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GLAUCOMA

AND ITS

CURE BY IRIDECTOMY.

Translated by

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*Member of the American Ophthalmological Society; Honorary Member of the Massachusetts
Medical Society; Member of the Albany County Medical Society, &c.*

From the French

OF

TESTELIN AND WARLOMONT.

Box 12

ALBANY:

J. MUNSELL, 82 STATE STREET.

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P R E F A C E .

The following pages contain a translation from a recent French work, a chapter of which appeared in a late number of the *Annales d'Ophthalmoscopique*. It furnishes an excellent synopsis of the whole matter of glaucoma, its nature, ætiology, objective and subjective manifestations, its pathology and proper treatment. The translator presents it in an English version with the motive of disseminating accurate knowledge of a disease as yet little understood in the general profession. Among the recent remarkable achievements in the diagnosis and treatment of ophthalmic disease and disorders of vision, none is more important than what has been accomplished in the diagnosis and method of curing glaucoma. Vague conjectures have yielded to precise knowledge, and a hitherto incurable disease, whose inevitable result was blindness, without even that forlorn event being always mitigated by relief from severe pain, has been rendered amenable to

curative measures. The urgent necessity of promptness in order to secure the happy results of timely surgical interposition, renders it highly important for the intelligent physician to be able to detect the characteristic features of glaucoma early, lest by a mistake in diagnosis the sight of his patient be hopelessly lost.

17 Washington Avenue,
Albany, N. Y., November, 1866. }

GLAUCOMA

AND ITS

CURE BY IRIDECTOMY.

1. The globe of the Eye is formed of two parts, one containing and the other contained. The containing part is composed of the membranes called external, *viz.*: conjunctiva, and sclerotica, and of the membranes called internal, *viz.*: choroid and retina, to which may be added the iris, which constitutes the anterior portion of the containing part, whenever the communication is interrupted between the posterior chamber and the anterior chamber. The part contained comprises the vitreous humor, the system of the crystalline lens, the uvea and the aqueous humor.

When there is a perfect equilibrium between the contained part of the eye and the membranous sphere, which encloses it, the tension of the globe is normal and its hardness physiological: the fluids there enclosed exert upon the enveloping membranes a pressure by virtue of which, each of them lives, is nourished and exercises regularly the different functions which are devolved upon it. When, on the contrary, this equilibrium comes to be interrupted, either through lack or through excess of internal pressure, the whole organ undergoes disturbances in its nutrition, in its outward aspect and in its form; likewise in the play of its functional manifestations.

Whenever the fluids of the eye become diminished or augmented in quantity, one of the two following results is produced; in the first case (atrophy), the eye becomes softened; in the second case (hypersecretion), its becomes hardened

and tense. This is because the ocular envelope is composed of extremely inelastic membranes, which collapse in the former, and are distended in the latter state. In each state special phenomena of the highest interest are developed.

In modern times, there is designated under the name of *glaucoma* a disease of the eye, characterized by a combination or totality of the symptoms responsive to a slow or rapid development of excessive intra ocular pressure, be the cause what it may. Among these symptoms are distinguished: *tension* of the globe, *pulsation* of the central artery of the retina, either spontaneous or very easily provoked, peculiar *excavation of the optic papilla*, *anæsthesia of the cornea*, *dilatation of the pupil*, *flattening and turbidness of the anterior chamber*, *green color of the bottom of the eye*, *sub-conjunctival injection* and *pain*. All these symptoms are the result of abnormal internal pressure, as will be demonstrated further on. No one of them pertains peculiarly to any determined disease or, in an isolated state, would suffice to characterize glaucoma; combined, on the other hand, they have a most precise signification.

To Professor Von Græfe is due this ingenious manner of regarding glaucomatous affections. It has enabled him not only to fix some order in the statement of ideas advanced before him, concerning a pathological process in respect of which authors had never till then succeeded in making themselves understood; but, besides, to arrive at a rational therapeutic treatment, whose happy results, while they have narrowed the still too large field of incurable afflictions, have raised the author to rank with the greatest benefactors of humanity. This fact once admitted, that internal pressure was the cause of glaucomatous affections, it became necessary to find the means of arresting or removing the cause of the disorder. This means Von Græfe has had the merit of seeking, and the fortune of finding.

Let us cast a rapid glance at the principal symptoms above enumerated, so far as they relate to the origination of the affection called "glaucomatous."

1st, *Tension*.—This is one of the first effects of the glaucomatous state, and precedes at times a great while the explosion of an attack of glaucoma. It is, then, a symptom of great value, above all, if it appears without any inflammatory complication. Mr. Bowman advises that, whenever a patient complains of enfeeblement of vision, the state of ocular tension should be learned, as this might lead directly to the diagnosis. For that purpose it is necessary to employ the two index fingers laid upon the upper lid lightly closed: one of the fingers fixes the eye by pressing upon it with a proper degree of force, while the other appreciates the tension, or rather both of them appreciate it, while acting thus in concert. Mr. Bowman has found it practicable and useful to distinguish nine degrees of tension, and in order to facilitate the notation he has designated them by special signs: T represents *tension*. Tn *normal tension*. The mark of interrogation (?) indicates a doubt, with which, in such matters, one is often forced to be content. The numerical figures placed after the letter T indicate the degree of augmentation of tension. If the T is preceded by the minus sign (—) it indicates a diminution of tension. Examples:

T 3. Third degree of tension, or *extreme tension*. A strong pressure of the finger cannot make an impression on the eye.

T 2. Second degree or considerable tension.

T 1. First degree. Slight, but positive augmentation of tension.

T 1 ?. Indicates a doubt as to tension.

Tn. Tension normal.

—T 1 ?. Indicates a doubt as to diminution of tension.

—T 1. First negative degree. Slight, but positive diminution of tension.

—T 2. Successive degrees of diminution of tension to

—3, the point where the finger makes a deep impression in the ocular tunics. It is easier indicating this by signs than by words.

Von Græfe has had an instrument made for the purpose of measuring the intra ocular pressure. Messieurs Donders and Hamer have also designed one, but these

different contrivances are not sufficiently accurate to serve advantageously instead of the application of intelligent fingers. The instrument recently devised by M. Dor has secured a remarkable accuracy in this respect.

2d, *Pulsation of the central artery of the retina.*—In the state of normal pressure sustained by the arteries of the interior of the eye, the blood courses without resistance through the canals which enclose it. When, on the other hand, resistance occurs, either on account of pressure made on the exterior of the organ, or of repletion of the globe, this same blood requires the impulse which the ventricular systole imparts to it, in order to overcome the obstacle opposing it. Hence the arterial pulse, which appears spontaneously in glaucomatous affections, and which is one of their most interesting symptoms, as a manifestation of the internal pressure. When this is only slightly increased, the pulsation may not be spontaneous, but then a very slight pressure of the finger upon the globe suffices to cause it.

3d, *Excavation of the optic papilla.*—At the beginning, the cupping extends specially from the external side, but soon all the surface of the papilla is sunken to its border. The choroidal margin, deprived in great measure of its pigment, is more or less effaced, and appears only in an indistinct manner on the sclerotic margin. The latter, on the other hand, represents now a broad ring, ordinarily yellowish, quite encompassing the optic nerve, the distinct periphery of which appears perfectly defined, and its color, changed to a greenish gray, grows darker and darker from the centre to the circumference. The vessels of the papilla, just where they reach its margin, dip into its concavity and disappear from sight in the whole extent of the perpendicular wall of the papillary cup which they traverse, to reappear, *de novo*, as soon as they have reached the posterior wall (or bottom) of the excavation, proving that the bottom of the depression is more extended than the anterior opening. This appearance is pathognomonic. The

cupping of the optic papilla is admirably recognized by means of the binocular ophthalmoscope, and in its absence, by the parallax in making the lens of an ophthalmoscope act as a prism when placed obliquely across the axis of vision. The cupping does not pertain to the first phase of acute inflammatory glaucoma, but it is the principal sign by which non-inflammatory glaucoma is recognized. This effect may be readily conceived, if it is borne in mind that the optic nerve enclosed in its neurilemma is free in the envelope which the dura-mater furnishes it to a certain degree, as a viscus in a serous cavity. These relations allow the nerve to retreat posteriorly into its sheath before a long continued pressure bearing on the *lamina cribrosa*. Ammon attributes the cupping of the optic nerve to atrophy of the vessels.

4th, *Anæsthesia of the cornea*.—This may be slightly pronounced; but in certain cases it is pushed to the extent of causing complete insensibility, so that the cornea may be touched without the patient shrinking. Now sensibility is almost always restored to this membrane from the moment when evacuation of the aqueous humor has caused even a momentary cessation of intra ocular tension, the evident cause of the anæsthesia, which is due to compression of the nervous branches distributed to the cornea.

5th, *Dilatation of the pupil*.—This is sometimes slight at the beginning; but when the disease is of long standing, the mydriasis may attain the last limits. It is the result of an actual *iridoplegia*, caused by the compression which the ciliary nerves undergo. This is proved by the fact that the pupil does not contract under the influence of light, which strikes one of the eyes, as occurs in the case of paralysis of the retina.

6th, *Flattening and turbidness of the anterior chamber*.—This results from the diminution of corneal convexity and the curved projection of the iris. The first effect is determined by comparison with a healthy eye by means

of reflected images, or by the employment of the ophthalmometer of Helmholtz. "When the radius of curvature of the cornea approaches that of the sclerotic, the periphery of the cornea is borne forward. A change of form in the anterior chamber and a diminution of the coving of the iris are produced. Now, the contrary takes place in glaucoma, where the iris bulges forward. It must be then that at the same time the cornea becomes flattened, a greater pressure takes place on the hyaloid than on the anterior chamber, a pressure which reëstablishes the equilibrium, or, more exactly, surpasses it and projects the iris forward." The cloudiness of the anterior chamber depends on the haziness of the aqueous humor and of the posterior wall of the cornea.

7th, *Greenish appearance of the fundus of the eye.*—This only occurs in cases of very long standing, or in those where the symptoms are declared at the very outset with great intensity. In simple glaucoma it is only observed very late. It appears due to the turbidity of the aqueous humor, to the cloudiness of the posterior face of the cornea, to the normal yellowish coloration of the crystalline lens in patients of a certain age, exaggerated by the refraction of light passing obliquely through a largely dilated pupil, and lastly, but in a small proportion, to the diffused opacity of the hyaloid body. At a certain period the crystalline becomes opaque, and takes a much greater part in the general appearance of the fundus of the eye. A mistake must not be made however, as the crystalline often appears cataractous, when it is only diplochromatic, a condition which Mackenzie attributes to a perversion of the action of nutritive vessels of the ciliary body.

8th, *Sub-conjunctival injection.*—This is explained by a mechanical obstacle to the deep circulation produced by an augmentation of pressure in the region circumscribed by the choroid and the crystalline system; hence the reflux of blood into the superficial veins, the anterior ciliary veins, which empty into the veins of the muscles, and

production of the vascularity—so characteristic, which authors have denominated “arthritic, abdominal, glaucomatous.”

9th, *Pain*.—In glaucomatous affections of slow progress, the pain is not fixed, rather extended in the brow and temple than in the eye, and often of intermittent character. When inflammation complicates them, the pain becomes acute, deep and agonizing, and has its principal seat in the eye, not without still spreading to the brow, the temples and the lateral regions of the nose. It is above all intense, when the disease is of sudden violence (*glaucoma fulminans*) and the membranes are surprised without having had time to allow of distension. If this ceases finally, it seems owing to the fact that the internal membranes become accustomed to endure a pressure, whose first shock caused extreme suffering. Depletive agents and *paracentesis corneæ* are measures which succeed best in calming it, until a fresh access supervenes to arouse all its first intensity.

2. Glaucomatous affections may be complicated with inflammation of the deep parts of the eye, or be entirely free from it, at least in appearance. This inflammation may be the first thing, and cause at the start an acute glaucoma, or attack on eye already a prey to other symptoms of *simple* glaucoma. Hence the different forms we are about to examine.

§ I. NON-INFLAMMATORY GLAUCOMA.

This is the *Glaucoma simplex* of M. Donders, first described by M. Græfe under the denomination of “amaurosis with cupping of the optic nerve.” Starting with this idea well fixed, that by glaucoma ought to be understood every affection of the eye, characterized by an exaggeration of intra-ocular tension, M. Donders considers as such every state in which this organ has acquired a certain hardness, without offering the least trace of inflammatory symptoms. With this tension coincide: the

pulsation of the central artery of the retina, the excavation (or cupping) of the papilla, the different modifications of vision (flashes of light, obscurations of sight, progressive narrowing of the visual field), ciliary pain and anæsthesia of the cornea. The absence of all inflammatory symptoms has suggested to M. Donders the idea that glaucoma, properly so called, has its origin in a neurosis of the secretory nerves of the eye, sustained and increased by the tension and traction of the iris as a result of the increase of the fluids secreted under the influence of this neurosis. Thus, from a reciprocal action, which the disease, once established, sets in operation, it cannot be spontaneously cured. This theory rests upon the opinion that the secretion of the humors of the eye is subject to the influence of the nervous system, as has been demonstrated in respect of the secretion of several glands, especially the lacrymal gland; an hypothesis based on the fact that paralysis of the trifacial nerve is often accompanied with an excessive softening of the globe, and that section of the trifacial (in rabbits) is soon followed by diminution of ocular tension.

Glaucoma simplex may appear as a result of primary irritation of the secretory nerves of the iris; but it may also be that this irritation is consecutive to the reflex action of the sensitive nerves of this membrane upon the secretory nerves, as happens whenever the iris is irritated by mechanical means, such as foreign bodies, distension of the crystalline after lesions of the capsule, and especially the traction in cases of anterior synechia, with a more or less staphylomatous condition of the cornea. The ocular tension is, in fact, invariably augmented under the influence of these different causes.

The strain of the iris plays also an important part in spontaneous glaucoma, considered as resulting from primary irritation of the secretory nerves. "Indeed," says M. Donders, "in spontaneous glaucoma, the pressure under which the secretion of the vitreous body takes place, may be, at first, only slightly augmented, and push the crys-

talline and iris forward scarcely appreciably, yet the tension of the iris, which is the result of it, in reacting on the secretory nerves, is a cause of further augmentation of pressure, which makes the tension of the iris increase anew. This circle, in which cause produces effects, which, in their turn become causes, explains why glaucoma is not spontaneously curable."

Glaucoma simplex has an essentially chronic course; ocular tension is its first objective symptom, but often before that has been ascertained, or even sought for, patients have complained of diminution of peripheric vision, while central vision remains unimpaired, so that these persons may still read small characters, while it is not possible for them to find their way about. The dimness of vision and flashes of light which are observed at the beginning of the other forms of glaucoma are most commonly absent in this. As to tension, it may offer all degrees from the slightest to the greatest. The most essential symptom of this morbid condition is the excavation of the papilla, the appearances of which we have noted above (i. e.: excavation like a cup, surrounded by a somewhat broad, yellowish white margin, displacement of the vessels, greenish grey tint of the papilla, etc.). It differs from the papillary retraction which is observed in cerebral amauroses in this, that in these the vessels are not displaced and diminished in volume, and in this, too, that the papilla, retracted and small, takes a pearly hue, with is not observed in the glaucomatous papilla. Finally, in cerebral amauroses accompanied with papillary retraction, the spontaneous pulse is only very exceptionally observed, and never except in a very feeble degree.

Glaucoma simplex may lead gradually to blindness, without patients being aware of its existence. The diagnosis is not difficult, the characteristic state of the papilla being seen, but at the very beginning, when this symptom does not exist, and only a slightly appreciable abnormal tension, coincident with a diminution of excentric vision and a

certain sluggishness of the pupil, is the only indication on which one may depend, large experience is needed to recognize it with certainty. A good *ophthalmotonometer** would here be of great assistance.

§ II. INFLAMMATORY GLAUCOMA.

I. *Acute form.*—*Acute glaucoma* may declare itself abruptly, coming as it were like a thunderbolt before any warning whatever has intimated the attack. Most frequently, however, (about seven times in ten, according to Von Græfe) a series of precursory signs precede it. Some patients state that they have felt pains in the brow and temples, occurring suddenly and accompanied by temporary blurring of sight; the family physician pronounced them as due to neuralgia, administered sulphate of quinia, and the pains subsided to reappear some months, weeks or days later. If, at this time, the physical state of the globe is carefully examined, an abnormal tension, intermittent or permanent, may be recognized, which, occurring suddenly in eyes, that afford no mark of inflammation or of abnormal injection, is of great diagnostic value (*glaucoma simplex*). At the same time presbyopia increases (the disease generally attacks persons who have arrived at an age where this is observed), iridescent rings encircle the flame of a candle, flashes of light shoot across the eye, objects appear enveloped in fog and a certain diminution of the field of vision is complained of. When this last symptom comes to be well pronounced, the images of objects near each other tend to be confounded, finding the way about becomes difficult, the dimness of vision grows much greater, and mydriasis is produced; while the aqueous humor acquires a turbid, milky aspect, behind which the pupil can no longer be seen in its physiological exactness and clearness.

* Name proposed by M. Donders for instruments designed to measure the tension of the globe.

All these symptoms may last months and years without the patients applying to a physician, or without the latter knowing how to interpret them, when suddenly, all at once, comes an attack, that, most frequently, is only an exaggeration of the different phenomena which we have just mentioned; but which is to change the scene. Under the influence of some accidental cause, such as a sudden cold, a severe tasking of the eyes with too bright a light, or without the occurrence of any appreciable cause, the patient is taken suddenly, most frequently after one or more sleepless nights, with a violent, intolerable pain in the eye, which flashes to the brow, the temples and sides of the nose as far as the bones of it extend. This pain, sometimes continuous, sometimes intermittent, is often so agonizing as to extort shrieks from the sufferers, and to plunge them into indescribable anxiety. Vision undergoes, at the same time, a serious alteration; sometimes in a few hours it becomes completely extinct, so that it is impossible to distinguish day from night. The eye is congested and suffused, and the conjunctiva raised up by serosity (chemosis). The pupil is widely dilated, and the iris is forced forward, so as to diminish the anterior chamber, which is filled with a turbid, foggy fluid. Sometimes the posterior surface of the cornea is also hazy, and the iris more or less discolored, adherent in numerous points to the anterior capsule of the crystalline (*synechia posterior*). Finally, the cornea is, in a measure, insensible to the touch.

It may be that all this combination of symptoms shall suddenly yield at the end of a few days to the active use of narcotics, of atropine, of depletion, or to paracentesis of the cornea; sometimes this remission is quite spontaneous: a certain diminution of vision, and particularly a narrowing of the visual field, sluggishness of the pupil, flattening of the anterior chamber, and discoloration of the iris in some places, are the only signs remaining of the attack, until a fresh access disturbs anew this always temporary remission.

It is rare, during this first attack, at least, when it has not lasted long, that the excavation of the papilla can be observed. Ordinarily, it is not produced until after a number of attacks. Besides, the turbidity of the vitreous, which often appears at the very beginning of the disease, and is one of its most constant manifestations, may hinder the ophthalmoscopic exploration of the *fundus oculi*.

These attacks succeed, generally, at tolerably short intervals, if the disease is not at once checked in its progress by the most energetic measures. They are in all respects like the first; but, each time, the disorders which follow them are more serious; the visual field is more contracted each time; and the sight becomes more and more obscure, if it was not entirely abolished at the first attack. While the vitreous body permits exploration of the *fundus oculi*, material alterations in the deep membranes may be observed, such as ecchymoses on the retina, and spots of exudation, or irregular collections of pigment on the choroid principally in the equatorial regions, which, together with the papillary excavation, constitute such lesions as the future will be unable to repair.

The disease which we have just described is essentially inflammatory; it is accompanied by febrile reaction, insomnia and inappetence, and, if prolonged, may have an unfavorable reaction on the constitution. It is now almost universally agreed in accordance with Von Græfe, to consider it as a genuine inflammation of the choroid and uveal region. In support of this opinion, one may consider: the diffuse opacity of the vitreous body, due probably to a pathological exudation from the choroid, which, as is known, presides over the nutrition of this medium; the *ectases* which are produced in the equatorial region of the choroid; the rigidity and infiltration of the iris, easily recognized in the strips excised from it; the dimness of the posterior surface of the cornea, due to alteration of the membrane of the aqueous humor and to synechiæ, such as are produced in serous iritis.

This inflammation may be consecutive to a state of *glaucoma simplex* (precursory period) which has produced the internal pressure, that the intercurrent choroiditis operates to increase. It may, also be primary, and, at first, only a serous choroiditis, producing at once a superabundance of fluids in the eye and all the phenomena thence resulting.

2. *Subacute and chronic form.*—The symptoms of glaucoma derive their character not only from the sudden invasion of the disease, and its extreme gravity, but from this fact, viz.: that the internal tension occurring in such a violent manner takes by surprise a coat of the eye little disposed to yield. The fullness of the eye is not moderated by a modification of the membranes, so as to be accommodated to the distension. The resistance they oppose is absolute, and hence this internal pressure, which expresses itself in every form, and which often causes irremediable disorders in a very few days.

When instead of invading thus suddenly, the choroidal exudation, from which results the excess in the *contained portion* of the eye, takes place slowly, the resistance on the part of the internal membranes is less absolute. Some distension occurs in them, which, in time, produces staphylomatous tumors. The optic papilla is forced backward; the internal membranes, the ciliary nerves, the retina conform themselves to the pressure, which harasses them, and the reactions from it become less active and lest painful. This is the condition which exists in *subacute glaucoma*. All the signs pertaining to *acute glaucoma* may be remarked here, but in a slighter degree, and others occur besides.

When an eye is to be invaded by *subacute glaucoma*, the precursory signs (obscurations of sight, narrowing of the visual field, intermittent ciliary pains) increase with time. There is, ordinarily, no more access, properly so called, but all the symptoms persist without ever entirely disappearing. Exacerbations only manifest themselves which,

each time, leave after them more appreciable disorders: the pain is continual, but the patient gives an imperfect statement respecting it; it is often to his mind only hemicrania, or neuralgia, which he does not dream has any relation to the eye, and his mistake is almost always supported by his physician, who sees nothing else in the case, and does not hesitate to regard the disturbance of vision as an epiphænomonon, which he makes very light of and neglects. How many a glaucoma has been thus announced long before hand, which it would have been easy to arrest in its leisurely disorganizing course! The state of the pupil characterizes it. This is widely dilated, no longer reëcts to the stimulus of light, and its depth, instead of being a bright black, appears of a greenish grey, dull and muddy. The cornea is dim, as if covered with a granular coating, and almost insensible to the touch. The arched vascularity (abdominal vessels) is distinct; it is composed of seven principal trunks, which, starting from the conjunctival cul-de-sac, reunite to form arches, which spread out around the cornea at a certain distance from its periphery, like a circle excentric to it. The look is lifeless. The glaucomatous aspect is characteristic, and distinguished by a totality (*ensemble*) which it is easier to catch at a single glance than to describe, whatever pains one may take in the description.

A more careful examination of the organ detects other equally important alterations: the anterior chamber has diminished in capacity, as much by the flattening of the cornea, as by the propulsion of the iris forward; the iris has assumed a smoky and discolored look; the aqueous humor is cloudy, as it were milky, a state which may change several times in the course of a day; the pulsation of the central artery of the retina, whether spontaneous or excited by the slightest pressure, manifests itself, so that the excavation of the optic papilla, with the disposition, so characteristic, of the vessels, and the tension of the globe in all its degrees, furnish the disease with a most reliable and distinct criterion.

It has been seen, that in *acute glaucoma*, there is ordinarily increase of existing presbyopia, or production of hypermetropia. In *chronic glaucoma*, the contrary frequently takes place, and presbyopic patients are found, obliged previously to use convex glasses for reading, who, either very suddenly, or at least in the lapse of a very short time, lose a great deal of their power of vision for distant objects, and become able to read without spectacles much nearer than they could before with convex glasses. Query: does this phenomenon depend on density, which the glaucomatous state impresses on the nucleus of the crystalline lens, and the increase of its refractive power? Such is the opinion of Mr. Mackenzie.

§ III. CONSECUTIVE GLAUCOMA.

Every cause of disorders that may induce after them either a neuropathic state of the iris, or an acute or chronic choroiditis, and as a result, a disproportion between the contents of the eye and the containing membranes, may give existence to a glaucomatous state which, in those cases, is called, "consecutive." These causes are especially: anterior synechiæ with a traction of the iris engaged in staphylomatous cicatrices, the accidents incidental to certain operations for cataract (too free division, couching, etc.), serous iritis, irido-choroiditis, occlusion of the pupil, sclero-choroiditis posterior, etc.

In treating of *glaucoma simplex*, we have shown, according to M. Donders, the mechanism by means of which irritations experienced by the iris, no matter what influence caused them, may establish a *consecutive* glaucomatous state. Anterior synechiæ figure at the head of these ætiological influences. The distention of the crystalline in consequence of too free an incision of the capsule, its disintegration in the operation of breaking up the cataract, and the rapid turgescence of the fragments, may occasion the same complication, in exciting either *glaucoma simplex* by the slow irritation of the iris

of which the contact of the foreign bodies is the cause, or inflammatory glaucoma resulting from acute irido-choroiditis. In each one of these cases the signs of the intra ocular pressure manifest themselves, and with them all the disorders which follow in consequence. Also serous iritis and irido-choroiditis may lead to the same result through excess of the secretions, which takes place in these morbid states.

On the condition of the ocular membranes, at the moment when the hydrophthalmic hypersecretion occurs, the more or less rapid development of glaucomatous accidents depends. If these membranes are rigid, void of all extensibility, this development will be only subordinate to the exciting cause; if, on the contrary, they enjoy a degree of suppleness and the hydrophthalmia proceeds with extreme slowness, the progressive distention of these membranes will be able to recoil from many threatening accidents, or even preserve the eye from them.

The slowly progressive development of tumors of malign nature may excite, at some moment, all the symptoms of acute glaucoma, and require the practice of iridectomy. A mistake is excessively easy, and even inevitable, if patients present themselves for the first time, at the moment of attack, to physicians, who have never before seen them. The impossibility of examining the fundus oculi, masked by the opacity of the media, and the perfect identity of symptoms with those of acute glaucoma, do not allow error to be absolutely escaped. At the most, one will sometimes elect, if it is learned that vision has been lost a long while, to excise the entire globe in cases which seem doubtful. This excision will then permit the removal of all the contents of the orbit, if the examination of the anatomical structure, made at the moment, indicates the necessity of it. Mr. Hutchinson cites four cases of this kind. In three of them a melanotic mass, and in the fourth a cancerous tumor occupied the fundus oculi and compressed the optic nerve. The disease only revealed itself as a detachment of the retina, which was perfectly diagnosed. Twice,

it was necessary to proceed in search of the cerebral end of the optic nerve, whose section afforded suspicious traces, in order to excise it as high up as possible, a search of which the success is not quite easy on account of the blood, which masks everything. Mr. Hutchinson advises, in these circumstances that one be guided by sight rather than by touch, to introduce the finger deep into the orbit, and to use it as a director for a pair of strong toothed forceps, with which to draw the trunk forwards, so that it may be excised sufficiently high up by means of curved scissors.

3. The different forms of glaucoma, which we have just passed in review, are not ordinarily as distinct as one might believe. Thus the passage from simple to subacute is often made without actual change, just in the same manner as the acute succeeds the latter. Hence a confusion arises, augmented still more by the sequences in the train of glaucomatous attacks. For practical purposes, Prof. Von Graefe has established the following classification:

I. Precursory period: this comprehends all the cases in which the periodical glaucomatous attacks do not as yet leave after them *any trace*.

II. Glaucoma must be considered as developed, as soon as the periods of access are no longer separated by intervals of complete remission; in respect to the gravity of the evil, it is necessary to distinguish the following varieties:

a. No appreciable symptoms of irritation: this is the *amaurosis with excavation* of the optic nerve of Graefe, the *glaucoma simplex* of Donders.

b. Transient symptoms of inflammation, slight opacity of the fluids of the eye, diminution of the clearness of vision, generally excavation of the optic nerve; glaucoma with intermittent inflammation.

c. Chronic inflammation with exacerbations; chronic inflammatory glaucoma.

d. Glaucoma under the form of an acute inflammation; acute inflammatory glaucoma (*ophthalmia arthritica*). This group comprises the cases of *glaucoma fulminans*.

III. When the glaucomatous affection succeeds another disease of the eye, for example, a staphyloma or a sclerochoroiditis, it constitutes secondary or consecutive glaucoma.

IV. When perception of light no longer exists, glaucoma may be considered as absolute.

V. The various changes in the eye often observed in cases of glaucoma: atrophy of the iris, opacity of the crystalline, etc., constitute glaucomatous degeneration.

4. *Pathological Anatomy.*—In glaucoma simplex, such as has been described by M. Donders, the optic papilla presents the only appreciable alterations. It is more or less deeply cupped; the *lamina cribrosa* is shrunken backwards, so as to be on the same plane, or even on a plane posterior to the internal sclerotic limit; this forms the fundus of excavation, of which, the sclerotica constitutes the lateral walls. The excavation, itself, is occupied partly by the vitreous body, partly by the *débris* of the intra-ocular extremity of the optic nerve in front of the *lamina cribrosa*. It has the form of a cup, enlarged midway, more narrowed at its entrance than at its fundus, which explains the disappearance of the vessels, that disappear from sight in passing along the lateral walls, in order to reappear when they have reached the fundus.

At the level of the choroid the papillary cup presents a distinct border, slightly widened; it is often shallower on the side towards the *macula lutea* than on the opposite side. When the glaucomatous pressure has persisted a long time, the central canal of the optic nerve itself may be dilated. When the disease is old and well marked, the nervous fascicles of the optic nerve are destroyed, and the walls of the central artery of the retina where it is depressed more or less hypertrophied, without, on that account, the trunk of the vessel being dilated; on the other hand, the vessels which are spread on the partitions, that separate these bundles of nerve fibres, are a good deal dilated.

In acute glaucoma, the changes resulting from inflamma-

tion come to be superadded to this state of the papilla. The capillaries of the choroid are enlarged and engorged with blood; sanguineous exudations of this membrane show themselves in the equatorial region, and irregular collections of pigment in front of the equator, where the subjacent elastic lamina is thickened. In the vicinity of the *ora serrata*, the choroidal epithelium is often completely wanting, which allows the naked, white sclerotic to be seen. The vessels of the ciliary body and of the iris are much dilated and distended, but their muscular elements are not altered. The retina is sometimes studded with hemorrhagic points (most frequently after iridectomy) and atrophied; generally the layer of rods and bulbs is conserved to a certain degree, but the internal granular layer, the ganglionic cells and the nervous fibres are more or less completely wanting, especially in front of the equator, and are very much changed in the posterior portion. The veins of the retina are dilated, while the arteries are pale and contracted; their coats are affected by atheromatous or fatty degeneration. Staphylomatous depressions are observed principally in the equatorial region, behind the insertion of the *recti* muscles; the retina and the choroid are there somewhat atrophied. Autopsies have not yet permitted positive assurance respecting the state of the sclerotic, and authors are not agreed as to the alterations of which this membrane is the seat.

According to M. Cusco, and he has based on this opinion a new theory respecting glaucoma, the sclerotic is affected in this disorder, with inflammation, accompanied with retraction and thickening of its tissue at the borders of the sclerotic limits causing deformation of the papilla. On the other hand it is known how often this membrane undergoes a manifest expansion, principally in the parts affected by staphyloma.

Sometimes the vitreous body is clear and normal, the same as the aqueous humor: at other times these two media are dull and milky. The vitreous body is often liqui-

fied; in a case where the fluid escaping from the anterior chamber during an iridectomy was received in a vessel, the presence of pus globules was fully determined. In another, the vitreous body was found tolerably hard (the patient, who had died of disease of the heart had been successfully operated on for iridectomy, six weeks before); it was transparent, although it presented a slightly amber tint, and was here and there traversed with irregular striæ of a dirty grey hue, caused by a proliferation of large round cells in the nucleus. The choroid offered no other alteration than a diminution of pigment; the papilla and the retina were unaffected. In acute glaucoma, fluid is effused into the vitreous body, while in chronic glaucoma entire solution of this body takes place; in the latter case a large proportion escapes, if a puncture of the sclerotic is made, and in the former only a few drops ooze out.

5. *Ætiology.*—In vain, would one seek to-day to still attribute glaucoma, no matter under what form, to an arthritic or rheumatic cause. Every practitioner knows that it is found, in a multitude of cases, in persons who have never shown the least disposition to these morbid states. All that is positively known is that glaucomatous affections are more frequently remarked, especially in the acute state, among females than among males, and principally between the ages of forty and seventy years, that is during the period of menstrual cessation. In some statistics prepared by M. Magawly, the disease is seen to have commenced:

	Men.	Women.	Total.
Between 10 and 20 years in.....	1	0	1
“ 20 “ 30 “	1	0	1
“ 30 “ 40 “	1	2	3
“ 40 “ 50 “	7	11	18
“ 50 “ 60 “	12	23	35
“ 60 “ 70 “	13	15	28
“ 70 “ 80 “	3	5	8
“ 80 “ 90 “	1	0	1
	—	—	—
	39	56	95

The total number of patients received at the ophthalmic

hospital was 1,943; 1,070 men, 873 women. It is a significant fact that 3.64 per cent of glaucoma was found among men, and 6.41 among women. Further, it is ascertained from this same statistical table that of 158 eyes attacked by glaucoma, 12 were of an acute character, and that 10 of these eyes belonged to women, 2 only to men. On the other hand, of 11 cases of glaucoma *simplex* 10 belonged to men, 1 only to women. Such a difference would not have been *cre* ~~rated~~ by chance, as the author sensibly remarks.

6. *Prognosis.*—The results afforded by iridectomy are so constant when the indications have been well apprehended, that it may be said, almost absolutely, that the prognosis of glaucoma is completely subordinate to the way in which it is treated. Left to itself, glaucoma leads fatally to blindness, sooner or later. Properly treated from the beginning, it may almost be said that it is only a disease of medium gravity. We have seen patients, siezed with acute glaucoma, having lost, amidst poignant sufferings, almost all sensation of light, recover, by means of an iridectomy, in less than a fortnight, sufficient vision to read the smallest type, and the new pupil, concealed by the superior lid, no longer served to recall the remembrance of this cruel pain. We have seen others, who were in the same circumstances, treated by antiphlogistics, chloroform, revulsives, antiperiodics, arrive at total blindness, spite of having received and followed the advice of distinguished practitioners. In a single word, one is authorized to blend the prognosis of glaucoma with that of the iridectomy applied to its treatment,

7. *Hypotheses as to the causes influencing the development of glaucoma.*—It has been remarked above (p. 16) that Prof. Von Græfe considers glaucoma as being always under the influence of inflammatory action, having its principle seat in the choroid and uveal tract. M. Donders, on the contrary, refers it to a neurosis of the ciliary nerves, and to the action of this on the secretory nerves of the iris (p. 12). It may be said that these two are the only opinions

which are really at issue. M. Magni also thinks that the ciliary nerves play an important part in glaucoma, but he attributes this to a primary, or progressive atrophy of these nerves, and not to irritation as does M. Donders. This hypothesis may have some value in respect of chronic or simple primary glaucoma; but so far as it relates to acute glaucoma, it does not appear tenable. The author of it, moreover, implies this, in citing, in order to support it, the slow progress of the disease. We shall say the same of the theory of M. Cusco, who places the cause of glaucoma in the progressive retraction of the inflamed sclerotic. In fact, as is known, acute glaucoma does not afford the least perceptible trace of inflammation. Perhaps it is not quite the same in chronic glaucoma, where the sclerotic undergoes manifest changes, but which generally appear to be consecutive. According to M. Cusco, these changes are owing to inflammation, acute or chronic, having its seat in the fibrous coat, the development of which is most frequently connected with the existence of a constitutional malady, and occasions retraction of its tissue, (a mechanical cause of all the signs of intra-ocular compression) and plastic infiltration of its blastema, the result of which is an increase of its thickness. It may be objected to this way of viewing things, that chronic scleratitis, especially when complicated with choroiditis, much rather occasions expansion and softening, than retraction of tissue (sclero-choroiditis posterior) and that it is besides always partial. However, the opinion of M. Cusco has its adherents; thus M. Coccus considers likewise the retraction of the sclerotic as the cause of glaucoma.

Mr. Hancock, like M. Cusco, thinks that glaucoma is due to gout or rheumatism, which affects the muscular fibres and the blood vessels of the ocular globe. He supposes that in the first or acute stage the ciliary muscle possesses excessive action, while later this muscle atrophies and thus loses its elasticity. He believes that, in consequence of special connections which exist between this

muscle and the vessels of the choroid, the circulation in the vessels is hindered; that their coats being already weakened by the antecedent malady yield, forming sacciform dilatations, rupturing or becoming varicose, and that these morbid changes determine the increase of intra-ocular pressure. His operation was suggested by this idea, that the ciliary muscle girds the eye as a band, and that it hinders the circulation, as a cord around a muscle does.

The opinion of Mr. Hancock is only supported by mere hypothesis, and seems to have no other object than to justify the pretended section of the ciliary muscle. Daily experience demonstrates that glaucoma is not more frequent in the gouty and rheumatic than in others. No one has observed the atrophy of the ciliary muscle, and it is impossible to understand how an atrophied muscle should compress the vessels more than in its healthy state. Moreover, if no one has observed this atrophy of the ciliary muscle in glaucomatous cases, it has, on the contrary, been observed by all who have examined for it in the eyes of the aged. It is now known that persons, who present the *arcus senilis*, have the ciliary muscles to a certain extent atrophied and affected by fatty degeneration. It is a result of the progress of age, and sooner or later it affects every one. Presbyopia, to mention it by the way, is the first symptom of the commencing ill, and yet the immense majority of the subjects of it never have glaucoma.

Mr. Wharton Jones thinks that the fundamental morbid condition of glaucoma consists of a strong venous congestion, affecting particularly the retina and choroid. The arteries of the retina are contracted and pale, while the veins are turgid and dark. The vessels of the white of the eye are in the same state, the veins corresponding to the *recti* muscles are engorged and tortuous, while the arteries are scarcely visible. In examining with a microscope the retina of a glaucomatous eye, he found the venous radicles to present varicose dilatations and am-

pullæ. It has been said that the capillaries are varicose, but he did not find them so; and in the whole of his researches upon the state of the blood vessels, he did not remember to have ever seen any thing which deserved the name of varicose condition of the capillaries. In glaucoma, the congestion of the choroid and of the retina occasions a certain degree of intra-ocular distention; then, in consequence of the persistence of the congestion, an increase of the fluid of the cells of the vitreous body takes place, which determines a corresponding increase of the intra-ocular distention, a distention which has its principal seat in the posterior segment of the ocular globe. One of the effects of this distention is that the iris and crystalline are pushed forwards, and that the chambers of the aqueous humor are diminished in depth. Another of these effects appears to be the excavation of the optic papilla. Iridectomy in glaucoma causes the venous intra-ocular congestion to cease, the circulation of blood becoming more free in the eye, absorption of the excess of fluid in the cells of the vitreous body is favored, so that the intra-ocular distention diminishes. The pain is removed and the retina, at least, if the combined action of congestion and pressure has not produced any material structural alteration, may assume again its functions and vision reappear. The excision of a bit of iris and the evacuation of a small quantity of blood, make the congestion of the choroid and retina cease, and promote the circulation as a consequence. Scarifications of the palpebral conjunctiva operate in the same way, in exercising a favorable action, when this membrane is the seat of strong inflammatory congestion. It is not only the loss of blood which does good, for this is insignificant, but it suffices also to empty certain vessels in order to allow the reëstablishment of the general circulation and restore its usual activity.

M. A. Desmarres divides all cases of glaucoma into *anterior* and *posterior*, based on the different systems of circulation in the eye, the anterior and posterior circulation.

Anterior, or acute glaucoma manifests itself in the anterior part of the vascular membrane of the eye; the iris and ciliary body are the only parts at first seized. All the symptoms are much complained of, the pains are sharp, inasmuch as the sensibility of the ciliary body and of the iris are infinitely greater than that of the posterior portion of the choroid. Acute glaucoma, through its duration alone, passes on to the chronic state. Posterior, or chronic glaucoma manifests itself in the posterior portion of the choroid. It invades at once the entire vascular system of the posterior hemisphere, compresses from the first the optic nerve and produces its excavation. It only communicates with the anterior portions of the vascular membranes, when the primary disorders have induced atrophy of the papilla. It begins slowly, without pain, without changes in the iris or in the pupil, and without diminution of the anterior chamber. The absence of a great part of the essential symptoms of glaucoma can only be explained, according to M. Desmarres, by the seat of the disease being in the posterior portion of the choroid. This membrane being less sensitive suffers less from neuralgia; the anterior ciliary nerves are not compressed in posterior glaucoma, and therefore the pupil conserves its normal size, and the iris does not cease to perform its functions. Chronic glaucoma does not stop any more than acute glaucoma where it took its origin; and as the first proceeds from the anterior towards the posterior portion of the choroid, and becomes transformed into a posterior glaucoma, in the same manner, the chronic glaucoma advances forward, little by little, invades the ciliary processes and iris, and may induce all the signs of acute, or anterior glaucoma.

M. A. Desmarres believes that iridectomy can have, and should properly be expected to have, an influence only upon that portion of the choroidal vessels, which has direct communication with the vessels of the iris. Daily experience demonstrates, in fact, that the operation suc-

ceeds in acute glaucoma especially during the first fortnight, when the disease is localized in the anterior hemisphere; but as soon as the glaucoma has passed beyond this limit, and the acute and anterior transforms itself into a chronic glaucoma, iridectomy is then of little use.

8. *Treatment of glaucoma.*—The fact, so well established by M. Von Græfe, of the existence of an exaggerated intra-ocular pressure as the cause of the glaucomatous state, being once admitted, the only therapeutic indication should be; to seek the proper means of reducing this excessive tension to its normal condition. If, this physiological tension being restored, the symptoms which before existed disappear, the strongest confirmation results of the prevision which attributed the symptoms, *a priori*, to an understood cause. The result has shown the correctness of the views of the illustrious Berlin professor. Not only did the means extolled by him result in abolishing the internal pressure, but it restored the organ, which was the seat of it, to its functional conditions, nearly as in the healthy state, whenever it was seasonably applied. M. Von Græfe has then the merit of having discovered, at the same time, both the nature of glaucoma and the means of curing it.

This means is *iridectomy*. We are not to demand of the discoverer, in what manner nature proceeds in order to accommodate herself to such an operation, and to find in it the elements of cure, which experience has recognized; we must accept the fact without exacting the explanation, too happy that the fact is henceforth incontestable. M. Von Græfe hazards, however, the following hypothesis, viz.: 1st, By diminishing the secreting surface of the iris, the quantity of fluid secreted is diminished; 2d, The excision of a portion of the iris, by relaxing the tension of the choroid, induces a diminution of the pressure through a modification of the muscles; 3d, Iridectomy acts strongly upon the circulation of the eye, and may

thus diminish the power of the secretions acting there. M. Donders explains the *modus operandi* of iridectomy by the cessation of the tension, of which the iris was the seat, tension, through influence of which the secretory nerves of the iris were excited to exaggerate the products of their secretion, whence resulted a fresh augmentation of this same tension; this chain of causes and effects is thus broken by the operation. Finally, according to Mr. Hart, the benefits of iridectomy result from the arrest of the hypersecretion, in consequence of the excision of nervous plexuses and ganglions of the ciliary body.

Whatever may be the different explanations, Græfe did not draw the germ of his operation from the ingenious promptings of his own mind, but derived it from observation. He had often observed in cases of partial staphyloma of the cornea and sclerotica, when iridectomy was practiced for the purpose of replacing the defective pupil, that the staphyloma disappeared spontaneously without having to be removed. Repeated experiments upon the healthy eyes of animals, from which large pieces of the iris were removed, gave the same result: the eyes became softer.

Besides these, also, a certain diminution of consistence of the eye followed the operation for artificial pupil in patients affected with leucoma complicated with anterior synechia. There was no need of more to put him on the track.

Iridectomy has become henceforth the means, *par excellence*, for the treatment of glaucoma. To argue in support of this statement would now be superfluous. It remains to examine carefully the indications and contra indications of the operation. It is, doubtless, from not having done this with sufficient care, that authors, in other respects to be recommended, have denied the importance of this new therapeutic measure.

A. *Non-inflammatory glaucoma*.—When one eye only is attacked, it is rare that the physician is consulted; the

functional disturbances are scarcely perceived by the patient, and if he should happen to perceive them and to complain of them, it is not with the thought of recourse to a severe treatment, and it would not be well to advise an operation under such circumstances. But, if the ocular tension is manifest, the papillary excavation deep, and the contracting of the visual field progressive, the indication for the operation exists, and it is the duty of the surgeon to propose it, as the *only means* of arresting the invading march of the disease.

If both eyes are attacked, the indication is much more urgent, and the benefits to result from the operation more appreciable. Besides, it must not be forgotten that, when well performed, iridectomy is a harmless enough operation, and that, if care is taken to form the new pupil under the upper lid, it can never cause either discomfort or deformity.

B. *Inflammatory glaucoma*,—*a.*—*Acute form.*—What we have just said respecting *simple glaucoma* applies to the initial, or precursory stage of *inflammatory glaucoma* (without papillary excavation), on the condition always that the symptoms be sufficiently pronounced and repeat themselves at short intervals. In other cases it may be well to temporize, especially if only one eye is bad. All procrastination, on the contrary, is forbidden when the second eye is involved. The operation should be done then as soon as the precursory symptoms appear, especially if they are accompanied with a marked dimness of vision, and it is all the more necessary, since in the prodromic period iridectomy has most chance of success.

The diagnosis of an attack of acute glaucoma being once determined, there are rarely any serious difficulties in the way. The operation should be done as soon as possible, without the least hesitation, and without losing a single moment, under any pretext whatsoever. Procrastination in cases of this nature is always a serious mistake, for its result may be to let the disease produce disorders,

in curing which, the operation would at a later period be powerless. "Every hour now is precarious," says Mr. Bowman, "the urgency of the operation is indicated by the intensity of the inflammation. The loss of vision depends then, in part, upon the presence of the inflammatory products in the substance of the retina and in front of this membrane, in part, upon the alteration of circulation in the nervous substance and the considerable pressure to which it is subjected. The operation causes all these unfavorable conditions to cease: the inflammation succumbs, its products are generally absorbed, and often very rapidly; besides, the eye is relieved of extreme glaucomatous tension, which probably preceded the beginning of the acute inflammatory attack, and which constituted originally the essence of the disease." Iridectomy is ordinarily followed, from the first instant, with a healthy expansion, the ocular tension ceases and the pain, excruciating until then, disappears as if by enchantment. Often, at the evening visit, patients say they are in paradise, so great is their relief.

One is not always fortunate enough to be consulted at the beginning of such an attack; frequently the disease has existed days, weeks and months; the patients are greatly reduced by want of sleep and pain, and can scarcely distinguish light from darkness. In these cases the operation is less favorable than in the early periods of invasion, but it should be no longer neglected. Should its only effect be to banish pain, this is a result always to be hoped for, and to secure it, the operation should be done without hesitation. As a general rule, so long as a certain degree of vision exists, iridectomy is competent to restore it to a good condition: it is not proper to despair, even when the sensibility of the retina appears completely abolished, provided always that the disease is not of too long continuance, and that the extinction of vision was produced with considerable rapidity. Mr. Bowman cites the example of a lady, aged 40 years,

that all perception of light was abolished for thirty-five days, and that eight days after the operation she read No. 8 of Jæger. Græfe considers this fact as quite exceptional, for he has never observed a like case of reëstablishment of sight, after a delay of more than ten days.

Not only does iridectomy cause the signs of inflammation to disappear, but it also speedily restores to the media their transparence, so as to render an ophthalmoscopic examination possible at the end of five or six days. The roundish ecchymoses of the retina may be then almost constantly remarked, of which the greater part are produced after the operation, and persist quite a long time. It is otherwise with those which are observed in the equatorial region of the choroid; these existed almost always before the operation and disappear very rapidly after it. It may also be observed that, in the case of a first attack, unless it be grafted upon a chronic glaucoma, the optic papilla has not undergone either cupping or displacement of its vessels.

The return of vision in consequence of iridectomy is only in a very small degree due to the escape of the turbid fluid which occupied the anterior chamber. It is chiefly owing to the reëstablishment of retinal sensibility. Græfe cites in this connection a case, where all qualitative perception of light had disappeared, and where, however, the turbidity of the media did not prevent the recognition of the periphery of the optic nerve by aid of the ophthalmoscope. Five days after the operation, the anterior chamber contained a good deal of effused blood, which prevented the bottom of the eye being any longer seen, and yet the patient distinguished already the number of fingers, which one held up at the distance of three or four feet. Generally, the maximum of amelioration of vision is obtained after two or three weeks. The ciliary pains ordinarily disappear immediately after the operation, except slight frontal pains, which persist sometimes two or three days. The corneal insensibility and the sub-

choroidal injection resist only a little longer. Sometimes the vision delays several weeks in regaining all its power. This delay is owing to the retinal ecchymoses occasioned by the operation, and for absorption of which it is necessary to wait sometimes a month or two.

b. Sub-acute and chronic form.—This is the form which most frequently presents itself to the knife of the operator. Patients, who are attacked with acute glaucoma, either because they are badly advised, or because fear restrains them, seek too often to escape it; but the sub-acute stage, which resists ordinary means indefinitely, ends inevitably in constraining them to it. Iridectomy is appropriate, speaking generally, in all cases where the object is to restore to the organ a certain degree of vision if the sight is not entirely gone, or has been gone only a short time; or to get rid of pain; or finally, if one eye only is attacked, to have a favorable influence, as it may be hoped, on the other, by removing the tension of the diseased eye, which may react unfavorably on the sound one. The operation should be done in the interval of the paroxysms, if the frequent repetition of them permits waiting for the end of an attack without fear that it may cause too many evils. Not a moment is to be lost, if the attack is acute and threatens to leave serious traces. However long standing cases may be, if ocular tension exists with neuralgic irradiations, it is proper to operate: the iridectomy causes the internal pressure to cease, removes the glaucomatous aspect, and lessens the alterations of structure in the iris. As to the excavation of the optic papilla, when once produced, it never entirely disappears.

The *prognosis* of iridectomy differs according to the case: It is, generally, the more favorable the less its duration, limited to the precursory period, the less excavated the optic papilla, and the less the visual field is contracted. In simple glaucoma the chances are so much the better, as excavation of the papilla is less pronounced. In inflammatory glaucoma, other things being equal, there is

the more to be expected from the operation, the earlier it is performed; nevertheless, it has been followed by perfect sight, although recourse to it was not had for several weeks or even several months after the invasion. Even when the first attacks were very violent and had been already somewhat often repeated, iridectomy has succeeded in preventing its recurrence and giving to patients a good degree of vision, if the papilla has remained healthy and the field of vision of nearly its normal extent. When the papilla is excavated the operation may indeed diminish the cupping, but not restore the papilla to its physiological state; also, it will afford ameliorations, more or less marked, but not perfect cures. An excessive contraction of the visual field only permits hope of amendment, more or less pronounced, as the diminution approaches the median line. The combination of these two unfavorable conditions ought to render the prognosis very guarded; the operation, however, ought not to be deferred, for while it may not cure, it effects, at least, a check in the progress of the disease, often an amelioration and almost always an immediate cessation of the pain. When every trace of quantitative perception of light has disappeared, the operation may still effect some amendment, but it is rarely more than the ability to perceive large objects. When the intra-ocular pressure is very great, and the flattening of the anterior chamber, turbidity of the humors, tension, iridoplegia and anæsthesia of the cornea are strongly pronounced, and the abolition of vision is the immediate result of this condition, as occurs in acute glaucoma, the prognosis of the operation is of the most favorable character, for it always causes a distension, and by that means, cessation of the symptoms which the internal pressure occasioned.

Indications of Iridectomy. — Prof. Von Græfe has arranged these under the following propositions, viz.:

1st. The best result is obtained in a case where an eye is menaced by glaucoma (the other being already lost). It is the duty of the physician to procure as soon as possi-

ble for the afflicted the counsel of a specialist, who should point out to the attending physician the symptoms which call for the operation.

2d. Glaucoma once in the process of development, the results of the operation are, in general, the more decided and durable, the earlier one operates. In very grave cases, which induce almost immediately loss of sight, it is necessary to perform an iridectomy as soon as possible. A prompt interference is then of capital importance, and as transportation of the patients in these cases is often difficult, it would be well if every physician, especially in the country and small towns, where ophthalmology is not specially cultivated, should understand the symptomatology of acute glaucoma and the operation of iridectomy. I believe the latter will occasion fewer difficulties than the former. Iridectomy demands less imperatively good assistants than many other surgical operations, as tracheotomy, for instance, which every physician must practice in urgent cases, sometimes in the most unfavorable conditions. Iridectomy occupies, in this respect, an exceptional position among ophthalmic operations, which being rarely of an urgent character remain as the domain of a small number of practitioners.

3d. Iridectomy has not the same efficacy at all periods of the disease, and in the last stages its effects are uncertain or null. It is painful to see how many incurably blind undertake long journeys, in the hope that their infirmity may be cured, while the period when they could have been helped has long since passed away. We recommend, in order to spare ourselves moments painful alike to ourselves and to our fellows, that the unfortunates who have completely lost their sight in consequence of glaucoma remain at home, and that little hope should be given those, whose disease is already of long standing and accompanied with marked enfeeblement of sight and diminution of the visual field.

It suffices to read these instructions in order to be con-

vinced that M. Von Græfe, so far from advising iridectomy in all cases, as he has been unjustly reproached with doing, reserves it, on the contrary, for certain well determined circumstances. Speaking generally, it is to be practiced whenever there is pain, even though no longer any chance exists of restoring the least degree of vision, not only when both eyes are lost, but also when one only is extinguished, in order to preserve the other from sympathetic influences which these pains may there arouse.

When, on the contrary, the sight has been lost for a long time, and the eyes are completely painless, the operation is useless. To practice it in such circumstances would have no other result than to discredit the procedure. It must not be forgotten moreover, that quite harmless as iridectomy most commonly is, it may occasion accidents, such as lesion of the crystalline capsule and swelling of the lens as a consequence, hemorrhages and traumatic symptoms of which ophthalmitis may be the final result.

Precautions demanded by iridectomy performed for glaucoma.—1. When the operation is done for acute glaucoma where the eye is greatly inflamed and the conjunctiva chemotic, chloroform is indispensable, unless express contraindications exist, in order to avoid having the patient, agitated by excessive pain, make such movements as may compromise everything.—2. The place of election for the new pupil is by preference the upper part of the iris. The pupil there placed will be completely hidden by the upper lid, sparing the patient at once a disagreeable deformity and the dazzling which occurs at first from too great a quantity of light in the eye.—3. In cases where great tension ceases suddenly, as happens from the aqueous humor flowing out suddenly, the blood vessels of the interior of the eye being quickly relaxed may burst and cause internal hemorrhages: hence the express indication to withdraw the knife with extreme slowness, in order to allow the fluid, which escapes from the anterior chamber, to flow out, drop by drop, as gently as possible. During this flow, the point of the blade should be watched and moved in a

direction rather towards the cornea than towards the crystalline for fear of wounding the capsule. M. Von Græfe is in the habit of making a slight pressure of the finger upon the globe of the eye while the aqueous humor is flowing, and, a little while after the operation, of applying a light compressive bandage (a pledget of charpie retained by a bandage) which is carefully removed some hours after. It is very well to observe this precaution.—4. If, as is usual, the pupil is largely dilated, it is of great advantage to cause it to contract before the operation, by means of extract of calabar bean, in the two-fold purpose of seizing more easily a large piece of iris and of avoiding more certainly the crystalline capsule.—5. It is a good practice when the incision is made, to provoke a hernia of the iris by pressing lightly on the posterior lip of the wound by means of a forceps prepared to seize the hernial protrusion if it presents. The introduction of numerous instruments, always dangerous, into the anterior chamber and the liability of injuring the crystalline system are thus avoided.

Other methods of treating glaucoma.—We shall be brief in what relates to this subject: antiphlogistics, derivatives, inhalations of chloroform, narcotics, anti-periodics or anti-neuralgics are only palliatives, and it is almost dangerous to cite them, if they are to serve as a pretext for deferring a moment the practice of iridectomy. They have never cured a case of glaucoma. Paracentesis of the cornea has counted on some success, but it has always been temporary. It must not be too much underrated, however, but it should only serve to secure more certainly the moment when iridectomy shall be practicable. The absence of an operator capable of practicing the latter properly, and the necessity of seeking one at a distance are circumstances which may render paracentesis useful. As a radical method, it must not be depended on, and besides iridectomy is not properly speaking more serious in its consequences than paracentesis.

AUTHORITIES.

Respecting glaucoma the following authorities may be consulted: Von Græfe. *Archiv für Ophth.* B. I, Abth. 1, S. 371, 382, u. Abth. 2, S. 299; B. III, Abth. 2, S. 456; B. IV, Abth. 2, S. 127; B. VI, Abth. 2, S. 254; B. VIII, Abth. 2, S. 242, et *Annales d'Oculistique*, tomes XXXIII p. 137; XXXVI, 171; XXXVIII, 237; XXXIX, 228; XLV, 180; XLIX, 136; LI, 100.—Ed. Jaeger. *Ueber Glaucom und seine Heilung durch Iridectomie*, Wien, 1858, et *Ann. d'Ocul.* t. XI, p. 92.—Donders. *Klin. Monatsbl.* B. II. S. 433, et *Ann. d'Ocul.* t. LIV, p. 120.—James Compte rendu de sa *Thèse sur le glaucome*, par Giraud-Teulon, (*Gaz. Méd. de Paris.* 12 avril, 1862, p. 235).—Wells. *Glaucoma and its cure by Iridectomy*, London, 1864.—Brown. *Brit. Med. Journ.* 1864, Jan. 30, p. 136.—Bader. *Ophth. Hosp. Reports*, Vol. II, p. 226.—Wharton Jones. *Three Clinical Lectures on Iridectomy and Glaucoma* (*Med. Times and Gazette*, 1864, July 23 and 30, Aug. 6.—Hancock. *Ophth. Hosp. Rep.* Vol. III, p. 13.—Nunneley. *Lancet*, 1861, Jan. 19 & 26, pp. 55, 82.—Pamard. *Thèse sur le Glaucome*, Paris, 1862, *Ann d'Oc.* t. XLVIII, p. 290.—Critchett. *Oph. Hosp. Rep.* vol. I, p. 57.—Magni. *Nouvelle Théorie du Glaucome* (*Ann. d'Oculist.* t. XLIX, p. 160).—Hulke. *Ophth. Hosp. Rep.* vol. II, p. 69, etc., and *Ann d'Ocul.* t. XLVI, p. 54.—Quaglino. *Giorno d'Oftal. Ital.* 1860, p. 169, and *Ann. d'Ocul.* t. XLVII, p. 274.—Haffmans *Méin. sur le glaucome* (*Arch für Ophth.* B. VIII, Abth. 2, S. 124.—A. Desmarres, *sa Théorie sur le glaucome*, par Galezowski (*Union Méd.* 1864, p. 201, and *Ann. d'Ocul.* t. LII, p. 248).—Magawly. *Contributions à l'histoire clinique du glaucome* (*St. Petersb. Medic. Zeitsch.* 1864, vol. VI, p. 193, and *Ann. d'Ocul.* t. III, p. 250).—Coccius. *Arch. f. Ophth.* B. IX, Abth. 1, S. 1.—Fribelius. *St. Petersb. Medic. Zeitsch.* III, 155, and *Ann. d'Ocul.* t. LIV, p. 221.—Little. *Ophth. Review* No. 7, 1865.—Bowman. *Controversy on Iridectomy*, etc., (*Brit. Med. Journ.* 1863–1864).

Ophthalmoscopic figures of Glaucoma.—Mackenzie, (French edition) T. II, p. XLIX. (Liebreich)—Ed. Jaeger, *Ueber Staar und Staaroperationen*, taf. VIII, fig. 34; *Beitrage*, etc., taf. XIX, XX.—Von Græfe, *Archiv für Ophth.* 1854 B. I, Abth. I, Taf. III, fig. 1.—Quaglino, fig. 23.—Bader, *Ophth. Hosp. Rep.* 1857, 1859, vol. I, pl. I, fig. 1, 2.—Liebreich. *Atlas d'ophth.* tab. XI, fig. 1, 2, 3, 4, 5.—Follin. *Leçons*, etc., pl. I, fig. 4 (2).

