

COMMUNICATIONS

INTRA-OCULAR PRESSURE IN PRIMARY CONGESTIVE GLAUCOMA*

BY

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THIS investigation was undertaken at the Institute of Ophthalmology, London, the patients being drawn from a series of 100 individuals. All of them suffered from glaucoma characterized by a clinical onset consisting of periodic halos, with episodes of blurred vision and ocular pain. They formed a group of primary glaucomas in the adult, defined in this paper as congestive. Other characteristics of the patients in this group have been described in a previous paper (Miller, 1952). Narrow chamber angles, full peripheral and central fields of vision, and absence of cupping of the optic disk in the early stage of the disease are the main ocular features.

A Typical Early Case.—On June 29, 1951, a female patient aged 45 years was referred to the glaucoma clinic with the following letter:

I should be grateful if you would accept this patient for investigation in the glaucoma clinic. The recent onset of halos is not convincing and I have been able to detect no positive evidence of glaucoma.

Eight weeks previously she had visited a cinema and after the performance complained of pain in the right eye with some blurring of vision. On the way home she noticed bluish rings round street-lights. Similar attacks had recurred at approximately weekly intervals, always in the evening after 8 p.m.

Examination revealed visual acuity of 6/5 right and left eye, shallow anterior chambers and narrow angles, no iritic atrophy, full fields of vision centrally and peripherally, negative dark-room and water-drinking tests, and an intra-ocular tension of 15 mm. Hg Schiötz in each eye. A 24-hour diurnal variation curve of the intra-ocular pressure was undertaken on two occasions with similar results. One of these is charted in Fig. 1. The negative results of all examinations could not outweigh the very typical history of attacks of halos occurring with blurring of vision and pain in the right eye, and arrangements were made for her to visit hospital when an attack was in progress. On September 25, 1951, she walked into the hospital at 11.30 p.m. complaining of halos seen with the right eye. Her intra-ocular pressure was found to be 44 mm. Hg right, and 20 mm. Hg left. No treatment was administered and next day the tonometer readings were 21 mm. Hg right and 21 mm. Hg left.

This case history shows the value of measuring the intra-ocular pressure in congestive glaucoma when symptoms are in evidence, and suggests that when the diagnosis is in doubt, a patient who complains of periodic halos should be instructed to report to a suitable centre for a tonometric reading during an attack, for the symptoms of early congestive glaucoma are nearly

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always worse in the evenings when consulting rooms and out-patient departments are closed. Two short case histories emphasize this point.

(1) Female, aged 35 years.—From the age of 22 years she had noticed periodic fogging of her left vision. The attacks were typical of congestive glaucoma, occurring always at night and accompanied by halos and ocular pain. She was examined many times, but always during the day, and she was assured, as many times, that her eyes were healthy: 6 weeks before she attended the Glaucoma Clinic she was carefully examined neurologically (including an EEG) and migraine was diagnosed. The diagnosis of congestive glaucoma was made when she was examined one evening by an ophthalmic surgeon during an attack. At this time her visual acuity was 6/5 right and 6/6 left and the fields of vision were full.

(2) Male, aged 49 years (diurnal variation curve Fig. 9a).—In the summer of 1948 he began to notice halos with both eyes at night. He was seen at 6-monthly intervals between 1948 and 1951. Each time his fields and tension were carefully examined and no abnormality was found. He was finally dismissed and told he was an "odd" case. At the time of diagnosis visual acuity was 6/5 in each eye and the fields were normal.

These cases demonstrate that an eye suffering from attacks of subacute congestive glaucoma may appear healthy and react normally between bouts of raised tension.

I have carried out 24-hour diurnal variation curves of intra-ocular pressure in a series of 25 early cases of proved congestive glaucoma most of whom had had no treatment. None of these patients complained of symptoms during the test. Twenty of these curves lay within normal limits and five showed minor deviations from normal. In congestive glaucoma the diurnal variation curve may be of no diagnostic value unless it is coincident with the appearance of symptoms. Fig. 1 gives an example of a typical curve showing no abnormality and Fig. 2 an example of a suspicious curve showing a minor abnormality.*

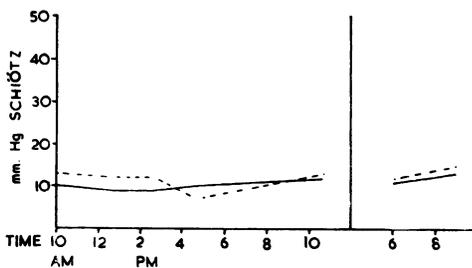


FIG. 1.—Normal 24-hour diurnal variation curve in a patient who was later proved to have congestive glaucoma.

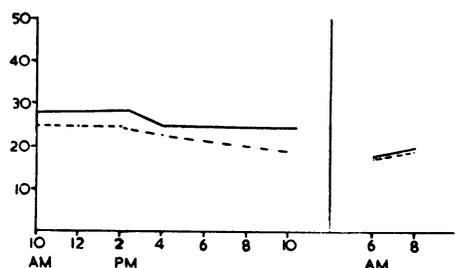


FIG. 2.—Slightly abnormal 24-hour diurnal variation curve in a patient with proved congestive glaucoma who had withheld miotics for 36 hours. No symptoms during this period.

Intra-Ocular Pressure during an Attack.—The onset of an attack of raised tension may take place quite dramatically and suddenly. I have been fortunate in witnessing several such attacks while examining established cases after miotics had been stopped for 24 hours; the results are seen in Fig. 3 (opposite).

* In all figures the tension of the right eye is recorded by an unbroken line, and of the left eye by a dotted line. The vertical line breaking the curves indicates that observations were discontinued while the patient was asleep.

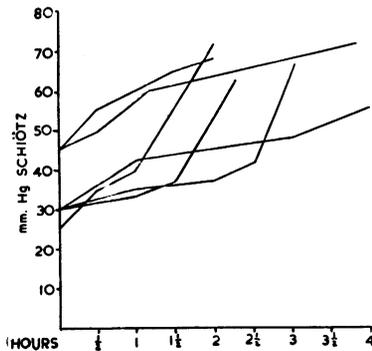


FIG. 3.—Rapid rises of intra-ocular pressure in six patients with established congestive glaucoma who had withheld miotics for 24 hours. Symptoms of halos, blurring, and ocular pain appeared, and increased with the rise in tension.

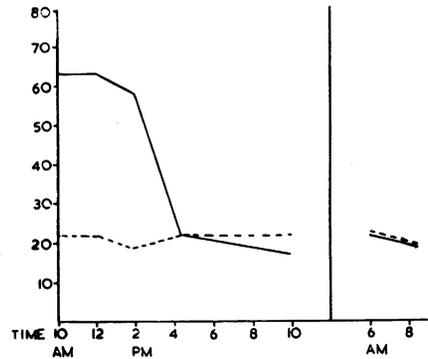


FIG. 4.—Spontaneous fall in tension in an untreated patient. (Same patient as Fig. 1).

A spontaneous fall of tension in an untreated case moves over as wide a range (Fig. 4). It will be observed that these sharp changes take place over a period of 4 hours or less and emphasize the futility of an isolated Schiötz reading. In all cases the patients were aware of halos, blurring of vision, and a feeling of fullness or pain in the eye when the intra-ocular pressure was at its height, and these symptoms were relieved when the tension fell spontaneously or with miotics. As far as I have observed, symptoms in an untreated case of congestive glaucoma always indicate an abnormally raised ocular tension, and the absence of symptoms in an untreated recent case indicates that the intra-ocular pressure has remained within, or not far beyond, normal limits during that period. The symptoms and the attacks of raised intra-ocular pressure are contemporaneous and episodic.

Spacing of Attacks.—Early in the course of the disease congestive attacks occur infrequently with long periods of freedom. Three typical early cases had attacks at the following times:

- (1) *Female, aged 57.*—Feb. 8, April 9, May 1, June 5 and 23, August 21 and 25.
- (2) *Female, aged 45.*—Five attacks between June 4 and 14; six attacks between July 8 and 22; attacks on July 29, 30, and 31, and on August 3, 7, 8, and 9.
- (3) *Male, aged 45.*—Jan. 7, 9, 12, 16, 18, 21, 25, 26, and 30; Feb. 7, 11, 18, and 19; March 3, 5, 6, 10, 11, and 17.

The attacks become more frequent as the disease progresses until they occur nearly every night, and the onset of symptoms occurs earlier in the day. Fig. 5*a* (overleaf) shows a curve from a patient who had reached the stage of developing attacks every evening.

Precipitating Factors.—The cinema and television are the commonest provokers of attacks and it is so rare for a patient with congestive glaucoma to deny the detrimental effect of the cinema on visual acuity that I would question my diagnosis in the face of it. What the precipitating factor in

visiting the cinema may be is not clear, because many patients who complain of halos after the theatre, cannot be induced to show a rise of tension when enclosed in a dark room for 30 min. to one hour during the day. The time of day may have some effect, although halos may occur after matinées; they disappear in about 20 minutes if the patient comes out into the daylight, but they continue and become more prominent if the patient comes out into the dark after an evening performance. It would seem that, whatever the precipitating factor may be, daylight has the power to lower the abnormally raised tension.

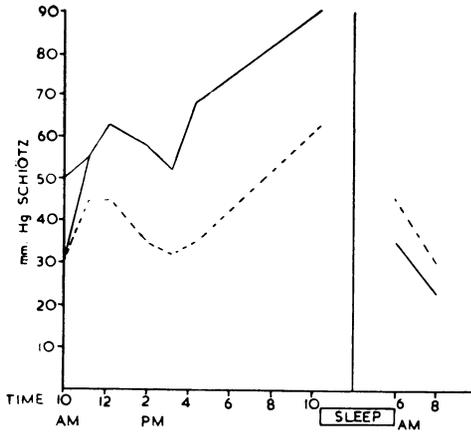


FIG. 5(a).—24-hour diurnal variation curve in an untreated patient who saw halos each night.

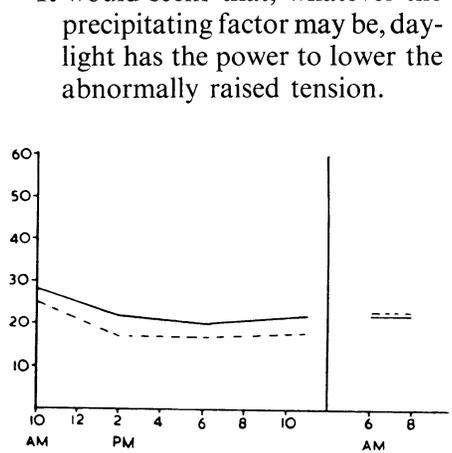


FIG. 5(b).—24-hour diurnal variation curve to show the effect of miotics. (Same patient as 5a).

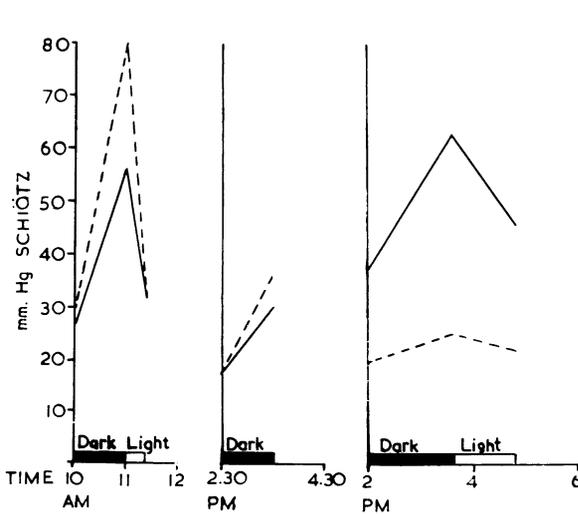


FIG. 6.—Three dark-room tests showing rapid rises of tension in all cases, and sudden falls in two cases on exposure to light.

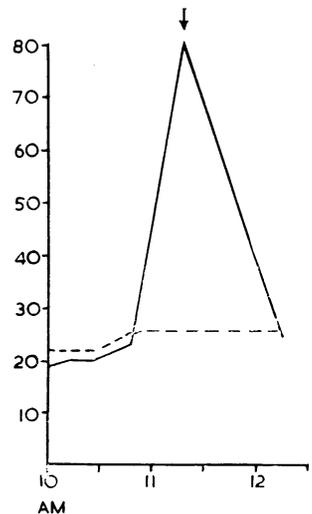


FIG. 7.—Spontaneous rise in tension in an untreated patient who was apprehensive at the time of examination. At the arrow, miotics were instilled to counteract the raised tension and remove the blurred vision.

There is no doubt that, in some cases, darkness of itself has a very dramatic effect, as in the three cases shown in Fig. 6, and it is common for patients to note the seasonal variation in the incidence of their symptoms, the attacks being more frequent and severe during the winter months.

Another common provocative agent is an emotional crisis. Attacks are described following a disagreement with a neighbour, on receiving sudden news by telephone of illness in the family, on excitement at a game of cards, before an examination, at the end of a hectic day, and so on. Such examples could be multiplied many times. Fig. 7 shows the rapid rise of intra-ocular pressure in a very nervous woman who was referred to the Glaucoma Clinic and who, at this visit, was very much afraid of encountering someone for whom she had a strong (though unjustifiable) dislike.

Prolonged visual concentration may precipitate attacks, especially if carried out under bad lighting conditions. Fig. 8(a) shows a sudden rise in a patient who spent the morning between 10 a.m. and 12 noon reading in a semi-dark corridor. Fig. 8(b) shows her diurnal variation curve taken on a different day.

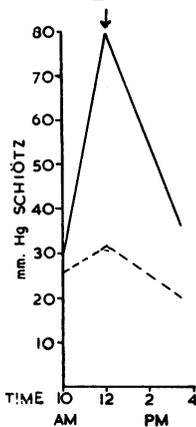


FIG. 8(a).—Spontaneous rise in tension in an untreated case after a period of reading in a poor light. At the arrow, miotics were instilled.

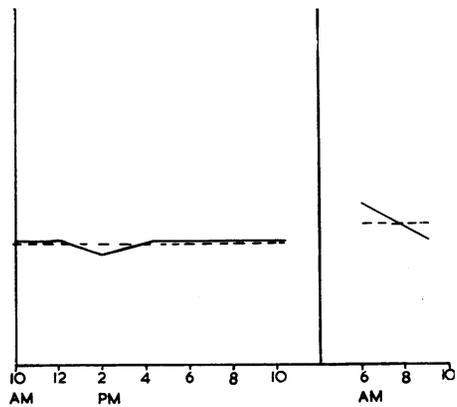


FIG. 8(b).—Diurnal variation curve of the same case taken on a different day.

Some women suffer from regular attacks during the pre-menstrual or menstrual period.

Relieving Factors.—There are also factors which tend to lower a raised tension, chief of which are sleep and rest. All patients, until very late in the course of the disease, state that their eyes are normal in the morning. Fig. 9a (overleaf) shows the effect of a night's sleep on an untreated case of congestive glaucoma of some 3 years' duration. Many patients are so aware of the beneficial effect of sleep that they modify their daily habits accordingly and sleep in the afternoon or in the early evening, and others

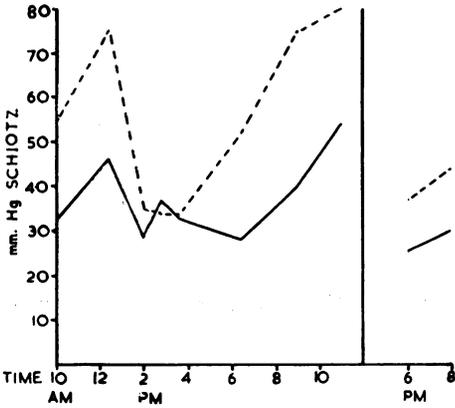


FIG. 9(a).—24-hour diurnal variation curve in a patient with untreated congestive glaucoma who had symptoms on most nights, to show the effect of sleep on the intra-ocular pressure.

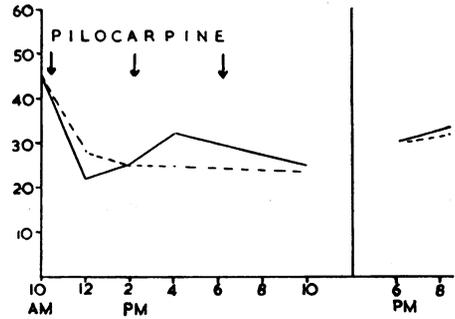


FIG. 9(b).—24-hour diurnal variation curve in a case of congestive glaucoma showing that miotics thrice daily may be inadequate therapy. (Same patient as in Fig. 9a).

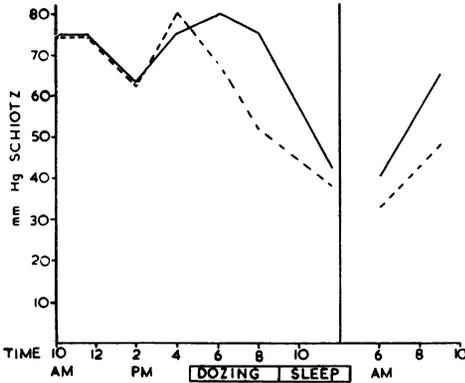


FIG. 10(a).—24-hour diurnal variation curve in an untreated case to show the effect of sleeping in the evening. (Same patient as in Fig. 10b).

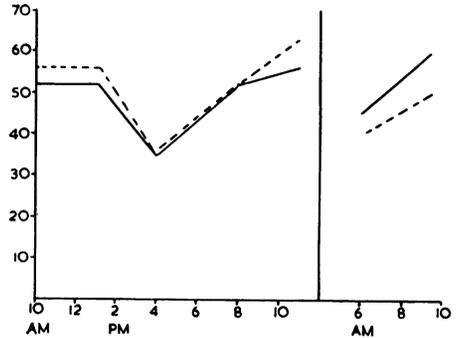


FIG. 10(b).—24-hour diurnal variation curve in a case of congestive glaucoma showing an uncontrolled tension despite miotics taken on a day when the symptoms were marked. (Same patient as in Fig. 10a).

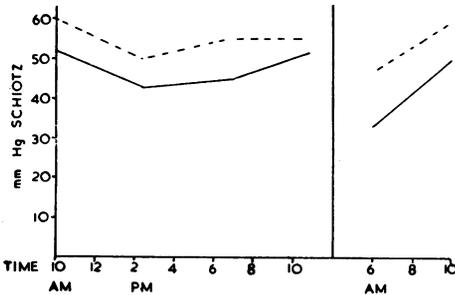


FIG. 11.—24-hour diurnal variation curve in a late untreated case to show the slight effect of sleep.

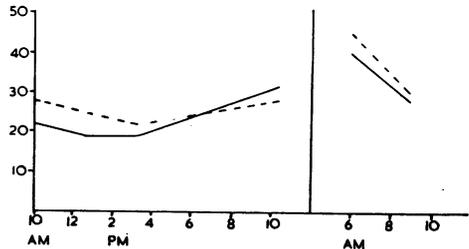


FIG. 12.—24-hour diurnal variation curve in a patient with established glaucoma who had withheld miotics for 48 hours. The patient gave a history of halos in the morning on rising.

adopt the philosophy of a quiet life at all times. Fig. 10(a) shows the effect of sleeping in the evening between 6 and 10 p.m. As the disease progresses the effect of sleep is less (Fig. 11) and the very occasional patient who complains of halos in the morning has a raised tension on rising (Fig. 12); but in the vast majority of cases sleep acts as balm to the eyes of those suffering from congestive glaucoma. "Incidentally I am sleeping better which to me accounts for the improvement", is a typical quotation from a patient's letter.

We have already seen that daylight will lower the abnormally raised tension (Fig. 6), but I have yet to find a patient who has noted this effect and applied it empirically as a therapeutic measure. An attack arouses a desire for complete rest both local and general, which is fulfilled by sleep and recumbency.

The effect of miotics is shown in Fig. 5(b). A successful iridectomy (Fig. 13), or a corneo-scleral trephine (Fig. 14), is as effective in the control of intra-ocular pressure; and an unsuccessful trephine shows the

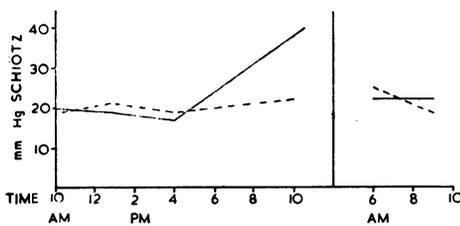


FIG. 13.—24-hour diurnal variation curve in a patient with established congestive glaucoma who had withheld miotics from the right eye for 48 hours. The left eye had undergone a broad iridectomy and its tension was stable without the aid of miotics.

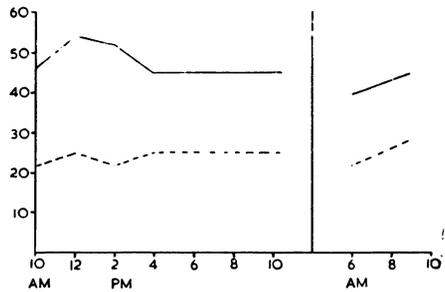


FIG. 14.—24-hour diurnal variation curve in a patient with established congestive glaucoma who had withheld miotics from the right eye for 24 hours. The left eye had undergone a trephine and its tension was stable without the aid of miotics.

characteristic curve of an untreated case (Fig. 15).

Progress of the Disease.—Most patients with congestive glaucoma who have been examined at the Institute are at first controlled on miotics which are used on waking, before leaving home for work, at lunch time, on arriving back home, and on retiring, making five instillations in all. There is good reason to think that a miotic given conventionally thrice daily is not enough. who used pilocarpine at 10.10 a.m., 2.20 p.m., and 6.10 p.m. The morning

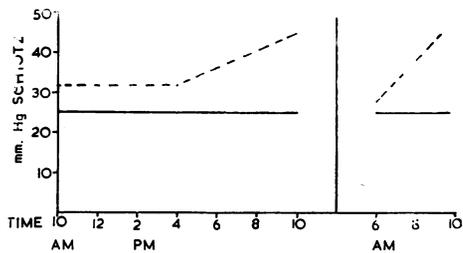


FIG. 15.—24-hour diurnal variation curve in a patient with congestive glaucoma who had undergone a trephine in the left eye. The trephine was not draining.

Fig. 9(b) shows a curve of a patient

tension (before treatment) is above normal on both days when the effect of the drug instilled the previous evening has worn off. Once a patient has used miotics, sleep would appear to be less effective in lowering tension.

The best guide as to the efficacy of treatment in an early case may be provided by an intelligent patient who reports the occurrence or absence of symptoms. It must be pointed out, however, that in advanced cases miotics occasionally mask symptoms without controlling the tension so that a follow-up examination of a patient on treatment must include Schiötz readings as well as enquiries as to the incidence of symptoms.

A majority of the cases progresses despite miotic therapy, and surgery becomes necessary, rarely because of a sudden acute attack, but usually because of periodic raised tension with symptoms despite miotics (Fig. 10*b*) or occasionally because of high tension sustained throughout the 24 hours despite good miosis, excellent visual acuity, and absence of symptoms. These findings are in accordance with Reese's conclusions on the rise of base-pressure as the disease advances (Reese, 1948).

A letter from a patient who was having periodic attacks despite miotics, describes the symptoms which call for surgery. His diurnal variation curve, taken on August 17, 1951 is shown in Fig. 2.

January 14, 1952. On Friday last I went to the dentist (evening) and when I came out my eye was rather bad, but my sight was satisfactory on Saturday morning.

I had another attack on Saturday evening, and to-night (Sunday) it is coming on again after writing this letter.

This makes five or six attacks since September 14. These attacks are much milder than before having drops and also less frequent. It appears that I cannot concentrate or read for any lengthy period without a recurrence of the trouble.

COMPARISON OF THE CLINICAL FEATURES AND VARIATIONS IN INTRA-OCULAR PRESSURE OF CONGESTIVE AND SIMPLE GLAUCOMA

The division of glaucoma in the adult into two separate entities, congestive and simple, is largely based on clinical features. Congestive glaucoma tends to occur in women, affecting eyes with narrow chamber angles and with a refraction more hypermetropic than their counterparts in simple glaucoma. The latter occurs in either sex, affecting eyes with wide, medium, or narrow angles.

The mode of onset is different in the two types, having an acute or subacute pattern in the congestive group, with periodic attacks of halos, ocular pain, and blurring of vision, and an insidious, non-specific onset in the non-congestive group. The diagnosis may even be made before symptoms arise in simple glaucoma.

At the time of diagnosis, the visual fields in congestive glaucoma are usually unaffected, whereas central field changes are an early and valuable sign of simple glaucoma. Cupping of the optic disk is absent in early congestive glaucoma and is always established (either pathological or physiological) by the time the diagnosis of glaucoma simplex is made.

Congestive glaucoma is diagnosed at an earlier age and at an earlier stage

in the course of the disease than is simple glaucoma so that the threat to vision is less. Finally, the individuals affected with glaucoma show a difference in their mental outlook. The congestive is often a conscientious perfectionist striving to maintain high standards and to win for himself or herself a respected place of responsibility in the community. Such characteristics are less evident among patients with simple glaucoma who are older, more philosophical, and passive (Armstrong, 1952).

When a study is made of the intra-ocular pressure and its variations, it is suspected that the difference between the two groups is possibly fundamental. The rises in intra-ocular pressure in congestive glaucoma are periodic. At first the attacks are spaced well apart, last for a few hours in the evening, reach their maximum before retiring, and are relieved by sleep. As the disease progresses they become more frequent, begin earlier in the day, last longer, and may even continue for several 24-hour periods. The diurnal variation curve of the intra-ocular pressure in simple glaucoma is a characteristic of the individual and will repeat itself faithfully from day to day but (as a general rule) the intra-ocular pressure tends to fall in the evenings (Langley and Swanljung, 1951). The variation between the highest and lowest pressure in congestive glaucoma tends to lessen with progress of the disease, due to a rise in the base-pressure (Reese, 1948). In simple glaucoma, on the other hand, the higher the maximum tension the greater the variation (Langley and Swanljung, 1951).

A study of the factors which influence intra-ocular pressure reveals the marked effect of the environment in congestive glaucoma and its apparent impotence in influencing the intra-ocular pressure in simple glaucoma. Thus darkness and the cinema, changes in emotional tone, fine visual work, and sometimes the hormonal changes of the female sexual cycle may produce sharp rises in pressure in congestive glaucoma, and such rises can be allayed or reduced by sleep and rest, or by the influence of daylight. In simple glaucoma on the other hand, the intra-ocular pressure is unaffected by these factors and shows no response to alterations in blood pressure, body posture, size of pupils, or the ingestion of food (Langley and Swanljung, 1951).

Lastly, the destruction of the eye as a seeing organ, measured by progressive field loss, is related in congestive glaucoma to the number and duration of the attacks of raised pressure, whereas in simple glaucoma the fields may be gradually and relentlessly destroyed unaccompanied by a high intra-ocular pressure.

Although these two groups of primary glaucoma in the adult have many distinct features early in the course of the disease, the later stages are barely distinguishable. Thus, cases of subacute intermittent congestive glaucoma may develop field loss in every way comparable to that seen in simple glaucoma, the optic disk may become cupped, the ocular tension may remain high and steady with little in the way of episodic variation, or may fall at

night and rise in the morning; sleep loses its effect and daylight can no longer restore the eye to normal. The late case of simple glaucoma may develop halos with blurring of vision due to corneal oedema, and if the angle of the anterior chamber is narrow, peripheral anterior synechiae may be produced. In such cases, in the absence of an accurate history, it is quite impossible to state whether the patient is suffering from congestive or simple glaucoma. It may be for this reason that some are sceptical of the existence of the two syndromes (Lloyd, 1952).

Summary

(1) Evidence is given to show that the periodic symptoms of early congestive glaucoma are always associated with raised intra-ocular pressure and that between such episodes the eye may appear healthy, react normally to all tests, produce no symptoms, and have a normal intra-ocular pressure.

(2) The factors precipitating and relieving the attacks are discussed and described with reference to actual cases. Precipitating factors are the cinema, television, darkness, emotional crises, and prolonged visual concentration. Relieving factors are sleep, rest, daylight, miotics, a filtering operation, and iridectomy.

(3) The changing pattern of the variations in tension is followed as the disease progresses.

(4) The clinical features and variations in intra-ocular pressure of congestive and simple glaucoma are compared and contrasted.

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