prove the vision in one eye abolished, in the other normal. For the explanation of such cases we have to look more deeply than at the head of the optic nerves.

Mr. President and gentlemen, I do not recollect having met, in my practice, with exactly a similar case, and therefore I wanted to place it on record without any further comment.

REMARKS.

DR. NOYES inquired if Dr. Knapp had tried nitrite of amyl in cases of ischæmia of the retina?

DR. KNAPP replied that he had, but without result.

DR. S. BULLER, of Montreal, Canada, remarked that he had used nitrite of amyl, and thought it was of advantage in ischæmia of the retina.

DR. WEBSTER remarked that, in regard to the treatment of these cases by nitrite of amyl, he would say experiments had shown that it was better to give nitrite of potassium.

There being no further remarks, Dr. Knapp proceeded to read his second paper, entitled, "Eight Cases of Sclerotomy for Glaucoma."

EIGHT SCLEROTOMIES FOR GLAUCOMA.

BY DR. H. KNAPP,

NEW YORK.

I DO not know, Mr. President and gentlemen, how far the operation of sclerotomy for glaucoma has found favor in this country. The practical and critical papers of Mauthner and Schnabel, published in the *Archives of Ophthalmology and Otology* during the last years, seemed to inspire us with confidence in this operation, if the recommendations of its originator, Quaglino, and early cultivators, De Wecker, Bader, and others, did not at once conquer our reluctance to abandon in its favor an operation which had given the most satisfactory results. I, for one, have followed the history of sclerotomy with great interest, yet such is my conservative spirit and my pious veneration of the immortal inventor of the glaucoma-iridectomy that it required the repetition of cases of so-called malignant glaucoma to impel me to make some cautious attempts at the new operation. As the results thus far have not been discouraging, I will

state my experience before the society in briefly sketching the seven cases (eight eyes) of glaucoma which I have operated upon by sclerotomy.

CASE I.—Mrs. F. F., Jewess, aged fifty-three, presented herself at my clinique, September 10, 1879. Her left eye had absolute glaucoma with a deep excavation; her right, inflammatory glaucoma for several weeks, $+T_2$. Faint perception of light; media turbid; fundus not visible. For personal reasons she was refused treatment, and advised to go at once to some other eye hospital. Three weeks later she returned, unoperated, and materially in the same condition. She and her husband begged so much, that I admitted them to the New York Ophthalmic and Aural Institute, and October 4th performed sclerotomy on both eyes, after previous instillations of eserine. The tension in both eyes had been $+T_2$. The operations were made with a v. Graefe's knife, very peripherically. Immediately afterward the pupil in each eye was drawn upward, and has remained so, in spite of continued instillations of eserine. There was no prolapse of iris, nor a visible incarceration. The healing was smooth. Tn in both; remained normal in right, but rose to $+T_1$ in left eye. The media of the right eye cleared up. S. R. $\frac{1}{\infty}$ as before, L. o. Some months later, Tn in both. R. opt. disk whitish, not excavated. L. as before. S. o. in both.

CASE II.—Mr. Henry Van S., Dutch, aged sixty, consulted me, March 1, 1880, having noticed a gradual decline of sight for a year. He had S. R. $\frac{20}{200}$, L. $\frac{20}{70}$. Corneæ, anterior chambers, irides normal, pupils small, promptly movable. R. + T? L. Tn. Excavation with atrophy, marked, in both. F., equal in both, very much contracted, from point of fixation 1″ or 2″ outward, when tested at a distance of 1′.

March 2d I performed sclerotomy on the right, iridectomy on the left—the better eye—both without accident. Recovery in both undisturbed. Result when last seen, May 20, 1880: S. R. $\frac{20}{100}$, L. $\frac{30}{200}$. Tn in both. The right eye has a central movable pupil, the left has a large, clear, peripheric coloboma, the remnant of pupil moving well. After the operation the sight in the right eye has steadily improved, that in the left steadily diminished. With cylindrical glasses no improvement in either. The field of vision in the left eye has remained as it was before the operation; in the right it had expanded to about twice its previous diameter. The atrophic appearance of the disk remained more marked in the right than in the left eye, and

the depth of the excavation, determined in the erect image, was 1.13 mm. in the right, and 0.94 mm. in the left eye. The tension in both eyes was never appreciably increased.

CASE III.—E. B., aged nine, of German nationality, of New York. One-sided megalophthalmus congenitus, with excavation of od. and increased tension; S.=o. Other eye healthy. As the enlargement in the first was still progressive, I made an upward sclerotomy, which healed nicely with a central round pupil. Eserine was instilled before and after the operation. The tension was at first reduced, later normal. During the next six weeks, as long as patient was under observation, the tension varied between the normal and slight increase; the latter condition, however, being more frequent and lasting. The size of the globe seemed to be unchanged.

CASE IV.—Mrs. A. M., a Jewess, aged fifty-four, had an acute attack of glaucoma six weeks before she presented herself, for which an operation had been advised, but refused. On admission, $+T_2$; ant. chamber shallow; pupil wide. S=o. Great pain, not materially relieved by eserine.

March 30, 1880, upward sclerotomy, somewhat difficult of execution on account of shallowness of ant. chamber. The tension was reduced after the operation, but some synechiæ formed on the lower edge of the pupil, probably from the use of eserine. Three weeks later the central pupil was somewhat irregular; a beginning of a cystoid scar showed itself at the inner part of the wound, near the vertical meridian; the tension was again moderately increased, but no pain was present. S.=o.

CASE V.—Mrs. A. C., aged sixty-five. Painful glaucoma after being struck on the eye eleven weeks previously. $+T_2$. Pupil very large; immovable, disk dimly seen; not excavated, S.=o. May 1, 1880. Upward extensive sclerotomy. No reaction. +T? S.=o. No pain.

CASE VI.—Mrs. C. P., American, aged fifty-six, presented herself June 25, 1880. Inflammatory glaucomatous attacks, with halos, and very gradual impairment of sight, in the left eye for four, in the right for two years. On admission both pupils were wide and immovable; lens diffusely opaque; $+T_2$ each. S. L.=o., R.=$\frac{10}{200}$. F. R. contracted inward to point of fixation, above and below in a line curving outward from point of fixation like an ellipse. L. od., complete atrophy and deep excavation. R., excavation, marked arterial pulsation.

Admitted to hospital June 26, 1880. Leeches to temple and

eserine did not reduce the eyeball tension nor make the pupil narrower.

June 27th.—Sclerotomy upward, leaving the pupil round. Eserine in evening and morning; no influence on pupil.

June 29th.—Pupil smaller in both eyes; neuralgia disappeared.

June 30th, 9 A.M.—Pupil R. less than medium size. Counts fingers well. In the afternoon the pupil was found pear-shaped and a part of the iris lay in the inner part of the scleral wound. The anterior chamber was of almost normal depth. Patient was not aware that anything happened to her eye, nor could she assign any cause for the displacement of the pupil. She had lain in bed, quietly on her back, the whole day. As soon as I had noticed the displacement of the iris I decided to perform iridectomy at once by excecting the incarcerating portion. In this attempt I was surprised by an occurrence which, under similar circumstances, it may be well to remember. I split the conjunctiva and episclera over the black patch of iris in the wound, with a v. Graefe's knife, without wounding the iris. The aqueous escaped and at the same time the iris receded into the anterior chamber. I introduced a blunt spatula into the anterior chamber, smoothed the iris gently and in such a way that the pupil became central, round, and narrow. As, after withdrawal of the spatula and passing the lids over the cornea and sclerotic, no displacement of the iris was visible, I instilled a drop of eserine into the eye and bandaged it. The further progress of the recovery was undisturbed. The wound closed perfectly. The pupil remained round. Tn. S. $\frac{10}{200}$. Discharged July 9th.

July 15th.—Seen again. F. and S. the same. T. not appreciably increased, but arterial pulsation again present, though not so marked as before the operation.

July 19th.—No arterial pulsation. Tn. S. $\frac{10}{200}$. Feels comfortable, and thinks she sees better.

CASE VII.—Mr. J. F., Jew, aged seventy-three. R. operated on for glaucoma seventeen years ago by a New York ophthalmic surgeon. Sight said to have rapidly failed after the operation. On admission, large outward coloboma, with columns adherent to thickened cicatrix. L. pupil less than medium size; sluggish; $+T_1$; iris dirty brown. S. $\frac{20}{70}$, E. F. elliptical from point of fixation outward, with a great axis of 15°.

The patient was exceedingly diffident, yet the decline of sight in his left eye had been so marked in the last three months that he felt he was on the way to blindness. Considering his age and the un-

fortunate result, I advised him to have a sclerotomy made, which I would undertake as less risky than an iridectomy, provided he would give me discretionary power to make iridectomy in case prolapse of iris should occur during or after the operation. He and his family consenting to that, I performed sclerotomy July 15th, thrusting a narrow-bladed knife through the upper peripheric part of the anterior chamber, the extent of puncture and counter-puncture being 6‴. In cutting the sclerotic and letting the aqueous slowly out, the pupil enlarged upward, with no tendency to contract by turning the knife on its axis. As soon as the knife was withdrawn, the iris prolapsed in the outer part of the wound. Instillation of eserine, closure of the lids, rubbing, reduction with a blunt spatula, opening the conjunctival bridge as in the previous case, and a renewed attempt at reduction with a blunt spatula, all failed. I therefore exsected the prolapse, making a clean, though small iridectomy, taking great care to remove the iris out of the wound. The pupil occluded by blood. He had pain for the first three nights. On the fourth day the pupil began to clear up, and the anterior chamber to fill again. The tension after the operation has been normal, and the resident surgeon writes me that the eye is doing well. The patient was seen again in January, 1880. S. and F. as before the operation.

Mr. President, I beg to make some comprehensive remarks on these cases:

1. The *mode of operation* was essentially that recommended by *Wecker* and *Mauthner*, using a v. Graefe's knife, making the distance between puncture and counter-puncture five or six lines long, and dividing the sclero-corneal juncture as deeply in the sinus of the anterior chamber as the position of the iris would permit. In every case a small scleral bridge was left in the centre, yet so thin that the blade of the knife shone through, as in making a microscopic section. The aqueous was let out slowly, in order to prevent a prolapse of iris, if possible.

2. *Accidents.*—In the first two operations the pupil was oval, the iris being slightly drawn toward the wound, yet without visible incarceration or adhesion. In Case VI. prolapse occurred spontaneously on the fourth day, but reduced itself when the aqueous escaped, after the conjunctiva over the prolapse had been cut. In Case VII. prolapse occurred during the operation, proved irreducible, and the protruding iris was exsected.

3. *Operative results.*—In all cases the tension was reduced in

the first weeks after the operation; but in some of them increased again later, without, however, reaching its former height. Pain and the other inflammatory symptoms, where they had been present, disappeared.

4. *Visual results.*—In the five eyes with absolute glaucoma, no degree of sight, of course, was restored. In one case of chronic glaucoma (Case VI.) the vision, thus far (three weeks after the operation), is as good as before. Patient seen in November, 1879. Her sight has remained the same. The last case does not count, since sclerotomy was combined with iridectomy, and was operated on only a week ago. The second case furnishes a good success in the eye operated on by sclerotomy, especially when contrasted with the failure of iridectomy on the fellow eye: in the former, some improvement of sight and enlargement of the field of vision; in the latter, gradual decay of sight. Both eyes were as much under the same conditions as possible.

Mr. President and gentlemen, I do not presume to draw any conclusions of importance from so small a number of operations. As far as they go they confirm the statements of Mauthner in his exhaustive and very suggestive papers on this subject—"Glaucoma Aphorisms"—published in the *Archives of Ophthalmology and Otology*, Vol. VII., p. 179, etc., and Vol. VIII., p. 25, etc. My own views as to the indications of sclerotomy are as follows:

1. In cases of simple chronic glaucoma with a narrow field of vision and marked excavation, I would prefer sclerotomy to iridectomy, and if both eyes are affected, operate on one at least by sclerotomy.

2. In megagophthalmus (buphthalmus) congenitus I would only perform sclerotomy, since in such cases iridectomy is almost always fatal to the eye.

3. In glaucoma of younger persons, *i.e.*, below thirty-five years of age, and in cases of hemorrhagic glaucoma, I would prefer sclerotomy to iridectomy, since the results of the latter operation in these cases are mostly unfavorable.

4. Encouraged by the experience derived from the above related operations, and on the strength of the statements of Wecker, Mauthner, and others, I consider it legitimate to try sclerotomy also in cases of acute glaucoma. If it prove equally curative as iridectomy, it will have a decided advantage over this operation by leaving the pupil round, small, and central.

REMARKS.

DR. NOYES remarked that his experience in sclerotomy for glaucoma was limited to a single case. It occurred in the person of a young woman under twenty years of age, who came to him in December last, having a subacute attack of glaucoma which passed into a chronic condition. She had a complete picture of glaucoma, and the eye was painful. She was told that an operation alone could afford her relief. She refused to submit to this for ten days, but finally consented, and sclerotomy was done. The effect of the operation was to relieve the pain and to reduce the tension to the normal. The pupil continued circular, and the eye, for a period of some weeks, remained normal. The tension became increased, and the other eye, which had been sound, broke out with an attack of acute glaucoma. Dr. Noyes feared to risk the operation of sclerotomy in the second eye, after his experience with the first, and made an iridectomy. The result of this was vision $\frac{20}{20}$, an uncommon result after this operation in glaucoma. In his judgment the fitness of the operation was about as Dr. Knapp had recorded. He continued his remarks by relating the history of a boy under ten years of age, who was brought to him with an excessively distended eyeball. The eye was twice its normal bulk, and the ciliary region was spread out into a dark zone one-fourth of an inch in length. It did not occur to him to perform sclerotomy, but he recognized the fact that iridectomy would be fruitless, and reasoned, in view of the existence of the posterior synechia and distention of the eyeball, that it would be desirable to remove the iris completely. This was accomplished by making a small section as near to the periphery of the iris and cornea into the anterior chamber as possible. A rather large, sharp-pointed hook was thrust over so as to reach the opposite side of the iris, when traction was made until the periphery of the iris gave way. As this gave way he removed, with the forceps, the entire structure. No important hemorrhage followed. A bandage was applied, and after three or four days it was found that the globe was recovering its normal diameters. In four weeks it was restored to the same dimensions as the other eye. The semi-transparent blue color became a uniform gray opacity. He did not know that such an operation had been tried in just such a case.

DR. RISLEY remarked that in November, 1878, he was consulted by a lady with absolute glaucoma in the left eye, her vision being $\frac{20}{100}$ in the right. Her field of vision was very narrow, but she could, with difficulty, go about with the remaining eye. Iridectomy had been proposed over and over again by other surgeons, but each time rejected. She finally, however, consented to the operation. A broad iridectomy above was done in November, 1878. Her field of vision widened out above to twice its former extent, and she retained vision until the following March, when it began to recede and pain came on. The first of April he found the stump of the iris at site of the

iridectomy adhering to the cornea, and then proposed and did a broad sclerotomy, making the puncture near the horizontal line and carrying the incision through the adherent stump of the iris, and succeeding in withdrawing his knife without prolapsus of the iris. The eye was bandaged, wound healed kindly, and a month later tension was normal. He saw her in June, two months after the operation, with her field of vision where it was after the iridectomy, and vision was still $\frac{20}{100}$, with a plus-cylinder.

DR. HASKET DERBY had a case where glaucomatous symptoms came on in a child seven years of age, after an operation for the removal of opaque capsule following a traumatic cataract. There was marked increase of tension, corneal anæsthesia, dilatation of the pupil, limitation of the visual field, and cupping of the disk. To avoid the deformity of an iridectomy, he had performed sclerotomy upward, in the usual manner. The wounds of puncture and counter-puncture had never solidly closed. Almost immediately a staphylomatous protrusion began to form about each of them, and up to the present time had steadily increased. There were now two rounded tumors, almost in actual contact, each about eight millimetres in diameter and six millimetres high, visible as protrusions through the closed lids. Vision had never returned. No pain had been suffered, and there were no symptoms of sympathetic irritation.

DR. WADSWORTH stated that he had only one case in which he had performed sclerotomy. This was in the person of a lady who came to him after the second attack of acute glaucoma, and with her vision reduced, as it had been for a number of weeks, to barely more than perception of light. Her pupils were very large, a little irregular, and scarcely affected by eserine. No view of the disk could be obtained. Sclerotomy was done in both eyes downward. The operation was performed as recommended by Wecker, the cut running into the inner surface of the sclera at the bridge even, but not going through it. After the operation there was no prolapsus of the iris. The operation was followed by relief from pain and the clearing of the media, but vision did not improve. The pupils still remained quite large and were drawn a little down, but no prolapse. The patient was a lady of sixty or sixty-five years of age.

DR. F. BULLER remarked that he had seen several cases in the practice of a London physician. He was of the opinion that this physician was in the habit of cutting entirely through the sclera; a staphylomatous protuberance at the seat of incision seemed to be the usual result. The doctor's own experience was confined to only one case. He performed an iridectomy in both eyes at the same time, with the result of making the tension normal. The tension remained normal for months. The patient then began to have spells of dimmer sight, then it would clear up again. This process continued for some weeks, and then he performed a sclerotomy downward, obtaining a very satisfactory result. The obscuration of the sight remained the same as before the operation, now two years ago. A bridge of sclerotic was left undivided.