circulation following massage. Compare with Fig. 4. Left field normal.

the lower field less marked (see Fig. 6). V. was now 6/60 by tipping the head slightly forward. At the expiration of two weeks, the treatment having consisted in the administration of iodides, nitroglycerin, and interrupted massage, the vision rose to 6/9, the head being tipped slightly forward. The scotoma remained unchanged. There was apparently no alteration in the caliber of any retinal vessel, except the upper temporal artery, which just beyond the disc and as far as it could be followed, was contracted.

The last ocular examination was made June 18, 1908, or a little more than one year after this sudden obstruction of vision had occurred, with the following results: The disc was normal in color; all retinal vessels, both arteries and veins, were filled with normally tinted blood, except the upper temporal artery,

which began to diminish in caliber just beyond the porus, and at the edge of the disc was especially contracted with a curious half twist in its course, beyond which it regained slightly in diameter, but remained diminished in size as compared with the other retinal arteries as far as it could be traced to the periphery. The field of vision was as in Figure 7. The letter vision, by tipping the head slightly forward, was 6/9.

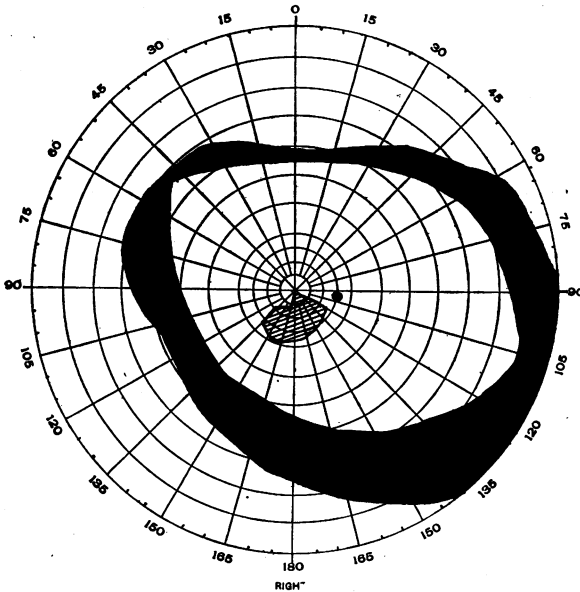


FIG. 6.

Case 4. Visual field four days after obstruction of central artery of retina; paracentral scotoma. Compare with Fig. 5.

Summary.—Briefly summarized, the conditions in Case 4 may be stated as follows: No apparent arterio-sclerosis, or not more than is usual at the age of life of this patient; general condition extremely good, with the exception of a faint apex, systolic, cardiac murmur, and a trace of albumin in the urine; sudden loss of the vision of the right eye after one short period of blurred sight on the day preceding its occurrence. Examination

thirty minutes after the onset of the blindness demonstrated probable faint light perception and complete obliteration of the entire arterial tree, all branches being emptied of blood, together with shrinking of all veins, except the lower temporal vein, which was distended with dark blood, and the two veins above the disc in which the blood current was reversed, and the columns

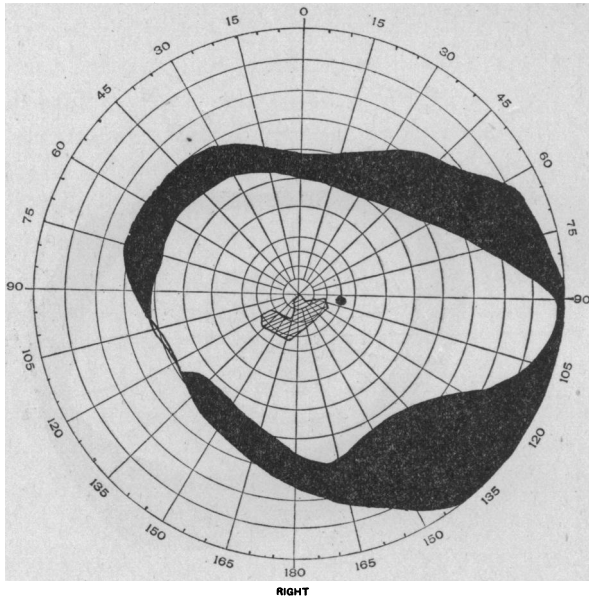


FIG. 7.

Case 4. Visual field one year after obstruction of central artery of retina; vision 6/9.

broken by bubble-like interspaces; no edema of the retina, and no formation of cherry spot in the macula; complete restoration of the blood currents in the previously emptied vessels after ten minutes of deep massage of the eye, except in one artery which passed directly upward between the two branches of the upper temporal vein, and in one vessel which passed directly outward toward the macula; three hours later even more perfect restoration of the blood currents than has just been described, except in the upper vessel already named; normal extent of the visual

field upward but decided contraction below, together with two wedge-shaped scotomas, both paracentral, one directly downward and the other one upward and outward from the blind spot, the latter occupying a position similar to the area of preserved vision which is not infrequently found in cases of sudden obstruction of the central artery of the retina; gradual restoration of the entire field, together with improvement of central vision, which ultimately reached 6/9, and now more than a year after the obstruction of the central artery, a moderately contracted visual field with a somewhat irregularly shaped paracentral scotoma in the region downward, originally occupied by the larger wedge-shaped scotoma; present ophthalmoscopic appearances entirely normal, except contraction of a branch of the temporal artery of the retina which passes directly upwards and curves downward toward the macula; no perivasculitis and no hemorrhages.

CASE 5. L. F., male, aged 19, was first seen December 4, 1906.

Family History.—The patient's parents are living; his mother has been subject to rheumatic pains. Five brothers and three sisters are living and in good health; five sisters died in infancy.

Past and Personal History.—The patient has never been robust; as a child he had measles and diphtheria. He had spermatorrhœa for about one year. He has not suffered from headaches, his digestion has been fairly good, although at times he has had gas-formation; the bowels have been regular. He has been subject to tonsillitis, but never has had rheumatism. He has had enlargement of the cervical glands.

For the past two years the patient has had attacks of visual disturbance which came at irregular intervals, once or twice a week, possibly but once in four weeks, and which persisted for one to two minutes. The first thing detected was a confusion of objects seen by the right eye. The vision would then become dim, and he only "saw with half an eye." If he looked at an object he could see only the upper half; less frequently only the

lower half. Upon one occasion this phenomenon was apparent to the left eye. After the hemianopsia had persisted about a minute, throughout the darkened area a series of irregular bright lines would be noticeable, followed by a clearing of this darkened area, after which for a limited time the originally obscured portion of the field would have a "more rosy hue and would seem brighter than the other half." For the relief of this condition he visited another hospital in January, 1906, but nothing abnormal appears to have been detected.

On December 6, 1906, while the patient was dressing, the vision of his right eye became dim. It appeared as though "there was a veil before my eye that was getting thicker and thicker." In a few minutes he was practically blind.

General Examination.—The abdomen was well developed. The edge of the liver was sharp and could be felt two fingers' breadth below the costal margin. The femoral and inguinal glands were distinctly enlarged; the cervical and axillary glands palpable; the epitrochlear gland was not enlarged. The vocal fremitus was good, and the resonance over both lungs normal. The cardiac impulse was moderately forcible, although diffuse, and was most marked in the fourth interspace slightly within the nipple line. Cardiac dullness began in the second interspace, extending to the left to the nipple line, on the right to one inch to the right of the sternum. There was a slight and inconstant systolic puff heard at the apex, and to some extent over the pulmonary region, most pronounced when the patient was standing. There was an accentuation of the second sound at the apex and in the pulmonary area. The systolic pressure was 123; the pulse 76. Examination of the blood and of the urine yielded negative results.

Examination of the Eyes.—V. of O. D. equalled hand movements in a small area on the temporal side. The media were clear, the arteries were reduced to threads and the veins about normal in size. The entire eyeground was covered with a white fog, which was most pronounced above, below, and to the

temporal side of the disc, which was pallid in color. At the macula there was a typical cherry red spot. These ocular examinations were made about eight hours after the first visual obscuration was noticed. The visual field is depicted in Fig. 8, and was taken by means of two candles. It represents only a small patch on the temporal side up and out from the blind spot.

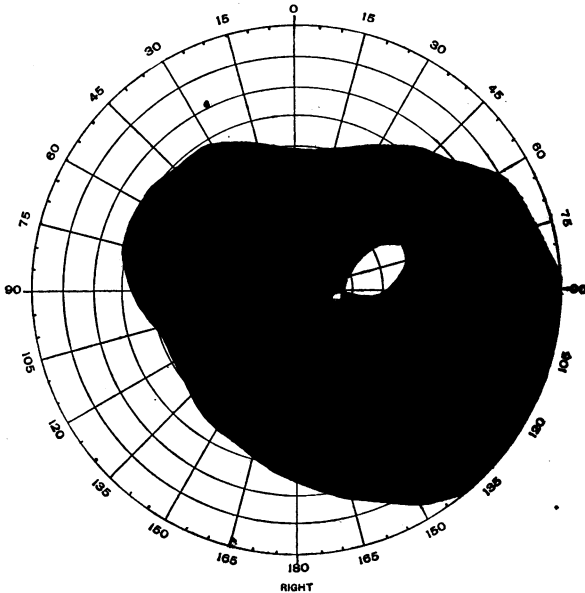


FIG. 8.

Case 5. Small preserved field on temporal side.

On the following day the conditions were much the same, with perhaps a greater extent of the retinal edema and even more pronounced reduction in the size of the blood vessels, in which there was no reversal of the blood currents. Pressure upon these vessels almost obliterated them, but did not cause pulsation.

V. of O. S. 6/6; refraction hyperopic; media clear; veins full; general eyeground in fair condition.

The treatment consisted in massage of the eyeball, the internal administration of iodid of sodium and nitro-glycerin.

On the day following the obscuration of vision, a large flame-shaped hemorrhage appeared upon the surface of the disc. Four days later the edema about the disc and in the macular region was less marked. The cherry spot, somewhat darker in color, appeared to be larger than at the original examination. A few small hemorrhages were detected in the immediate neighborhood of the macula.

On January 3, 1907, or eleven days after the loss of vision, a beginning white atrophy of the disc was already most marked. Cholesterin crystals were evident in the macula. Vision at this time and during subsequent examinations, as late as the 14th of January, 1907, was 6/150 eccentrically. The vision of the left eye continued to be normal.

Although the patient was seen from time to time, no careful re-examination of his eyes was possible until the 18th of March, 1908, that is to say, about fifteen months after the loss of vision. The results of this examination are as follows: V. of O.D. = ; Snellen 45 can be detected when held one meter from the eye upward and outward. The media were clear; the disc exhibited advanced atrophy. In the macular region there was a granular round spot about two-thirds the size of the disc, a darker red than the surrounding fundus and containing a number of white punctate spots, among which could be detected some cholesterin. Both sets of vessels were much reduced in caliber (Fig. 9, colored plate). The general appearance of the fundus is depicted in the accompanying water color. Many of the vessels were lined by white borders, and these were especially noticeable along the smaller branches which proceeded from various directions toward the macula. Most of these branches could be ultimately traced only by means of the white lines, the vessels themselves, that is to say, as carriers of blood-streams, being indistinguishable. The eye was deviated slightly upward and the visual field obliterated, except for a small area on the temporal side surrounding the blind spot.

Examination of this eye according to the plan suggested by

Fischer, demonstrated that light was perceived just as soon as it fell upon an area immediately surrounding the entrance of the optic nerve. In order to make this test, a screen in which a hole 5 mm. in diameter had been made, was placed between the source of light and the eye to be examined. Through this aperture the light was reflected by means of an ophthalmoscope mirror which enabled the observer to note accurately upon which part of the retina it impinged. Corresponding to this functioning area are the visual fields exhibited in Figures 10 and 11.

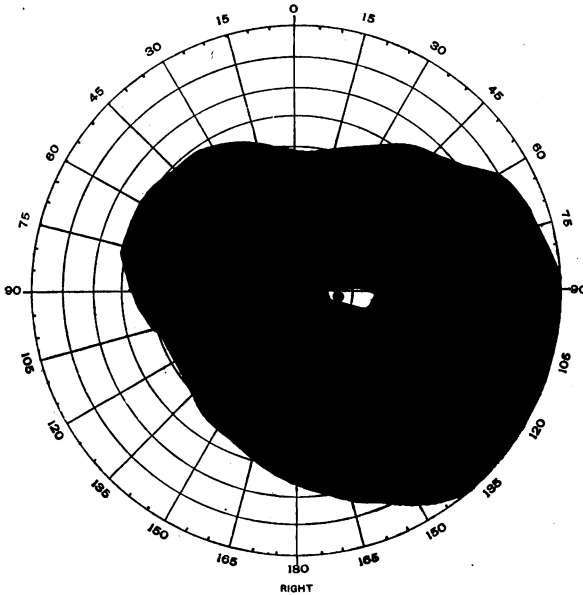


FIG. 10.

Case 5. Small visual field representing area of functioning retina surrounding blind spot.

Summary.—Briefly summarized, the conditions in Case 5 may be stated as follows: Some enlargement of the cervical glands; distinct enlargement of the femoral and inguinal glands; history of tonsillitis but no rheumatism; no marked cardiac disease, and only an inconstant systolic murmur heard at the apex and to some extent over the pulmonary region; loss of the

vision of the right eye, immediately preceded by a few minutes of dim vision, but for two years before this occurrence numerous attacks of visual disturbance coming on at irregular intervals, once or twice a week and persisting for one or two minutes; these attacks of visual disturbance manifested themselves in the form of a vertical hemianopsia, sometimes with obliteration of

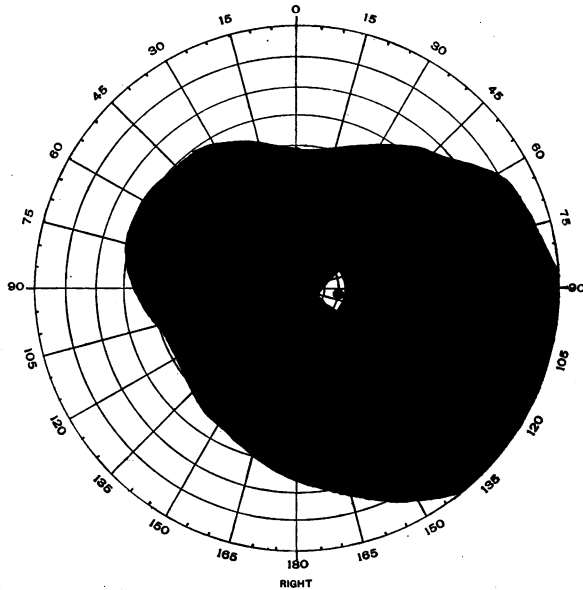


FIG. II.

Case 5. Small visual field representing functioning area of retina surrounding blind spot. Left field normal.

the upper and sometimes with obliteration of the lower half of the object under observation, followed by a gradual clearing of the darkened area, which before vision was completely restored assumed temporarily a rosy hue and seemed brighter than the other half of the visual field. Examination of the affected eye was made about eight hours after the visual obscuration began, and presented the typical signs of obstruction of the central artery of the retina, namely, contracted vessels, area of white edema and cherry red spot; vision was reduced to the

perception of hand movements in a small area of the visual field on the temporal side; gradual subsidence of the acute symptoms and the development of post-embolic atrophy, with the preservation, however, of the visual area already named, which persists at the present time, more than a year after the occurrence of blindness, and which is indicated in the maps of the visual field herewith presented.

Remarks.—That central scotoma as part of the symptomatology of obstruction of the central artery of the retina is a comparatively uncommon phenomenon is indicated by the researches of R. Fischer¹, who at the time he wrote (1891) could find only eight genuine and four doubtful cases. From his analysis he concludes that “embolism (obstruction) of the macular arteries should be regarded as the cause of the scotoma in most of the cases, but not with certainty in all of them.” The same explanation is accepted by other writers (Snell, Hawthorne, and others). For those cases to which apparently occlusion of the macular arteries does not apply, Fischer has suggested the following theories: (a) In addition to obstruction of the central artery, occlusion of one or other of its branches or accompanying vessels in such a manner that the central opticus-fibers are affected, and a defect appears in the center of the field of vision; (b) special individual susceptibility of the center of the retina to defective nourishment, in its turn dependent upon the diminished force or supply of the blood-streams; (c) cilio-retinal artery occlusion, causing a loss of that central portion of the visual field which in other instances the permeability of such a vessel, if present, sometimes preserves when the central artery is obstructed (Knapp); (d) actual demonstrable lesion in the macular region, for example, a hemorrhage. None of these theories satisfactorily explains the condition in Case I, in which a large central scotoma merged or “broke through” into loss of the upper field, and was the prominent symptom of the onset

¹ Ueber Embolie der Arteria Centralis Retinae, Leipzig, 1901, p. 202.

of blindness. Except for the bank of retinal edema and the cherry spot in the macula, the signs were somewhat analogous to those of retrobulbar neuritis; indeed, in some cases of the latter affection, according to Fischer, these appearances have been seen. Twenty hours after the blindness the surface of the disc was congested, and the veins dark and uneven; the arteries were not materially shrunken and one of them (the lower temporal) was markedly uneven. There was no evident occlusion of the macular vessels, and no lesion in the center of the retina other than the cherry spot. It is conceivable, we think, if the obstructing tissue, or obstructions additional to that in the central vessel, as Fischer suggests, did not by pressure cause this scotoma, that the central vessel lesion originated an edema which spread along and compressed the axial fibers of the optic nerve with sufficient force to invalidate their function and interpret itself by this large central visual defect. Subsequently atrophy of these fibers took place, and a smaller absolute central scotoma was the ultimate effect.

The inferior paracentral scotoma in Case 4 is to be explained by interference with macular vessel supply, which, indeed, is still evident in one small branch which curves upward and descends toward this region.

Careful examination of the clinical histories of patients who have suffered from sudden obstruction, either of the central artery of the retina, or of one of its branches, will usually develop the fact that there have been periods of temporary blindness, sometimes of exceedingly short duration, of the affected eye prior to the final partial or complete loss of sight. Indeed, sudden loss of vision preceded by such temporary obscurations, to use the language of Hawthorne, brings the diagnosis of embolism, or perhaps, more accurately, obstruction of the central artery of the retina, definitely under suspicion. At one time, it will be remembered, no less an authority than Priestley Smith thought that these temporary obscurations might be utilized to elaborate a differential diagnosis between thrombosis of the

retinal artery and embolism of this vessel, inasmuch as he stated that the former condition was apt to be preceded by previous attacks of temporary blindness in the affected eye, and giddiness, faintness, and headache — symptoms which are usually absent, in the latter condition. To what exactly such periods of temporary obscuration should be credited, is not definitely known; perhaps they should be attributed to alterations in the caliber of the central vessel, or to spasm in association with endarterial disease which subsequently is the cause of the permanent obstruction; perhaps to spasm alone, which, again to quote Hawthorne, is a speculative suggestion, and which from the investigation of Coats, seems to be eliminated as a factor; perhaps, finally, to temporary arterial collapse, as has been reported by Hoppe, the collapse being so great that for the time there is contact between the arterial walls, forming a sort of valvular closure which depends upon a temporary lowering of arterial pressure, so that such pressure is overcome by the intraocular tension.

That such temporary periods of absolute blindness lasting from a few minutes to as much as half an hour, during two to twelve years, may precede the ultimate total obstruction of the central artery is evident from Cases 3 and 5. It is quite impossible to believe that small obstructions, which afterwards passed away, could have been the cause of these attacks of blindness for such long periods of time, that is to say, obstructions in the form of emboli or thromboses. Exactly how to explain them when they occur in the form of a vertical hemianopsia, as they did for two years in Case 5, is not easy. They could hardly have depended upon disturbance of the circulation in the occipital lobes, or at the base of the brain, and we are led to believe that the theory of arterial wall collapse or spasm, local in the retina, or the central artery, furnishes the best explanation of this somewhat unusual phenomenon.

The opportunity of observing the fundus of the eye during an attack of transient blindness believed to be due to spasm of

the retinal artery, is comparatively infrequent. Within the last two years, several papers concerned with the subject have been published, notably those by Zentmayer¹, D. F. Harbridge², and R. A. Lundie³. Reference to Hoppe's case⁴ of apparent embolism of the central artery of the retina, attributed to arterial collapse has already been made. While it is true, as Coats⁵ maintains, that "there is at present no pathological proof that the obstruction may be caused by spasm apart from endarteritis," it is equally true from the clinical standpoint that the effect of spasm must be reckoned with. Harbridge's patient was repeatedly examined, not only by Harbridge himself, but also by Zentmayer, de Schweinitz, and others, and the following phenomena observed: At the beginning of an attack there was gradual diminution in the caliber of the inferior temporal artery, rapidly succeeded by the other retinal arteries, until they were completely collapsed. Following quickly upon the arterial change, the veins underwent a similar process. The nerve-head became pallid, the retina somewhat hazy. The retina vessels looked like ribbons against the fundus. This condition continued about four minutes. Then the inferior arteries began to fill, quickly followed by the others, and by the veins, the inferior becoming enormously distended. Sight was restored immediately upon the filling of the vessels, while the pupil was still dilated.

Through the courtesy of Dr. Harbridge, we have been permitted to observe closely similar appearances in another of his patients, a woman aged about 35, whose case history he has not as yet reported. The obliteration of the entire arterial tree of the right retina of the patient described in Case History No. 4, and which remained complete for about forty minutes, at the expiration of which time the current was restored, except in one artery which passed directly upward, may be explained by assuming the presence of spasm in association with endarteritis,

¹ Trans. Section on Oph., A.M.A., 1906, p. 582.

² Ophthalmology II, 1906, p. 647.

³ Ophthalmic Review, XXV, 1906, p. 129.

⁴ Archiv. f. Ophthal., LVI, 1, 1907, p. 177.

⁵ Royal London Ophthalmic Hospital Reports, XVI, 1904-1906, p. 303.

which under the influence of treatment relaxed, except in the vessel already named in which the obstruction remained permanent; or by assuming that the obstruction (embolus or thrombus) originally located in the central vessel was dislodged by the massage until it reached the small artery passing upward, where it remained.

It is a matter of observation that in a number of cases of obstruction of the central artery of the retina a small area of vision is preserved on the temporal side of the field, and this was notably evident in Case 5 of the present series. We were able to confirm Fischer's observation that under these circumstances the perception of light is confined to a small area around the papilla by noting that the moment the ophthalmoscopic image of a flame fell on this region it was at once appreciated, although the rest of the fundus was unresponsive. Coats, referring to this phenomenon, says he has not met with a perimeter tracing to show the exact position of the functioning area, but we have succeeded, with the aid of our exceedingly intelligent patient, in securing such a map which exactly represents the area in which light was perceived (Figs. 10 and 11). The most satisfactory explanation of this condition is, to use the language of Coats, that the capillary anastomosis between the ciliary and retinal vessel systems in this region is capable of keeping up the nutrition of a small zone of retina in the immediate vicinity of the disc.

An interesting visual field phenomenon in Case 4 was the temporary presence (about two weeks duration) of a scotoma similar in shape and position to that of the area of preserved vision representing the region around the papilla which remained functionally active in the retina of Case 5. It is true, it did not surround the normal blind spot, but extended somewhat up and out from it, and in this respect corresponds in shape to the first map of the visual field of Case 5, *i. e.*, the area of preserved vision (Fig. 8). It would seem possible, therefore, that this scotoma may have been due to a temporary failure of circulation in the

capillary anastomoses between the ciliary and central vessel systems before referred to, just as the preservation of circulation in these vessels accounts for the area of retained vision in other cases. It is also possible that it was caused by obstruction of a small lateral branch whose collapse was noticeable during the earlier weeks of the visual disabilities of this patient.

Concerning the value of deep massage of the eye for the restoration of the circulation after obstruction of the central artery of the retina little need be said. It has been practiced by a number of surgeons abroad, and has been particularly advocated in this country by Würdemann, Gifford and others. It is regarded as irrational by W. T. Shoemaker¹, who thinks the pressure is liable to stop the flow of such blood as remains in the vessels, and furnishes favorable conditions for further agglutination of the vessel walls. He believes in the efficacy of the nitrites, and regards with favor forced muscular action of such a character as to accelerate the heart and the peripheral circulation. A careful examination of the literature, however, indicates that a number of cases have been most favorably influenced by deep massage of the eyeball, as was notably the case in one of the patients of the present series, in whose retina after ten minutes of such massage there was almost complete restoration of the previously emptied arterial circulation. It is quite possible, as Jackson² points out, that the good results under these circumstances depend upon the fact that the original obstruction was not due to embolism or thrombosis, but to arterial collapse, or to spasm, and that it is not proved that an embolism has by this means become dislodged or a thrombus has been removed. Be this as it may, there is enough evidence to render the trial of this procedure worthy of respect, and it would seem to us that its efficiency is enhanced by the previous instillation of pilocarpin. The indication for the use of the nitrites is evident.

¹ *Journal of the American Medical Sciences*, 1904, p. 677.

² *The Ophthalmic Year Book*, 1904, p. 119.

The remaining case of the series, or the one in which an extensive vasculitis and perivasculitis was the ultimate outcome of the original obstruction, requires no special comment, except to point out its unusualness. It would seem to indicate that the original process had depended upon systemic intoxication, probably specific, although not definitely established.

DISCUSSION.

DR. F. H. VERHOEFF, Boston: I should like to offer a possible explanation of the central scotoma in Dr. de Schweinitz's case. Microscopic examination shows in most cases obstruction of the central artery within or immediately behind the lamina cribrosa. In some cases the obstruction is farther back (drawing on the board). If it is here (within the lamina) the collateral circulation is good and the nerve fibers do not suffer, but if it is far back here the collateral circulation is poorer and the nerve fibers would be injured. Owing to the fact that the macular fibers are the most vulnerable a central scotoma would result.

In connection with the question of intermittent vision, it seems unlikely to me that muscle spasm could be a factor in the arterio-sclerosis cases. In these the muscle fibers are degenerated and the phenomenon would seem more likely due to changes in blood pressure. In younger people, however, muscle spasm of the central artery no doubt may occur.