

MALIGNANT GLAUCOMA

BY *Paul A. Chandler, M.D.*

DEFINITION

THE TERM "malignant glaucoma" was first applied by von Graefe (1) to a form of postoperative glaucoma which took a very unfavorable course and usually resulted in blindness. His description was in part as follows:

One sees bad cases in which if the anterior chamber is flat there is a rise in tension during the immediate postoperative period. The iris and lens are in contact with the cornea. The eye begins to tear, there is circumcorneal injection. . . . The patient is aware of great tenderness in the ciliary region, and complains of more or less ciliary pain. Visual acuity falls in an alarming fashion. . . . In summary there can be no doubt that through operation a new acute glaucomatous process is brought about which is unusual only in the continued failure of the anterior chamber to form.

Though the anterior chamber is usually described as completely flat, with tension high, in some cases the anterior chamber is formed but shallow after operation, with tension normal for a few days. Then the anterior chamber becomes flat or nearly so, and the tension rises. Subsequent writers have used the term "malignant glaucoma" to refer to the type of glaucoma described by von Graefe, and it is this type of postoperative glaucoma we are concerned with in this presentation.

INCIDENCE

Malignant glaucoma has been observed after iridectomy (1-12), trephining (13, 14), cyclodialysis (15-17). Of the six cases herein reported four followed iridencleisis and two followed trephining. It is difficult from the available reports to determine the actual incidence. Mehner (8) in 634 iridectomies reported an incidence of 4 percent, Brandt (13) had one case in 177 trephine operations. Sulzer (11) reported 7 cases in 252 iridectomies, and Hahnloser (12) 4 in 97 iridectomies. Von Graefe (1) reported an incidence of 2

percent. Judging from the few statistical reports in the literature, the incidence must be quite low.

PREDISPOSING FACTORS

In acute congestive glaucoma the complication is apparently less common than in chronic glaucoma. Von Graefe (1) stated that it occurred only in chronic glaucoma. It has been reported (8, 17, 23) in acute glaucoma, but the cases for the most part were neglected ones in which the attack was of from two days to several weeks duration before treatment was undertaken. Cases 2 and 6 herein reported were recent cases of the acute congestive type. In chronic glaucoma it is apparently about equally common in the congestive and noncongestive types (11, 12). Priestley Smith (6) stated, "It is most to be dreaded, I think, in cases of chronic noncongestive glaucoma, where the smallness of the cornea shows that we have to deal with an unusually small eye." In all reports where a detailed preoperative examination of the eye is recorded it is stated that the anterior chamber was very shallow and the preoperative tension high (6, 8, 11, 12, 15, 17). This was true of all six cases reported here. In most reported cases in which one eye took a malignant course postoperatively, if operation was done on the second eye, even months or years later, the course was the same (1, 2, 7, 14, 16, 17, 23). This was true in Cases 2, 4, and 5. In Case 1 the right eye did not take a malignant course after trephining, whereas the left eye did, but it was the least severe of all cases reported.

PATHOLOGY

I was able to find in the literature only four rather incomplete pathologic reports of cases of malignant glaucoma. Weber (4) gave a brief pathologic report of an eye which was enucleated six months after operation. In Schieck's (5) case, he described only an enormous dilatation of the choroidal vessels, almost like a cavernous angioma. The greatest dilatation was in the region of the vortex veins.

Priestley Smith (6) reported a case in which the cornea measured 10 mm. in diameter. There was a hypermetropia of 4 diopters. An uncomplicated iridectomy was done. The anterior chamber did

not re-form and high tension persisted. Gradually the lips of the wound separated, and what appeared to be a cystoid cicatrix formed, but the tension remained high. When the cystoid mass was punctured it was found to be the lens. The eye was later excised. The eye was found to be small, 21-22 mm. in diameter in all meridians. All anterior outlets were completely obstructed by the lens. Smith mentioned another eye which had been removed after failure of iridectomy to control the glaucoma. The anterior chamber was flat and the lens completely blocked the wound.

Mehner (8) reported a case in which enucleation was done two months after iridectomy. The cornea was not remarkable, except that he saw no endothelium. The lens and iris were in contact with the cornea. There were extensive posterior synechiae, and there was cataracta complicata. The lens was subluxated, not only forward, but a little nasally. Nasally many of the zonular fibers were broken, temporally they were all ruptured, and the remainder were stretched. This is the only case in which the zonular fibers are specifically mentioned.

MECHANISM

Heerfordt (18) and Schieck (5) felt that the primary fault was obstruction of flow from the vortex veins, producing marked congestion of the choroid and ciliary body which held the lens in its forward position. Heerfordt cited several cases which he thought would have developed malignant glaucoma had he not employed prophylactic measures. These measures consisted in getting the tension to normal with miotics, or, if this was not possible, doing a paracentesis without completely emptying the anterior chamber. Postoperatively he advocated the continued use of miotics, but dilated the pupil periodically to prevent adhesions. The cases he reported, however, would not be expected to take a malignant course, for they nearly all had a normal anterior chamber, preoperatively. Thiel (19) believed that the sudden widening of the intraocular blood vessels on opening the eye played the most important role. He thought that hyperemia of the choroid and ciliary body caused the iris and lens to be pushed forward so as to block all drainage. The sudden shallowing of the anterior chamber a

few days after operation with an acute rise in tension which has been observed in some cases and occurred in Cases 1, 2, and 4 could well be due to an acute congestion of the uveal tract. In Case 5 the patient was very unstable from a nervous and emotional standpoint. The tension rose and fell according to her emotional state. Such rapid fluctuations in tension could best be explained on the basis of circulatory changes in the uveal tract. However, congestion of the uveal tract, either from the glaucomatous process or as a result of suddenly opening the eye when the tension is high, is probably a feature common to many glaucomatous eyes in which the postoperative course is uneventful. Furthermore, if congestion of the uveal tract were the principal feature, one would expect the complication to occur more frequently in acute congestive glaucoma than in chronic glaucoma, but the reverse is apparently the case, and even in chronic glaucoma it occurs as commonly in non-congestive as in congestive cases.

Whether due to congestion of the uveal tract or simply to emptying the anterior chamber, the essential feature of the condition is the forward displacement of the iris lens diaphragm, completely closing the angle and blocking the wound. Tension remains high and the eye is lost unless in one way or another the anterior chamber can be re-formed. The extremely shallow anterior chamber which is always seen preoperatively indicates that there is an unusually large lens or a lens disproportionately large in relation to the anterior segment. As a rule, in glaucoma operations the anterior chamber becomes flat when the eye is opened. It may remain flat for a considerable period after a filtering operation, but the eye usually remains soft, due to filtration from the wound. This means that aqueous can pass freely around the lens and hence escape through the operative wound anteriorly. If the lens is unusually large it apparently acts as a block between the posterior and anterior chamber. Cases may be observed in which the block is not quite complete and in which, therefore, a malignant course is barely escaped. In these cases the eye remains firm after the anterior chamber is opened, and may still be firm at the end of the operation, but the eye is found to be soft when the first postoperative dressing is done. If the block is complete the tension never

falls. A vicious circle is set up so that the more the pressure builds up in the posterior chamber, the more firmly is the lens held in its forward position.

PROPHYLAXIS

For prophylaxis it would seem advisable to get the tension as low as possible preoperatively. No case has been reported in which the tension was within the normal range at the time of operation. In cases of special risk Priestley Smith (6) advocated posterior sclerotomy, either before the operation or immediately afterward if the tension remained firm. Thiel (19) and Lauber (20) likewise advised preliminary posterior sclerotomy in cases in which malignant glaucoma was feared. That posterior sclerotomy cannot be depended on to prevent the complication in all cases is demonstrated in Case 5.

TREATMENT

For treatment of malignant glaucoma, once it has developed, various measures have been suggested. First of all, it can be stated that judging from reports in the literature, further anterior operations such as iridectomy, trephining, cyclodialysis, and iridencleisis are completely ineffective. This is further illustrated in Cases 2, 4, and 5. Weber (4) performed a posterior sclerotomy and then made firm steady pressure on the cornea through the lid for 1-2 minutes. The anterior chamber was re-formed with blood-stained fluid and the tension fell. The procedure was carried out as a rule from the 10th to the 20th day postoperatively, in order to give the wound time to heal, but was done sooner if the process was very severe. Priestley Smith (6) employed Weber's procedure successfully in one case.

Posterior sclerotomy has been advocated by Lauber (20), Mehner (8), Manschat (21), and others. In Manschat's case, two days after trephining the sclera and evacuation of considerable vitreous, the anterior chamber was re-formed, and thereafter tension was controlled. In several of Mehner's cases the anterior chamber failed to re-form, even after repeated posterior sclerotomies, and the eyes were lost. Essential details are lacking in many of the reports, so that it is difficult to evaluate the efficacy of posterior sclerotomy in

these cases. Certainly it is not effective in all cases. Furthermore, the condition may recur after a period of normal tension and re-formed anterior chamber, as illustrated in the left eye of Case 2. The general impression gained in reading the reports in the literature is that if posterior sclerotomy is to be effective, it should be done immediately malignant glaucoma develops. It would seem logical, if posterior sclerotomy is done, to fill the anterior chamber with air at the same time. In Case 1, air injection alone forced the lens back, and apparently broke up the vicious circle. It should be noted, however, that in this case the tension was not unduly high. It does not seem probable that air injection alone would be sufficient in the very severe cases.

In 1877 Pagenstecher (9) suggested lens extraction as a treatment for malignant glaucoma. The first report of its successful use was made by Rheindorf (7) in 1887. In his case, bilateral iridectomy had been done for inflammatory glaucoma of four days' duration. There was no light perception in either eye. Postoperatively the anterior chambers did not re-form and tension remained high. Three days after the iridectomy, lens extraction was carried out on the left eye. There was considerable vitreous loss. Three days later the same procedure was done on the right eye. In both eyes the anterior chamber re-formed, tension was normalized and remained normal during a follow-up period of two years. Vision of counting fingers was obtained in both eyes. Rheindorf stated that he had employed lens extraction successfully in eleven other cases. Priestley Smith (6) in 1891 suggested that lens extraction would be a logical procedure in these cases. Mehner (8) quoted Czermak and Schweigger as favoring lens extraction, and mentioned one successful experience. Zeeman (14) reported one case in which lens extraction was used successfully. Kubik (23) in 1937 reported a typical case of malignant glaucoma after iridectomy. Trephining and cyclodialysis were ineffective, but lens extraction was successful, with normalization of the tension over a follow-up period of six months.

Case 6 herein reported illustrates an excellent result from prompt extraction of the lens. In Case 2 lens extraction was likewise apparently chiefly responsible for saving the eye. In this case the anterior chamber had been flat for several days. The tension,

which had been high at first, postoperatively, was reduced to normal by vigorous massage of the eye. This had the effect of forcing out vitreous and doing in effect a posterior sclerotomy. Since there was drainage directly from the posterior chamber, it seems unlikely that the anterior chamber would ever have formed had the lens not been removed. In Case 3 lens extraction was delayed for four weeks, and in Case 4 for some months. All vision was eventually lost in both cases.

The reported cases are too few in number to enable one to be certain as to the best method of treatment. Air injection into the anterior chamber was successful in a single relatively mild case (Case 1). Posterior sclerotomy has been successful in some cases, but several failures have been reported (8, 15, 19). Prompt extraction of the lens appears to offer the best chance of relieving the condition. This is well illustrated in the excellent result obtained in Case 6. In the few available reports, lens extraction has apparently been successful in every instance, if performed promptly. If it is delayed too long, extensive peripheral anterior synechiae may form and the tension will not be completely relieved, as in Cases 2, 3, and 4 in this series. From a theoretical standpoint, lens extraction would appear to be a logical procedure. In Mehner's case the lens was somewhat dislocated and the zonular fibers were extensively torn, so that the lens would probably not have gone back into its normal position, no matter what was done. Even if posterior sclerotomy causes the anterior chamber to form and relieves the tension, the anterior chamber remains very shallow, and there is a possibility of further attacks of increased tension, with eventual loss of the eye, as in the cases reported by Schweigger (2), Samelsohn (22), and others, and in the left eye of Case 2 in this series. Furthermore, there is always the possibility of the lens later becoming opaque. For the milder cases, air injection into the anterior chamber, with or without posterior sclerotomy, is a logical procedure, and may be attended by success, but, in the light of present knowledge, prompt extraction of the lens would appear to be the treatment of choice even in these cases.

All reports in the literature indicate that if malignant glaucoma ensues after operation on one eye it invariably follows operation on the second eye. This is also illustrated in Cases 2, 4, and 5 in this

series. In Case 1 the left eye, only, took a malignant course, but it was relatively mild. Therefore, if the glaucoma has taken a malignant course after operation on one eye, it would seem logical to employ lens extraction with broad basal iridectomy as the initial procedure, should operation be required for the second eye.

SUMMARY AND CONCLUSIONS

Malignant glaucoma is defined as a form of postoperative glaucoma in which, after any anterior operation for glaucoma, the anterior chamber remains or shortly becomes flat and the tension rises. It apparently occurs in approximately 2 percent of cases, and is only seen in eyes with a shallow anterior chamber and an elevated tension at the time of operation.

The essential feature of the condition is a forward displacement of a relatively large lens, which then blocks communication between the posterior and the anterior chamber, as well as all essential outlets from the eye. Congestion of the uveal tract may play a part in pushing the lens into its forward position and holding it there. For prophylaxis, the tension should be brought as near to normal levels as possible, preoperatively, with miotics. Posterior sclerotomy has been employed prophylactically, but there is apparently no certain method of preventing the complication in predisposed eyes.

For treatment, air injection into the anterior chamber was successful in one relatively mild case. Posterior sclerotomy has been successfully employed, but has failed in several instances. Prompt extraction of the lens would appear to be the treatment of choice.

If one eye takes a malignant course after glaucoma surgery, the fellow eye is almost certain to take the same course after operation.

If malignant glaucoma ensues after operation on one eye and operation is necessary on the other eye, extraction of the lens is the operation of choice.

Case 1. J.C., female, age 66. First seen February 11, 1946. Vision Right and Left with glass, 20/30. Tension Right 48, Left 41. Anterior chambers shallow, moderate cupping right disc, no cupping left disc. Loss of upper nasal field and upper Bjerrum scotoma right eye. Normal field left eye. Miotics prescribed. Tension remained in the low twenties until May 1946, when it rose to 32 in the right eye. On May

28, 1946, trephining operation was done on the right eye. The anterior chamber was flat for a few days postoperatively, but tension remained soft. The anterior chamber re-formed in about a week, but remained shallow. During the next few weeks tension remained soft, but the lens gradually became opaque. The further history of this eye includes a lens extraction and further difficulty with glaucoma, not pertinent to this discussion.

The tension in the left eye, in spite of miotic therapy, gradually rose, and ranged from 30 to 40. On November 26, 1946, an iridencleisis with anterior sclerectomy was done on the left eye. During the first few days postoperatively, the anterior chamber remained extremely shallow to flat, but tension was soft. On December 2, six days postoperatively, tension was 42. On December 4 it was 45. The anterior chamber was extremely shallow or flat. An air injection into the anterior chamber was done. Following this the chamber remained formed, and was practically normal in depth.

During the next three years tension in the left eye ranged under miotic therapy from the low twenties to the high thirties, for the most part under 25. A nuclear opacity has gradually developed in the lens. Vision with glass is now 20/70 in this eye, tension is difficult to control, and lens extraction is contemplated.

Case 2. A.N., female, age 56. First seen April 12, 1948, with a history of blurred vision in the left eye. In both eyes the anterior chamber was extremely shallow. In the right eye, vision with glass equaled 20/30, no cupping of the disc, tension 24, field normal. In the left eye, vision with glass equaled 20/50, marked cupping of the disc, tension 55 Schiötz, nasal field gone, and some restriction of upper temporal field. Patient was admitted to the hospital, and since the tension could not be reduced with miotics, on April 13, 1948, a combined cyclo-dialysis and iridectomy was done. Postoperative course was somewhat stormy. The anterior chamber was formed, but very shallow, there was hyphemia for 10 days postoperatively, and the eye remained red. On May 10, nearly one month after the first operation, patient was readmitted to the hospital with acute pain in the left eye. Tension was 69, the anterior chamber was practically flat. Vision equaled 6/200. The condition of the right eye was unchanged, tension 22. Tension in the left eye could not be reduced with miotics, and an air injection into the anterior chamber was done on the left eye. The next day tension was still markedly elevated, and the anterior chamber was flat. A posterior sclerotomy and air injection into the anterior chamber was done. After this operation the anterior chamber remained formed and the tension normal.

On May 24 the patient was readmitted to the hospital with a tension of 69 in the left eye. The anterior chamber was formed, but extremely

shallow, right eye remained normal. A cyclodialysis was done. Two days later tension was 51, and it remained at a high level during the next few days in spite of all treatment. On June 4 an iridencleisis with anterior sclerectomy was done; 48 hours later tension was 43 and the anterior chamber was flat. Six days postoperatively tension suddenly came down to 16, and there was evidence of a filtering scar. On June 24 the anterior chamber in the left eye was very shallow, tension was 40. No further surgical treatment was advised for the left eye, since vision was reduced to faulty light projection.

The right eye had been under continuous miotic treatment during this period, and the tension had never been elevated. On October 11, 1948, there was an acute attack of glaucoma in the right eye, which had previously remained normal. Tension was 51. Tension could not be reduced with miotics, and admission was advised but refused. One week later tension in the right eye was 67, and the patient was admitted to the hospital. The anterior chamber was extremely shallow. On October 19, 1948, an iridencleisis with anterior sclerectomy was performed on the right eye. The following day the anterior chamber was flat and the tension considerably elevated. Vigorous massage was carried out, and the tension became soft. During the next four days the anterior chamber remained flat. There was no separation of the choroid. On October 23, 1948, an intracapsular lens extraction was done. When the conjunctival flap was lifted vitreous was encountered under it, and there was considerable vitreous loss with the extraction. Postoperative course was complicated by a leaking wound and a flat anterior chamber with separated choroid. The anterior chamber eventually remained formed, and the patient was discharged on November 9, 1948, with normal tension. On November 28, 1948, patient was readmitted with an elevated tension, which was thought to be due to a pupillary block from adhesion of the iris to the hyaloid membrane. A transfixion of the iris was carried out. Following this, tension remained in the low twenties until December 13, 1948, when it was 48. It was reduced with miotics, and the patient was discharged in a few days. On December 27, 1948, patient was readmitted with a tension of 48 in the right eye. Gross peripheral anterior synechiae could be observed. The possibility of another pupillary block could not be ruled out. A combined cyclodialysis and peripheral iridectomy was done. From that time up to the present the patient has used DFP 0.1 percent once a day and 4 percent pilocarpine three times daily. Tension has remained 22 or less, and when last seen (May 8, 1950) tension was 21, there was no pathologic cupping of the disc, the visual field was full, and vision with a cataract glass equaled 20/40.

Case 3. B.G., female, age 55. First seen January 14, 1949, hypermetropia +4.50 both eyes, corrected vision 20/15 in each eye. Shallow

anterior chamber both eyes, no pathologic cupping, full fields, tension Right 40, Left 35. Tension could not be reduced with miotics and became ever higher. On January 31, 1949, an iridencleisis with anterior sclerectomy was done on the right eye. The anterior chamber remained flat postoperatively, and on February 15, 1949, tension was Right 59, Left 45. During the next two weeks tension ranged from 55 to 75 in the right eye, 40 to 45 in the left. On February 28, 1949, an extracapsular cataract extraction was done on the right eye. Postoperatively the wound broke open, requiring excision of vitreous and resuturing of the wound. During the next few months the tension was considerably elevated in the right eye at various times, there was a good deal of reaction from the lens cortex, and all vision was eventually lost.

Tension in the left eye under miotics ranged from 30 to 65, mostly above 50.

Case 4. M.G., female, age 55. History of having used drops twice daily for four years. When last seen by her previous oculist, tension was Right 75, Left 65. Vision in the right eye with glass 20/25, in the left 20/20. Tension Right 55, Left 40, anterior chambers shallow; field was full in the right eye, considerably contracted in the left.

A trephining was done on the right eye March 8, 1949, and on the left eye March 16, 1949. Anterior chamber remained flat in the left eye, and shallow to flat in the right. On April 23, 1949, tension was Right 38, Left 70. On April 26, 1949 a cyclodiathermy was done on the left eye over the temporal half. Tension remained high in both eyes. On May 10, 1949, an iridencleisis with anterior sclerectomy was done on the right eye, and the same operation was done on the left eye on May 14, 1949. On June 24, 1949, tension was Right 18, Left 13. Vision in the right eye equaled 20/100, in the left eye faulty light projection. The right lens gradually became opaque. On November 28, 1949, tension in the right eye was 56. The tension remained high, and on January 4, 1950, an anterior sclerectomy with extraction of the lens was done. Following this the tension in the right eye remained 28 or less. Vision was light projection above and temporally. There was no light perception in the left eye.

Case 5. A.F., female, age 55. This patient was extremely psychoneurotic, uncooperative, and very difficult to handle from first to last. On many occasions she would not allow tonometry or perimetry. When first seen in May 1945 vision in the right eye equaled 5/200, in the left 20/20. There was marked cupping of the right disc, slight of the left. The anterior chambers were extremely shallow. Tension was 90 McLean in each eye. Miotics were prescribed; tension remained high. On October 20, 1945, a trephining operation was done on the right eye; 36 hours after the operation tension was again stony hard. Tension also remained elevated in the left eye in spite of miotics. On January

15, 1946, it was possible to measure her visual fields. Only a temporal island remained in the right eye, and a marked constriction of the field in the left. When the patient would allow tonometry on February 1, 1946, tension was 56 in the left eye. On March 8, 1946, tension in the left eye was 70 mm. Schiötz.

On March 15 a wide basal iridectomy combined with a posterior sclerotomy was done on the left eye. During the next two weeks the anterior chamber remained flat, and tension in the left eye varied from 30 to 50 mm. Tension always became considerably more elevated in association with emotional upsets. On April 3, 1946, an iridencleisis was done on the left eye, and a posterior sclerotomy carried out at the same time. During the next several days the tension seemed to be lower, and on April 10 was 30 mm. Schiötz in the left eye. During the next two weeks tension in the left eye ranged from 20 to 50 mm. Schiötz, and again it was noted that the tension was always higher during periods of emotional upset. DFP and other miotics were used without any reduction in the tension. Lens extraction was advised, but the patient would not consent to it. By August 1946 the patient had no light perception in either eye, tension in the right eye was 70 mm. and the left 50 mm. Schiötz.

Case 6. N.E.M., male, age 76. Patient was first seen November 25, 1949, complaining of severe pain in the left eye. The eye had been blind for 20 years following occlusion of the central artery of the retina. The left eye was in a state of absolute glaucoma, with a tension of 80.

In the right eye tension was 22, the anterior chamber was shallow, vision equaled 20/50. There were a few changes in the lens. Ten days later patient developed severe pain in the right eye. On December 5, 1949, he showed all the evidence of an acute attack of glaucoma in the right eye, with a tension of 65 Schiötz. The anterior chamber was extremely shallow. There was no response to intensive miotic therapy, and an iridencleisis with anterior sclerectomy was done. The patient was comfortable for the next 24 hours, tension was normal, the anterior chamber flat. During the second hospital night he complained of severe pain in the operated eye. The following morning the anterior chamber was flat and tension was 55. Tension could not be reduced by miotics, and an intracapsular lens extraction was carried out with some loss of vitreous. Thereafter the anterior chamber remained well formed, and the postoperative course was uneventful. Since that time tension has remained below 20 without treatment, and in April 1950 vision with a cataract glass equaled 20/30.*

*The reports on Cases 3, 4, 5, and 6 were kindly furnished me by Dr. A. B. Reese, Dr. Wendell L. Hughes, Dr. David O. Harrington, and Dr. J. Howard Stokes.

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DISCUSSION

DR. ALGERNON B. REESE. The characteristic feature of malignant glaucoma is an advancement of the lens. Dr. Chandler is inclined to believe that the lens is pushed forward by congestion of the uveal tract. I believe the lens comes forward as a result of an increase in vitreous pressure. I did not locate this section of a malignant glaucoma until the day I left for Hot Springs, so I did not have a chance to have a micro-

photograph made. Therefore, you will have to accept on faith alone much of what I tell you. Obviously the lens is quite far forward and, in studying it, one can see that the hyaloid of the vitreous occupies cracks and crevices back of the lens. This gives the definite impression that a swelling of the vitreous is the main factor in pushing the lens forward. I should like to point out in this slide that there is plenty of space between the equator of the lens and the nearest scleral point.

The next slide is another instance of malignant glaucoma and shows a phakocele in a trephine operation. Dr. Chandler mentions this occurrence in one of his cases. I might also say that in this case there seemed to be ample space between the equator of the lens and the nearest scleral point.

Wadsworth has studied some of the eyes with glaucoma which have been operated on by various methods and has analyzed them with particular regard to ensuing acquired myopia. He finds that in more than 70 percent of the cases acquired myopia occurred, the average approximating one diopter. An advancement of the lens 1 mm. would account for 3 diopters of myopia. Another observation was that the pressure of the eye is temporarily elevated following operation. The elevation persists for various periods postoperatively, and the myopia levels off to normal later as the pressure decreases. In other words, the degree of myopia is in some degree commensurate with the elevation of the intraocular pressure. Furthermore, it has been observed that acquired myopia sometimes ushers in glaucoma; that is, the patient will show some degree of acquired myopia at the time the onset of glaucoma is imminent. At the present stage of this analysis, indications are that this acquired myopia is prone to occur in the shallow-angle type of glaucoma. It is the shallow angle which Dr. Chandler emphasized as a feature of the cases that show malignant glaucoma. Therefore, it is possible that malignant glaucoma represents merely an abnormal degree of advancement of the lens following surgery.

Dr. Chandler also stated that another feature of malignant glaucoma is the fact that intraocular pressure is definitely elevated at the time when surgery is done. If the increase in vitreous pressure is a factor in the increase in intraocular pressure (which I am inclined to think it is in the shallow-angle type), then when the anterior chamber is evacuated and the pressure on that side is decreased, the vitreous pressure will be permitted further to manifest itself by an advancement of the lens.

I hope some of you have been fortunate enough not to encounter any cases of malignant glaucoma. If you have, you have probably had the same experience that we have had: that all glaucoma operations are of no avail. I face the future with some hope in regard to any cases of this kind which may come under my care, as Dr. Chandler now gives us what I think is a rational therapeutic approach.

DR. F. H. VERHOEFF. We remember our early cases better than any others, and I remember the first case of this kind I had. It was about 45 years ago. I do not remember the patient's name, but I remember she lived in Jamaica Plain. In those days almost all private operations were done in the patient's home; we turned the patient around so that his or her head was at the foot of the bed. It would save patients a lot of money if we did more operations in homes. As I remember it, this was a case of acute glaucoma. I did an iridectomy and the lens came forward; evidently the lens was trying to get out of the eye, so I helped it do so. Soon afterwards I read in the literature that others advocated the same thing, and I was convinced it was the proper procedure in cases of malignant glaucoma. I saw the patient afterwards and she did not have glaucoma in the other eye for as long as she remained with me.

This case brought out a point not mentioned by Dr. Chandler, namely, the difficulty of explaining to the patient that she has had a highly successful operation, yet, owing to the aphakia, she cannot see with the eye.

DR. PAUL A. CHANDLER. I found in the old literature quite a few writers who laid emphasis on congestion of the uveal tract in this disorder, and in these modern times many writers lay a good deal of emphasis on this, especially in connection with acute glaucoma, but I did not mean to give the impression that I subscribe entirely to that theory. I do not. It is difficult to prove or disprove, but it seems to me that there is sufficient explanation for the difficulty, in just opening the eye and allowing the iris-lens diaphragm to move forward. When the eye is operated on in persons with high tension, as many eyes have to be, particularly of this type, if the pressure is 60 in the anterior chamber, it is 60 in the posterior chamber. One can imagine it takes an appreciable amount of time after opening the anterior chamber for the pressure in the posterior chamber to stabilize itself. I conceive that in this condition the lens-iris diaphragm comes forward rapidly when the anterior chamber is opened, and the posterior chamber does not have an opportunity to release its pressure; the pressure remains high and even goes higher. The iris and lens are pushed against the cornea. In Dr. Reese's slide of the case which he had the opportunity to examine, he thought that there was a space between the lens and the scleral lip which would suggest that there was still room for aqueous to percolate around the lens and into the anterior chamber, and perhaps escape from the wound. In the few pathologic cases reported in the old literature the lens itself blocked the wound in the area of the coloboma, and if it held the iris against the cornea in all other places it would, of course, prevent any escape of fluid from the eye. I had a

beautiful opportunity to do the right thing on the second case after we had lost the first eye after several operations. I had the opportunity, I believe, to cure the second eye very simply by extraction of the lens, and even considered it, but did not consider it strongly enough. I have regretted it ever since, and I am sure the patient has.