

be the operation of choice in the majority of cases. I am well aware that the endonasal operation is preferred by many operators of large experience, and I am simply stating my own preference, and I know that some of my colleagues, for instance, Dr. Posey, hold similar views.

DR. S. HANFORD MCKEE, closing: This demonstration may seem elementary to this Society, but there is so little in the different text-books on ophthalmology and ocular pathology on the subject that I thought it might be of interest to the Society.

GLAUCOMA IN MYOPIC EYES

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While the anatomic peculiarities of the hypermetropic eye predispose it to glaucoma, glaucoma of the simplex variety does not infrequently occur also in myopia. Lange* and Gilbert† believe that the refraction of the eye determines the clinical form of glaucoma. They found myopia present in about one-third of the cases of glaucoma simplex, while myopia occurred in only one-tenth of the cases of congestive glaucoma.

I have the records of 32 cases of glaucoma in myopic eyes, with the following findings: The degree of myopia in 26 was below 5 D., in 6 it was between 5 and 10 D. The age varied between forty and fifty in 3, between fifty and sixty in 6, sixty and seventy in 11, over seventy in 12; the majority, therefore, was over sixty—perhaps somewhat older than the rule. The type of glaucoma was always the chronic one (simplex); in one case only were there some symptoms of uncompensation (congestion); there were no cases with acute symptoms.

* *Klin. Monatsbl. f. Augenh.*, 1920, 1, p. 540.

† *Arch. f. Ophth.*, lxxxii, p. 393.

The features in these eyes were: Depth of the anterior chamber—in only 3 was the anterior chamber shallow; in 12 it was normal, and in 17 it was deep. The intra-ocular tension was usually but slightly elevated; in only 6 was it over 40 (Schiötz); it was generally around 32 (28 to 36). In 4 the tension was low, 18, 18, 20, 20, which constitute a group of which mention will be made later. The optic nerve changes in some cases consisted in a shallow cup with central depression of the vessels, the bending of the vessels occurring especially at the upper margin of the disc. In others there was a nasal displacement of the vessels, a well-developed conus, and in many a complete halo; the optic nerve showed usually distinct atrophy. Axenfeld* says that the value of Bjerrum's sign is not realized because of the myopic conus. I am not able to confirm this, as our fields taken on a Bjerrum screen at one meter with a one or two millimeter object showed all varieties of glaucomatous field-defect, from a prolongation of the blind spot up or down or both, joining to form a complete ring, to a concentric contraction.

As for treatment, some were controlled by myotics, others were operated upon by iridectomy, cyclodialysis, or a form of scleral resection. Though some cases went on slowly to progressive deterioration whether they were operated on or not, the results of the operative cases on the whole were surprisingly good, considering the degenerative nature of the lesion. The technique of the operation was simplified by the deep anterior chamber, and one never encountered the terrific problems and disasters furnished by the highly hypermetropic eye, with practically no anterior chamber and rudimentary cornea.

There were, in addition, two cases of glaucoma with myopia in adolescents, aged sixteen and twenty-two years. In one with myopia of sph. 1.50, V. = 20/100; tension was 45, with deep anterior chamber; peculiar iris atrophy;

* D. O. G., 1924, p. 140.

optic nerve, deep cup, central depression of vessels, and halo. The field was concentrically contracted. The sclera at operation was found unusually thin. In the second case also with a myopia of sph. 1.50, V. = 20/50 (three years ago vision was emmetropic); tension 36, with superficial atrophy of iris; deep anterior chamber; optic disc, deep cup. Field, concentric contraction. Both of these cases showed trophic changes in the iris, and a definite thinning of the anterior scleral capsule, which suggested that the myopia was secondary to the glaucomatous process.

Two cases deserve mention on account of the subnormal tension, 18 and 20, notwithstanding cupping of the optic nerve-heads and definite glaucomatous field defects.

Although the diagnosis of glaucoma in these cases is difficult, repeated tonometric and perimetric examinations will indicate the line of treatment.

In conclusion, may I summarize my observations and say that glaucoma in myopic eyes is of the simplex type, with deep anterior chamber, low increased tension, characteristically shallow cup, and the usual glaucomatous field defects; and that operation, if indicated, gives us, on the whole, surprisingly good results.

DISCUSSION

DR. H. H. TYSON, New York: While the association of simple glaucoma with myopia has been noted before in ophthalmic literature, I consider that the subject is one of decided importance. My interest in this subject was first aroused in 1908, when I observed a myope with sph. — 10.50 \ominus cyl. — 3.00 ax. 105°, upon whom Dr. C. S. Bull had performed a classic iridectomy in the left eye, but no operation on the right. She has been under observation for the past seventeen years, with the interesting result that, as regards vision, field, and tension, the eye with no operation is the better of the two at the present time. Extremes of tension, R.E., 32–17, L.E., 34–17; usual average around 22 while under treatment. Vision in unoperated eye is still 20/30. I have examined my notes upon a considerable number of other cases with myopia,

ranging from -1.25 D. to -16.00 D., ages from forty-three to seventy-eight years, averaging about sixty-three years, and tension varied from 44 before to 17 after or during treatment; period of observation extended from two to seventeen years. Pupils were usually slightly oval vertically, or from 1 to 7 o'clock; anterior chambers were fairly deep. Visual fields in the beginning showed contraction which began in the superior nasal quadrant. Tension relatively low, usually about 28 to 30; excavation of discs moderate, and in some cases the entire disc not involved in the beginning, but was eventually. It is interesting in these cases to watch the ocular reaction, rise in tension, to systemic disturbance, such as intestinal toxemia, acute nasal inflammation, shock, emotional stress, and so forth, each reacting to its own idiosyncrasy.

In the cases with high myopia and extensive posterior sclerochoroidal changes, with moderate cupping and relatively slight increased tension, it is possible to overlook the glaucomatous conditions. I have recently found records of two cases in which this occurred, the previous examinations having been made in the offices of competent ophthalmologists.

In 75 per cent. of the cases tension was kept within normal range with myotics, the vision and the fields not deteriorating. The remaining 25 per cent. were operated upon, usually with a broad peripheral iridectomy or trephines. I think that the prognosis, as a rule, is good, either with medical or surgical treatment, depending upon the case.

DR. ALEXANDER DUANE, New York: It is important to get testimony on this subject from observers in different parts of the country, since the experience certainly varies. Dr. Feingold has pointed out that the variations depend on differences in locality and in the races examined. In a city like New York, where many races meet and myopia is frequent, the proportion of glaucomatous myopia is naturally greater than in many other places. My own experience agrees closely with that of Dr. Knapp. I have seen a relatively large proportion of cases of glaucoma and myopia, both of low and high degree. While the proportion is undoubtedly less in other places, yet the experience of Dr. Knapp and others must make us modify the dictum that myopic eyes are comparatively immune to glaucoma, and lead to the practical conclusion that with such eyes we should not forego the precautions that we adopt in eyes that are hypermetropic.

DR. W. H. WILDER, Chicago: My experience would lead me to the same conclusion reached by Dr. Knapp, that we encounter frequently in myopic eyes conditions that lead to hypertension and glaucoma. I think it is very important for ophthalmologists to have this matter presented to them, for the reason that many of the practitioners in ophthalmology throughout the country are not fully enough alive to the fact that glaucoma may develop in such an insidious way as to elude cursory observation, and even in myopic eyes. I think if this is strongly emphasized in our discussions and teaching, it will incite them to make more careful observation of the peripheral vision, which is so essential in determining early degrees of chronic glaucoma. One might naturally conclude that the impairment of vision in a myopic eye was due to central choroidal changes incident to the myopia, and neglect to measure the fields and to take the tension of the eye over certain periods. So I think the teaching should go out that, in communities where myopia does exist to a great extent, myopia by no means exempts an eye from chronic or simple glaucoma. One other thought in connection with this subject is that in the myopic eye we probably have a weakened condition of the sclera which causes it to yield more readily to intra-ocular pressure. It is said the sclera of the myopic eye is a little thinner than that of the hyperopic eye, particularly at the posterior pole, and this may account for the distention there that may result in a posterior staphyloma. Be that as it may, we have in these cases of glaucoma occurring in myopia a good illustration of the uncertainty that attaches to our tonometric measurements, no matter how carefully they be made, which shows that we must not rely absolutely on such measurements except as they apply to the individual cases, as we compare the observation of one day with that of subsequent tests. It is quite as necessary to have a series of observations in tonometry in a given case, as it is to have a careful temperature curve in cases of general infection. It is only in that way that we can place reliance upon our tonometric measurements. Given a myopic eye that is more subject to distention than the hyperopic eye, we would naturally expect to find in such a series of tonometric measurements that the myope would show a lower average of tension, but yet in that particular eye it might be quite as dangerous as a relatively high tension in an ametropic or a hyperopic eye.

DR. GEORGE S. DERBY, Boston: I would like to ask Dr. Knapp to specify more closely in regard to the class of myopic patients,

especially as to the treatment. I refer to those cases in which you get an undoubted glaucoma with myopia, occasionally a very high myopia, sometimes in comparatively young people, that is, people under fifty, in whom it is never possible to find increased tension. I can think of one case in which the tension averaged around 14 and never rose above 16 or 17. How does Dr. Knapp handle those cases?

DR. ALLEN GREENWOOD, Boston: I want to emphasize what Dr. Wilder said in calling attention to the timeliness of this excellent paper of Dr. Knapp. The reason I do so is because a short time ago I saw a woman in consultation who had a myopia of 16 D. She had been seen by several oculists, some of repute, who had told her that she had some symptoms of glaucoma, but assured her husband that she had such a high myopia that it was impossible for her to have glaucoma. Thus it shows that the general feeling among a great many is that high myopia is sufficient to rule out a diagnosis of glaucoma.

DR. J. E. WEEKS, New York: There are a number of points that I would like to speak of simply to corroborate Dr. Knapp's statements. One is that the myopia we encounter in cases of glaucoma, a myopia usually of low degree, is probably due to hypertension that has existed for quite a long period of time. The changes in the fields of vision, in my experience, correspond to the changes in the fields that we meet with in glaucoma without myopia. In considering the fields of vision in these cases we must bear in mind the fact that in myopia of high degree there is a concentric diminution of the fields peculiar to myopia—a diminution that must not be confounded with changes that take place as a result of glaucoma. It has been my custom to take the tension of all eyes that are myopic, particularly those in which the myopia is progressive, in children as well as in adults. In all cases of progressive myopia it is my custom to have a myotic used at night. I think that the myotic has a favorable effect on the progress of the myopia. An increase in the myopia implies a tension that is a little higher than the individual can sustain at the period of life at which it takes place.

In regard to the period at which hypertension may come on, it seems that it occurs in myopia of all degrees. I have recently had a case in which the myopia was 9 diopters in one eye and 13 in the other. After watching the patient for three or four months I

found it necessary to operate. The operation, which was a Langerange, has restored the tension to normal and preserved the vision unimpaired.

All ophthalmologists of large experience in glaucoma with myopia have seen cases that did well without operation. However, the operative results have been most satisfactory in the cases that have come under my observation. In regard to the form of operation, I think that that depends on the individual operator, who should choose the procedure that gives the best results in his hands.

DR. ROBERT SCOTT LAMB, Washington, D. C.: I think we are all interested in the etiologic factors in connection with these cases, and I want to ask Dr. Knapp if any basal metabolism tests have been made in these cases, as it seems as if nutritional changes play an important part.

DR. G. E. DE SCHWEINITZ, Philadelphia: I am not familiar with the incidence of glaucoma in myopia, as this may be related to the region in which the patients live. A good many cases have occurred in my clinical service, and although I have no statistical record with me, my observations coincide closely with those recorded by Dr. Knapp in his excellent and instructive paper.

The fields of vision did not in any material degree differ from those we are accustomed to find while investigating glaucomatous eyes with hyperopic refraction, except in one instance, where both upper fields were lost, somewhat in the manner of an altitudinal hemianopsia, except that a very narrow, spire-like band of preserved field rose from the center of each horizontal meridian, and reached almost to the upper limit of the field. I have not before or since observed a similar field in glaucoma. The eyes were highly myopic, and the cups, which in most of the glaucomatous myopic eyes which have been studied have been shallow and shelving, were deep and steep.

Of the 10 or 12 cases which I now have clearly in mind, the myopia has ranged from 1.5 D. to 12 D.; in some of the cases there was a moderate corneal astigmatism. The presence of gross choroidal changes, such as we are accustomed to find in progressive myopia, were uncommon; indeed, they were conspicuous in only one case.

Those eyes which were submitted to operative interference responded satisfactorily—iridectomy, corneoscleral trephining, and cyclodialysis (two cases) were employed. In one patient, a day

or two after cyclodialysis, there occurred a sudden acute rise of tension, which speedily yielded to the influence of myotics. This is the only instance of acute glaucoma which I have observed in a myopic eye of high degree, the myopia being 9.5 D. I have never encountered acute *primary* glaucoma in these circumstances.

DR. WALTER B. LANCASTER, Boston: I can corroborate the views of the other speakers that glaucoma in myopia is not rare, but that a good many oculists, some of large experience, believe it to be rare. This is instanced by the fact that I have seen a number of cases where a diagnosis of glaucoma in the presence of myopia was not made because the oculist was sure such cases did not exist.

Dr. Knapp has spoken of glaucoma without rise of tension, and it seems to me that these cases are frequently tragedies or near tragedies. I would, therefore, like to speak of the diagnosis. I think the consultant is apt to be misled because he sees the case only once. I have had a number of cases that I have studied for a period of years and then sent for some consultant who has disagreed in the diagnosis, because he was unable to see any rise of tension. I am accustomed to base the diagnosis on these two points: If, after watching a patient over a period of months or years, the optic nerve gradually becomes more and more excavated, even if there is no rise in tension, I suspect I have such a case. Later on, when the field begins to contract, I feel sure I have, and if the field continues to contract without being controlled by a myotic, I advise operation before the prognosis becomes bad because the disease has progressed too far.

DR. WALTER R. PARKER, Detroit: I regret to say I have no accurate figures in mind as to the frequent occurrence of glaucoma in myopia, but that it does occur in our part of the country I am very certain.

I arise to make a suggestion as to a choice of operation where other methods of treatment have failed and we are forced to resort to some operative procedure. What I have to say applies in my own practice not only to glaucoma associated with myopia, but also with ametropia or hyperopia. It is this: When the chamber is deep, the iris not atrophic, and the fields not markedly contracted, do an iridectomy. In all other cases resort to an operation which has for its object the establishment of a filtrating cicatrix.

DR. HIRAM WOODS, Baltimore: I want to mention a case I have

been watching for seven years—a woman who was thirty-seven years of age when she first came to me. She had been assured that the poor vision in her right eye could not be glaucomatous because of her myopic refraction. She had about 3 diopters of myopic astigmatism against the rule (axis 120°), and the correction of this gave her normal central vision. But there were—(1) a dim area in the upper nasal field which has since become a scotoma; (2) a Bjerrum scotoma; (3) glaucomatous bending of the blood-vessels; (4) tension over 40, which became normal under myotics. Central vision has remained normal and tension easily controlled by myotics.

DR. W. GORDON M. BYERS, Montreal, Canada: It has been my experience that often in cases of glaucoma occurring in myopes the disturbances are attributed by the patient to an increase in their short-sightedness. As a consequence, advice is tardily sought, and the glaucomatous changes are apt to be advanced when the patients first come under observation.

DR. HARRY S. GRADLE, Chicago: May I ask Dr. Knapp, first, what has been the response to adrenalin, used diagnostically, in these cases of glaucoma occurring with myopia? Second, in these cases has he found the distribution of pigment as described by Koeppé? And third, in the few cases of glaucoma of adolescence, did he find any excess of cells in the anterior chamber with slit-lamp examination?

DR. ARNOLD KNAPP, closing: I am entirely in accord with Dr. Wilder that it is likely that ophthalmologists sometimes dismiss cases of myopia with the belief that the changes are entirely myopic, overlooking the fact that the optic nerve changes are necessarily slight. The atrophy around the optic nerve (annular conus) should be suggestive of glaucoma, especially when there is bending of the vessels, particularly at the upper margin, which I think is a very important sign of intra-ocular pressure.

Dr. Derby asks in regard to the cases of low tension. I think these are very difficult to interpret. I cannot help but feel that there must be an optic nerve process in these cases independent of glaucoma. Exactly what to do with these cases is again very difficult. We naturally do not want to operate unnecessarily, but if the diminution in the field should be definite and progressive, it seems to me that operation is the right thing to do, even if the tension is low.

Dr. Weeks referred to the changes in the fields in myopia. I have been particularly interested in examining the blind spots in myopic cases without glaucoma, but I have never been able to find any pathologic field defects in these eyes. I wish Dr. Weeks had stated how much increase of tension he had found in cases of progressive myopia. I think this is an extremely interesting and important suggestion.

I am sorry, Dr. Lamb, that the basal metabolism was not studied in my cases. There was nothing, judging from the general appearance of the patients, to show that they were in any way abnormal.

Dr. Lancaster also spoke of cases of low tension. I think there are cases of moderate cupping of the optic nerve with low tension in which you find no field defects, which to my mind suggest that there is probably an optic nerve process present which is not dangerous. I think until we have some more information from the pathologist about the optic nerve conditions in these borderline cases it is impossible to decide what is best to be done. I also agree with Dr. Lancaster that if the field progressively contracts and the optic nerve continues to depress, an operation is necessary.

I think Dr. Parker's recommendations in regard to operation are exactly in accordance with the experience we have been able to gather from our cases.

Dr. Gradle asks in regard to the adrenalin reaction. It was present in these cases in about the same proportion as in the usual glaucomas. We did not examine these cases for the Koeppel pigment sign with the slit-lamp, nor for any particular changes in the anterior chamber.