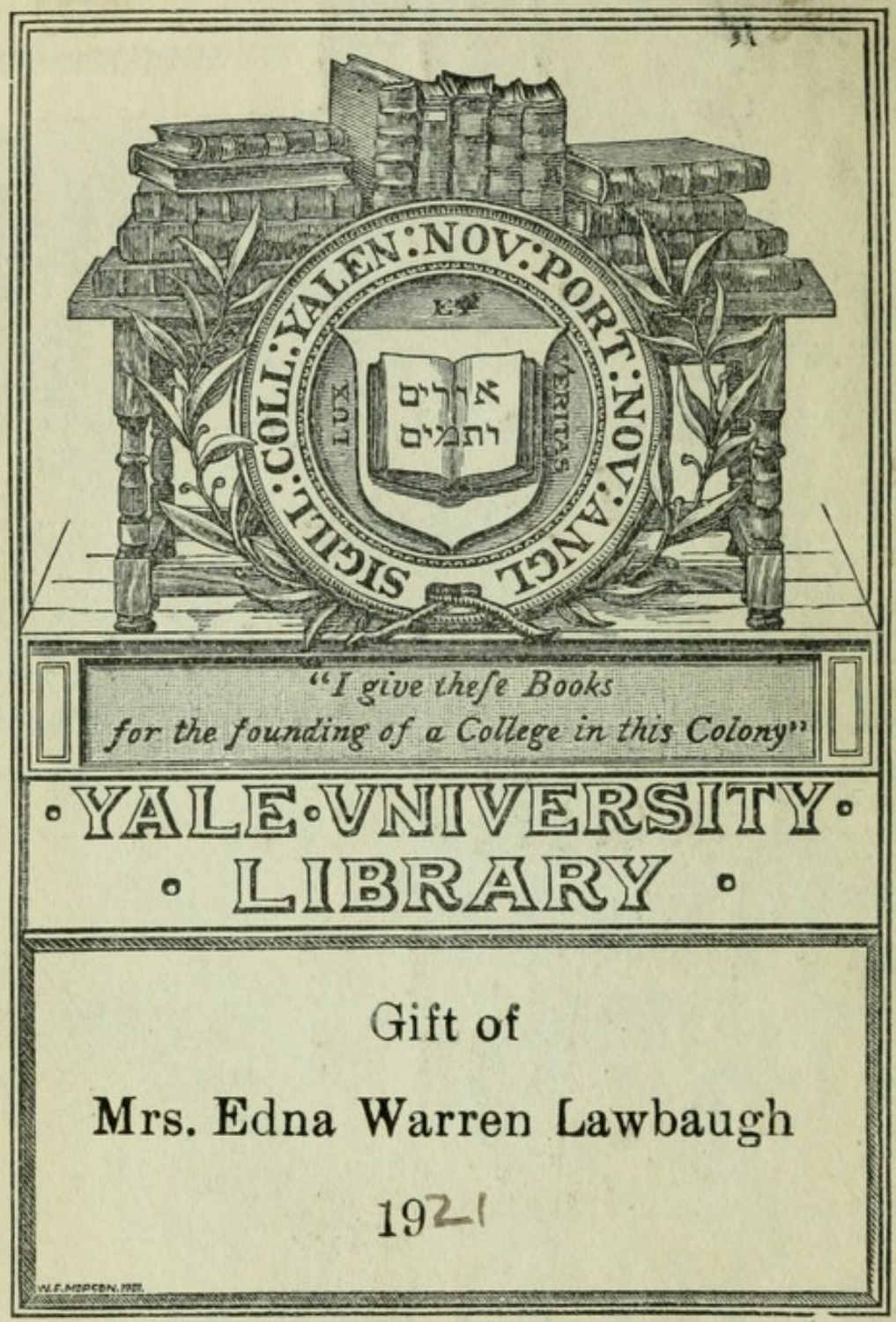
**Practical handbook of the diseases of the eye / D. Chalmers Watson.**

# PRACTICAL HANDBOOK OF THE DISEASES OF THE EYE

D. Chalmers Watson



# DISEASES OF THE EYE.

# PRACTICAL HANDBOOK

OF THE

# DISEASES OF THE EYE

BY

D. CHALMERS WATSON, M.B., C.M.

*Ophthalmic Surgeon, Marshall Street Dispensary, Edinburgh; late Clinical Assistant, Ophthalmological Department, Royal Infirmary, Edinburgh*

*WITH NINE COLOURED PLATES*
*AND TWENTY-FOUR ILLUSTRATIONS IN THE TEXT*

NEW YORK
THE MACMILLAN COMPANY
EDINBURGH: WILLIAM F. CLAY
1897

Dedicated,

WITH EVERY TOKEN OF REGARD AND ESTEEM,

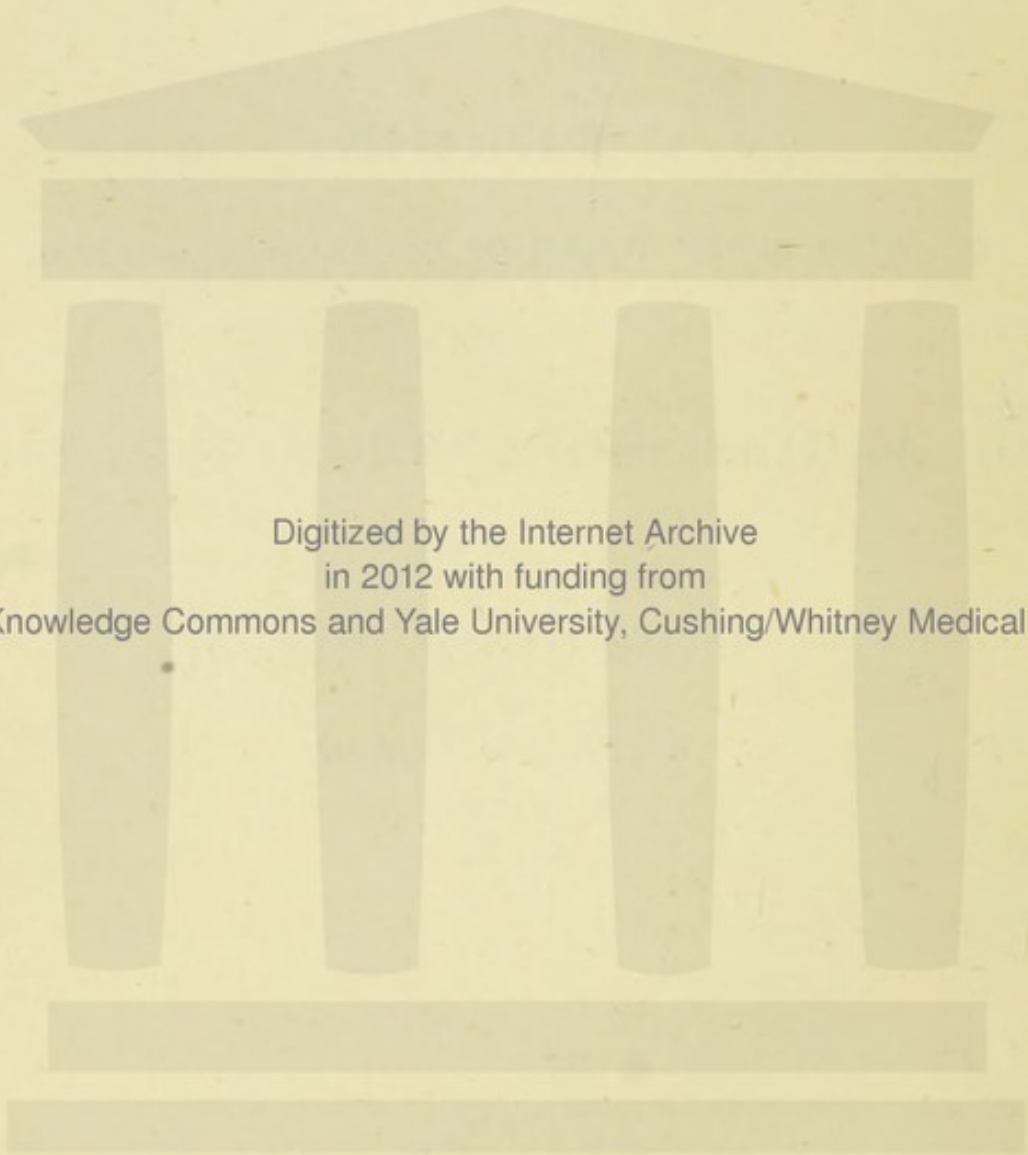
TO

D. ARGYLL ROBERTSON, M.D., LL.D.,

BY HIS

FORMER CLINICAL ASSISTANT,

*THE AUTHOR.*



# PREFACE.

In the following pages I have endeavoured to give a concise and practical account of the more common diseases of the eye, and the methods employed in their diagnosis and treatment. The time at the disposal of medical students for studying special subjects is necessarily limited, and the result is, they are frequently unable to take full advantage of the larger text-books, and of the clinical material and teaching at their disposal.

In these pages I have accordingly adopted a style of treatment that seemed best calculated to make the book a clinical *vade-mecum*, as well as an introduction to the various standard works.

The basis of the work is the clinical teaching of Dr Argyll Robertson, and I take this opportunity of expressing my great indebtedness to him for the many privileges afforded me as his Clinical Assistant, and further, for his kindness in looking through the work before going to press.

In its preparation I have frequently referred to the various standard works, notably to those of Berry, Swanzy, and Priestley Smith.

I would express my great indebtedness to Mr Berry for kindly revising most of the proof sheets, and for many valuable suggestions, of which I have availed myself. To Dr M'Kenzie Davidson I am also indebted for a similar favour.

To Mr Priestley Smith I am also under a deep obligation for kindly criticism, and for many hints, especially in connection with the chapters on Glaucoma and Strabismus; and my best thanks are due to Mr J. S. Martin for assistance in the revision of the text, and for many hints in its preparation.

I am indebted to Mr Swanzy for permission to copy his diagram illustrating the principle of Snellen's Types, and to Mr Berry for permission to use his coloured diagram of the Macula, and figures illustrating Astigmatism and the Visual Angle.

The rest of the coloured plates have been copied from Jaeger's Atlas, some of them being slightly modified for teaching purposes. I am indebted to Miss Geddes, M.B., C.M., for their careful representation.

In a work of this kind there are necessarily many imperfections, but I have aimed only at providing a reliable and practical guide to the study of eye diseases.

19 Rutland Street,
Edinburgh, *April* 1897.

# CONTENTS.

# LIST OF COLOURED PLATES.

# LIST OF ILLUSTRATIONS IN THE TEXT.

# PRACTICAL HANDBOOK

OF THE

# DISEASES OF THE EYE.

## CHAPTER I.

## EXAMINATION OF THE EYE.

THE systematic examination of the eye must be both *subjective* and *objective.* The former includes a consideration of the various symptoms complained of by the patient. The latter consists in the examination of the external and internal parts of the eye. The more common subjective symptoms complained of are the following :—

Defective vision.
Symptoms of asthenopia.
Pain.
Photophobia, or dread of light.
Lacrymation.
Distortion of images,—Metamorphopsia.
Black spots or motes in front of the eye,—Muscæ volitantes.
Diplopia, or double vision.
Subjective sensations of light,—Photopsia.

## Defective Vision.

Vision may be imperfect for near or for distant objects, or for both. Further, the defect in vision may be more marked at a particular time, *e.g.*, at night, in a bright light, or after much reading or sewing. All these points require careful investigation, and, when taken in conjunction with other points in the history of the case, often convey much information as to its probable nature.

## Symptoms of Asthenopia.

Asthenopia usually depends on an error of refraction. The symptoms develop some time after commencing to read, sew, or otherwise engage the eye for near work, and are due to weakness in the power of accommodation. The patient finds he can use the eyes for near work for a time without discomfort, but soon he is unable to do so. This is due to the fact that the ciliary muscles are unable to sustain the effort required for the particular work in which the patient is engaged. The symptoms are—

*a.* A feeling of tiredness or pain in the eyes.

*b.* A hot sensation in the eyes, frequently attended with lacrymation.

*c.* The letters on a page run together and present a blurred appearance.

*d.* Headache.

**Pain.**—Pain is a frequent symptom in eye disease. It may be dependent on—

1. Inflammation or other gross lesion of the structures of the eye; or,
2. Neuralgia, hypersensitiveness of the retina, or error of refraction.

Among the former causes, iritis, cyclitis, glaucoma, and orbital tumours are the most important. Such pain may be localised to the eye, or it may be located in the forehead or temple. In cases of neuralgia, it depends on a lesion of the supra- or infra-orbital nerves. When dependent on an error of refraction, the pain develops some time after commencing to read, or sew, or otherwise strain the power of accommodation.

**Photophobia**, or Dread of Light.

Photophobia may be due to diseased conditions of the surface of the eye, *e.g.*, conjunctivitis, phlyctenular ophthalmia, irritation of a foreign body, or iritis; or it may be due to a diseased condition in the interior, *e.g.*, hyperæsthesia of the retina. When due to the former causes, it is usually accompanied by lacrymation.

**Lacrymation**, or Excess of Watery Secretion.

Lacrymation commonly results from some obstruction in the lacrymal apparatus. It is also a prominent symptom in superficial inflammations of the eye, and is then frequently associated with a hypersecretion of mucus from the follicles of the conjunctiva.

**Metamorphopsia**, or Distortion of Images.

Metamorphopsia, or distortion of images, is met with in some diseased conditions of the interior of the eye, *e.g.*, choroiditis, posterior sclero-choroiditis, retinal hæmorrhages, and irregular astigmatism. The images may appear too large (macropsia) or too small (micropsia).

**Muscæ Volitantes.**—Black spots or motes in front of the eye.

In many instances the ophthalmoscope reveals nothing. In others ophthalmoscopic examination reveals the presence of dark spots or threads in the interior, conditions characteristic of diseased states, especially disease of the vitreous.

**Photopsia.**—Subjective sensations of light.

This condition is present in some cases of disease, *e.g.*, glaucoma. In other cases subjective sensations of colour exist, and to this the term chromatopsia is applied.

## OBJECTIVE EXAMINATION.

The objective examination is carried out by the sense of sight and that of touch, and is aided by various appliances for making a more detailed investigation of the parts in the interior of the eye, *e.g.*, ophthalmoscope, perimeter, &c. The examination should be made in a

definite and systematic manner, the steps in the examination being as follows :—

I. Inspection of palpebral fissures, eyelids, eyelashes, and external structures of the globe.

II. Determination of the visual acuity, testing in turn the light, form, and colour sense.

III. The field of vision.

IV. The intra-ocular tension.

V. The mobility of the eyes and the pupillary reactions.

VI. Oblique or focal illumination.

VII. Ophthalmoscopic examination.

## I. Inspection.

By inspection we determine whether the eye is normal in position or displaced in any direction —laterally, vertically, or anteriorly. If the eyes appear small and deeply sunk in the orbits, that suggests the existence of hypermetropia; whereas if the eyes are prominent and the temporal portions of the globe present a flat look, that suggests myopia. *The size of the two palpebral fissures* should be noted and compared. In such conditions as intra-orbital tumours or exophthalmic goitre, the palpebral fissure is wider than normal, whereas in cases of ptosis from paralysis of third nerve or from trachoma, the fissure is narrower than normal.

*The eyelids and eyelashes* should be examined, and the position of the lower punctum lacrymale noted.

Under normal circumstances the punctum is in close apposition to the surface of the globe, and is invisible unless the lower lid be drawn down. The condition of the *conjunctival mucous membrane*—ocular and palpebral—should be noted, special attention being directed to the presence of anæmia, congestion, inflammation, or the presence of a foreign body. It is frequently necessary to examine the inner surface of the upper lid, and this is done in the following way:—The lid is slightly raised from the globe by the thumb of one hand being applied to its outer surface in such a way as to cause the eyelashes to bulge forwards. The eyelashes are then grasped between the thumb and forefinger of the other hand, and the lid in this way pulled downwards and forwards, while the patient is told to look down. At the same time the skin below the first thumb is pressed well downwards, slight upward traction being at the same time exerted on the eyelashes. With these movements the tarsal cartilage is carried down and everted, and its mucous mem brane exposed.

The *cornea*, *pupil*, *anterior chamber*, and *iris* should then all be systematically noted. Fine opacities in the cornea, alteration in the size of the pupils, irregularities in the pupillary margin, shallowness or increased depth of the anterior chamber, or any loss of lustre in the iris will thus be determined, and the appreciation of one of these points alone may complete the diagnosis.

## II. Determination of the Visual Acuity.

The *light* sense, *form* sense, *colour* sense, &c., must all be examined.

In some cases of disease, the light sense is retained while the form sense and colour sense may be lost. There are probably separate centres for each of these perceptions, these centres being situated near each other in the posterior part of the brain. A small lesion may destroy the colour sense or form sense, and an extension of that lesion may involve all three perceptions.

In determining the light sense, it is not enough merely to ascertain whether the patient appreciates light thrown on the eye. Fine gradations of light should be used, and the smallest amount which is capable of producing sensation in the retina noted. As regards the colour sense, it must be borne in mind that some people are naturally colour blind, or colour confusers. (*Vide* page 169.)

In determining the visual acuity, the following tests should be applied :—

1. Is there perception of light?
2. Is there projection of light? In other words, can patient state whether a fine gradation of light projected upon the eye comes from above, below, or his right or left side. This is especially important in connection with detachment of the retina and other lesions.

3. Is there perception of hand movements? This is tested by the hand of the examiner being moved vertically and then from side to side in front of the eye being examined.

4. Can patient count fingers, and if so, at how many feet distant?

5. Snellen's test types.

## Principles of Snellen's Test Types.

Two black objects on a white ground can be seen as discrete, when separated by a space which subtends an angle of 1′ with the eye. That is to say if the visual angle A or B is equal to 1′, as represented on the diagram.

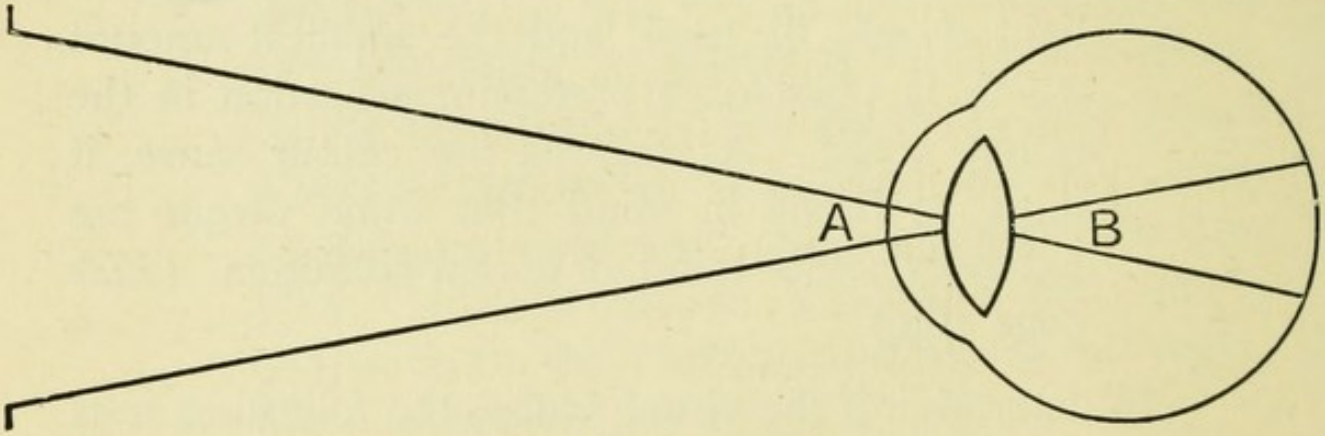



FIG. 1.—DIAGRAM OF VISUAL ANGLE. (AFTER BERRY.)

This forms the basis for the practical scale of visual acuity embodied in Snellen's types. They consist of a series of letters painted black on a white background, and so devised that *at the distance at which they should be seen*, their height subtends an angle of 5′ at the eye, as represented on the

diagram, while the spaces separating the portions which must be seen as discrete in order that the letter may be recognised, subtend angles of 1′ at the distance at which they should be seen by any one possessing normal visual acuity.

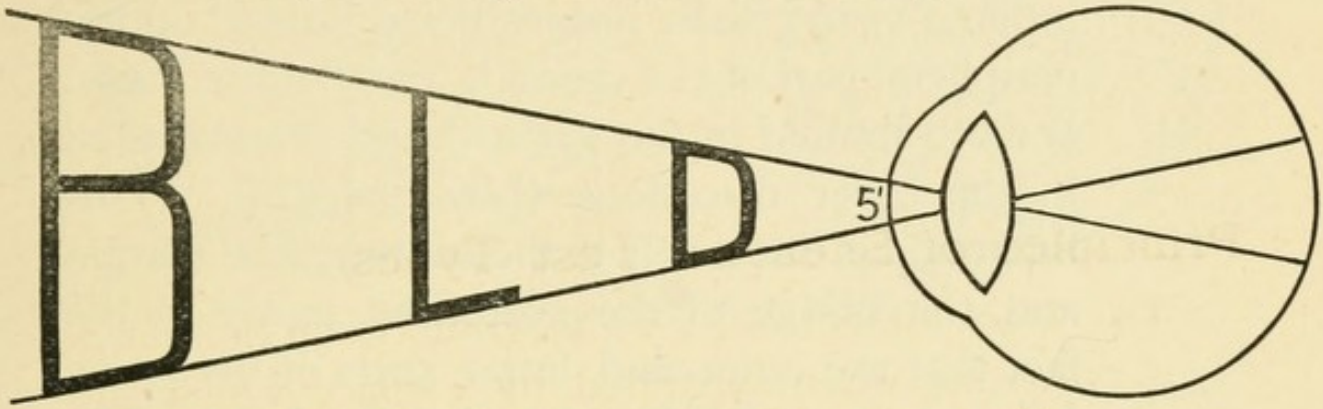



FIG. 2.—TO ILLUSTRATE PRINCIPLE OF SNELLEN'S TYPES. (AFTER SWANZY.)

Subjects with normal vision should be able to read the smallest line at six metres or twenty feet distance. This is expressed as $V = \frac{6}{6}$. If the patient can only make out the third line from the top, such vision is expressed as $V = \frac{6}{12}$, as the patient can only read at six metres what he should be able to read at twelve metres. If the top line of letters only can be read at six metres, vision is expressed as $\frac{6}{60}$, as the patient can only read at six metres what he should be able to read at sixty metres.

## III. The Field of Vision.

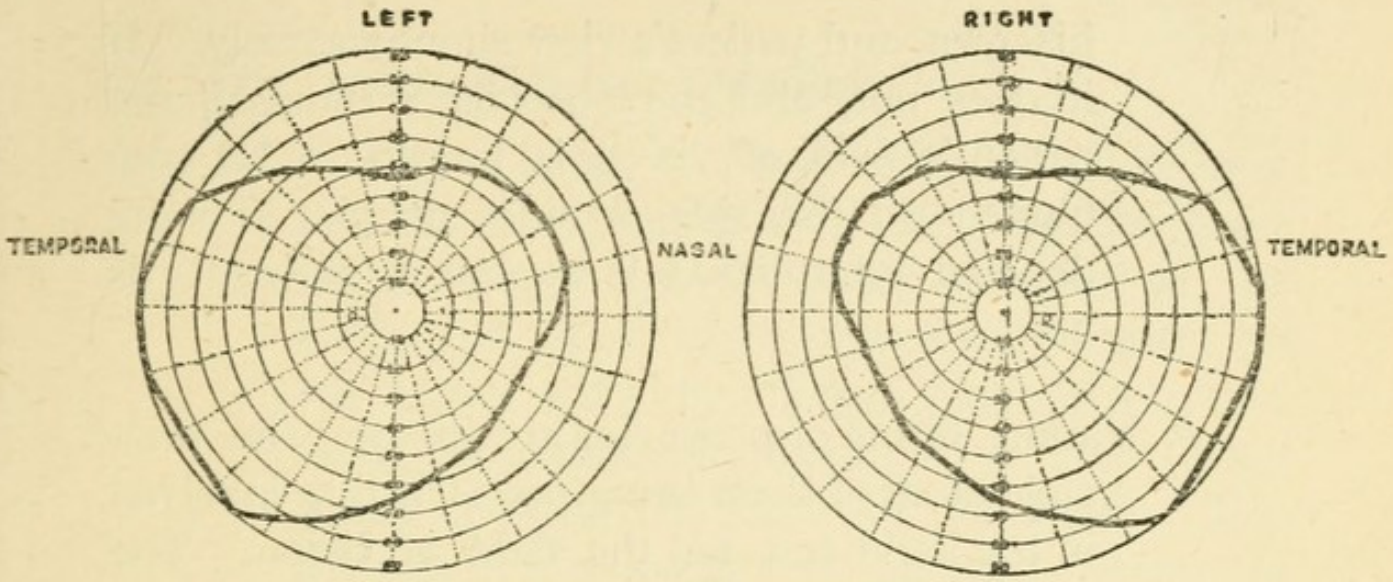
When looking straight forwards, the normal eye not only sees clearly certain objects in the direct line of vision, but also obtains a less distinct view of other objects which lie to the right side or the left side of, above, and below the direct line

of vision. Everything that is so seen is included in "The Field of Vision." The object fixed by the eye is seen by central or direct vision, its images being formed on the macula, while the other objects in the field are seen by excentric or indirect vision, their images being formed on the peripheral part of the retina. The field of vision is more limited in the *upward* and *inward* than in the other directions (*vide* diagram). This limitation is due partly to the supra-orbital margin and the bridge of the nose, and partly to the fact that the outer and lower parts of the retina being less used, are functionally less active. Normally, the field extends 90° outwards, 60° inwards, 70° downwards, and 50° upwards (*vide* diagram).

*Manner of Investigation.*

There are two methods of investigation—
*a*. By the hand.
*b*. By the perimeter.

*a*. By the hand. For practical purposes a fairly accurate knowledge of the state of the field of vision may be obtained by hand movements. The patient, being placed with his back to the light, about two feet distant from the observer, is directed to cover one eye, and with the other to fix steadily the eye of the observer that is opposite his own. The observer then moves his hand in different directions (from the periphery inwards), from above, below, the right and left sides, and notes whether it comes into




FIGS. 3, 4.—NORMAL FIELD.

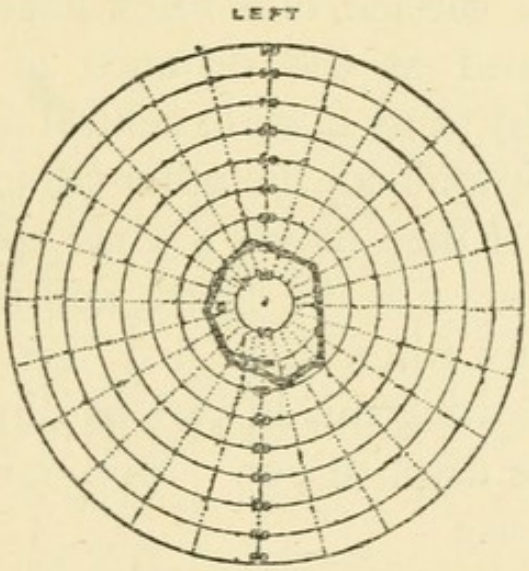
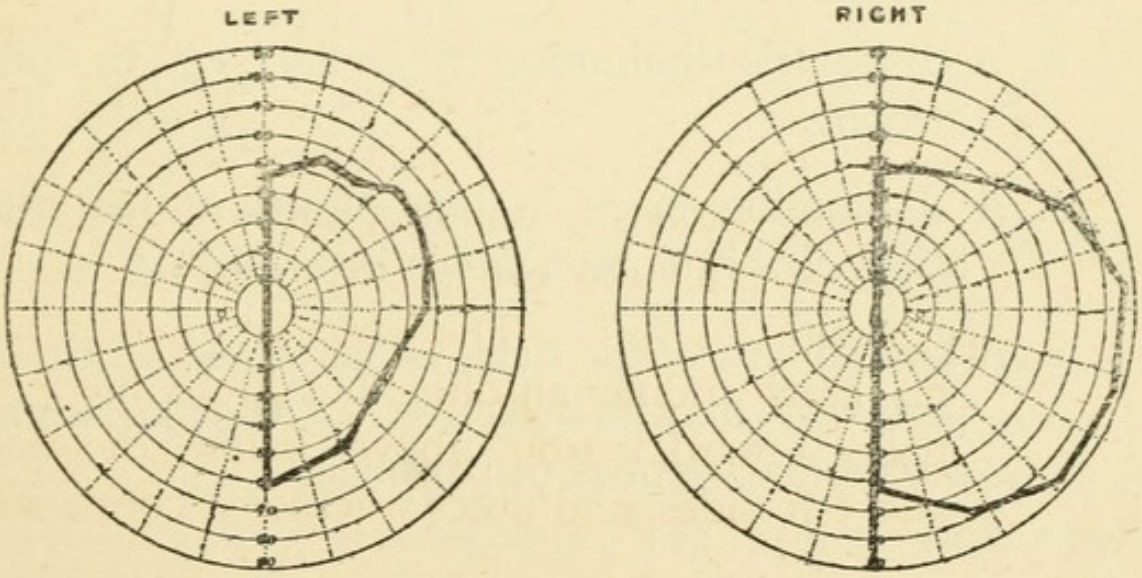



FIG. 5.—CONCENTRIC DIMINUTION IN A CASE OF OPTIC ATROPHY.




FIGS. 6, 7.—LOSS OF ONE SIDE OF THE FIELD OF VISION—HOMONYMOUS HEMIANOPSIA.

his own and patient's view simultaneously. If it does not, and the observer is normal, the patient's field of vision is known to be contracted on the side or sides noted. If more detailed information is wanted, a perimeter is used.

*b.* Various forms of perimeter are in use; the principle of all of them being precisely that involved in the hand test for the field of vision. The simplest consists of circles drawn concentrically on the surface of a black board. The patient is placed at the distance of one foot, and directed to fix a white central spot with the eye to be examined, the other being covered. The observer then moves a white spot from the periphery towards the centre, and marks with chalk the place where it is first seen by the patient. By repeating this in various directions, the field may be mapped out. More complicated forms are in use.

In disease there may be—

*a.* A concentric diminution in the field, *e.g.*, in optic atrophy.

*b.* A diminution more in one direction than the other, *e.g.*, in homonymous hemianopsia.

*c.* A limited part of the field, either at the centre or periphery, may be defective. This is known as a scotoma—central or peripheral.

## IV. The Intra-Ocular Tension.

*Method of Testing.* — Direct the patient to look towards the ground, then pass the fore and middle fingers gently under the roof of the orbit, and exert slight downward pressure on the globe with the fingers alternately, care being taken that the pressure is exerted downwards towards the floor of the orbit. The resistance encountered during such pressure is the intra-ocular tension.

*Physiological Variations.* — There is no perfectly uniform standard. Considerable experience is essential for a proper estimation of the degree of tension, and the student should take every opportunity of testing normal and diseased conditions, *in every case comparing the two eyes.* Considerable variations are met with within the limits of normal tension, the conditions being known as "firm normal" or "soft normal," according to the degree of resistance. The important point to attend to in all cases is the careful comparison of the tension in the two eyes.

*Increased or Diminished Tension.* — Any increase or diminution in tension is graphically represented by +, or −, 1, 2, or 3, according to its degree. Thus, in a case where the tension is quite appreciably increased, the condition is spoken of as T + 1; and in those cases where

the eyeball is exceedingly firm and almost stony hard, the tension is described as T + 3.

## V. The Mobility of the Eyes and Pupillary Reactions.

The mobility of the eyes should then be examined, and any paresis or paralysis of the external muscles determined. The reactions of the pupil both to light and accommodation should then be carefully investigated. (*Vide* page 97.)

## VI. Focal or Oblique Illumination.

Focal or oblique illumination is performed in the following way:—The rays from the source of light used for ophthalmoscopic examination are concentrated by means of a strong convex lens on the cornea. By slight movements of the convex lens the different parts of the cornea can be in turn minutely examined. This method is specially useful in revealing very fine opacities in the cornea, slight changes in the iris in cases of a doubtful nature, and the presence of minute foreign bodies.

## VII. Ophthalmoscopic Examination.

Ophthalmoscopic examination concludes the investigation. The light reflected from the interior of the eye is reddish, this being due to the vessels of the choroid. If there is any want of transparency in the media a shadow is produced. The manner of examination and the appearances presented will be considered later.

## CHAPTER II.

# THERAPEUTICS.

THE therapeutic measures adopted for the treatment of diseases of the eye may be classified as follows:—

*a.* General.

*b.* Local.

1. Medical.
2. Surgical.

## General Remedial Measures.

1. *General Tonics.*—With regard to these measures, it must be borne in mind that the eye is a specially sensitive part of a complex whole, and that owing to its very sensitiveness it is readily influenced by various deranged conditions of other parts of the body. Thus we find in many cases that treatment directed to improving the tone of the whole system, and especially the nervous system, is followed by a speedy amelioration or removal of the symptoms. In such cases the eye symptoms may have been dependent either on—

    1. A weakness of the ciliary muscles;
    2. Irritability of the retina; or
    3. Irritability of the higher visual centres in the brain.

Again, in many cases, especially in children, the eye condition depends mainly on some constitutional weakness or taint, *e.g.*, tubercle or syphilis, and the treatment must mainly be directed to improving the general tissue nutrition. As examples of this we find phlyctenular ophthalmia, interstitial keratitis, conjunctivitis, iritis, and others.

2. *Rest.*—Rest is of prime importance in the treatment of many diseases, both of the exterior and interior of the eye. It admits of the recuperative power of nature working out its own cure. There are different ways in which rest may be obtained, *e.g.*—

   *a.* By a darkened room.
   *b.* Avoidance of reading, sewing, and the like.
   *c.* The use of tinted goggles.
   *d.* The use of a shade to the eyes.

**Local Remedial Measures.**—Medical.

These consist mainly in the use of various lotions, ointments, powders, or other applications to the surface of the eye. In the selection of these various remedies, in cases of inflammation and the like, one is guided by—

1. The character and amount of the secretion.
2. The duration of the inflammation.
3. The condition of intra-ocular tension.

*Poultices* of all kinds should as a rule be avoided, and especially so in conjunctival affections. The popular belief in poultices of bread and water, tea leaves, wet cloths, and the like, is the cause of

much serious damage to the eye. The various remedies for local application may be classified as follows :—

*a.* Soothing.
*b.* Astringent.
*c.* Stimulating.
*d.* Mydriatic.
*e.* Myotic.

## Soothing Applications.

These are indicated in the earlier stages of various acute inflammations. Among them may be mentioned the following :—

*a.* Boracic lotion ; 6 grains to the ounce.
*b.* Warm water.
*c.* A stream of cold water applied over the closed lid.

And in the form of ointments.

*d.* Boracic ointment ; 4 grains to the ounce of lard.
*e.* Calomel ; 2 grains to the ounce.

## Astringent and Stimulating Applications.

Such applications are indicated in the later stages of many inflammations. The following are among the most useful :—

*Lotions.*

Sulphate of zinc, or alum, 4 grains to the ounce.
Chloride of zinc, $\frac{1}{4}$ to $\frac{1}{2}$ grain to the ounce.
Corrosive sublimate, 1 in 3 to 5000.
Hot water. The brief application of hot water either to the surface of the eye or to the

closed lid has a stimulating and counter-irritating action, and is at the same time sedative.

*Ointments.*

Yellow oxide of mercury ointment; 4 grains to the ounce.

Iodoform ointment; 10 to 15 grains to the ounce, especially useful in septic cases.

Calomel; 4 grains to the ounce.

*Powders.*

Boracic acid, finely powdered.

Calomel. Useful in chronic cases, and sometimes in acute.

Iodoform, finely powdered, especially useful in septic cases.

## Use of Lead and Silver.

*Preparations of lead* should be avoided, or used with great caution. They should never be used in cases associated with an abraded surface, *e.g.*, ulcer of cornea. This is owing to the fact that there is a deposit of white insoluble lead chloride on the surface of the eye, a condition which is not removable.

*Nitrate of silver* is exceedingly valuable in the treatment of many affections of the eye, its uses depending on its stimulating, escharotic, counter-irritating, and antiseptic properties. Its use, however, should be restricted to local applications made by the surgeon, as, if given to the patient

and applied in solution for a length of time, there is great risk of permanent dark staining. As illustrations of its use we have—

1. The application of $\frac{\text{gr. x. or xv.}}{\bar{3}\text{i.}}$ solution to the mucous membrane of the lids in cases of purulent ophthalmia.
2. The application to the edges, or to the surface of a hypopyon ulcer.
3. Blistering the upper lid with the solid silver nitrate in cases of phlyctenular ophthalmia.

Numerous other illustrations might be quoted.

## Mydriatics and Myotics.

*Mydriatics.*—Atropine, homatropine, Duboisine, and cocaine are the commonly used mydriatics. They are used in strengths varying from $\frac{1}{4}$ to 4 grains to the ounce, according to the effect desired. With the exception of cocaine, they tend to increase the intra-ocular tension, and therefore are contra-indicated in cases of glaucoma. Owing to this tendency, their use in elderly people must be carefully watched.

*Myotics.*—Eserine and pilocarpine are the two solutions used as myotics. They are used in a similar strength to the above, according to the effect desired. They decrease intra-ocular tension, and are very serviceable in the treatment of glaucoma. Pilocarpine is weaker in its action than eserine.

All these applications must be applied *to the surface of the eye* with a special dropping tube. The patient

should always receive the most detailed instructions as to the method of application. Occasionally one or other of these mydriatics or myotics is used in the form of an ointment.

**Local Remedial Measures.**—Surgical.

These fall to be considered under operations. Special mention must be made of the use of cocaine as a local anæsthetic of the greatest value in all operations on the eye. Surgical measures may be directed to—

1. Effecting a cure, *e.g.*, removal of a cataract.
2. Arresting the progress of disease, *e.g.*, iridectomy in glaucoma.
3. Improving vision, *e.g.*, by forming an artificial pupil in cases where the natural pupil is occluded.

Among other remedial measures of service *the electromagnet* holds a prominent position for the removal of iron or steel particles from the interior of the eye. The injection of antiseptic substances into the interior of the eye, and especially *chlorine water*, in cases of purulent infiltration after a perforating wound, is a recent addition to intra-ocular therapeutics.

## CHAPTER III.

### Diseases of the Eyelids.

---

# ANATOMY OF THE LIDS.

The structure of the eyelid from within outwards is :—

1. *Mucous Membrane.* — The conjunctival mucous membrane forms the innermost part of the lid. It contains numerous mucous follicles, and has underneath it, both in the upper and lower lids, some non-striped muscular fibres (muscle of Muller). In the upper lid these fibres assist the levator palpebræ superioris in elevating the lid. They are supplied by the sympathetic. Hyper-secretion from the mucous follicles is present in conjunctivitis, the secretion being glutinous, and making the eyelids adhere together, especially in the morning. Contraction of the orbital muscle of Muller is met with in cases of exophthalmic goitre, this contraction being indicated by the involuntary widening of the lid aperture.

2. *Tarsal Cartilage.*—The tarsus or tarsal cartilage is a band of dense fibrous tissue, thicker and broader in the upper than in the lower lid. To its free margin the levator palpebræ superioris is

attached, and the follicles of the eyelashes are imbedded in its substance. It also contains numerous glands, which pour out an oily secretion at the margin of the lid.

3. *Muscular Fibres*—the orbicularis palpebrarum. This muscle closes the eye, and is supplied by the seventh nerve.
4. *Skin*—beneath which there is some loose areolar tissue.

A knowledge of these various points in the anatomy of the lids is essential for a thorough understanding of diseased states. The more common diseased conditions are :—

| | |
|---|---|
| Blepharitis ciliaris. | Entropion. |
| Trichiasis. | Hordeolum or stye. |
| Ectropion. | Tarsal or Meibomian cysts. |

## BLEPHARITIS CILIARIS.

An inflammatory condition of the edge of the lids with formation of pustules and crusts.

### Characterised by

Reddening of the edge of the lid with irritability and tenderness, followed by pustule formation at the point of emergence of the eyelashes, these pustules bursting and leaving the eyelashes gummed together into bundles. Later, the eyelashes are cast off, leaving permanent deformity. Its occurrence is always an indication that the general health is low.

### Associated Conditions.

1. Conjunctivitis involving globe.
2. Trichiasis or misdirected eyelashes.

### Treatment.

1. Thorough cleanliness, frequent bathing with warm antiseptic lotion, and the careful removal of all the crusts.
2. An ointment to the lids at night, *e.g.*, calomel $\frac{\text{gr. v.}}{\bar{3}\text{i.}}$ Care must be taken to see that all the crusts are removed before the application of the ointment.
3. Tonic treatment—iron, cod liver oil, &c.
4. In the more chronic cases, stimulant applications, *e.g.*, the occasional use of nitrate of silver solution, $\frac{\text{gr. x.}}{\bar{3}\text{i.}}$ applied with a brush; or yellow oxide of mercury ointment, $\frac{\text{gr. iv.}}{\bar{3}\text{i.}}$ applied night and morning.

## TRICHIASIS.

An inward misdirection of the eyelashes.

### Causes.

1. Sequel to blepharitis ciliaris.
2. Sequel to injuries of the eyelids.
3. Granular conjunctivitis.

### Symptoms.

Those of the conjunctivitis or other cause inducing it. Discomfort or actual pain in the eyes is usually the most prominent symptom. On examining the eye, the misdirected eyelashes can be seen in contact with the eyeball, and the cornea and conjunctiva at the site of friction are markedly injected.

### Treatment.

The affection is a troublesome one. Attention must be directed to the exciting cause, and the general health improved by tonic remedies. Local treatment varies with the severity of the case.

*Palliative.*

Simple epilation or removal of the offending eyelashes with forceps. This requires to be repeated from time to time as the hairs grow again.

*Curative.*

*a.* By ligature, with a view of obliterating the hair follicle.

*b.* By electrolysis.

*c.* Transplantation of skin or mucous membrane—indicated in cases associated with entropion.

## DISTICHIASIS.

A congenital peculiarity, consisting in the presence of a double row of eyelashes.

# ENTROPION,

OR

# INVERSION OF THE EDGE OF THE LIDS.

Three forms are met with — Spasmodic, Cicatricial, Congenital.

## Spasmodic Entropion.

This is due to spasm of the fibres of the palpebral portion of the orbicularis muscle—a condition specially met with in children affected with phlyctenular ophthalmia. It is also seen in old people after operations, and is then a troublesome complication, interfering with the healing process. It may also be induced by the presence of a foreign body.

*Treatment.*

*a.* The application of sticking-plaster or collodion to the skin covering the lids ; or

*b.* Slitting the outer commissure—*canthoplasty.*

## Cicatricial Entropion.

This follows a loss of substance of the conjunctiva, and is therefore most commonly seen after injury, *e.g.*, a burn. Trachoma is the other great exciting cause. The inverted eyelashes produce much irritation of the cornea, with chronic vascularisation and intransparency of that structure.

*Treatment.*—The condition calls for radical cure by operation.

### Congenital Entropion.

The appearance here is quite characteristic. The surfaces of the eyelashes, and not their points, are in contact with the cornea, and there is therefore less irritation than in the other forms. The prominent symptom is a watery condition of the eye. The condition is probably due to abnormal development of the fibres of the orbicularis muscle in the vicinity of the lid margin.

The *treatment* consists in the removal of an elliptical piece of skin from the lid.

## ECTROPION,

OR

## EVERSION OF THE EYELID.

### Causes.

1. Chronic conjunctivitis. Cases of chronic conjunctivitis are commonly associated with deep-seated infiltration into the substance of the lids. This brings about a loss of power in the palpebral fibres of the orbicularis muscle, which is followed by eversion of the punctum, epiphora, and excoriation of the cheeks, by the irritation of the tears.

2. Cicatrisation after injury, usually from a wound or burn.

3. Long-standing paralysis of seventh nerve. Here the weakened atonic condition of the orbicularis muscle favours the occurrence of eversion.

### Symptoms.

The symptoms are eversion of the lid, epiphora and frequently some excoriation of the cheeks, induced by the tears. There is usually also a varying amount of chronic conjunctivitis.

### Treatment.

In the earlier stages, strict attention to the chronic conjunctivitis, using non-irritating applications, and, in some cases, slitting the canaliculus, may cure the condition.

In the later stages, and in all cicatricial cases, operative measures must be had recourse to. There are many methods of operation, two of the most valuable being—

*a.* Snellen's operation.

*b.* Argyll Robertson's. Referred to later.

## SYMBLEPHARON.

A union between the ocular and palpebral conjunctiva, resulting from inflammation and apposition of raw surfaces, the usual exciting cause being a burn.

*Treatment.*

*a.* Preventive.—Use oil freely in treatment of burns.

*b.* If very slight, leave alone.

*c.* If calling for treatment, section of the uniting band, and transplantation of contiguous conjunctiva, or a fold of mucous membrane from the lip.

## HORDEOLUM OR STYE.

A localised purulent inflammation situated at the follicle of an eyelash.

*Characters.*—A painful hard swelling gradually undergoing suppuration, usually attended by some œdema of the surface of the lid.

*Treatment.*—The application of nitrate of mercury ointment, 1 in 8, frequently effects a cure. Cold applications may be of service in the early stages, and hot fomentations in the later stages. Constitutional treatment, including a course of salines with iron, is indicated.

## MEIBOMIAN CYSTS

### (TARSAL CYSTS—CHALAZION).

*Characters.*—A localised hard swelling in the lid, due to a chronic inflammatory condition in the connective tissue surrounding the Meibomian gland. They are frequently multiple, and are usually situated deeply in the lid close to the mucous membrane. Occasionally they point externally.

*Treatment.*—Evert the lid, make a single incision over the swelling, and scoop out the contents of the cyst.

## CHAPTER IV.

### Diseases of the Lacrymal Apparatus.

---

# ANATOMY OF THE LACRYMAL APPARATUS.

*The Lacrymal Apparatus consists of two parts—*

1. The secreting part—the lacrymal gland with its numerous fine ducts.
2. The drainage part—the punctum, canaliculus, lacrymal sac, and nasal duct.

*The lacrymal gland* lies in a depression at the outer angle of the orbit. It is oval in shape, about the size of an almond, and its broader concave surface rests on the convexity of the upper and outer aspect of the eye-ball. Numerous fine ducts pass from it and open at various points on the upper and outer half of the conjunctiva.

*The punctum* is a minute projection, with a central depression, situated at the junction of the inner fourth and outer three-fourths of the lid. It is normally in close apposition to the eyeball, and is

therefore invisible unless the lid be slightly everted. It leads into the canaliculus.

*The canaliculus.*

*The superior canaliculus* first ascends a little, then takes a bend and passes inwards and downwards.

*The inferior canaliculus* first passes slightly downwards, then passes transversely inwards to the lacrymal sac.

*The lacrymal sac* is lodged in a groove formed by the lacrymal bone and the nasal process of the superior maxillary bone.

*The nasal duct* is a membranous canal about three-quarter inch long, passing downwards, backwards, and a little outwards. The line of the duct is indicated by a line passing from the sac to the junction of the ala of the nose and cheek.

The more common diseased states affecting the lacrymal apparatus are—

1. Epiphora.
2. Acute Dacryocystitis.
3. Chronic Dacryocystitis.

A knowledge of the various points referred to in the anatomy of these structures is essential for a proper understanding of the symptoms and treatment of these conditions.

# EPIPHORA, OR WATERY EYE.

May be due to any of the following causes :—

*a.* *Misdirection outwards of the orifice* of the lacrymal duct. Under normal circumstances the orifice is not seen unless the lid be everted.

*b.* *The orifice* of the duct may be unduly narrow. This will be made out on examination with a magnifying lens.

*c.* *Obstruction* either of the lacrymal or of the nasal portion of the tear passage.

NOTE.—All injuries to an eye are much more serious if the eye previously was affected with epiphora, and particularly so if there be in addition blepharitis. Similarly, operations on such an eye are much more liable to have an unfavourable result, and therefore preliminary treatment directed to the epiphora is called for. This is especially important in cases of cataract.

## Operation of Slitting the Canaliculus.

The object of the operation is to convert the lacrymal duct into an open gutter. The skin of the lower lid, and through it the inner portion of the lid margin, is put on the stretch by the thumb being applied to the skin of the cheek below the eye and traction exerted. The point of the probe-pointed knife (Weber's) is then inserted into the punctum and passed inwards, with the cutting edge of the knife

directed upwards *and a little inwards* till it touches bone —the inner wall of the sac. The bridge of tissue forming the roof of the canaliculus is then divided up to its entrance into the sac. The slit canaliculus does not heal up, as union takes place between the skin and the mucous membrane on either side of the cut surface. To ensure the maintenance of the channel however, a probe should be passed along the canaliculus on the following day.

## ACUTE DACRYOCYSTITIS,

OR

## INFLAMMATION OF THE LACRYMAL SAC.

This condition may arise—

*a.* Idiopathically, as the result of cold.

*b.* As an intercurrent affection in a case of chronic obstruction; the patient having suffered from watery eye for some time previously.

### Symptoms.

The region of the sac and surrounding integument are swollen, tense, and reddened. The eyelids may become œdematous, and in severe cases the appearance presented may be that of an erysipelatous condition. The affection is a painful one, and is accompanied by a copious watery secretion. After suppuration has occurred, the pain may only be relieved by a free incision into the sac.

### Treatment.

*In the early stages.*—Slitting the canaliculus, application of poultices, and administration of a free purge may suffice to avert the inflammation. The removal of any obstruction in the nasal duct is also indicated.

*In the later stages.*—A free *vertical* incision should be be made into the sac, and kept open for several days. Any fistulous opening that threatens to remain can be obliterated by passing a red-hot wire along it.

## CHRONIC DACRYOCYSTITIS,

OR

BLENORRHŒA OF THE LACRYMAL SAC.

### Cause.

An obstruction of the nasal duct, with resulting retention of secretion in the gland, this secretion soon decomposing, due to the action of bacteria washed in from the surface of the eye. The obstruction is usually due to a swelling of the mucous membrane. In a few cases the obstruction is due to a stricture of the duct. Some cases are associated with diseased bone.

### Symptoms.

Patient complains of a watery eye (epiphora); also of a swelling in the region of the lacrymal sac. On

examination, the region of the sac and surrounding integument are swollen and tense, the walls of the sac appear to be much thickened, and pressure on the sac causes a backward flow of a turbid muco-purulent secretion.

## Treatment.

1. Slitting the canaliculus.
2. Direct patient to press out the contents of the sac many times daily.
3. Antiseptic treatment. The application of an antiseptic lotion, *e.g.*, corrosive sublimate, 1-4000, frequently has a very beneficial effect in modifying the secretions and rendering them much less irritating.
4. The passage of lacrymal probes to clear the nasal duct. This should not be done on the same day on which the canaliculus is slit. A probe should thereafter be passed about once a week till the passage is quite free.

## CHAPTER V.

### Diseases of the Conjunctiva.

---

# INFLAMMATION.

The mucous membrane of the conjunctiva, like other mucous membranes, is liable to be affected by—

1. A catarrhal inflammation,—Acute simple conjunctivitis.
2. A purulent inflammation,–Purulent conjunctivitis.
3. A membranous inflammation,—Diphtheritic conjunctivitis.

There are, however, other two special forms of inflammation met with, viz.—

4. Phlyctenular conjunctivitis.
5. Granular conjunctivitis.

In cases of purulent and diphtheritic conjunctivitis the inflammation is very liable to involve the cornea, the results being more serious.

# ACUTE SIMPLE CONJUNCTIVITIS.

## Causes.

1. Exposure to cold, or to any mechanical or chemical irritant, *e.g.*, dust, vitiated atmosphere, or foreign body in the conjunctival sac.

2. Secondary to a catarrhal inflammation of the nose or throat.

3. Sequel to an acute illness, as measles, scarlet fever.

## Symptoms.

*Subjective.*—The subjective symptoms are smarting pains in the eye like that due to the presence of fine sand or dust, photophobia or dread of light, and temporary obscuring of vision, due to the secretion in front of the cornea altering the refraction of the rays of light entering the eye.

*Objective.*

1. Injection of conjunctival vessels, this being most marked at the periphery.

2. Increased secretion of a muco-purulent and glutinous nature.

3. Some œdema of the lids is present in severe cases.

## Treatment.

*General.*—Prevent exposure to cold, wet, and any irritating atmosphere, *e.g.*, tobacco fumes. The eyes must be rested completely. The bowels should be regulated, the functions of the skin attended to, and the diet made bland and nutritious and free from stimulants. Further, the internal administration of anti-strumous remedies, as iron and cod liver oil, is indicated.

*Local.*—Thorough cleanliness, frequent bathing of the eyes with a weak, non-irritating antiseptic lotion,

such as boracic acid, 1 in 50, and the application of an ointment to the lids at night, usually suffices to cure the condition. If the discharge is copious, a solution of silver nitrate (grains ten to the ounce) should be applied with a camel's hair brush to the mucous membrane of the lids once daily or every second day. The mucous membrane should be carefully dried before this application is made, otherwise the silver may be precipitated by the tears as the chloride of silver, instead of being deposited as a protective coating of the albuminate.

## PURULENT CONJUNCTIVITIS.

*Causes.*

Exposure to gonorrhœal infection, or to leucorrhœal discharge in the maternal passages.

The former gives rise to purulent conjunctivitis in adults; while the latter is the form of inflammation arising in infants a few days old, and known as ophthalmia neonatorum. It is one of the main causes of congenital blindness.

*Symptoms.*

As in simple conjunctivitis, but in about thirty-six hours after the onset there is a marked increase in the severity of the symptoms, with an altered character of secretion. Later, there is much serous effusion under the conjunctiva (chemosis). The secretion is copious, markedly purulent, and

*highly infectious.* The eyelids are reddened and œdematous. *The cornea tends to become affected*, and in severe cases it becomes perforated and sloughs.

*Prognosis.*

Always very guarded. It depends largely on the extent of involvement of the cornea. This disease frequently leaves behind a permanently useless and deformed eye.

*Result.*

1. Complete recovery.
2. A permanent dense corneal opacity.
3. A staphyloma—a projection forwards of the cornea.
4. A shrunken disorganised stump.

*Treatment.*

1. PROPHYLACTIC.

   *a.* Attention to the maternal passages.

   *b.* Attention to the child at birth. Careful washing of the eyes with corrosive sublimate lotion (1 in 4000).

   *c.* When one eye is affected, the greatest care must be taken of the other eye. It should be kept covered, preferably by a shield specially made for the purpose (Buller's shield).

   *d.* The attendant must be scrupulously careful in his handling of the case, lest his own eye become affected, and also to avoid causing any abrasion of the cornea.

2. LOCAL.

*a.* Thorough removal of the discharge every half-hour. Great care must be taken to destroy the cloths used to remove the secretion.

*b.* Corrosive sublimate lotion, 1 in 3000, applied every four hours.

*c.* Application of nitrate of silver $\frac{\text{gr. x.-xv.}}{\bar{3}\text{i.}}$ painted over the mucous membrane of lids daily.

*d.* Iodoform powder dusted into the eye twice daily.

*e.* An ointment to the lids at night, calomel or yellow oxide of mercury, four grains to the ounce.

*f.* Peritomy, or incision of conjunctiva, is useful in cases attended by great chemosis.

## PHLYCTENULAR CONJUNCTIVITIS.

*Clinical Features.*

The clinical features are those of simple conjunctivitis, with, in addition, the presence of little blebs or phlyctenules, usually situated close to the corneal margin, injection being most marked in the vicinity of the phlyctenules. Photophobia is a very marked feature, and there is frequently blepharitis. The vesicles may become pustular,

when the condition is spoken of as *pustular conjunctivitis*. There is frequently some involvement of the cornea—*phlyctenular keratitis*.

*Treatment.*

The treatment should be local and constitutional, and along the lines laid down for catarrhal conjunctivitis. The administration of anti-strumous remedies, and the local application of yellow oxide of mercury ointment $\frac{\text{gr. iv.}}{\text{ʒi.}}$, are specially valuable. Plenty of light, open air, exercise, and good nourishing food are essential elements in treatment. There is a marked tendency to relapse, hence the importance of constitutional treatment being maintained.

## DIPHTHERITIC CONJUNCTIVITIS.

A membranous inflammation of the conjunctiva, occurring either alone or along with diphtheria of the throat. Constitutional symptoms are usually very pronounced, and, in the early stages especially, there is a great risk of the necrotic process extending to the cornea.

*The treatment* consists in isolation of the patient, removal of as much of the membrane as possible, the local application of antiseptic remedies, and constitutional treatment directed to maintenance of the general strength and counteracting the effects of the poison.

# CHRONIC SIMPLE CONJUNCTIVITIS.

## Causes.

1. Sequel to acute.
2. Exposure to vicissitudes of weather, or to a strong light.
3. Living in an atmosphere vitiated by irritating fumes, such as tobacco.

An error of refraction, which necessitates much straining of accommodation, and therefore maintains a certain amount of hyperæmia, may act as a predisposing cause.

## Clinical Features.

A hot irritable sensation in the eyes, with excess of watery secretion, and agglutination of the lids in the morning, are the symptoms complained of. Objective examination reveals injection of the conjunctival vessels, most marked over the lids, and frequently some eversion of the lower lid with epiphora. On further examination, an error of refraction — usually hypermetropia — may be present.

## Treatment.

1. Remove the cause, *vide* above. Tinted glasses (goggles) may be advisable, also spectacles to correct the error of refraction.

2. Diet—light and non-stimulating; avoidance of alcohol.

3. Locally.

   *a.* Mild remedies, such as boric lotion, and a simple ointment applied to the lids at night, are usually sufficient.

   *b.* Stronger remedies, *e.g.*, alum $\frac{\text{gr. iv.}}{\bar{3}\text{i.}}$, are occasionally useful.

   *c.* The application of silver nitrate solution, $\frac{\text{gr. x.}}{\bar{3}\text{i.}}$, applied with a brush to the mucous membrane of the lids, is of service in obstinate cases.

4. General tonic treatment — directed to the correction of any digestive disorder, or to any rheumatic or gouty tendency.

## GRANULAR CONJUNCTIVITIS.

### (GRANULAR LIDS OR TRACHOMA.)

A form of inflammation characterised by the appearance of granular looking elevations in the conjunctiva, and by the subsequent cicatritial changes caused by the fibroid degeneration and loss of substance to which these give rise (Berry). The disease is most prevalent in low marshy countries, and it specially affects certain races, *e.g.*, Australians, Chinese, Egyptians, and in this country Jews and Celts.

## Clinical Features.

The clinical features vary in different cases. The inflammation may be acute, or chronic from the outset; it is met with at all ages except in childhood; it is further a contagious disease.

*Subjective Symptoms.*—The subjective symptoms are pain, photophobia, lacrymation, a varying amount of muco-purulent secretion, and, in the more advanced stages, defective vision.

*Objective Symptoms.*—The objective symptoms in the early stages are limited to the palpebral conjunctiva, but in the later stages the cornea is involved. On everting the lid, greyish or yellowish-grey elevations are seen in its mucous membrane, and there is some reddening of the margin of the lid with injection of the conjunctival vessels. The upper part of the cornea becomes vascularised in the later stages, the vessels being conjunctival in origin, this condition being known as Pannus.

## Prognosis.

Unfavourable. The disease tends to progress.

## Treatment.

*General.*

1. Attend to hygiene.
2. Prevent the spread of the disease; direct patient to keep a basin, towels, sponges, &c., strictly for his own use.

3. Make the diet bland and nutritious. Alcohol and tobacco fumes should be avoided, and general tonic remedies administered.

*Local.*—In the acute stages use only mild non-irritating applications, *e.g.*, boric lotion, and a simple ointment. In the later stages the treatment may be palliative or surgical.

*Palliative*, *e.g.*, alum lotion, $\frac{\text{gr. ii.-iv.}}{\text{℥i.}}$; zinc chloride lotion, $\frac{\text{gr. ½-i.}}{\text{℥i.}}$; or sulphate of copper applied to the granulations every two or three days. Nitrate of silver applied with a brush, in the strength of gr. x. to xv. to the ounce, is specially useful in cases associated with much muco-purulent secretion. Tinted goggles may be useful as preserves.

*Surgical.*—Surgical measures are frequently indicated. These consist either in—

1. Forcible expression of the contents of the follicles, or
2. Cutting away the fold of conjunctiva which passes from the upper lid to the cornea.

## SPRING CATARRH.

A form of recurrent chronic conjunctivitis. The term is misleading, as the affection is also met with in summer and autumn.

*Characters.*

Elevated greyish swellings of the mucous membrane of the lids and globe, attended by photophobia

and lacrymation. The swellings are due to hypertrophy of the epithelium of the conjunctiva.

*Treatment.*

The affection is a very troublesome one. Some cases do well with tinted glasses as preserves, and mild non-irritating local applications; others require astringent lotions and stimulating applications, as nitrate of silver, sulphate of copper, or iodoform ointment. Scarification of the mucous membrane of the lids is sometimes serviceable, and constitutional treatment is usually indicated.

## PTERYGIUM.

A chronic inflammation or hypertrophic thickening of the conjunctiva, so called because of its fancied resemblance to the wing of an insect. It is caused by constant irritation, mechanical or thermal, and is met with mainly in miners and masons, and in subjects who have lived abroad in hot countries.

### Clinical Features.

A triangular area of thickened conjunctiva is seen at the inner or outer angle of the eye, more commonly at the inner angle, the apex of the wedge being directed towards the cornea. The cornea is sometimes involved, and in these cases vision is interfered with; otherwise the condition is unaccompanied by symptoms, except those of slight disfigurement. In exceptional cases it may interfere with the movements of the eye.

*Treatment.*

*a.* As a rule, leave alone.

*b.* Removal under cocaine may be had recourse to in cases where the patient is young and the disfigurement is marked.

## PINGUECULA.

A small rounded yellow tumour deposited in the conjunctiva covering sclerotic, and situated close to the corneal margin. The swelling consists of inflammatory thickening of the deeper tissues of the conjunctiva. The name owes its origin to the idea originally held of its being fatty in nature. It is met with in advanced life, and is of no importance apart from the slight disfigurement to which it gives rise.

## CHAPTER VI.

### Diseases of the Sclerotic and Cornea.

---

# SCLERITIS AND EPISCLERITIS.

These two conditions may, for practical purposes, be regarded as synonymous, the latter term being restricted to an inflammation of the superficial covering of the sclerotic.

*Causes and Course of the Disease.*

1. Rheumatism or gout in the great majority of cases.
2. Tubercle.

The inflammation mainly affects adults, and it involves a localised area of the sclerotic, especially that portion of it near the corneal margin. It is met with especially in spring when cold winds are prevalent, and it shows a marked liability to recur, till ultimately the whole sclerotic may have been the seat of inflammation.

## Symptoms.

*Subjective.*—Dull aching pain in eye, accompanied by a varying degree of photophobia, lacrymation, and disturbance of vision.

*Objective.*

*a.* Marked injection of vessels of the sclerotic and conjunctiva, the pink zone round the cornea being very prominent.

*b.* The sclerotic presents a peculiar purplish tint, due to injection of its vessels.

*c.* A thickening of coats of eye. In the later stages, however, there is marked thinning of the sclerotic, which then presents a characteristic bluish appearance.

*d.* Tension occasionally increased (T +), and the eye may be tender on pressure, denoting cyclitis.

## Treatment.

The treatment is mainly constitutional. The diet should be bland, nourishing, and free from stimulants. The functions of the bowels, skin, and kidneys should be promoted. Among medicinal remedies, cod liver oil, iron, salicylate of soda, colchicum, creasote, and arsenic are useful. *Locally*, warm fomentations, the application of pilocarpine gr. ii. to the ounce, counter-irritation, and in very obstinate cases operative measures—peritomy or iridectomy—may be had recourse to.

# STAPHYLOMA OF SCLEROTIC.

A projection forwards of the sclerotic, usually situated near the margin of the cornea, but met with in other situations.

## Causes.

1. Thinning of sclerotic from previous scleritis.
2. Increased intra-ocular tension, the result of choroidal disease or old standing glaucoma.

## Clinical Features.

A rounded projection, not sharply defined, but fading gradually off, of a bluish colour, due to the shining through of the uveal tract. The pupil sometimes presents an oval outline.

Defective sight is the chief symptom complained of. It is due partly to disease in the interior, and partly to altered refraction brought about by the abnormal curvature of the eye.

The condition tends to increase, and may become complicated by increased intra-ocular tension. In the later stages the disfigurement is very pronounced.

## Treatment.

1. Iridectomy, especially in cases associated with increased tension.
2. Paracentesis, allowing escape of some vitreous, and thus relieving the intra-ocular tension.
3. Enucleation, in very bad cases.
4. Mules' operation. (*Vide* page 213.)

# PHLYCTENULAR OPHTHALMIA,

OR

# STRUMOUS OPHTHALMIA.

This affection is merely a variety of pustular conjunctivitis, the conjunctiva over the cornea being, however, markedly affected and frequently showing ulceration.

The disease is most common in strumous subjects of eight to twelve years of age.

## Clinical Features.

*Subjective.*

1. Intense photophobia, the eyelids being firmly contracted (blepharospasm) and head bent to shield the eyes from the light.
2. Severe lacrymation.
3. Excoriation of cheeks by the irritation of the tears.

The appearance of the patient is usually quite characteristic.

*Objective.*

1. Marked injection of conjunctival and subconjunctival vessels, the pink zone round the cornea being very marked.
2. Small vesicles in cornea (hence name phlyctenular), these bursting in a few days and giving rise to a superficial ulcer.

3. Signs of a debilitated constitution.
4. A small fissure or crack at the outer commissure.

The disease lasts usually from three to six weeks.

## Treatment.

*Constitutional.*—Open air, exercise, good nourishing food, and general anti-strumous remedies. Patient must not be kept in a dark room, but must be sent out into the light, provided with a shade.

*Local.*

1. Atropine $\frac{\text{gr. iv.}}{\text{ʒ}}$ once daily, warm boric lotion frequently, and an ointment to the lids at night.
2. Various other remedies are occasionally of great service, *e.g.*—
   - *a.* Dusting with calomel.
   - *b.* The application of solid nitrate of silver to the fissure at the outer commissure.
   - *c.* Blistering the upper lid with solid nitrate of silver.

   The swelling and œdema of the lid which follows this application relieves the congestion, and at the same time thoroughly rests the eye from the irritation of light.

# DISEASES OF THE CORNEA.

*Anatomy.*

The cornea is a non-vascular connective tissue, the capillaries ending in loops at its circumference. It contains lymphatic channels and numerous nerve fibrils, branches of the ciliary nerves. Pos-

teriorly, it is covered by a homogeneous elastic membrane covered by a single layer of epithelium (Descemet's membrane).

Inflammation of the cornea may be—

1. Primary, when the focus of inflammation is in the cornea ; or,
2. Secondary or diffuse interstitial, when the focus of inflammation is outside the cornea and extends into it.

## PRIMARY KERATITIS.

This may be traumatic or idiopathic.

**The Clinical Features** are those of infiltration, ulceration, or abscess, according to the origin and severity of the inflammation. The cornea may become vascularised, the vessels being derived from the superficial conjunctival vessels, and also from the deeper vessels round the cornea. The iris may become attached to the back of the cornea (Anterior Synechiæ).

**The treatment** consists in resting the eyes from any irritation, whether mechanical, as dust or smoke, or sunlight, or reading ; and, locally, in the frequent application of warm corrosive lotion 1 in 4000, and weak yellow oxide of mercury or iodoform ointment applied night and morning. The local application of atropine drops, four grains to the ounce, may be required to prevent extension to the iris.

# INTERSTITIAL KERATITIS.

An interstitial infiltration of the cornea.

## Causes.

1. Scrofula.
2. Syphilis. *Vide* other evidences — teeth, family history, &c.
3. Exposure to cold,
4. Severe straining of the eyes,

} more especially in subjects with a tubercular or syphilitic taint.

## Course of the Disease.

The course of the disease is exceedingly chronic. It lasts over a period varying from a few months to two or three years. It may resolve altogether, but frequently leaves a permanent corneal opacity with resulting interference with sight.

## Symptoms.

*Subjective.*

Dimness of sight is the most prominent feature.

Pain, photophobia, and excess of lacrymal secretion may be present, but are usually not very pronounced.

*Objective.*

Haziness of the cornea, which later becomes vascularised interstitially, the vessels being derived from the anterior ciliary circumcorneal network. This vascularisation imparts a reddish appearance to the part of the cornea

affected (Salmon-coloured Patch). The intra-ocular tension is at first usually increased, but in the later stages may be decidedly diminished.

In the later stages, localised opacities are seen in the substance of the cornea.

## Prognosis.

The prognosis, on the whole, is good. Recovery, however, is usually very slow, many cases lasting a year or more.

## Treatment.

1. *Constitutional.*—Fresh air, good nourishing food, plenty of milk, cream if possible, cod liver oil, iron and other general tonics, with iodide of potassium and mercury in specific cases, form the proper line of treatment.

2. *Local.*—Depends on stage. In every case eyes must be rested as much as possible. Frequently no further local treatment is required.

*In Early Stages.*

Soothing, non-stimulating applications.

Boric lotion.

Eye salve to the lids at night.

Atropine $\frac{\text{gr. iv.}}{\text{ʒi.}}$ a few drops applied occasionally, used tentatively. It lessens the tendency to iritis.

*In Later Stages.*

A more stimulating line of treatment.

Dusting with calomel powder.

Mixed drops (*Argyll Robertson*)—

Acid Borac. Cryst., gr. iv.
Atrop. Sulph., gr. i.
Vini Opii (*Sine Aromat.*), ℥i.
Glycerini, ℥ii.
Aquæ Dest., ℥v.

Misce.

*Sig.*—A few drops applied with a dropping tube twice daily.

NOTE.—If these drops are too irritating, the proportion of vini opii and glycerini may be diminished. The atropine may be omitted if desired.

## Associated Conditions.

1. Disease of choroid—disseminated choroiditis.
2. Alteration in tension. In the early stages the tension may be increased, and in the later stages it may be markedly diminished.

# NEURO-PARALYTIC KERATITIS.

An inflammation of the cornea, met with in cases of paralysis of the fifth cranial nerve. As a result of the paralysis, the cornea is in a state of anæsthesia, and is on that account insufficiently protected, and reacts readily to any irritation, such as cold or presence of foreign particles. When once inflammation has set in,

it tends to spread, shows no tendency to heal, and is soon followed by ulceration.

*Prognosis.*—The prognosis is not good; the condition tending to progress.

*Treatment.*—The eye should be kept covered, so that the secretion can be retained for lubrication, otherwise treatment should be directed to the primary lesion.

## HERPES ZOSTER FRONTALIS.

In cases of herpes zoster frontalis, associated with an eruption of vesicles on the side of the nose, from involvement of the naso-ciliary branch of the nerve, corneal changes of a neuro-paralytic nature are met with. Herpetic blebs, similar to those on the skin, develop on the cornea, and produce small ulcers or fine opacities. The affection is exceedingly painful, and its treatment, which is mainly palliative, is unsatisfactory.

## HYPOPYON.

*Septic inflammations of the cornea, purulent iritis, and purulent cyclitis* are liable to be accompanied by the deposit of pus in the anterior chamber, a condition known as hypopyon. This condition is an extremely important one, as it is the most frequent cause of one-sided blindness in adults. In its origin it may be idiopathic or traumatic, the latter being by far the most common. A

marked predisposing cause is the *presence of epiphora* from chronic obstruction in the lacrymal apparatus, the result of dacryocystitis or chronic conjunctivitis. The purulent secretion present in these two affections inoculates the cornea, and the pus spreads into the anterior chamber. When the hypopyon results from inflammation, with ulceration of the cornea, the term *hypopyon keratitis* is applied to the condition.

### Appearances in Hypopyon.

Great differences exist in the density of the pus. It may be thick and fibrinous, and remain attached to the posterior surface of the cornea, or it may fall to the bottom of the anterior chamber. In cases of hypopyon keratitis there is an ulcer on the surface of the cornea, the characteristic feature of the ulcer being the purulent infiltration of its spreading margin.

### Subjective Symptoms.

The subjective symptoms are pain, muco-purulent secretion, and photophobia,—the severity of the symptoms varying much in different cases.

### Treatment.

When dependent on a pre-existent iritis or cyclitis, the treatment should be directed to the primary inflammation.

### Treatment of Hypopyon Keratitis.

There are two most important indications for treatment. These are, firstly, attend to the dacryo-

cystitis or other condition causing the epiphora, and secondly, the use of antiseptics. These modify the secretions and so render them less irritating to the surface of the eye and to the interior of the cornea. The treatment is as follows :—

*a.* Frequent bathing of the surface of the eye with 1 in 3000 corrosive sublimate lotion, the application of iodoform powder, and the use of iodoform ointment $\frac{\text{gr. x.}}{\text{ʒi.}}$ to the lids at night.

*b.* Keep the pupil dilated, so as to diminish the tendency to iritis.

*c.* Apply with a camel's hair brush a solution of nitrate of silver $\frac{\text{gr. xv.}}{\text{ʒi.}}$ to the ulcer, and more especially to its spreading margins.

*d.* Operative treatment is called for in severe cases—

1. The application of the actual cautery to the spreading margins of the ulcer ; or

2. Incising the floor of the ulcer, letting the pus out of the anterior chamber ; or

3. Making an incision into the floor of the anterior chamber, an operation known as Saemisch's section.

4. In the later stages an iridectomy may be indicated for visual purposes. That is, in cases where a corneal opacity remains and obscures the pupil.

## CONICAL CORNEA.

This is a condition resulting from thinning and want of resistance of the cornea, the cause of its development being unknown. The thinning begins in the centre of the cornea, with the result that the curvature of the cornea at that part is increased and a condition of myopia with astigmatism induced. The disease usually develops after puberty, and tends to steady aggravation, but may remain stationary for a time. On ophthalmoscopic examination a peculiar circular-shaped shadow is seen. In the later stages the cornea becomes opaque, and vision is entirely lost.

*The treatment* consists in the trial of suitable glasses. These, however, have only a limited application. Various operative measures have been employed, most of them, however, being more or less doubtful in their results.

## STAPHYLOMA OF THE CORNEA.

A forward projection of the cornea resulting from a previous sloughing inflammation. The staphyloma may be complete or partial, and consists of corneal tissue, iris and cicatritial tissue. It is liable to undergo calcareous degeneration.

### Clinical Features.

Impairment of vision and disfigurement are the leading symptoms complained of. In recent cases the projection presents a bluish-black appearance,

and in old standing cases a white appearance. In pronounced cases there is a tendency to inflammation and ulceration.

*Treatment.*

In the early stages an iridectomy may be done to relieve tension. In the later stages, when vision is gone, one of the following operations is performed :—

*a.* Abscission or removal of the staphyloma.

*b.* Evisceration—removal of the eyeball, but leaving sclerotic.

*c.* Enucleation of the eyeball.

## OPACITIES OF THE CORNEA.

Opaque areas in the cornea resulting from previous inflammation, as from interstitial keratitis or hypopyon.

### Appearances.

These vary with the severity of the previous inflammation. In mild cases there are one or more faint opaque areas in the cornea (nebulæ), better seen on oblique illumination; in more severe cases, and especially in cases after hypopyon, there may be a very dense whitish thickening of the corneal structures (leucoma).

The symptoms produced are—

*a.* Disfigurement, especially in cases resulting from hypopyon.

*b.* Interference with sight, the amount depending on extent of involvement of pupillary area of cornea. The defective sight is due not only to obstruction to rays of light, but to their dispersion, caused by the irregularity imparted to the surface of the cornea by the cicatrisation.

## Treatment.

The treatment depends on the age of the patient and on the character and severity of the case.

*a.* In young subjects there is much greater probability of resolution and return to normal.

*b.* If it has existed over two years, it will be permanent; if more recent, the stimulating applications and tonic treatment referred to under Interstitial Keratitis may be of service in promoting absorption.

*c.* If there be any regular astigmatism associated, the vision may be improved by cylindrical lenses. This is a most important point to be attended to.

*d.* In cases of central opacity an iridectomy is valuable.

*e.* Tattooing may be resorted to for the disfigurement.

## CHAPTER VII.

### Blows—Burns—Foreign Bodies.

---

# BLOWS ON EYE.

In all cases of injury to the eye, a careful examination both of the external and internal portions of the eye should be made. The following conditions may be met with :—

*If injury be slight.*—Conjunctival ecchymosis, without deeper-seated injury.

*If injury more severe—*

*a. Iritis.* Traumatic iritis, evidenced by loss of lustre of the iris, irregularity of the pupil, &c.

*b. Irido-dialysis*, a separation of the iris from its attachment to ciliary body. This is always accompanied by hyphæma or blood in the anterior chamber.

*c. Dislocation of the lens*, evidenced by the oval shape of the pupil, iris quivering from loss of support, and ophthalmoscopic examination. The tremulous appearance of the eye, resulting from the loss of the support which the iris normally gets

by its apposition to the capsule of the lens, is called irido-donesis.

*d. Traumatic cataract.* A traumatic cataract usually presents a characteristic flocculent appearance. It is liable to be accompanied by iritis or cyclitis.

*e. Hæmorrhage into the Vitreous*, characterised by marked disturbance of vision, and, on ophthalmoscopic examination, signs of blood in the vitreous chamber. In severe cases there may be no light reflex.

*f. Rupture of choroid*, usually between the nerve and the macula. The choroid does not stretch so readily as the other coats, and is therefore more liable to rupture. The condition is characterised by marked disturbance of vision, altered tension (T–), and ophthalmoscopic evidence of rupture.

*g. Detachment of the Retina*, characterised by the history of sudden loss of vision, this being limited to a particular part of the field, and on ophthalmoscopic examination, evidence of detachment.

*h. Traumatic Amblyopia.* The loss of vision met with after severe cases of injury to the eye, in which no evident external or internal lesion has been produced, probably results from anæsthesia of the retina.

*i. Paresis or paralysis of circular fibres of iris*, evidenced by increased size of pupil on the affected side and disturbance of near vision in that eye. This dilatation may be temporary or permanent.

*If injury still more severe.*

There may be *Rupture of sclerotic*, with loss of aqueous, and prolapse of the iris, these being followed by general septic infection of the interior of the eye. The site of the rupture is usually at the upper and inner parts of the eye, the result of *contre-coup*, the outer portion of the eye from its exposed position being the side usually subjected to the blow.

## BURNS OF EYE.

The usual cause is a piece of lime or molten metal.

### Appearances.

There is a varying amount of destruction of the conjunctiva of the lid and globe of the affected area, the parts presenting a dull white appearance due to exposure of sclerotic. The parts around are inflamed and œdematous. In more severe cases the sloughing process may affect the sclerotic, leading to perforation.

## Prognosis.

The prognosis should *always* be a guarded one, but especially so in severe cases. In these cases adhesions between the lid and globe may develop, notwithstanding treatment specially directed to its prevention.

## Treatment.

Thorough removal of the irritating substance. The eye must on no account be tied up. The line of treatment must be soothing, and *specially directed to the prevention of adhesions between the globe and eyelid.*

*a.* Eye lotions — Warm boric lotion applied thrice daily.

*b.* Oils—Castor, almond, or olive, a few drops put into the eye every hour.

*c.* Slight traction on the eyelid from time to time, by pulling down the skin of the cheek. This is specially useful in preventing adhesions.

*d.* If cornea becomes affected, atropine drops twice daily, $\frac{\text{gr. iv.}}{\bar{3}\text{i}}$

# FOREIGN BODIES IN THE EYE.

The foreign body may be lodged in the—

*Sites.*
- Conjunctival sac.
- Cornea.
- Anterior chamber.
- Iris.
- Posterior chamber.

*Composition of the Foreign Body.*

It is usually a piece of sand, iron, rust, glass or steel. When lodged in the anterior parts of the eye it is popularly spoken of as fire in the eye. It is important to note that some substances, *e.g.*, iron or steel, undergo oxidation, and associated with that, there is more marked irritation than is met with in the case of other substances that do not oxidise. If the foreign body be septic, it sets up a severe inflammation. This is specially true of septic foreign bodies lodged in the posterior chamber.

*Foreign Body in the Cornea.*

This may be lodged *in the centre or at the periphery.* In the former case, if the foreign body be aseptic, there may be little or no irritation set up, due to the absence of any friction of the lids. In the case of foreign bodies lodging in the periphery of the cornea, there are marked signs of conjunctival irritation in the upper or lower portion, according to the site of the foreign body. *Treatment* con-

sists in the removal of the foreign body by a spud. Not infrequently, owing to attempts previously made to get rid of it, the foreign body is more deeply situated, in which case a sharp pointed needle may be used with advantage. If the foreign body is centrally instituted, the local application of eserine is of service, providing a coloured background on which the foreign particle is more readily seen.

*Foreign Body in the Anterior Chamber or Iris.*

When a foreign body has perforated the anterior chamber, make an incision into the margin of the cornea, and employ forceps for its removal. A portion of iris may require to be removed at the same time. The electro-magnet should be used for steel or iron particles.

*Foreign Body in the Posterior Section of the Eye.*

In all cases where there is a suspicion of a foreign body having lodged in the interior of the eye, a careful and systematic examination of the cornea, anterior chamber, iris, and lens should be made, and that should be followed by ophthalmoscopic examination. The condition is at all times a serious one, owing to the tendency to the development of a septic inflammation, or a sympathetic ophthalmitis.

The following points assist the diagnosis :—

*a.* The history of the case.

*b.* Any evidence of perforation of the cornea, *e.g.*, shallow anterior chamber, blood or pus in the anterior chamber, anterior synechiæ or adhesions.

*c.* Any evidence of an abrasion or wound in the iris, or foreign body projecting behind the iris, or bulging forwards of the iris.

*d.* Any discoloration of the lens, such as is met with from oxidation of a metallic body.

*e.* Any restriction of the field of vision above, the lower part of the retina being covered with blood or pus.

TREATMENT.

No definite rules can be laid down for treatment. The line of treatment will depend on the state of vision, and on the nature and position of the foreign body. All cases must be carefully watched for a considerable time, owing to the risk of sympathetic ophthalmitis. When the foreign body is aseptic and producing no irritation, it should be left alone. The electro-magnet is indicated in cases of metallic substances. Many cases call for evisceration or enucleation.

## CHAPTER VIII.

### Diseases of the Iris and Ciliary Processes.

---

# STRUCTURE AND INNERVATION OF THE IRIS.

The iris is a thin circular contractile curtain, hanging vertically behind the cornea, and presenting in its centre a circular aperture, the pupil. It is composed, from before backwards, of the following structures :—

*a.* A delicate layer of polyhedral cells continuous with Descemet's membrane.

*b.* Stroma, composed of fibres and cells forming a delicate meshwork containing vessels and nerves, the vessels being derived from the ciliary branches of the cavernous plexus.

*c.* Pigment cells, which impart the colour to the iris.

*d.* Involuntary muscular fibres—

1. Circular fibres—well defined, forming the sphincter pupillæ, supplied by a branch from the third nerve, usually from that branch which supplies the inferior oblique.

2. Radiating fibres—less defined, and not so easily demonstrated, forming the dilator pupillæ, supplied by sympathetic fibres. The sympathetic also supplies the blood-vessels in the iris.

*Course of Fibres to the Sphincter.*

The nucleus for the sphincter lies far forwards in the third nucleus. The fibres occasionally pass in the sixth nerve.

*Course of Fibres to the Dilator.*

They take origin in the medulla, pass down the cord, leave it in the lower cervical and upper two dorsal nerve roots, pass through the rami communicantes to the sympathetic, then into the superior cervical ganglion, then to the plexus round the carotid, and from there in various ways to the eye.

## IRITIS.

### Causes.

1. Exposure to cold, especially in rheumatic subjects.
2. Traumatism.
3. The poisons associated with syphilis, tubercle, gonorrhœa, various fevers, chlorosis.
4. Sympathetic ophthalmitis.

### Clinical Features.

*Subjective.*

1. Pain of a deep-seated throbbing nature, worst at night, interfering with sleep, and most marked in the forehead and temple.
2. Photophobia, usually considerable.
3. Marked impairment of sight—sees "through a mist."
4. Constitutional disturbance of tongue, stomach, skin, &c.

*Objective.*

1. Injection of subconjunctival vessels, seen as a pink zone round the corneal margin.
2. Altered colour and loss of lustre of the iris, which is darker than normal, presents a muddy appearance, and has lost its well-marked striated appearance.
3. Pupil greyish and not black in colour, due to turbidity of the aqueous.
4. Shape of pupil is irregular, the irregularity being due to adhesions to capsule of lens (posterior synechiæ). This is especially seen after the use of a mydriatic. Pupil also reacts sluggishly if at all, under the influence of light.
5. Lacrymation.
6. Alteration in tension.

## Treatment.

The pain is relieved by warm fomentations, and in severe cases an opiate. A few drops of a solution of sulphate of atropine, $\frac{\text{gr. iv.}}{\text{ʒi.}}$, should be dropped into the eye twice daily. This keeps the pupil dilated, prevents adhesion, and is further of service in diminishing the blood supply to the iris. Constitutional treatment is indicated—mercury, salicylate of soda, &c., according to the cause.

## Complications.

1. Increased tension, in which case the atropine must be stopped and eserine substituted.
2. Involvement of the ciliary processes or choroid. This complication is most frequently seen in

cases of serous iritis, and is more common in women than in men.

3. The occurrence of annular adhesions between the lens and iris. This blocks the pupil, and, by interfering with the natural flow of lymph out of the posterior chamber, leads to an increase in the intra-ocular tension, and subsequent changes in the interior of the eye. This condition is known as Iris Bombé. The anterior chamber is shallow, except at the point in the centre which corresponds to the pupil.
4. A recurrence of the attack. For recurrent iritis, an iridectomy is the most valuable line of treatment.

## Characters of the Various Types.

*Rheumatic Iritis.*—Here there is little or no tendency to adhesions, the exudation being mainly serous in character. This form occurs most frequently during the prime of life, and shows a marked tendency to recur.

*Syphilitic Iritis.*—This is characterised by a local nodular infiltration of the iris tissue, the nodules being vascular. It is known as gummatous iritis.

*Traumatic Iritis.*—This is usually complicated by other injury, *e.g.*, cataract.

*Tubercular Iritis.*—This is a rare form, occurring usually about puberty. Nodules develop in the iris, and there is considerable constitutional disturbance. The disease is very untractable, and not infrequently passes into a condition of phthisis bulbi, a condition calling for enucleation.

# SEROUS IRIDO-CYCLITIS,

OR

# DESCEMETITIS.

Serous irido-cyclitis is an inflammation of the iris and ciliary body, with fibrin deposit on the posterior limiting membrane (Descemet's).

## Ætiology and Symptoms.

The ætiology is uncertain. The condition specially affects young adults of a weakly constitution or of a syphilitic taint. It is more frequent in women than in men. It may also result from a trauma or a sympathetic inflammation. The subjective symptoms are—

*a.* Dimness of sight.

*b.* Pain, usually not pronounced.

*Objective Symptoms.*—Diffuse haziness of cornea, especially of its deeper portion. On oblique illumination there are seen numerous small dark spots (deposits of lymph) on the inner surface of the cornea. The iris has lost its lustre, reacts sluggishly to light, and frequently shows adhesions between it and capsule of lens (posterior synechiæ). The tension of the eye is frequently increased.

The progress of the disease is exceedingly tedious, frequently lasting many months.

### Treatment.

*General.*—Attend to the general health. Mercury and iodide of potassium, singly or combined, are very valuable. Iron and other tonic remedies are also of service. Smoked glasses are useful as preserves.

*Local.*—Local treatment consists in the use of a warm boracic lotion, and in the local application of atropine, the use of which, however, should be carefully watched. Mercurial inunctions to the temple are frequently of service.

## CYCLITIS.

Anatomy of Ciliary Processes.

The ciliary processes are appendages of the choroid, being formed by a plaiting and folding inwards of its various layers at their anterior margin. Their structure is therefore that of the choroid. The choroid, ciliary processes, and iris are all anatomically continuous from behind forwards.

An inflammation of the ciliary processes results from an injury, or from extension of an inflammation of the choroid or iris.

### Symptoms.

1. Pain in the eye, usually a deep-seated throbbing pain.
2. Marked impairment of vision.
3. A varying degree of photophobia and lacrymation.

*Objectively.*

*a.* Tenderness on pressure over the globe. - This is the most characteristic feature.

*b.* Signs of involvement of the iris—distended iridal veins, violet injection round the cornea, and the pupils usually slightly dilated.

*c.* Tension of the eye usually slightly increased.

In traumatic cases the disease is very apt to set up sympathetic inflammation.

### Treatment.

Hot fomentations or hot poultices.

Atropine locally, $\frac{\text{gr. iv.}}{\bar{3}\text{i.}}$, useful by diminishing the blood supply to the ciliary processes, as well as by its sedative action.

Internal administration of mercury, iodide of potassium or salicylate of soda, according to the cause.

## SYMPATHETIC OPHTHALMITIS.

An inflammation of the eye, affecting primarily the iris, and secondarily the cornea, cilliary processes, and choroid.

### Causes.

1. Wounds of eye, especially in ciliary region.
2. Irritation produced by a foreign body in the eye, *e.g.*, a piece of wood or a dislocated lens.

3. Degenerative changes occurring in a diseased eye.

The condition usually develops in from two to six weeks from time of the injury. When due to degenerative changes, it may be years later.

## Clinical Features.

*Subjective.*

The symptoms are very slight, and are apt to be overlooked.

*Objective.*

The appearances of inflammation, iritis, &c., with glueing down of the iris to the capsule of the lens, this tending to obliteration of the posterior aqueous chamber, and thus interfering with nutrition, and tending to degeneration and softening of the various structures of the eye.

In early stages, tension increased.

In later stages, when deeper structures involved, tension diminished.

## Theories of Occurrence.

1. By direct spread of the poison along the optic nerve.
2. By the lymphatics in the sheath of the nerve. This is the most probable theory.
3. By selective affinity, the poison circulating in the blood tending to involve a similar structure.

## Treatment.

Warm fomentations, the local application of atropine, and mercurial inunction are the remedies of greatest service in relieving the pain and cutting short the inflammation. Further, the question of *enucleation of the primarily affected eye* has to be carefully considered. This is frequently a matter very difficult of decision, as it has to be remembered that sometimes the sight ultimately present in the primarily affected eye is better than the sight present in the eye which was the seat of the sympathetic inflammation.

## Guiding Rules for Enucleation.

*a.* If the primarily affected eye is useless for visual purposes, and there is the slightest indication of inflammation in the other eye, enucleate at once.

*b.* If there be in the interior of the eye a foreign body which cannot be extracted, then enucleate, as the risks of sympathetic inflammation are very great.

*c.* If the injury is very severe, involving especially the ciliary region, and there is little prospect of useful vision, then enucleate as a prophylactic measure.

*d.* If the inflammation in the primarily affected eye be very severe, the iris and ciliary processes being seriously involved, and no subsidence of the inflammation occur within six weeks, then enucleate, even though a little vision remains.

CHAPTER IX.

DISEASES OF THE LENS.

---

# DISEASES OF THE LENS.

## Anatomy.

In childhood and youth the lens is perfectly colourless and of equal consistence throughout. In later life certain changes take place. It then becomes yellowish in colour and increased in density, and the central portion becomes harder than the rest, constituting the *nucleus*. The capsule of the lens is elastic and homogeneous. The increased density and associated loss of elasticity in the lens in later life are important factors in the causation of the failure of the accommodative power characteristic of Presbyopia or old sight. The reflection of the light from the surface of the lens in old people frequently gives rise to a semi-opaque grey appearance, which sometimes leads to a wrong diagnosis of cataract. In these cases ophthalmoscopic examination reveals the media to be perfectly clear.

# DISLOCATION OF LENS.

Dislocation of the lens may take place from the following three causes—

1. A congenital malposition, due to deficient development of the lens capsule (ectopia lentis).
2. As the result of disease, *e.g.*, sclero-choroiditis.
3. As the result of injury. Here the lens may be displaced in three directions.
   - *a.* Under the conjunctiva.
   - *b.* Into the anterior chamber.
   - *c.* Into the vitreous chamber.

## Appearances.

The appearances vary with the degree of dislocation. If it be partial and slight, it may only be discovered on ophthalmoscopic examination with the pupil fully dilated, the margin of the lens then appearing in one direction as a black line. In cases of greater displacement the margin of the lens may lie across even the undilated pupil, in which case one-half of the eye will be hypermetropic and the other half myopic. In traumatic cases the lens may be displaced to one of the positions mentioned above, and there set up acute inflammation.

## Symptoms.

These also vary with the degree of dislocation.

- *a.* Those due to loss of power of accommodation.
- *b.* Monocular double vision.
- *c.* Irido-donesis—trembling of the iris when eye is moved, this resulting from loss of support.

### Treatment.

In cases of partial dislocation, leave alone. In traumatic cases also no treatment should be adopted, unless there be signs of marked irritation, in which case an attempt should be made to remove the lens.

## CATARACT.

Cataracts may be classified as follows :—

I. ACCORDING TO THE TIME OF LIFE AT WHICH THEY DEVELOP.

1. Senile.
   - *a.* Involving the cortex—*Cortical cataract.*
   - *b.* Involving the nucleus—*Nuclear cataract.*

2. Congenital.
   - *a.* Partial or lamellar.
   - *b.* Complete.

II. ANATOMICALLY.

1. When the cells lining the capsule are affected. *Capsular cataract.*
2. When the lens fibres or lens substance proper is involved. *Lenticular cataract.*

Lenticular cataract is further classified into—

Cortical, when the cortex is specially affected.

Nuclear, when the nucleus is specially affected.

Lamellar when some lamellæ only are affected.

III. CLINICALLY, according to whether—

1. Idiopathic.
2. Traumatic.

## Causes.

The following causes are assigned :—

1. Senile atrophy of lens fibres, followed by degeneration of their substance.
2. Altered nutrition of lens, as in diabetes, or in workmen who are exposed to great heat.
3. Traumatism—as a result of an injury the lens capsule is torn, and the lens substance is exposed to the disintegrating effect of the aqueous humour.

## Process of Formation in Senile Cataract.

The cataract formation usually commences in the centre of the lens, and spreads out towards the periphery. In the earlier stages a few dark streaks are seen in the lens substance, and in the later stages the whole lens is dull and opaque. Not infrequently there is a well-marked radiating arrangement of the opaque parts of the lens. The consistence of the cataract varies much in different cases, being sometimes hard and amber-coloured, more frequently soft and yellowish, while occasionally it is hard in the centre, and soft or almost fluid at the periphery.

## Subjective Symptoms.

Defective sight, more especially in a bright light, this arising from the fact that as the pupil is then con-

tracted, the area of the pupil corresponds closely to the central part of the lens where the cataract is most advanced.

If patient was previously myopic, he may be able to dispense with his glasses, owing to alteration in the refractive power of the lens; this he regards as *second sight.*

## Objective Symptoms.

1. Impairment of vision, the amount varying with the degree of ripeness of the cataract. When cataract is fully ripe, and the interior of the eye is in a healthy state, the patient should still be able to—

   *a.* Appreciate very small changes in illumination, *i.e.*, he should have good Perception of Light.

   *b.* Say from what side a light is thrown upon the eye, whether from above, below, or one or other side, known as Projection of Light.

   *c.* Appreciate the direction of hand movements at the distance of about a foot or eighteen inches.

2. Altered colour of the pupil. This varies according to the extent and variety of the cataract. The area of the pupil is usually opaque and whitish or yellowish-white in colour.

3. The gait is characteristic in the later stages. The patient walks with the head bent down on the breast, the object being to shield the retina from light. This is a good symptom, indicating that the interior of the eye is in a healthy state.

4. Ophthalmoscopic examination reveals the presence, in the earlier stages, of dark brown or blackish streaks in the lens substance, the arrangement of the affected parts varying much in different cases. When the cataract is ripe, the whole lens, centrally and peripherally, is opaque, and no reflection is obtained from the interior.

## Points to be attended to in the Treatment of Cataract.

1. Thoroughly investigate the condition of the interior of the eye. This can best be done in the earlier stages, and is of the utmost importance as regards prognosis. If cataract is far advanced when first seen, specially test the projection of light. This is especially important in connection with detachment of the retina.

2. During the ripening process. If only one eye is affected, as a rule no treatment is called for. If both be affected, the vision can be improved by the use of weak atropine drops $\frac{\text{gr. } \frac{1}{4}}{\bar{3}\text{i.}}$ once daily. This allows the passage of the rays of light through the peripheral non-affected portions of the lens substance.

3. Is the cataract ripe? and is the interior of the eye healthy?

The appearance of the cataract, considered along with the amount of vision possessed by the patient, suffice to determine these points.

## VARIETIES OF CATARACT.

### Congenital.

There are two main forms of congenital cataract, the *lamellar* cataract in which, part of the lens only is affected, and the *complete* or congenital total cataract, which is usually soft and involves all the layers of the lens. In the lamellar form the opacity is limited to several lamellæ, external to which the lens is transparent, and in this form, the capsule and outermost part of the lens are not affected. The complete cataract is frequently associated with nystagmus, in which case the prognosis is not so good. The treatment consists in operation and removal of the lens substance. The operation is described later.

### Traumatic.

In this variety the cataract presents a characteristic flocculent appearance, and is frequently associated with some inflammation of the iris. Treatment consists in the use of atropine locally to keep the pupil dilated, and at a later stage, when the lens is well disintegrated, in the removal of the lens

substance. The prognosis should be guarded owing to the liability to complications in the interior.

POSTERIOR POLAR.

Here the part affected is deeply set in the lens substance. It is often irregular in shape, and is usually associated with disease in the interior, especially retinitis pigmentosa.

GLAUCOMATOUS.

Cataract complicated by glaucoma. Here the cataract is the lesser affection, and treatment should be directed to the glaucoma.

## CHAPTER X.

### GLAUCOMA.

---

# GLAUCOMA.

GLAUCOMA is a disease characterised by increased intra-ocular tension, all the symptoms being attributable to an increase of pressure in the chambers of the eye.

It may be *primary*, when the increased tension develops without previous recognisable disease in the eye; or

It may be *secondary*, when the increased tension follows obvious antecedent disease in the eye, *e.g.*, kerato-iritis, synechiæ, injury, dislocation of the lens, tumour growth, or hæmorrhage.

*In its manner of onset* the disease varies considerably. In some cases it develops suddenly, and is associated with general constitutional disturbance and signs of intense congestion (acute glaucoma). More commonly it develops slowly, and is unaccompanied by congestion (chronic glaucoma). Premonitory symptoms are met with in all cases of acute glaucoma, but there may be no premonitions in the chronic form.

## Pathology and Ætiology.

The initial causes of glaucoma are various, but all lead in one way or other to diminished escape of fluid at the angle of the anterior chamber, hence the excess of fluid in the eye and the increase of tension. In most forms of glaucoma the fluid accumulates in the vitreous chamber, pushing the lens and iris forwards, and thus compressing the filtration angle. Sometimes it collects in the posterior aqueous chamber, pushing the iris forwards; sometimes in the anterior chamber, pushing iris and lens backwards. These differences depend on the nature of the initial cause (Priestley Smith).

## Predisposition.

Certain subjects are predisposed to glaucoma.

*a.* Rheumatic and gouty subjects after middle life.

*b.* Nervous, careworn people.

*c.* Those subject to recurrent iritis.

## Exciting Causes.

1. Application of atropine.
2. An attack of nervous depression, fatigue, or sleeplessness.
3. Injuries.

These all act by bringing about an alteration in the vascular conditions in the interior of the eye.

## Premonitory Symptoms.

These are present in the acute, and sometimes in the chronic form.

1. Rapidly increasing presbyopia.
2. Coloured spectra on looking at a flame, always in the form of coloured rings.
3. Attacks of temporary impairment of vision.
4. "Neuralgic" pains in brow or eyes.
5. *In acute glaucoma*, there is, at the onset, restlessness at night, sickness, vomiting, and general constitutional disturbance. These symptoms are not infrequently put down to a "bilious attack," their real significance being overlooked.

## Clinical Features.

1. Anterior chamber shallow, pupil dilated, colour of iris altered, cornea hazy, the whole eye presenting a dull steamed appearance.
2. A distended tortuous condition of the episcleral veins, a result of the obstruction to the return of the venous blood of the choroid.
3. Tension increased +1, +2, or +3; in this last the eyeball is stony hard (*vide* Intra-ocular Tension).
4. Contraction of the field of vision, especially to the nasal side. In advanced cases there is absolute blindness.

5. Ophthalmoscopic examination shows cupping of the disc with pulsation of the retinal artery, the latter increased by pressure on the globe.

6. Anæsthesia of cornea, the result of pressure from œdema.

Nos. 1 and 2 are present in acute glaucoma, but frequently not in chronic, while Nos. 4 and 5 are present in chronic, but frequently not present in acute glaucoma.

## Prognosis.

The gravity of the prognosis varies a good deal in different cases. Generally speaking, if the vision is at all seriously defective, the prognosis is bad. It however depends greatly on the following two points:—

1. The period at which the case came under treatment; and

2. The presence of complications, either before or after operative interference.

## Treatment.

The treatment varies according to the stage of the disease.

*a.* Preventive—use great care in the application of atropine in old people.

*b.* Curative.

1. Eserine, applied once or twice daily, the strength and frequency being the minimum

which suffices to contract the pupil and keep it contracted. This may effect a cure, but if not, it frequently suffices to arrest any further increase in tension.

2. Paracentesis—puncturing the anterior chamber. This treatment is useful in cases in which the treatment by eserine or other myotic has been too long delayed. It however, as a rule, only gives temporary relief.

3. Iridectomy.—The performance of an iridectomy is the most valuable line of treatment. It usually arrests the growth of the disease, and not infrequently it permanently cures the condition. Its beneficial action is probably due to its increasing the patency of the filtration angle of the anterior chamber.

4. Constitutional treatment.—Tonics, quinine, &c., and in appropriate cases morphia, form the proper line of treatment. Saline aperients are specially useful in the treatment of acute glaucoma.

## SECONDARY GLAUCOMA.

The term secondary glaucoma is applied to those forms met with in eyes which are the site of other affections, either inflammatory or traumatic, *e.g.*, iritis, trau-

matic cataract, or dislocated lens. In differs from primary glaucoma in two important particulars—

*a.* It is met with at all periods of life; and

*b.* It affords a more hopeful prognosis, as the exciting cause may frequently be removed.

## BUPHTHALMOS,

OR

## MEGALOPHTHALMOS.

This disease is a form of glaucoma met with in early childhood, possibly arising in intra-uterine life. It is not a common affection, and in cases encountered there is frequently a hereditary history of the disease.

*Characters.*

The whole eye is markedly prominent, the cornea is considerably enlarged in diameter, the anterior chamber is deep, and the sclerotic is thinned. There is further decided increase of the intra-ocular tension, usually accompanied with pains in the eye and cupping of the optic disc. The vision is very seriously impaired.

*Treatment.*

In some cases the application of myotics, eserine, or pilocarpine, is useful in arresting the disease, or at any rate in alleviating the symptoms. Otherwise no treatment is of any service.

## CHAPTER XI.

### PANOPHTHALMITIS—DISEASES OF THE ORBIT.

---

# PANOPHTHALMITIS,

OR

# GENERAL INFLAMMATION OF THE GLOBE.

THIS affection may be acute or chronic. In the latter form the clinical features are similar to the former, though less severe. By some authorities the pathology of the affection is considered to be a purulent choroiditis.

## Causes.

Traumatic, pyæmic, idiopathic.

## Subjective Symptoms.

*Constitutional*—rigors, fever, and general systemic disturbance.

*Local*—severe pain, photophobia, and lacrymation.

## Objective Symptoms.

Chemosis of the conjunctiva of the lid and globe, turbidity of the aqueous humour, intense congestion of the blood-vessels, and opacity of the vitreous from purulent infiltration, form the

characteristic features. In the later stages the eye may be protruded forwards from involvement of the cellular tissue of the orbit, and the cornea may slough. The inflammation may extend to the dura mater. There is no tendency to sympathetic ophthalmitis.

### Treatment.

*The Treatment may be Palliative or Radical.*

*The former* includes such remedies as bathing the eye freely with corrosive sublimate lotion 1 in 3000; the application of a solution of silver nitrate gr. xv. to the ounce to the mucous membrane of the lids daily; and the application of iodoform ointment gr. x. to the ounce.

*The latter* includes the injection of chlorine water into the vitreous, and where that fails, the operation of enucleation or that of evisceration. Such radical treatment is frequently necessary.

## DISEASES OF THE ORBIT.

The main diseases of the orbit met with are—

Inflammation.
Foreign body.
Aneurism.
Tumour.

### Inflammation of the Orbit.

This may be traumatic or idiopathic. When due to an injury, the inflammation mainly affects the cellular tissue, inducing a cellulitis, whereas inflammation

occurring idiopathically usually affects the periosteum. Pain is a prominent feature in both instances, but is specially marked in cases of periostitis. Occasionally the inflammation spreads to involve the cellular tissue anteriorly, and produces an almost erysipelatous condition of the skin of the lids and cheek.

*Treatment.*

External applications of dry heat are useful. Salicylate of soda and quinine may be tried in idiopathic cases. A saline aperient should be administered at the outset of the inflammation. If suppuration threatens, open freely, as otherwise the abscess may burst through the conjunctiva or the lid.

## Foreign Body in the Orbit.

This occurs as a result of a foreign body striking the eye and perforating it. It may set up effusion of blood, which is liable to break down and suppurate. If the foreign body be aseptic, and set up no irritation, it may be left alone; but if the eye is at all seriously involved, enucleation should be had recourse to.

## Aneurism of the Orbit.

This may be of traumatic or idiopathic origin. The usual cause is the bursting of the internal carotid into the cavernous sinus. As a result of this, the ophthalmic vein becomes dilated, and arterial blood passes into it, and gives rise to a large pulsating tumour, over which a murmur may be heard. In traumatic cases the aneurism results

from injury to the ophthalmic artery. Proptosis, or protrusion of the eyeball, is the most marked subjective symptom.

*Treatment.*

*a.* Ligature of common carotid; or

*b.* Compression of the common carotid and electrolysis.

## Orbital Tumours.

The leading symptom produced by orbital tumours is proptosis or protrusion of the eyeball. Tumours may be simple or malignant in nature, more commonly the latter. They may arise from the following situations:—

*a.* The bony wall of the orbit.

*b.* The lacrymal gland.

*c.* The blood-vessels in the orbit.

*d.* The cellular tissue.

*e.* From the interior of the eye after perforation. (*Vide* page 193.)

*a. Tumours from Bony Wall.*—The usual site of an exostosis is at the upper and inner angle of the orbit. The tumour is of very slow growth, and displaces the eye downwards, forwards, and outwards. It may extend into the cranial cavity, a point of importance as regards prognosis for cure of the condition by operation.

*b. Tumours from Lacrymal Gland.*—These are rare, and are usually adenomata.

The treatment consists in removal by operation.

*c. Vascular Tumours.*—Occasionally a tumour is met with in the orbit, which is composed of a small

amount of connective tissue and many dilated blood-vessels. The ætiology of such a tumour is obscure.

Electrolysis forms the proper line of treatment.

*d. Tumours of the Cellular Tissue.*—These constitute the most important varieties of orbital tumour. They may be simple or malignant, more commonly the latter. Among simple tumours we find dermoids and hydatids, both of which are rare. Among malignant tumours we find sarcomata and carcinomata (secondary).

*Symptoms.*—The leading symptoms are :—

1. Protrusion of the eyeball,—Proptosis.
2. Lateral displacement of the eye, with limitation of movement.
3. Pain, the amount varying much in different cases.

*N.B.*—A tumour originating in the orbit does not invade the eye, but one originating in the eye may invade the orbit. So that if a tumour be found involving both the eye and the tissues of the orbit, it has originated in the eye.

*Treatment.*

1. If the diagnosis is not clear, iodide of potassium should be administered, gr. x. or xv. t. i. d.
2. Removal by operation, which means complete removal of the contents of the orbit.

## CHAPTER XII.

# THE PUPIL AND ITS DERANGEMENTS.

THE pupils are normally circular in outline, and when equally lighted should be of similar size. They are larger in children than in adults. Their size is regulated by the iris muscle, which contains two sets of fibres, each set having an independent nerve supply. The circular fibres forming the sphincter pupillæ are supplied by the third nerve, while the radiating fibres, the dilator pupillæ, are supplied by the sympathetic. The normal size of the pupil results from active contraction, counteracted by active dilatation, and when either from any cause preponderates, myosis or mydriasis results.

**The iris has three actions,** two reflex and one associated :—

1. Reflex contraction of the sphincter on exposure of the eye to light.
2. Reflex dilatation by the radiating fibres, on stimula tion of some cutaneous nerve.
3. Contraction on accommodation, usually associated with convergence. This is known as the associated action.

REGARDING THE LIGHT REFLEX, the following points should be noted :—

*a.* When one eye is shaded its pupil dilates, and on exposure contracts quickly. This is the direct reflex action.

*b.* The other eye will act similarly, but to a less extent. This is the indirect reflex action, and is due to the fact that the sensory impulses from the optic nerve pass into both optic tracts (*vide* diagram).

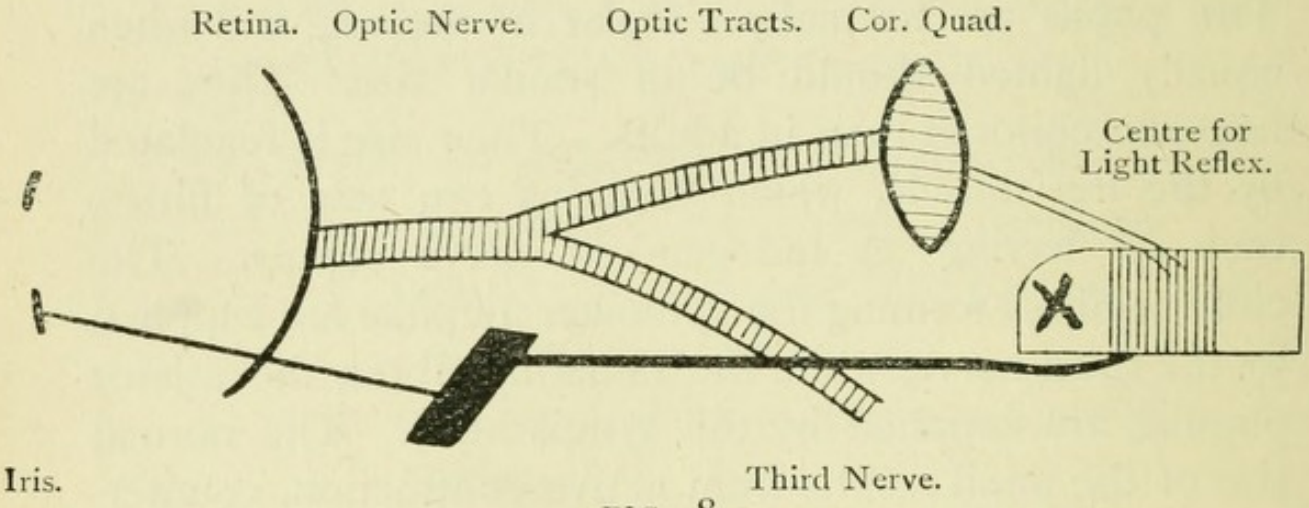



FIG. 8.

This reflex action is lost when the eye is blind from disease of the nerve or retina. If only one eye is blind, the direct reflex is gone, but the indirect reflex is increased, unless the third nerve be diseased. Further, it should be noted that the reflex action is sometimes lost without there being any affection of sight, and also without loss of the associated action. Considerable differences in range and rapidity of contraction of the pupil are compatible with health. If, however, there is marked inactivity with a small pupil, that is highly suggestive of spinal or cerebral disease.

**The nucleus for the third nerve** is a tract of grey matter beneath the aqueduct of Sylvius, continuous behind with the nucleus of the fourth nerve, and also connected with the sixth nucleus. The anterior part of the centre controls accommodation (X, Fig. 8), the next part controls the action of the iris to light, both of these functions being subserved by the anterior fasciculus of the nerve root. The posterior part controls the internal recti, which are concerned in the act of convergence.

The course of the fibres is represented on the diagram as follows :—

| *Afferent.* | *Efferent.* |
|---|---|
| Optic nerve. | Third nerve, probably the second fasciculus of origin. |
| Both optic tracts. | Ciliary ganglion. |
| The corpora quadrigemina. | Ciliary nerves. |
| Anterior part of nucleus behind the centre for accommodation. | |

REGARDING THE DILATOR FIBRES.

The motor fibres lie in the cervical sympathetic, and the fibres connecting this with the cord in the lowest part of the cervical region. The centre is supposed to be beneath the corpora quadrigemina, lying to the outer side of the centre for light reflex.

## MYOSIS.

PATHOLOGICAL MYOSIS may be due to—

*a*. Any condition which *stimulates* either the centre for pupillary contraction or the fibres passing from it (irritative myosis).

*b*. Any condition which *paralyses* the pupil-dilating centre, or fibres passing from it (paralytic myosis).

**Irritative Myosis, or Spasmodic Myosis.** This may be due to the following conditions :—

1. Inflammatory conditions of the eye attended with photophobia. The myosis here takes place reflexly through the fifth nerve.
2. Hyperæsthetic conditions of the retina.
3. A tumour or local inflammation affecting the third nerve, either at its centre or in its course.
4. Irritation of the brain substance as by meningitis, cerebral hæmorrhage, or the commencement of a hysterical or epileptic fit.
5. Myotics — *e.g.*, eserine, pilocarpine or nicotine. These probably act by stimulating the circular fibres of the iris.
6. Opium, especially in its later stages, stimulates the centre for pupillary contraction.
7. Hypermetropia. — Hypermetropes are constantly using their power of accommodation, and associated with that there is a contracted pupil.

**Paralytic Myosis.** This may be due to the following conditions :—

1. Paralysis of the cervical sympathetic from injury or from pressure of a tumour or aneurism. Here one pupil only is affected.
2. A spinal lesion in the lower cervical and upper

dorsal region, the lesion being in the posterior columns. Here both pupils are usually affected.

In the earlier stages pupils react both to light and accommodation.

In the later stages pupils do not react to light, but react to accommodation (the Argyll Robertson symptom).

3. Old iritis, with adhesions to capsule of lens. Here the pupil is usually somewhat irregular in outline.

4. General paralysis of insane.

5. Apoplexy of pons. This may be an irritation myosis; its exact ætiology is not determined.

## MYDRIASIS.

An abnormally large pupil may be due to one or other of the four following causes:—

*a*. Any condition which paralyses the circular fibres of the iris, supplied by the third nerve, *e.g.*,

1. Application of mydriatics, as atropine, hom-atropine, Duboisine.

2. Compression of brain, as in traumatism or apoplexy.

3. Glaucoma.

4. Blows on the head.

*b.* To conditions which produce irritation (stimulation) of sympathetic fibres in any part of their course, *e.g.*,

1. Early stages of spinal meningitis.
2. Tumours in the neck or mediastinum.
3. Application of cocaine locally.

*c.* Diminished sensitiveness of the retina—due either to general weakness, as in anæmia and debility, or to diseased conditions of the nerve or retina itself.

*d.* Myopia.—Myopes have large pupils as a rule, because their power of accommodation is always kept relaxed.

## MYDRIATICS.

Atropine, Homatropine, and Duboisine are the commonly used mydriatics. The strength of the application varies with the effect desired. For the stronger solutions the strength should be from 2 to 4 grains to the ounce, boracic lotion or some other suitable preserving medium being used as a solvent. For the weaker solutions the strength varies from $\frac{1}{10}$ to $\frac{1}{4}$ grain, according to the effect desired. The preparations used are—

*a.* The sulphate of atropine.
*b.* The hydrobromate of homatropine.
*c.* The sulphate of Duboisia.

Duboisia is specially suitable in cases where atropine does not agree. Homatropine is specially useful for oph-

thalmoscopic examination purposes, as its action is more rapid, and its effects pass off more quickly. All these preparations may be obtained and used in the form of lamellæ.

## Pharmacological Actions.

Atropine paralyses the peripheral terminations of the third nerve, thus inducing dilatation of the pupil. It also paralyses the ciliary muscle, and thus interferes with accommodation. It further paralyses the peripheral terminations of sensory nerves, and is therefore sedative. Lastly, while in health it tends to diminish intra-ocular tension, in disease, it tends to increase the tension, a fact that must always be borne in mind in the use of the drug.

## Therapeutic Uses.

1. For purposes of ophthalmoscopic examination. Homatropine is especially useful, as its effects pass off more quickly.
2. In the correction of errors of refraction, more especially those with spasm of accommodation.
3. In perforating wounds of the cornea when centrally situated. Here the use of a mydriatic prevents prolapse of the iris.
4. In many forms of inflammation of the iris, ciliary processes, and cornea. Their use in these cases lessens the tendency to adhesions of the iris, and diminishes the secretion and photophobia.
5. In cases of cataract, during the ripening process. Here a weak mydriatic improves sight by keeping

the pupil large, and allowing the passage of rays of light through the peripheral non-affected portion of the lens.

### Contra-indications.

1. In cases where there is the least tendency to increased tension. This must be particularly attended to, especially in elderly subjects.

2. In inflammations of the eye accompanied by glutinous secretion. In such cases atropine, as a rule, does not answer well.

## COCAINE.

Cocaine is also a valuable mydriatic, and is frequently used as such, especially in cases of disease associated with pain. It acts by stimulating the fibres of the dilator pupillæ. The preparation commonly used is the hydrochlorate of cocaine, in a strength varying from 2 to 4 grains to the ounce. In comparison with atropine, cocaine is a weaker mydriatic. In many cases a combination of cocaine and atropine is exceedingly useful.

## MYOTICS.

Eserine and pilocarpine are the commonly used myotics. Both of them contract the pupil, partly by stimulation of the peripheral terminations of the third nerve, and partly by direct stimulation of the muscular fibres. In disease they both tend to diminish the intra-

ocular tension. Both may be used in the form of lamellæ. The preparations used are—

1. Eserinæ sulphas (or hydrobromas), $\frac{1}{4}$ to 4 grains to the ounce.
2. Pilocarpinæ nitras, of a similar strength.

## Therapeutic Uses.

*a. In glaucoma.* Eserine is most valuable in diminishing intra-ocular tension. It should be applied in the strength of $\frac{1}{2}$ to 4 grains to the ounce once or twice daily, according to the acuteness or severity of the condition.

*b. In perforating wounds of the cornea at the periphery.* In such cases a myotic diminishes the tendency to prolapse of the iris.

*c.* In cases of *foreign body in the cornea near its centre.* Here a myotic is of service in providing a coloured background which renders the foreign body more readily visible, and therefore more easily removed.

*d.* After certain operations, *e.g.*, *cataract*, to prevent prolapse of the iris through the wound in the cornea.

*e.* In cases of *paralysis of the ciliary muscle*, as in post-diphtheritic paralysis, or from the application of atropine. In such cases eserine is of service in improving near vision.

PILOCARPINE is less powerful in its action than eserine, and is specially useful in cases where treatment has to be continued for a lengthened period.

## CHAPTER XIII.

### Mechanism of Accommodation and its Derangements.

---

# MECHANISM OF ACCOMMODATION.

An eye at rest is focussed for its *far point.* The normal eye at rest focusses parallel rays—its far point is therefore infinity. When focussed for a distant object it is in a state of negative accommodation; when from this state it becomes adapted for the focus of a near one, it is said to enter into a condition of *positive accommodation.*

*Positive accommodation*, or as it is commonly called, "accommodation," is brought about by the action of the ciliary muscle, which by its contraction relaxes the suspensory ligament, allowing the natural elasticity of the lens to bring about a greater convexity in its shape, thus increasing its refractive power (Helmholtz).*

*The near point* is that point for which the eye is adapted when exerting its full power of accommodation, or in other words, is that point which in the strongest state of refraction of the eye, has its conjugate focus on the retina.

---

* This theory of accommodation is the one generally accepted. It is right to say, however, that, in view of observations made by Tscherning, some authorities consider that the theory of Helmholtz is no longer tenable.

The range of accommodation is the area through which the eye can be fairly focussed, *i.e.*, from its far to its near point.

*This power of accommodative effort* is most marked in early life, and gradually diminishes from childhood upwards, till in late life it is entirely absent. Thus a child of ten years should be able to read small print at a distance of $2\frac{1}{2}$ inches. Ten years later the near point has receded half an inch, and at the age of forty, the near point of distinct vision is $6\frac{1}{2}$ inches (*vide* Table).

TABLE FOR NEAR POINT OF DISTINCT VISION IN EMMETROPES.

| | | | |
|---|---|---|---|
| Æt. 10 years - | $2\frac{1}{2}$ in. | Æt. 35 years - | $5\frac{1}{2}$ in. |
| „ 15 „ - | $2\frac{3}{4}$ in. | „ 40 „ - | $6\frac{1}{2}$ in. |
| „ 20 „ - | 3 in. | „ 45 „ - | 8 in. |
| „ 25 „ - | $3\frac{1}{2}$ in. | „ 55 „ - | 18 in. |
| „ 30 „ | 4 to $4\frac{1}{2}$ in. | „ 60 „ - | 24 in. |

The amount of accommodative power will be influenced, as will be readily understood, by—

*a.* The consistency of the lens; and

*b.* The functional activity of the ciliary muscle and its nerves. This will be further referred to under Presbyopia.

Associated with the act of accommodation, we find two other things occurring—

1. Contraction of the pupil, brought about by the action of the circular fibres of the iris, supplied by the third nerve.

2. Convergence of the optical axes, due to the combined action of the internal recti muscles.

*The centres for accommodation and for pupillary contraction* are situated near one another, and are co-ordinated to act together in accommodation, and with the act of accommodation there takes place a convergence of the optical axes, the eyes converging for the near point. This relationship between the act of convergence and that of accommodation is liable to become disturbed, and such disturbance is not infrequently the cause of symptoms met with in diseased conditions.

## PRESBYOPIA.

When the near point of distinct vision recedes beyond nine inches it becomes difficult to read small print comfortably, especially in defective light. This occurs after the age of forty-five, and is known as presbyopia or old sight. The symptoms it gives rise to are—

*a.* Exhaustion of the eyes at night.

*b.* The eyes become watery and painful.

*c.* Symptoms of conjunctivitis.

### Causes.

1. A flattening of the lens, whereby it loses in refractive power.
2. Increased density of the lens, whereby it becomes less easily acted upon by the ciliary muscle.
3. Weakness of the ciliary muscle.

### Treatment.

To correct presbyopia one has to supplement the defective range of accommodation by a convex lens. A good working rule is to prescribe convex lenses, which bring the near point of distinct vision to about nine inches. As age increases the strength of lens requires to be increased. The following is an approximate table giving the strengths of the convex lens required for the different periods of life :—

| | | | |
|---|---|---|---|
| 45 years | + 1 dioptre. | 60 years | + 4 dioptres. |
| 50 „ | + 2 „ | 70 „ | + 5 „ |
| 55 „ | + 3 „ | | |

In myopes presbyopia comes on later, in hypermetropes earlier than in emmetropes.

## SPASM OF ACCOMMODATION.

Spasm of the ciliary muscle is a condition met with in some cases of error of refraction, hypermetropia or myopia. It results from the constant straining of the ciliary muscle. It gives rise to shortsightedness, which may simulate myopia. The differential diagnosis is made from the following points :—

*a.* The near point of distinct vision is not nearer to the eye than corresponds to the age of the patient.

*b.* The use of atropine.

# PARALYSIS OF ACCOMMODATION.

## (CYCLOPLEGIA.)

Accommodation is due to the third nerve, and a paralysis of accommodation is due to a lesion either of the nerve itself or the nerve centre. Such a condition may be induced by injury or tumour growth involving the nerve or its nucleus, or to a degenerative lesion involving the centre, such as is occasionally seen in tabes. It also occurs as a sequel of diphtheria.

**The evidence of paralysis** in normal or in hypermetropic eyes is, that near vision fails and distant vision remains good, while near vision can be restored by the use of a convex lens. In myopes and presbyopes the diagnosis is more difficult, as in them the loss of the power of accommodation makes little difference to sight.

**The treatment** should be directed to the cause. In cases of post-diphtheritic paralysis the vision may be improved by the use of eserine—one grain to the ounce.

## CHAPTER XIV.

### Physiology of Refraction (Normal and Abnormal)—Retinoscopy.

---

# PHYSIOLOGY OF REFRACTION

Rays passing vertically through a transparent medium of uniform density go straight (*a*), but if these same rays pass obliquely from one medium into another of different density (*b*) they become altered in their course, and the law of refraction is—

> "When a ray passes from a rarer to a denser medium, it is refracted *towards* the perpendicular (*c*); but when it passes from a denser to a rarer medium, it is refracted *from* the perpendicular (*d*)."

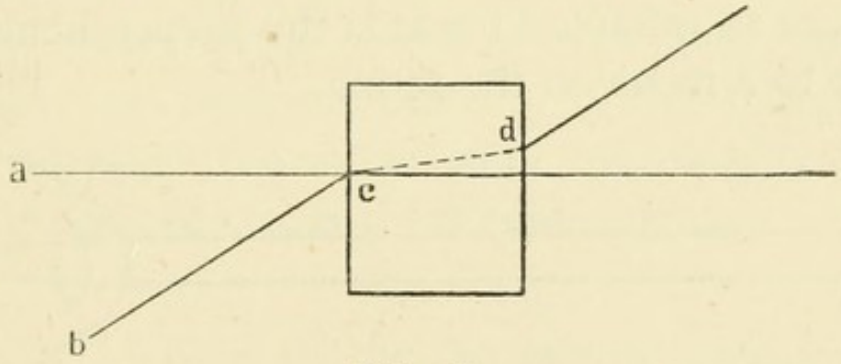



FIG. 9.

The above diagram illustrates the refraction by a medium with parallel surfaces. How are the rays refracted when the two surfaces are not parallel—*e.g.*, in a

prism (Fig. 10). On entering the prism the rays that strike obliquely (C) are refracted towards the perpendicular; while on leaving it the rays are refracted from the perpendicular. As a result, both on entering and leaving the prism the rays are refracted towards its base (B).

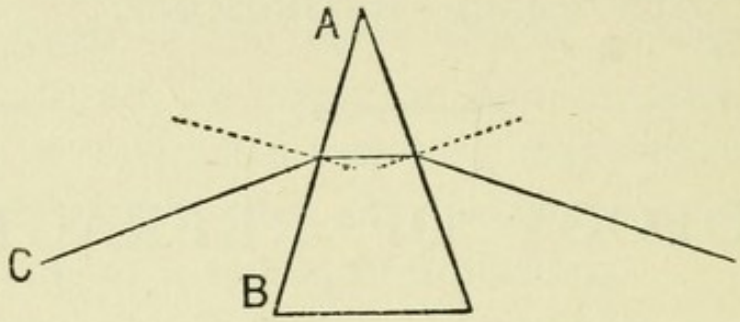



FIG. 10.

(Dotted lines indicate perpendiculars.)

*A convex lens* may be viewed as two prisms placed base to base; a concave lens as two prisms placed apex to apex.

**The refracting media in the eye** are the cornea, the aqueous, the lens, and the vitreous, and the normal eye is constructed in such a way that the rays are so refracted towards the perpendicular as to come to a focus on the retina.

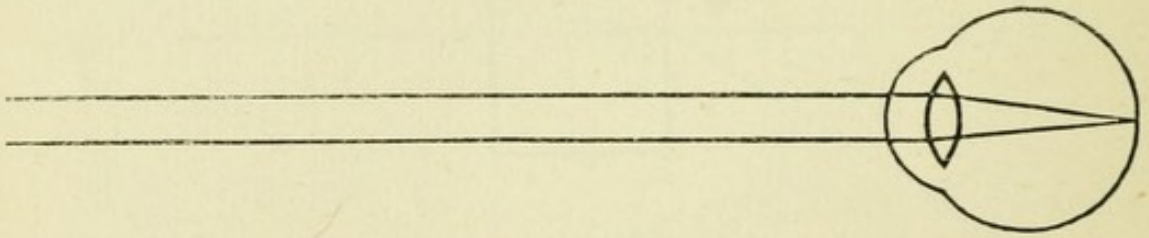


FIG. 11.

This holds good for parallel rays, viz., those over twenty feet distant, and also practically for those that are approximately parallel. This is known as emmetropia,

or normal refraction (Fig. 11). When parallel rays meet in front of the retina this constitutes myopia—the antero-posterior axis of the eye being too long (Fig. 12).

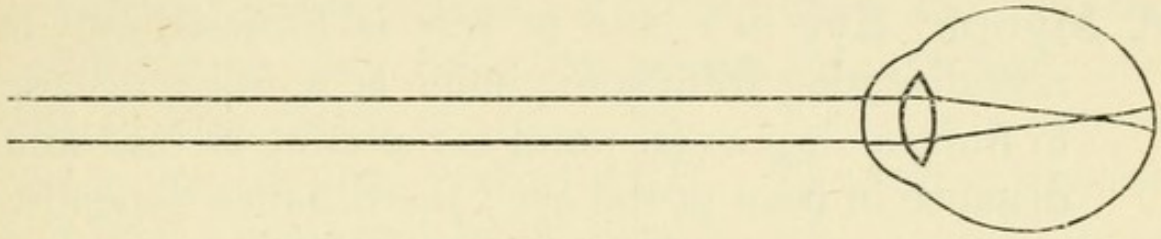


FIG. 12.

When parallel rays meet behind the retina, this constitutes hypermetropia—the antero-posterior axis of the eye being too short (Fig. 13).

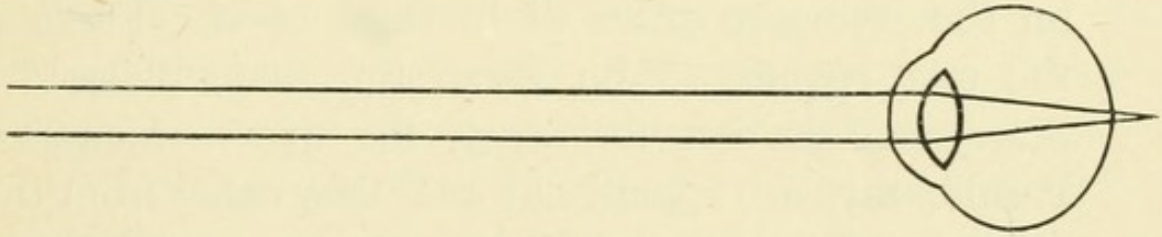
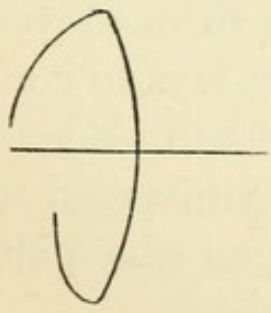


FIG. 13.

*When looking at nearer objects* the rays of light entering the eye are more divergent, and in order to bring these rays to a focus on the retina the refractive power of the eye must be increased, and this increase in refractive power is brought about by the action of the ciliary muscle (*vide* Mechanism of Accommodation). The accompanying diagram illustrates the condition of the lens when focussed for (1) distant objects, and (2) near objects.



Note (1) the flat anterior surface; (2) large pupil.

Note (2) the convex anterior surface; (2) small pupil.

FIG. 14.

**An Emmetropic Eye** alone when at rest is focussed for parallel rays; its far point is therefore infinity.

**A Myopic Eye** in a state of rest is focussed only for rays diverging from some point at a finite distance in front of it; its far point is therefore at that finite distance in front of the eye; the distance depending on the degree of myopia.

MYOPIA IS REMEDIED by the use of a concave lens of strength sufficient to spread out the rays, rendering them more divergent, and so bring them to a focus on the retina in place of in front of it. Further, the rays require to be given the same degree of divergence as that for which the eye is focussed. Parallel rays are spread out as if they came from the far point of the eye.

**A Hypermetropic Eye** in a state of rest is focussed only for rays which converge towards a particular point, lying at a finite distance behind it; its far point is therefore at that finite distance behind the eye; the distance depending on the degree of hypermetropia. The hypermetropic eye can only focus converging rays.

HYPERMETROPIA IS REMEDIED by the use of a convex lens of strength sufficient to cause the rays to converge and come to a focus on the retina in place of behind it. Further, the rays must be converged to the same extent as the rays are converged which are focussed on the retina.

# LENSES.

Lenses, convex, concave, and cylindrical, are numbered according to their refractive power, the standard being that of one metre or 40″ focus. This lens is called a lens of one Dioptre, or shortly 1 D. The refractive power of a lens is estimated by its focal length, the focal length and refractive power being in inverse ratio to one another. Thus a convex lens of 4 D. has a focal length of $\frac{1}{4}$ D. or 10 inches. Convex lenses are numbered from a quarter Dioptre (+.25 D.) to 20 D. Similarly with concave or minus lenses. Cylindrical lenses are required in cases of astigmatism where one meridian is more refractive than the other. These cylindrical lenses refract only in one direction, and that is at right angles to the axis of the cylinder; the rays which pass through the lens in the axis of the cylinder being unaltered in their refraction.

# RETINOSCOPY.

Retinoscopy, or the shadow test, is employed in the diagnosis of errors of refraction.

## Method of Use.

The patient being in a darkened room, and the source of light placed at the side of his head and shaded from him, the surgeon seats himself three or four feet distant, and with a weak concave mirror—one of 15 or 16 inch focus—reflects back the light on the eye, thus obtaining the red reflection. He

then slowly rotates the mirror first on the vertical and then on the horizontal axis, and notes the existence of a shadow moving in the same or opposite direction to that in which the mirror is rotated. An eye of normal refraction (Emmetropia) gives a faint quickly-moving shadow, which moves in the opposite direction in both meridians, but especially in the vertical.

HYPERMETROPIA.

In hypermetropia the shadow is more marked and moves against you in all directions. The degree of hypermetropia is estimated by determining the convex lens, whose strength is just sufficient to reverse the direction of the shadow.

MYOPIA.

In myopia the shadow moves with you in all directions. In very high degrees of myopia (over 8 or 9 D.) the shadow is not well defined, and in those cases retinoscopy is not so serviceable. The degree of myopia is estimated by interposing concave lenses in front of the eye being examined, beginning with a weak one and gradually increasing in strength till the direction of the shadow is reversed.

ASTIGMATISM.

In astigmatism the direction of the shadow varies according o the variety of astigmatism. Here one meridian is more refractive than the other, and in its treatment cylindrical lenses are required. (*Vide* Astigmatism.)

## EXPLANATION OF THE SHADOW TEST.

(After BERRY.)

When light is thrown into the eye from any source the size of the illuminated area of the fundus will depend on the distinctness of the image of the source of light on the retina, while the positions of the illuminated area will alter with that of the source of light, and move in a direction opposite to that in which the illuminating source is moved. When a concave mirror is used the direction of the rays, after reflection, is such as if they came from somewhere in front of the mirror or between it and the eye, where an image of the source is formed, and this apparent source is displaced in the same direction as that in which the mirror is rotated. On this account the illuminated area of the fundus is displaced in the opposite direction. What is seen, however, by the observer is not the illuminated area itself, but its image, as formed by the eye. In cases of emmetropic or hypermetropic refraction (when the rays from every point of the area meet behind the eye, or so far in front of it as to be behind the eye of the observer) the movement of the illumination, or the shadow which borders it, is in the same direction as that which actually takes place in the eye, *i.e.*, as we have seen against the mirror. Whereas in cases of myopia (when the rays meet before they reach the observer's eye) it is in an opposite direction to that taken by the area of illumination at the back of the eye; that is, it is "with the mirror."

# MYOPIA (SHORT SIGHT).

Ordinary myopia or short sight is a condition which develops usually about the age of ten or twelve, and remains stationary after full development. The myopia associated with diseased conditions in the interior of the eye may develop at any time of life, and tends to become progressively worse.

## Causes.

1. Alteration in the form of the globe, which is elongated antero-posteriorly, due to thinning of the coats posteriorly (staphyloma posticum). This is spoken of as axial myopia.

2. Increased curvature of the cornea—the result of inflammation.—Curvature myopia.

3. Increased refractive power of the lens, seen in the earlier stages of cataract.—Index myopia.

## Subjective Symptoms.

*a.* Imperfect vision *of distant objects.* Patient sees near objects very clearly. The distant vision is improved by concave lenses.

*b.* Eyes readily become fatigued, may become watery and painful (asthenopia).

## Objective Symptoms.

1. The appearance of the eyes may be characteristic; being more prominent than normal, the temporal portion of the globe presenting a flattened appearance, and the pupils usually large because power of accommodation is kept relaxed.

2. Near point of distinct vision is nearer to the eye than corresponds to his age.

3. Retinoscopy or shadow test. The shadow moves with you in both meridians. This is not a good test in very high degrees of myopia—over 7 or 8 Dioptres.

4. *On indirect examination* the details of the fundus are seen without the use of a convex lens, and on movement of the eyes from side to side the vessels seem to move in the same direction as the eye is moving.

5. A white crescentic ring is often seen by the side of the disc. This is known as the myopic crescent, and is due to the absence of choroid at that part—the result of posterior sclero-choroiditis.

ASSOCIATED CONDITIONS IN THE MYOPIA OF DISEASE.

Disease of the choroid—thinning and atrophy.
Disease of the retina—detachment.

Presbyopia occurs later in life in myopes than in emmetropes.

## Treatment.

In school children attention must be directed to their attitude at work; desks of a proper height, and a good light. Glasses must be prescribed, and may be either for distant vision only, or in the higher degrees for constant use. A useful working formula is as follows:—

*a.* Before full growth, correcting glasses should be worn for near work. It is immaterial whether they are worn or not for distance.

*b.* After full growth, twenty-two or so, there is not the same necessity for wearing full strength for reading. (Berry.)

*c.* The glasses prescribed should be the *weakest* with which the patient sees the objects clearly.

*d.* See that the frames for the glasses are in every way suitable.

*e.* In cases of extreme myopia, over 15 Dioptres, the question of removal of the lens may be considered.

## HYPERMETROPIA (LONG SIGHT).

### Causes.

1. Congenital flattening in shape (axial hypermetropia).
2. Deficient refractive power of the eye.

### Subjective Symptoms.

*a.* Defective near sight—the vision being improved by convex lenses.

*b.* Symptoms of asthenopia—headache, eyes readily become fatigued, may become watery and painful.

*c.* Those of conjunctivitis—brought about by the constant straining of the power of accommodation.

*d.* Strabismus or squint—this is not infrequently the leading symptom complained of.

### Objective Symptoms.

1. The appearance of the eyes may be characteristic, being small, deeply sunk, and flat on the surface. The pupils are usually small.

2. The near point of distinct vision is further removed from the eye than corresponds to his age (*vide* Table).

3. On indirect examination—

   *a.* Retinoscopy or shadow test—the shadow moves against you in both meridians.

   *b.* Details of fundus seen without a convex lens, and on movement of patient's eyes from side to side, the vessels seem to move in the opposite direction from that in which the eye is moving.

Hypermetropia is known as *total*, *manifest*, or *latent*, the different varieties being due to the altered conditions of refraction brought about by continued straining of the power of accommodation (ciliary muscle). Thus :—

1. *Total hypermetropia* is the amount indicated by the refractive power of the strongest convex lens with which patient can see distant objects clearly *when his power of accommodation is paralysed by atropine.*

2. *Manifest hypermetropia* is the amount equal to the refractive power of the strongest convex lens with which patient can see distant objects clearly without atropine.

3. *Latent hypermetropia* is the difference between 1 and 2, and is the amount uncorrected by the glass which corrects the manifest hypermetropia. It is greatest in early life, owing to the greater func-

tional activity of the ciliary muscle, and it does not exist after the age of forty or forty-five.

### Treatment.

Correct only the *manifest* hypermetropia.

1. If small in amount and patient young, order glasses for reading, which brings his near point to that corresponding to age.
2. If over 2 D, it is usually better to order glasses for constant use, and prescribe the strongest with which patient sees distant objects clearly.
3. If patient still have asthenopic symptoms, or if over thirty years of age, order a second and stronger pair for near work, as for reading, sewing, &c.

## ASTIGMATISM.

Under normal conditions, as the curvature is the same in all sections of the cornea, rays which pass through it all tend to meet at one point; the eye is emmetropic. If, however, different sections give different curvatures the rays cannot all meet at one point; the eye is astigmatic. As a rule the curvature in the vertical meridian is greater than the curvature in the horizontal meridian, and there is a regular progression from the point where the curvature is greatest to the point where the curvature is least.

Two varieties of astigmatism are met with—irregular and regular.

## Irregular Astigmatism.

Here the rays passing through any single meridian of the eye are irregularly refracted, and are not brought to a focus to a single point. The two conditions which give rise to this form of astigmatism are :—

*a.* Previous ulceration of the cornea, which has left behind some irregularity of its surface.

*b.* Conical cornea or keratoconus.

### On Ophthalmoscopic Examination.

The red reflection is obscured at parts by shaded spots, and at the parts of the retina behind these shaded spots the retinal vessels appear somewhat twisted. Examination by retinoscopy reveals very marked irregularity of shadow movement.

In doubtful cases examination with Placido's disc will reveal the presence of an irregularity on the surface of the cornea.

### Treatment.

In a case of pure irregular astigmatism no treatment is of any service. There is frequently some regular astigmatism associated, and the correction of that will materially improve vision.

## Regular Astigmatism.

A condition in which the rays passing through any single meridian are brought to a focus at a single point, but the different meridians vary in their

refraction. Further, the meridians of greatest and least refractive powers are always at right angles to each other. The following varieties are met with (vide diagram):—

1. *Simple hypermetropic astigmatism*—when one meridian is normal in its refraction, and the other (usually the horizontal) is hypermetropic. This condition is remedied by a convex cylindrical lens of suitable strength and axis—axis therefore usually vertical.

2. *Compound hypermetropic astigmatism*—when the eye is hypermetropic in both meridians, but more so in one than the other. It is remedied by a convex spherical lens with the addition of a convex cylinder corresponding to the difference between the two meridians.

3. *Simple myopic astigmatism*—when one meridian is normal and the other (usually the vertical) is myopic. It is remedied by a concave cylinder, axis usually horizontal.

4. *Compound myopic astigmatism*—when the eye is myopic in both meridians, but more so in one than the other. It is remedied by a concave spherical with a concave cylinder corresponding to the difference between the two meridians.

5. *Mixed astigmatism*—when the eye is hypermetropic in one meridian and myopic in the other. The eye is usually myopic in the vertical and hypermetropic in the horizontal meridian.

# TO ILLUSTRATE ASTIGMATISM.

(After BERRY.)

1. Simple Hypermetropic Astigmatism.

2. Compound Hypermetropic Astigmatism.

3. Simple Myopic Astigmatism.

4. Compound Myopic Astigmatism.

5. Mixed Astigmatism.

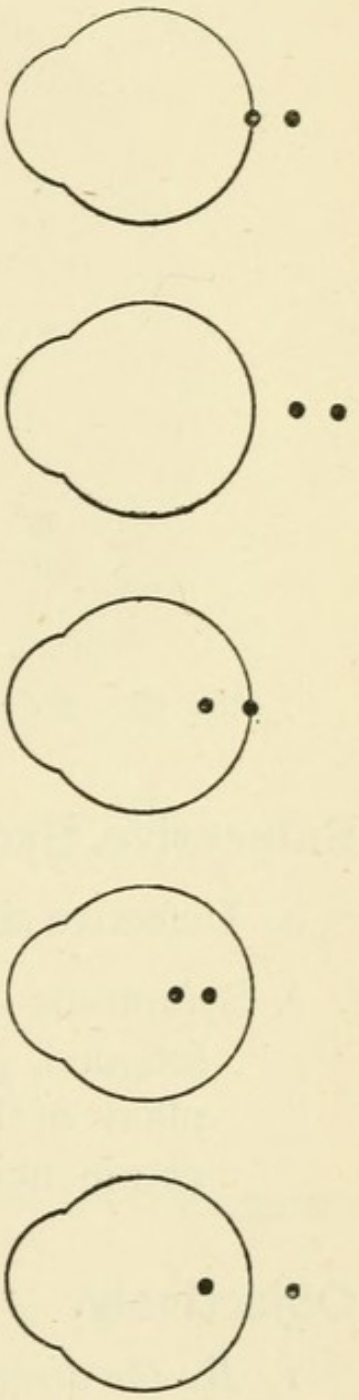


FIG. 15.

In astigmatism the lines in the different directions are not equally distinctly seen. The line seen most distinctly corresponds to the axis of the astigmatism. Therefore in treatment the axis of the cylindrical lens must be put at right angles to that line.

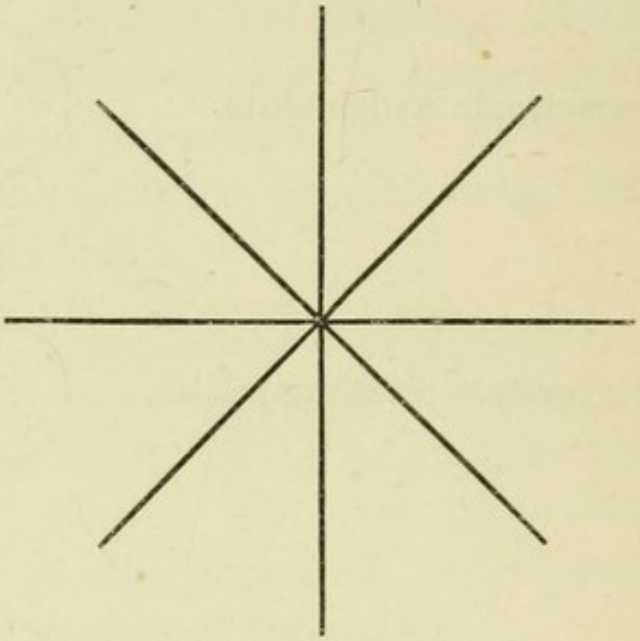


FIG. 16.—FAN USED FOR DIAGNOSIS OF ASTIGMATISM.

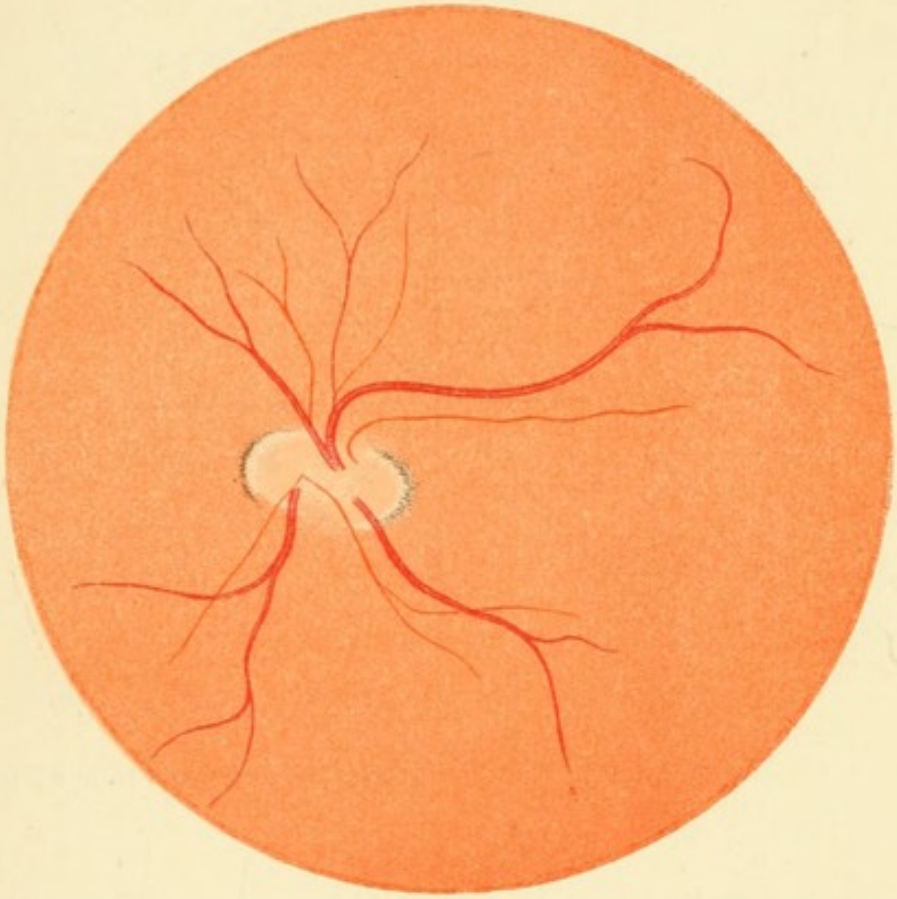
## Subjective Symptoms.

*a.* Defective sight.

*b.* Symptoms of asthenopia—the eyes readily becoming fatigued, painful, and watery. Patient may complain of headaches coming on some time after commencing to read.

## Objectively.

1. *By the direct method.* Observer cannot focus accurately at the same time vessels running in different directions—vertically and horizontally.



FUNDUS IN ASTIGMATISM.

*Note.*

1. The irregular oval disc, the upper and lower margins ill defined.
2. A thin line of choroidal pigment.
3. The whole fundus apparently anaemic.

2. *By the indirect method.* The disc appears oval in outline, and on removal of the convex lens from the eye the oval character is more marked.

3. *By retinoscopy.*

4. *By the use of trial lenses.* The vision, though improved by spherical lenses, is not brought up to normal by their use, and the addition of a cylindrical lens brings about marked improvement in vision.

## Treatment.

In prescribing for a case of astigmatism, it is well first to correct the meridian of least refraction with a spherical lens, and then further to correct the meridian of greatest refraction with a cylindrical lens. To illustrate—

Given a case of H. astigmatism, R. eye + 2 D. in vertical.
+ 4 D. in horizontal.

Here one would prescribe + 2 D. spherical, which corrects 2 D. in both directions, and then add + 2 D. cyl. *axis vertical*, which corrects the 2 D. in the horizontal. It will be remembered from what has been stated before, that rays passing through in the vertical axis of this cylinder are unaltered, while those passing at right angles to the axis are refracted to the extent of 2 D.

### Other Examples and their Correctness.

In connection with the following examples it must be kept in mind that the cornea is usually more

curved, and therefore more refractive, in the vertical, than in the horizontal meridian.

*Ex.* 1. Simple hypermetropic astigmatism of 2 Dioptres, in the usual direction. Prescribe convex cylindrical lens of 2 D. axis vertical.

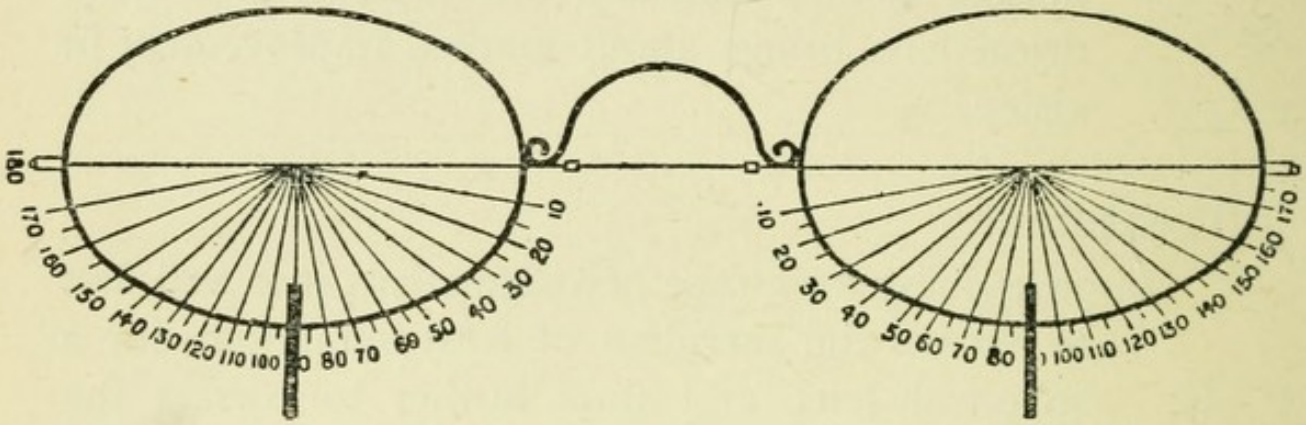



FIG. 17.

| R. | | L. | |
|---|---|---|---|
| SPH. | CYL. | SPH. | CYL. |
| | +2 Dioptres axis vertical. | | +2 Dioptres axis vertical. |

*Ex.* 2. Compound hypermetropic astigmatism. 2 Dioptres vertical and 4 Dioptres in horizontal meridian. Prescribe + 2 D. spherical lens, and add + 2 Dioptres cylinder axis vertical.

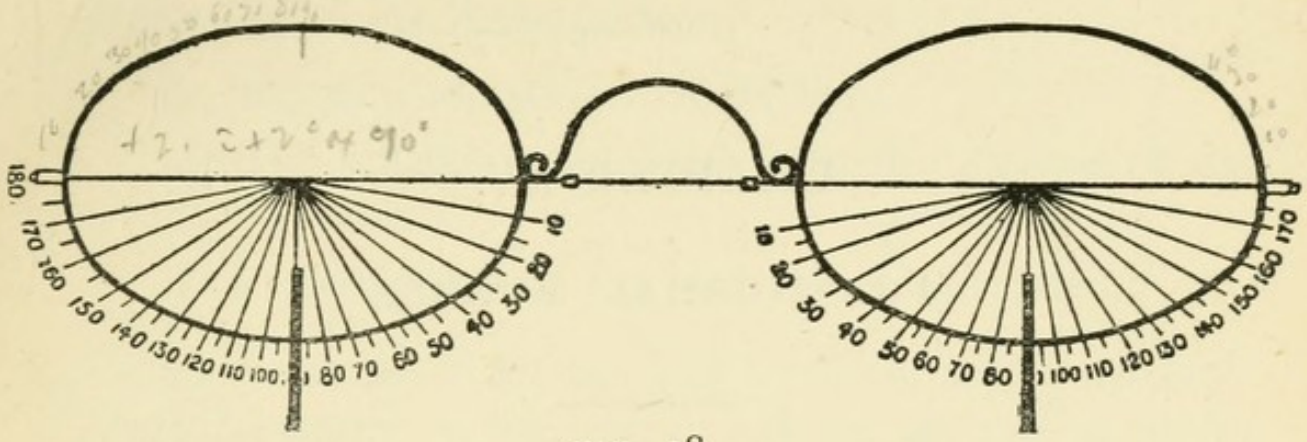


FIG. 18.

R. L.

| SPH. | CYL. | SPH. | CYL. |
|---|---|---|---|
| +2 Dioptres. | +2 Dioptres axis vertical. | +2 Dioptres. | +2 Dioptres axis vertical. |

*Ex.* 3. Simple myopic astigmatism of $1\frac{1}{2}$ Dioptres, in the usual direction. Prescribe concave cylindrical lens of 1.5 D. axis horizontal.

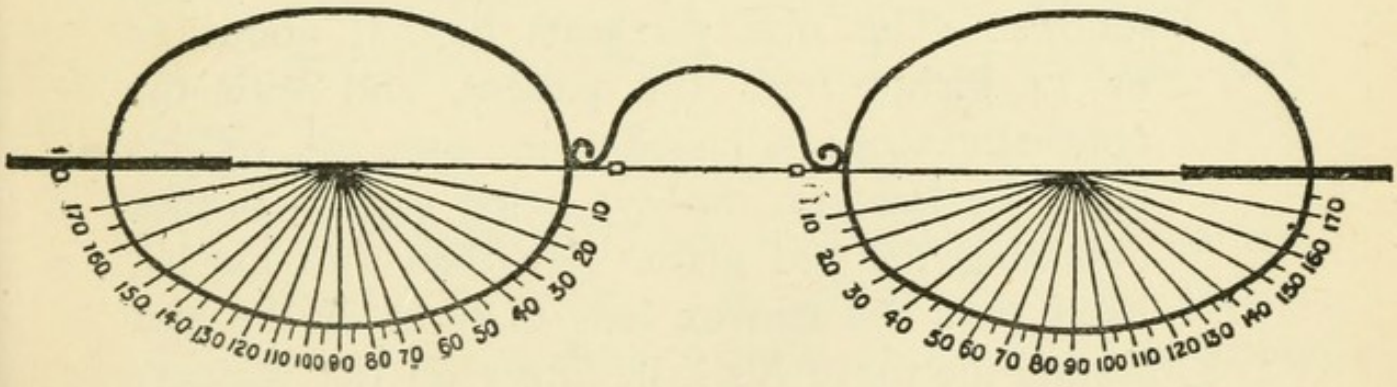


FIG. 19.

R. L.

| SPH. | CYL. | SPH. | CYL. |
|---|---|---|---|
| | −1.5 Dioptres axis horizontal. | | −1.5 Dioptres axis horizontal. |

## CHAPTER XV.

### The Normal Fundus.

---

# EXAMINATION OF THE FUNDUS.

The fundus can be examined either by the Indirect or Direct method. The former gives a magnified *inverted* image of the parts, the latter gives a much greater magnification and an *erect* image.

## Indirect Method.

In this method of examination, in addition to the ophthalmoscope, a convex lens of about 14 dioptres is used. The method of use is as follows:—The observer seats himself about 12 or 14 inches from the patient, and with the ophthalmoscope adjusted to his own eye, reflects back the light on the eye being examined, thus obtaining the red glare. He then with his left hand puts the convex lens in front of the eye, resting the tip of his little finger on the patient's forehead, and holding the lens about $1\frac{1}{2}$ inches from the eye. Thereupon, either immediately, or perhaps on slight withdrawal of the convex lens a little farther from the eye, he will get a magnified *inverted* image of the fundus.

*Difficulties in the Examination.*

*a.* Suitable adjustment of the light.

*b.* The reflection obtained from the surface of the cornea.

*c.* Reflections from the interposed convex lens.

These various reflections may be discarded on practice. A slight rotation of the convex lens on its axis is useful in allowing the observer to look past them.

The appearance of *the disc*, the *macula lutea*, and the *rest of the fundus* should be carefully and systematically noted.

## Direct Method.

By this method an erect image with a greater magnification is obtained. The method of use is as follows :—After a suitable adjustment of the light, the observer reflects back light at two inches, with the small concave mirror of the ophthalmoscope. The observer thus obtains an image of the structures from which the light has been reflected.

DIFFICULTIES IN THE EXAMINATION.

1. *Accommodation*, either on the part of the patient or the observer. The patient should be directed to keep looking steadily at an object at some distance away. By so doing, his accommodation is kept relaxed.

On the part of the observer greater difficulty is encountered in thoroughly relaxing the accommodation. For the purpose of self-education,

a good method is to take a printed sheet, and stare at it in such a way that its characters become indistinct. This is accompanied by a certain sensation in the eye, and is an indication that accommodation is relaxed.

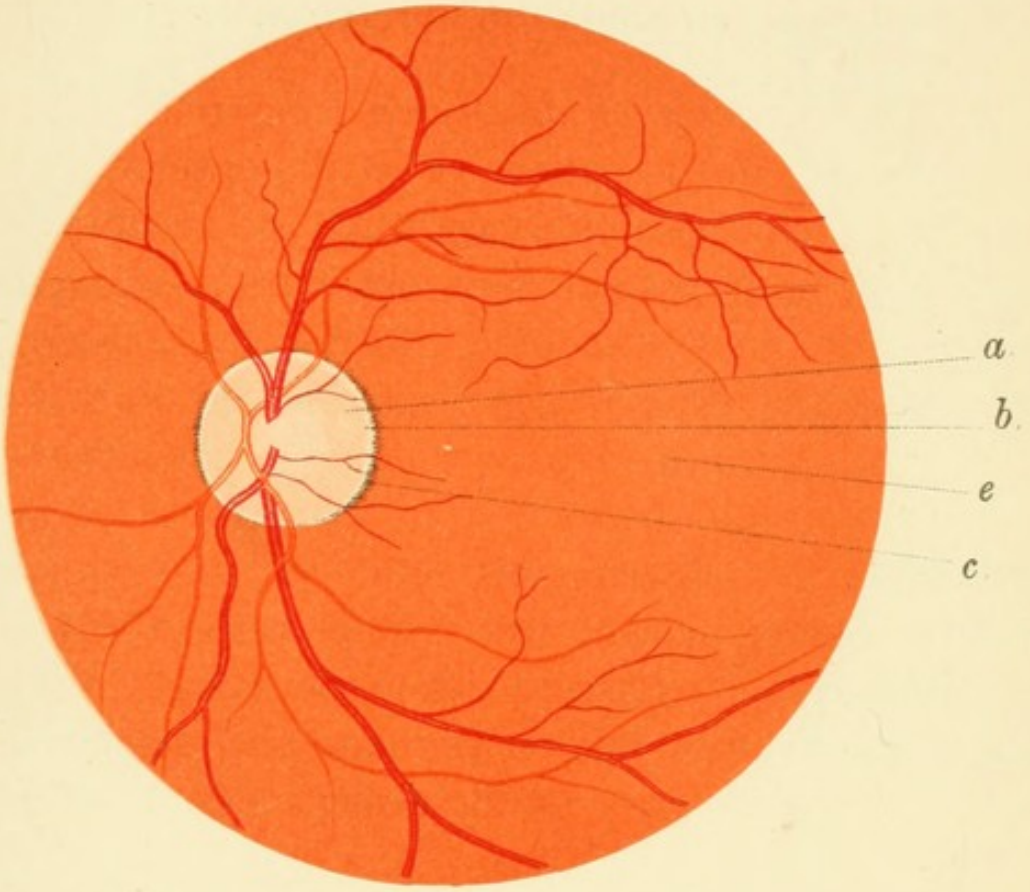
2. *The existence of ametropia* (abnormal refraction) either in the patient or in the observer. Under normal circumstances, when the accommodation of both patient and observer is relaxed, rays from the retina of the former leave the eye in a parallel direction, and are received on that of the latter, forming a picture. On the other hand, when the patient is hypermetropic or myopic, the rays leaving his retina will be diverging or converging, and will require respectively convex or concave glasses for their focussing. Advantage is taken of this to estimate the amount of the refractive error by the direct method. Thus—

Given a case of hypermetropia, the amount is indicated by the strength of the convex lens which the observer requires to put behind the sight hole of the ophthalmoscope in order to get a clear and distinct impression of the fundus.

## THE NORMAL FUNDUS.

### The Papilla or Optic Disc

Is seen as a pale pink disc, frequently slightly oval in shape. It is sometimes surrounded by a whitish




NORMAL FUNDUS.

*Note.*

*a.* The optic disc, of a faint rose pink tinge.

*b.* The scleral line, a thin white line round the disc.

*c.* The choroidal ring, a thin band of dark pigment.

*d.* The vessels, the arteries being narrower and lighter than the veins.

*e.* The region of the macula, free of large vessels.

ring—the scleral ring; and outside that a dark circle of pigment—the choroidal ring. The scleral ring is due to the margin of the choroid not coming right up to the papilla, and the choroidal ring is due to excessive development of pigment. The vessels of the disc will be referred to later.

PHYSIOLOGICAL VARIATIONS.

*a.* *The colour of the disc varies*, being partly dependent on the rest of the fundus. If the rest of the fundus be very dark, the disc appears paler by contrast.

*b.* *The edges of the disc* may be slightly indistinct, especially the upper and lower margins. This is well marked in some instances of hypermetropia in young subjects. This appearance is sometimes mistaken for optic neuritis.

*c.* *Physiological cupping* of the disc may be present, due to a broadening out of the normal depression met with at the centre of the disc. It differs from pathological cupping (in glaucoma) in being bilateral and in not corresponding to the margin of the disc. The cupped portion appears whiter in colour than the surrounding portion of the disc, and, if the cupping be steep, the vessels on that portion are not in focus at the same time as the vessels on the rest of the disc. (*Vide* Plate II.)

*d.* The appearance of the *lamina cribrosa*, in the form of grey spots, surrounded by bluish-white lines.

The grey spots are the nerve fibres and the white lines are the fibrous tissue of the lamina.

## The Retina.

The retina is usually invisible, but may be seen as a dull sheen of reflected light near the macula.

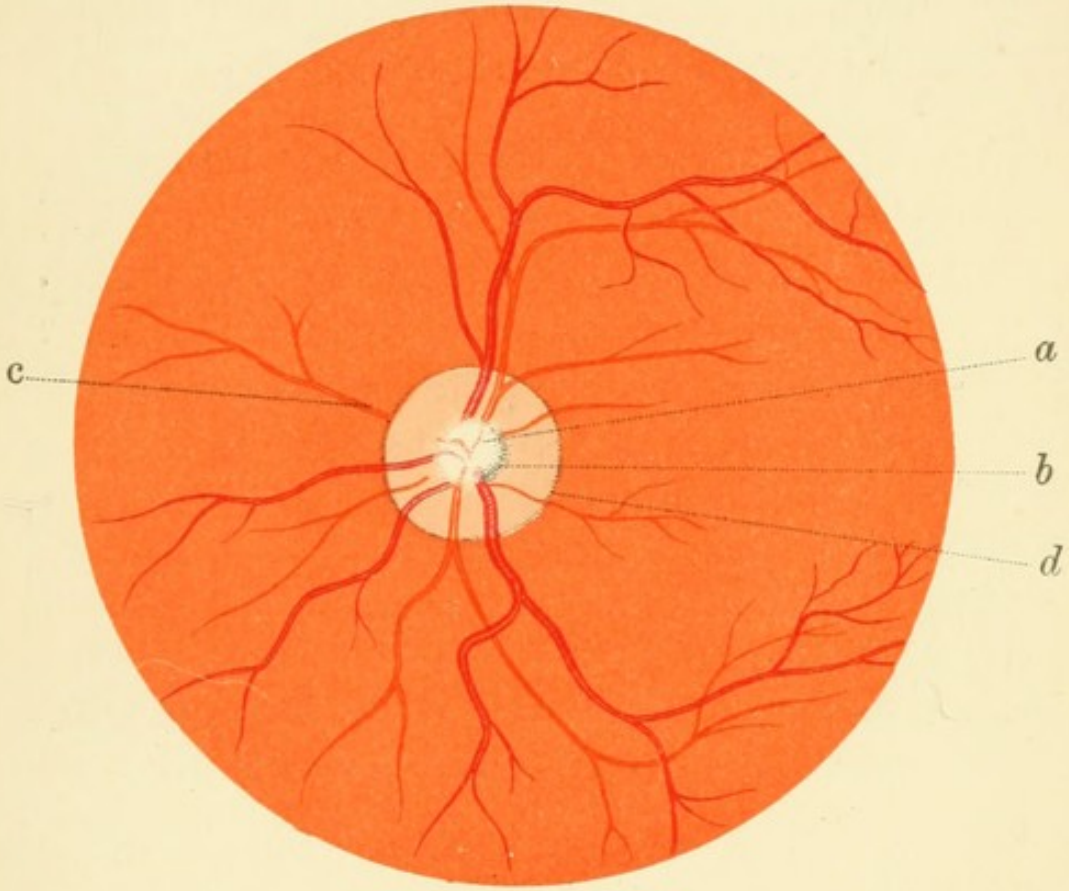
*The retinal arteries* in the disc and retina are paler, smaller, and more tortuous than the corresponding veins. They can be recognised as thin red lines with a light streak in their centre. The main trunk of the artery as it emerges from the disc divides into a superior and inferior branch, and thereafter undergoes further subdivision as it passes outwards. The arrangement of the branches varies much in different cases. (Plate I.)

*The retinal veins* are darker in colour, wider, and the light streak in their centre is very much narrower.

Not infrequently vessels come into view at the margin of the disc. These are either branches of the central artery of the retina which have passed out of the nerve before entering the disc, or they are branches of the posterior ciliary arteries. They are known as *cilio-retinal vessels*. (Plate II.)

## The Macula Lutea.

The macula lutea, or yellow spot, is situated in the centre of the retina, in the direct line of vision. It is situated to the outer side of the disc about two diameters from the disc margin. In size it is about twice that of the disc, and in outline it is




PHYSIOLOGICAL VARIATIONS.

*a*. Note the marked Physiological cup in which area the vessels are not in focus.

*b*. The lamina cribrosa.

*c*. A cilio retinal vessel.

*d*. Faint boundary of dark pigment, the choroidal ring.

oval, the long axis being horizontal. The fundus at the macula is darker in colour, contains very few blood-vessels, and is sometimes surrounded by a faint halo of reflected light. This halo is most marked in children of dark complexion and hypermetropic refraction. In the centre of the macular region there may be seen a bright spot—the fovea centralis. (Plate III.)

## The General Fundus Oculi.

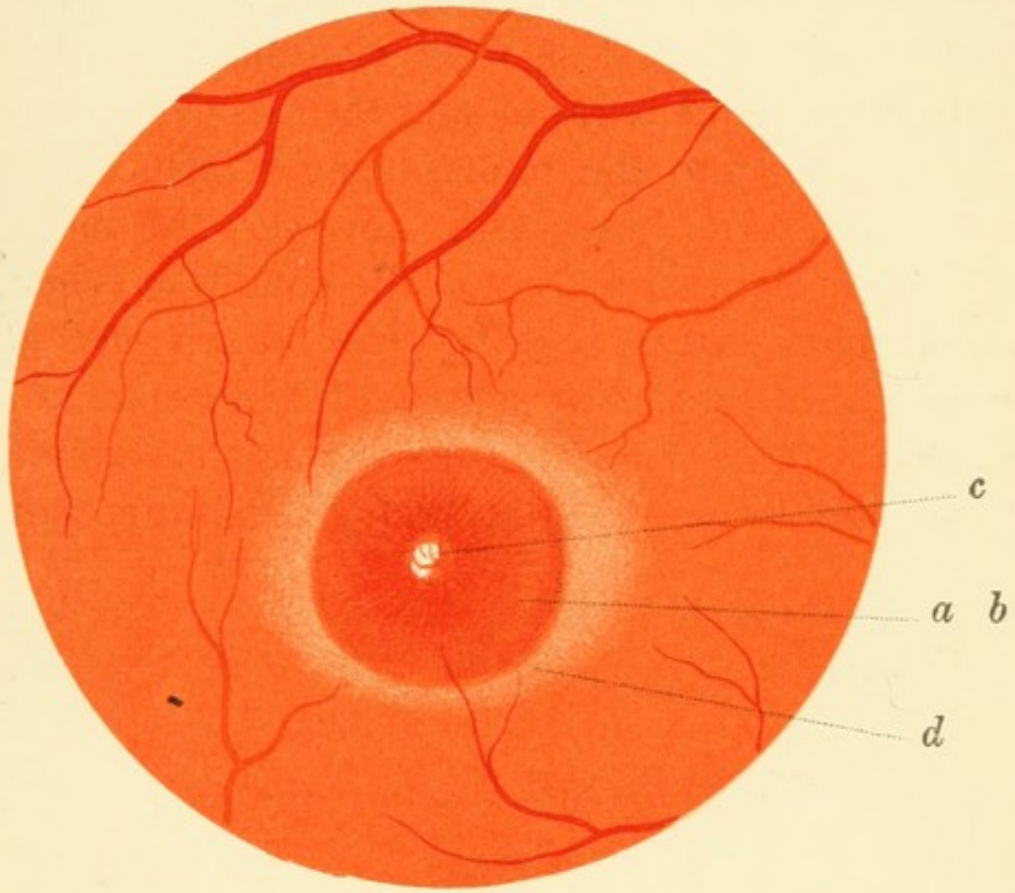
The red reflection obtained from the general surface of the fundus is due to the vessels of the choroid. The colour of the normal fundus depends largely on the amount of pigment in the hexagonal cells of the retina and in the choroid, and the degree of pigmentation of the retina corresponds closely to the amount of pigment elsewhere. In subjects of a dark complexion the fundus is darker than in fair subjects, and *vice versâ*. In a person of medium complexion the veins in the choroid may be seen as a dense network of broad and narrow stripes, separated by darker or lighter interspaces according to the amount of pigment in the stroma of the choroid.

## SENILE CHANGES.

In later life the disc presents a dull appearance, the retinal pigment diminishes in amount, rendering the choroid more visible, and there is frequently a yellowish band of choroidal atrophy round the disc.

# OPAQUE NERVE FIBRES.

A condition produced by some of the nerve fibres in the inner layer of the retina regaining their medullary sheath after passing through the lamina cribrosa. As a rule the nerve fibres lose their medullary sheath before entering the lamina cribrosa, and the axis cylinders, which are continuous into the retina, being translucent, do not reflect light. In these cases, however, the medullated fibres reflect light strongly, and the condition is seen as *a brilliant white patch, extending from the disc some distance outwards, and presenting a striated appearance at its termination.* This condition is normal in some lower animals, and in man is of no pathological importance.




NORMAL MACULA.

*Magnified erect image (after Berry.)*

*Note.*

*a.* The region of the macula, relatively void of vessels.

*b.* The fundus is slightly darker at that area.

c. The fovea centralis, a pinkish white spot in the centre of the macula.

*d.* A bright band of reflected light is occasionally seen round the macula.

# CHAPTER XVI.

## Diseases of the Optic Nerve and Retina.

---

## OPTIC NEURITIS.

### NEURO-RETINITIS.

### Appearances.

*In the earlier stages.* Slight hyperæmia and cloudiness of the disc, which soon loses its semi-translucent appearance and acquires a reddish-grey tint. The margins of the disc are ill defined, the veins distended and tortuous, and the arteries rather contracted. The retinal vessels later become obscured by exudation.

*In the later stages.* The disc is swollen, engorged, and presents a characteristic dull woolly appearance. Its outline is completely lost, and there may be hæmorrhages present in it, or in the adjacent portion of the retina. Later, the veins and arteries gradually diminish in size and the ophthalmoscopic appearances are those of optic atrophy.

### Symptoms.

Vision may not be seriously disturbed, except in the very late stages when atrophy has developed. Both eyes are affected, one usually being in a more advanced stage.

### Causation.

A tumour of a tubercular, gliomatous, sarcomatous, or specific nature; tubercular meningitis; rheumatism; lead poisoning; an inflammatory process in the orbit.

In cases where there is a gross intra-cranial lesion, the neuritis probably depends on the irritation produced by the fluid which distends the sheath of the nerve, this distension resulting from increased intra-cranial pressure.

### Treatment.

Treatment should be directed to the cause in each individual case. Among medicinal remedies, iodide of potassium, arsenic, mercury, and salicylate of soda are the most useful. In suitable cases surgical treatment, directed to the removal of a tumour or to the relief of tension, is indicated.

## RETRO-BULBAR NEURITIS.

### Causes.

Exposure to cold in rheumatic subjects, syphilis, sequel to a severe illness, and other causes not fully determined.

### Characteristics.

*Subjectively.*—Impairment of sight sometimes very marked, and occasionally pain in the back of the orbit, this pain being aggravated by movement of the eye or on pressing the eye back into the orbit. Both eyes or only one may be affected.

*Objectively.*—Frequently ophthalmoscopic examination reveals little or nothing abnormal. There may be slight haziness of the disc, or some inequality in its appearance, *e.g.*, one-half being abnormally pale. A central scotoma or blind spot is usually present, with concentric limitation of the field of vision. The scotoma is irregular in size and shape.

## Diagnosis.

The only condition liable to be mistaken for it is Toxic Amblyopia, and the differential diagnosis is made from the following three points :—

In toxic amblyopia—

1. The history of the case.
2. The condition is bilateral, and the defect of vision is the same in the two eyes, provided the refraction be alike in the two eyes.
3. Scotomata are regular in outline.

## Prognosis.

The prognosis is not so favourable as in toxic amblyopia. About a half make a good recovery, others leave a permanent defect, while some go on to optic atrophy and complete blindness.

## Treatment.

Treatment should be directed to the supposed cause. Rest to the eyes is the most important factor in treatment.

# OPTIC ATROPHY.

Four varieties are met with—

*a.* Post-neuritic atrophy—the condition following optic neuritis.

*b.* Secondary to disease of retina or choroid, *e.g.*, retinitis pigmentosa, choroido-retinitis, syphilitic retinitis.

*c.* As a simple degenerative change, *e.g.*, locomotor ataxy, general paralysis, cerebro-spinal sclerosis.

*d.* Primary optic atrophy—a purely local affection, cause unknown.

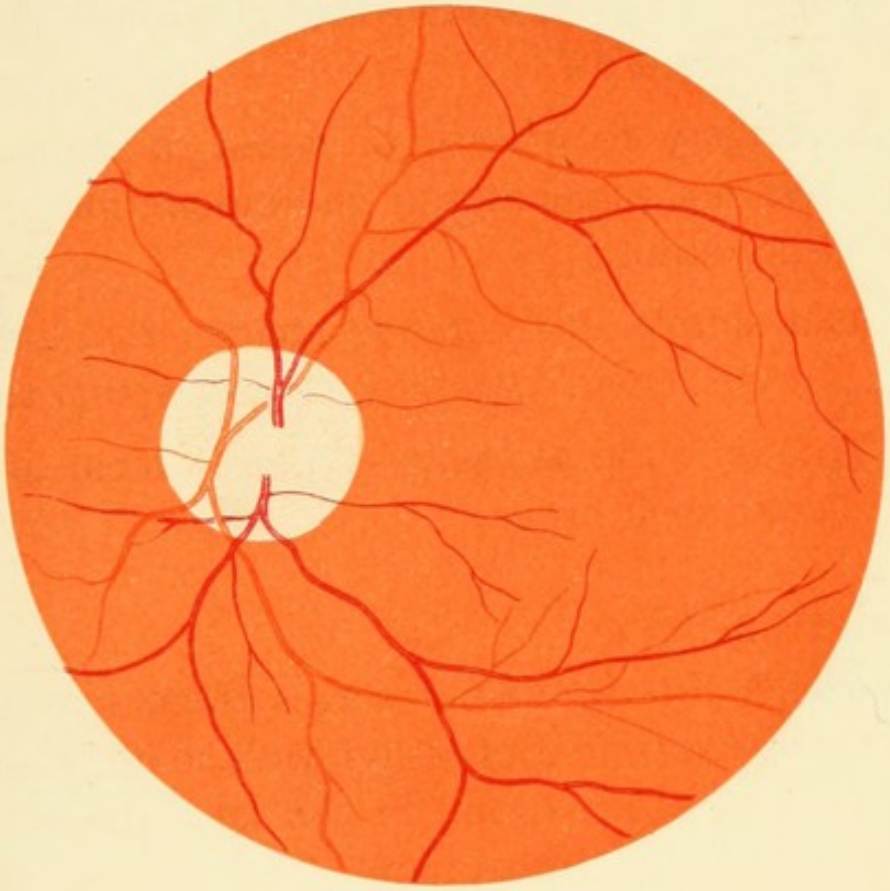
## Clinical Features.

*Subjective.*—In the earlier stages there may be only slight impairment of vision, with some contraction of the field of vision; in the later stages there is very marked impairment, and frequently total blindness. (Fig. 4, page 11.)

*Objective.*—1. An alteration in the colour of the disc, which presents a dull white, greyish, or faintly blue colour.

2. A diminution in the size of the vessels, both arteries and veins. There is no distinct relation, however, between the size of the vessels and the extent of the atrophy.

3. In the later stages the disc presents a shallow cupped appearance.



## Optic Atrophy

*(White atrophy.)*

*Note.*

1. The marked pallor of the disc.
2. The diminution in size of the retinal vessels.

In cases of post-neuritic atrophy the disc is usually of a dull white or greyish colour; in cases secondary to retinal disease it is usually yellowish-white; in the other varieties a very white or bluish-white appearance is characteristic. (Plate V.)

### Prognosis.

The prognosis depends greatly on the field of vision. If there is marked peripheral, and especially a concentric restriction, the prognosis is bad. Central defects allow a more hopeful prognosis.

### Treatment.

The treatment should be directed to the supposed cause.

## DISEASES OF THE RETINA.

### The Structure of the Retina.

The retina is the delicate nervous membrane on the cells of which visual impressions fall. For clinical purposes its structures may be viewed as follows:—

*a.* An inner layer of nerve cells and nerve fibres, the latter being the direct continuation of the optic nerve, the fibres of which lose their medullary sheath when they pass through the lamina cribrosa.

*b.* An outer layer of hexagonal epithelial cells loaded with pigment, the amount of the pigment varying much in different cases.

*c.* Blood-vessels—arteries and veins, the former being lighter and smaller than the latter.

# RETINITIS.

Any inflammation of the retina is characterised by—

1. A diffuse cloudiness of the retina.
2. Engorgement of its vessels, especially the veins, well marked both in the disc and retina.
3. Indistinctness of outline of the disc.
4. A varying degree of exudation and hæmorrhage.

Three varieties are described—

*a*. Albuminuric.
*b*. Hæmorrhagic.
*c*. Syphilitic.

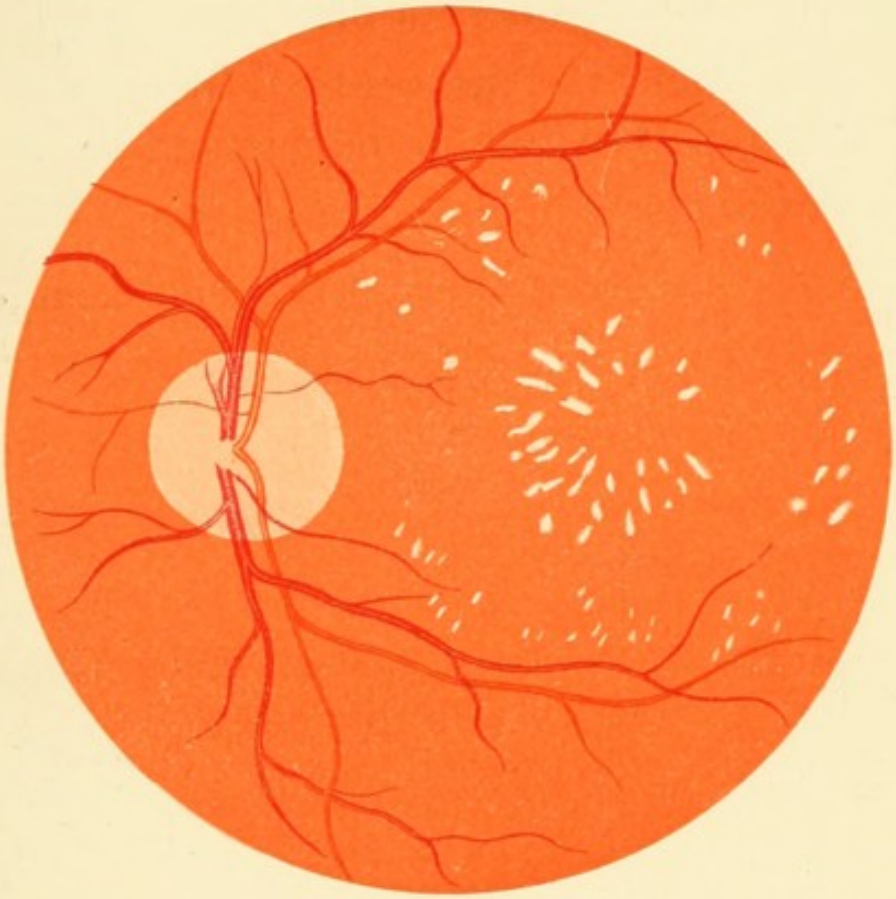
The last named will be described under Choroiditis, because of its association with that condition.

# ALBUMINURIC RETINITIS.

Albuminuric retinitis is met with in subjects affected with sub-acute and chronic nephritis. It is also sometimes seen in cases of albuminuria of pregnancy.

## Subjective Symptoms.

There may or may not be marked interference with view, the degree of impairment depending on the extent of the changes at the macula. It should be noted that defective sight in cases of Bright's disease may depend on central causes (uræmia).



ALBUMINURIC RETINITIS.

*Note.*

1. Numerous white spots in the Retina, especially around the macular region.
2. The spots are elongated, indistinctly outlined, and radiately arranged around the macula.

### Objective Symptoms.

The features are those mentioned above. The special point indicative of albuminuric retinitis is, in the later stages, the presence of white patches in the retina, most marked near the macula, around which they are arranged like the spokes of a wheel. These patches result from fatty degeneration of the exuded inflammatory products. (Plate VI.)

The *prognosis* is bad. The condition is bilateral, but one side usually shows more advanced changes. In the later stages optic atrophy may be present. Most cases die within two years. In the albuminuria of pregnancy the prognosis is more favourable.

*Treatment.*—The treatment should be mainly directed to the renal condition. In addition, the eyes should be protected from a strong light and from the strain of reading.

## HÆMORRHAGIC RETINITIS.

### Pathology.

The pathology is not fully determined. In some cases a severe heart lesion or widespread arterial disease is present. Other cases depend on thrombosis.

### Clinical Features.

The condition is characterised by numerous small extravasations which frequently present more or

less of a radial arrangement, the retina intervening being dull and opaque from œdema. The disc is usually swollen, and shows distended veins and small arteries. In the later stages, optic atrophy and small atrophic patches are seen in the retina.

*The prognosis* is bad because of the supervention of optic atrophy.

### Treatment.

The eyes should be shaded from bright light, and reading should be avoided. Otherwise treatment should be on general principles, special attention being directed to the condition of the heart, circulation, and kidneys.

## RETINAL HÆMORRHAGES.

Retinal hæmorrhages are seen in many general diseases which affect the quality of the blood, or the nutrition of the vessel wall, *e.g.*, idiopathic anæmia, leucocythæmia, purpura, Bright's disease. They are also met with in retinitis, thrombosis of central vein, embolism of the central artery, and in glaucoma. A few cases occur as the result of injury to the eye.

**The subjective and objective symptoms** depend on the position and severity of the hæmorrhage. One small hæmorrhage at the macular region will give rise to much more serious disturbance of vision than several larger hæmorrhages at the periphery.

*Objectively* the appearances vary according to the depth of the hæmorrhage—

*a.* If in the superficial layer of fibres, the hæmorrhage usually presents a striated appearance.

*b.* If in the deeper layer, the shape of the hæmorrhage is more irregular.

**The results** vary with the cause and severity of the case. Small hæmorrhages may be absorbed. Larger ones leave behind degenerated patches, which appear as yellowish-white or whitish areas in the retina.

## RETINITIS PIGMENTOSA.

A sclerosis and pigmentary degeneration of the connective tissue of the retina. The real pathology is not fully determined. It is probably an interstitial inflammatory condition.

### Ætiology.

In most cases there is a hereditary history of the condition. It is especially met with in subjects whose parents are related by blood, and also in those who are congenitally deaf and dumb. Some cases are probably of syphilitic origin.

### Clinical Features.

*Subjective Symptoms.*

1. Defective vision, especially at night—nyctalopia.
2. Gradually increasing contraction of the field of

vision. Patient may be able to read, though he cannot walk about alone. Central vision tends to slow deterioration.

*Objective Symptoms.*

*a.* Characteristic pigment spots in the retina. These are seen as stellate spots of a dark or black colour, with inter-communicating processes, the appearance presented being very like that of bone corpuscles. This deposit of pigment is most marked in a zone between the disc and the periphery. (Plate VII.)

*b.* Pallor of the disc, the vessels of which are small. In the later stages there may be well-marked atrophy of the disc.

*c.* Posterior polar cataract may be present. This is seen as a small opacity in the posterior part of the lens, its centre corresponding with the posterior pole of the eye.

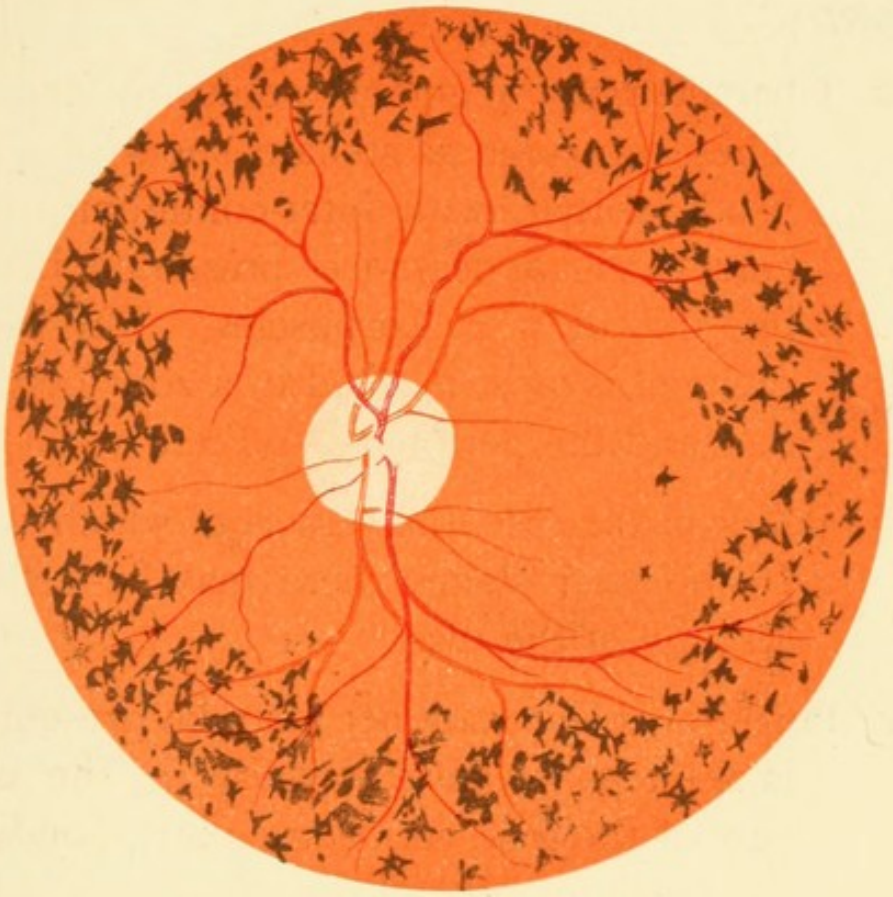
*d.* Atrophic patches may be present in the choroid.

## Prognosis.

The prognosis is bad. The condition is bilateral, and tends to slow deterioration.

## Treatment.

Treatment consists in resting the eyes from undue strain, and attending to the general health. Iodide of potassium should be tried in doubtful cases. Otherwise no treatment is of service.



## Retinitis pigmentosa.

*Note.*

1. Numerous dark pigment spots in the periphery of the fundus, most of them lying behind the retinal vessels, but a few of them lying in front of and concealing them.

2. The shape of the spots—*a*. points.
   *b*. wedge shaped
   *c*. star shaped.
   } Their appearance is like that of bone corpuscles.

3. The disc is pale, vessels fairly normal.

# DETACHMENT OF THE RETINA.

A separation of the retina from the choroid, the intervening space being occupied by a clear serous fluid.

It may result from *accident* or *disease.*

It may be—Primary, unaccompanied by inflammation.
Secondary, to cyclitis or to tumour growth.

## Pathology and Ætiology.

Its exact ætiology is not determined. The primary form is believed to depend upon a *consolidation and shrinking of the vitreous* which drags on the retina, causing a rupture and allowing some liquid which has replaced the shrivelled vitreous to pass behind. Eyes highly myopic are especially liable to be affected.

## Clinical Features.

These will vary according to the part detached, and its rapidity of development.

*Subjective Symptoms.*

1. The sudden onset of loss of vision. The defect in the field of vision will correspond to the part detached, and, as the upper part of the retina is that usually affected, the lower part of the field is the one which is defective.
2. Images of objects appear disturbed or veiled.
3. Objects seen floating in front of the eyes (muscæ volitantes).

*Objective Symptoms.*

The diagnosis is easy if the media are clear, but is more difficult in cases complicated by cataract, or opacities in the vitreous. On ophthalmoscopic examination, a portion of the fundus suddenly disappears out of focus and presents a greyish reflex. This is the detached portion, and when the eyeball is moved, a wave-like motion is imparted to it. The retinal vessels may be seen over its surface, and they are of diagnostic importance in doubtful cases. They present a dark and not a red appearance. The tension of the eye is usually diminished.

## Prognosis.

The prognosis is bad. In most cases the detachment tends to increase, due to the weight of the fluid, and it may ultimately lead to absolute blindness. In idiopathic cases the other eye frequently becomes affected.

## Treatment.

Little can be done. In recent cases, rest in bed for a period of several weeks may be of service. No reading should be attempted, and a bright light should be avoided.

# HYPERÆSTHESIA OF THE RETINA.

This is a condition seen in some cases of hysteria, facial neuralgia, and after long-continued exposure to a

bright light. The symptoms it gives rise to are—(*a*) *photophobia*, (*b*) *lacrymation*, (*c*) *blepharospasm* (contracted lids), these symptoms only being manifest on exposure to light.

*Treatment.*—Consists in resting the eyes from a bright light and from reading, and attending to the general health.

## TRAUMATIC ANÆSTHESIA OF THE RETINA.

This is a condition met with after a blow, or some such injury to the eye-ball. Amblyopia, contraction of the field of vision, and a normal fundus form the clinical picture. Complete recovery usually takes place, but some permanent defect may remain.

## BLINDING OF THE RETINA.

This is a condition sometimes met with—

*a.* After exposure to a very strong sunlight.

*b.* From the effects of electric light.

*c.* In cases of snow blindness.

These two latter causes may at the same time set up a peculiar form of ophthalmia, attended with much photophobia, pain, and secretion.

*Treatment.*—This should in each case be directed against the cause. The eyes should be rested, and coloured glasses worn.

# EMBOLISM OF CENTRAL ARTERY OF THE RETINA.

This is characterised by the occurrence of *sudden* and usually *complete* and *permanent* blindness. In some cases where the blocking is only partial a certain amount of sight may be retained. Occasionally a small portion of the temporal side of the field is left unimpaired. The condition is met with in some cases of severe circulatory derangement, *e.g.*, mitral stenosis.

## Ophthalmoscopic Appearances.

The central portion of the retina, and especially the portion immediately around the macula and disc, is whitish and opaque, due to œdema. This œdema is streaky round the disc. There is marked diminution in the size of the retinal arteries, and of the veins to a less extent. The arteries may present a thread-shaped appearance, owing to the interference with the flow of blood through them. At the centre of the macula, corresponding to the fovea centralis, there is a bright red spot known as the "cherry red spot." Pressure on the eye does not bring out pulsation in the artery. Atrophy of the disc is an after-result.

NOTE.—*a*. Thrombosis in the retinal veins, and

*b*. Hæmorrhage into the sheath of the nerve,

both produce appearances which closely simulate the above. The former is usually accompanied by retinal hæmorrhages. In all of those cases the state of the kidneys should be carefully investigated.

CHAPTER XVII.

DISEASES OF THE CHOROID AND VITREOUS.

---

# DISEASES OF THE CHOROID.

## Anatomical Note.

*The choroid* is a vascular pigmentary tissue covering the posterior five-sixths of the eye, and extending as far forwards as the cornea. Its structure from without inwards is as follows:—

1. A membrane of elastic fibres with openings in it for the vessels and nerves communicating with Tenon's capsule.

2. The choroid proper, consisting of—

   *a.* An outer layer composed of small arteries and veins, vasa vorticosa, with numerous pigment cells interspersed between them.

   *b.* An inner layer composed of a fine capillary plexus, lined internally by the lamina vitrea, which separates the stroma of the choroid from the pigment layer of the retina.

*The choroid* is usually not visible on account of the pigment in the hexagonal cells of the retina.

# CHOROIDITIS.

Inflammation of the choroid may be a serous choroiditis or a purulent choroiditis. This latter is rare, and is usually a part of a general panophthalmitis. Of the serous variety three forms are described—

*a.* Disseminated.

*b.* Central.

*c.* Syphilitic chorio-retinitis.

## CHOROIDITIS DISSEMINATA.

### Subjective Symptoms.

*a.* Defective vision and distortion of objects (metamorphopsia).

*b.* Subjective light and colour sensations and muscæ volitantes.

### Objective Symptoms.

*In the early stages.*—Yellowish areas of localised hyperæmia and exudation are visible in the choroid, and over those patches the retinal vessels may be distinguished. The disease is seldom seen in this stage.

NOTE.—It is always important to note the relationship of the retinal vessels to any abnormality in the fundus, as that relationship differentiates between disease of the choroid and disease of retina.

CHOROIDITIS

*(Advanced.)*

*Note.*

1. The fundus of the eye is covered by large and small spots, over which the retinal vessels may be seen.
2. Some of those areas are sharply defined and bounded by a layer of dark pigment, others are indistinctly defined.
3. The macular region is extensively involved.

*In the later stages.*—Numerous small more or less rounded spots, whitish or deeply pigmented, are seen throughout the fundus. They are situated for the most part peripherally, and there is frequently much black pigment deposit in the affected areas. In old standing cases the affected patches may appear as irregular perfectly *black spots* or areas from which all trace of choroidal vessels has disappeared.

*Prognosis.*—If the macular region be involved, the prognosis is bad. Further, if the patches have well-defined margins, the prognosis is more favourable than in other cases where the margins are ill defined. Some cases remain stationary, others show a tendency to become worse.

Plate VIII. illustrates an advanced case of choroiditis. The patches are of various sizes and associated with a good deal of pigmentation.

*Treatment.*—Iodide of potassium and mercury are useful in recent cases, especially in those of syphilitic origin. General tonics, *e.g.*, iron, strychnine, and arsenic, may be of service. In all cases the eyes should be rested, and in the acute stages complete rest, and the use of dark tinted glasses are indicated.

## CENTRAL CHOROIDITIS.

A localised inflammation affecting the choroid behind the macula. It is characterised by very marked diminution or loss of central vision, the patient being quite

unable to read. On ophthalmoscopic examination the fundus is healthy except for a small area at the macula, where there is an alteration in colour of a localised area, which is sharply defined and usually bounded by a layer of pigment. There is little or no tendency to the disease advancing. The condition specially affects subjects after middle life. No treatment is of any service.

## SYPHILITIC CHOROIDO-RETINITIS.

A condition met with in cases of inherited syphilis, and also in the late secondary stages of acquired syphilis. In the latter it may only affect one eye.

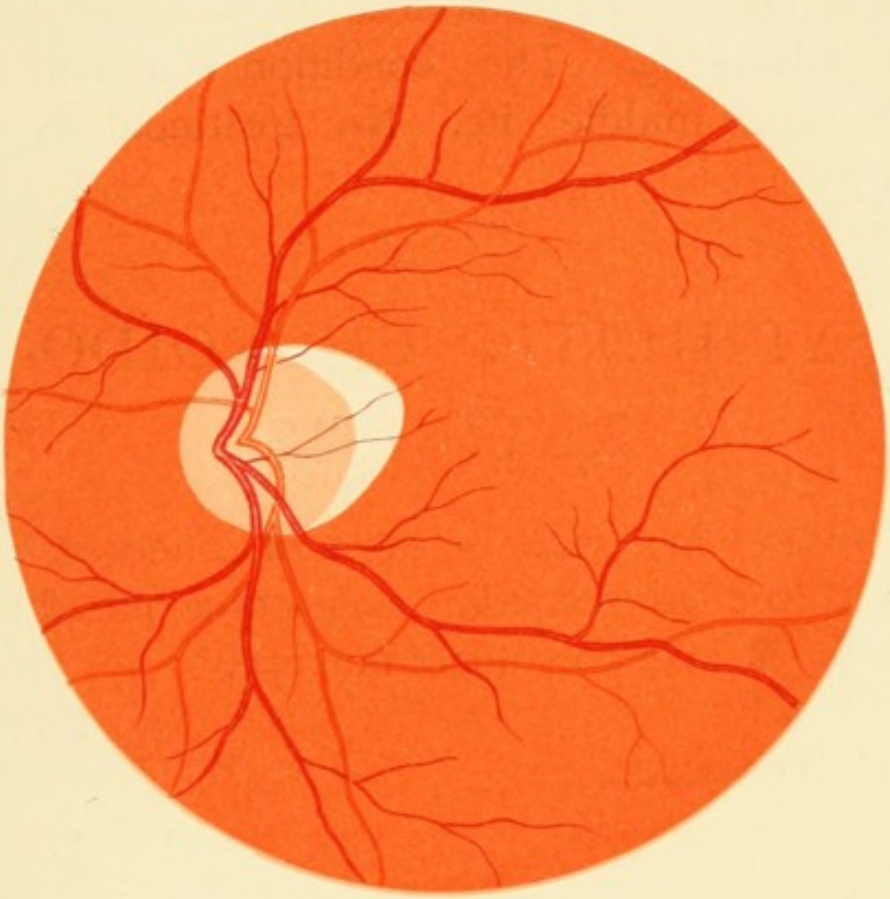
### Clinical Features.

*Subjective.*

1. Night blindness—nyctalopia.
2. Objects appear smaller (micropsia), or distorted (metamorphopsia).
3. Defective vision, especially in the later stages. Scotomata may be present, both subjective (observed by patient) and on examination by perimeter.

*Objective.*

*a.* The retina is dull and non-transparent. Its vessels are distended and tortuous. The disc is hazy.



STAPHYLOMA POSTICUM

*the result of Posterior Sclero Choroiditis.*

*Note.*—The white crescent by the side of the disc, due to exposure of the sclerotic.

In this case the boundary is well defined, when not well defined the lesion is progressive.

*b.* The vitreous shows extensive *and diffuse dust-like opacities.* These are pathognomonic of the condition.

*c.* The choroid shows yellowish-white spots with deposit of pigment in them.

### Prognosis.

In the early stages, there is some chance of a good recovery. The condition does not usually tend to advance.

### Treatment.

In the early stages mercury, both internally and by inunction, and, in the later stages, iodide of potassium should be administered. The general health should be promoted by general tonic treatment. In the more acute stages the eyes must get complete rest.

## STAPHYLOMA POSTICUM.

### (POSTERIOR SCLERO-CHOROIDITIS.)

This condition has already been referred to under myopia (page 119). It is seen as a crescentic white patch situated usually at the temporal margin of the disc, and is frequently associated with atrophy of the choroid beyond. It is important to note that when the patch is not well defined, the staphyloma will probably be progressive. (Plate IX.) The treatment should be directed to the myopia, and to the general health.

# OPACITIES OF THE VITREOUS.

These are usually secondary to chronic inflammation of the choroid, retina, or ciliary body. The opacities themselves probably consist either of the primarily diseased cells, or of connective tissue cells developed in the process of inflammation. In some cases they result from effusion of blood from the vascular membranes of the eye.

*Varieties of Opacities.*

*a.* Fine, diffuse, dust-like opacities, characteristic of specific disease of retina and choroid.

*b.* Fine flakes or threads scattered throughout the vitreous.

*c.* Membranous opacities, more rare—probably result from old extravasations.

## Symptoms.

The symptoms complained of are defective sight, and the presence of specks seen floating before the eye. The severity of the symptoms varies according to the density and number of the opacities, and also to the presence of any associated condition in the interior of the eye.

## Diagnosis.

On ophthalmoscopic examination, in a not too bright light, the opacities can be seen floating in the

vitreous when the eye is moved rapidly from side to side. Opacities in the lens must be distinguished, but as they are fixed and more or less radiating, there is little difficulty in differentiating them.

## Prognosis.

The prognosis depends on the cause, and especially on the condition of the retina and choroid. Small opacities may become absorbed, especially in young subjects. In older subjects detachment of the retina may supervene, and it should be borne in mind that detachment of the retina is not infrequently preceded by the occurrence, in a marked degree, of the subjective symptom of floating bodies.

## Treatment.

General constitutional treatment is indicated, with iodide of potassium in specific cases.

### Synchisis, or Liquefaction of the Vitreous.

This condition occasionally results from an extravasation into the vitreous, and it is also associated with the presence of dark specks seen floating in the vitreous. The rapidity with which small opacities alter their position with the movements of the eye is characteristic of this condition.

## Muscæ Volitantes.

These are motes or specks seen floating before the eyes, without any loss of vision or evidence of opacities in the vitreous on ophthalmoscopic examination. They are probably connective tissue cells of the vitreous. As a rule they are of no significance, and patient should be directed to pay no attention to them.

## Hæmorrhage into the Vitreous.

This may result from an injury, or a diseased condition of the retina or choroid. It is characterised by the sudden onset of defective vision, the amount being proportionate to the extravasation. In severe cases there may be no perception of light. On oblique illumination the presence of blood in the vitreous may be determined, and in the more severe cases, ophthalmoscopic examination may reveal complete abolition of all light reflex, the area of the pupil being perfectly black.

*Treatment.*

Severe physical work, and all work necessitating stooping should be avoided. Iodide of potassium is useful in promoting absorption. So also is mercury internally, or by inunction to the temples. The functions of the bowels and kidneys should be attended to, and the general health promoted.

## Foreign Bodies in the Vitreous.

These are usually the result of perforating wounds of the cornea or sclerotic, the foreign body usually

consisting of a piece of iron, steel, copper, or glass. It is sometimes very difficult to determine whether there be a foreign body in the interior or not. If the media are clear, the foreign body may be seen on very careful examination, but if extravasation has occurred, the position of the foreign body may not be determined. In every case a thorough examination of the cornea, sclerotic, and iris must be carried out, and any evidence of perforation closely looked for.

*Complications.*

*a.* Intense inflammation in vitreous and adjacent parts.

*b.* Sympathetic ophthalmitis.

*Treatment.*

If the foreign body be present, its removal must be attempted, either by the use of forceps, or in the case of a metal, the electro-magnet. If it is visible, its removal may be comparatively easy. If it cannot be removed, the eye should be enucleated, because of the great danger of sympathetic ophthalmitis.

## CHAPTER XVIII.

### AMBLYOPIA—HEMIANOPSIA—COLOUR BLINDNESS.

---

# AMBLYOPIA AND AMAUROSIS.

DEFINITION.

Defective sight, without any discoverable pathological condition in the fundus or elsewhere. When the vision is entirely lost, the term Amaurosis is applied.

*Varieties.*

Congenital.
Traumatic.
From disuse.
Toxic.
Hysterical.

## Congenital Amblyopia.

This may affect one or both eyes, and is probably due to defective development of the centres in the brain. It is sometimes attended by nystagmus, and in some cases predisposes to strabismus. No treatment is of service.

**Traumatic Amblyopia.**—This may be temporary or permanent.

*A blow on the eye* may be followed by concussion of the retina. The prognosis in such a case is favourable, recovery usually occurring within a few days.

*A blow on the forehead or temple* may be followed by temporary, or permanent amblyopia. If the latter, the injury has probably ruptured the optic nerve fibres, and in a few months optic atrophy develops. The prognosis is unfavourable.

**Amblyopia from Disuse.**

This is especially met with in cases of strabismus. The images are suppressed in the weak eye, to prevent the discomfort of double vision. Treatment should be directed to the strabismus.

## TOXIC AMBLYOPIA.

CAUSES.

Tobacco in excess.

Alcohol.

Exposure to bisulphide of carbon, as in rubber works.

CLINICAL FEATURES.

1. Rapid impairment of vision affecting both eyes equally. This is an important diagnostic point. It should be noted, however, that occasionally both eyes are not equally defective, this being due to the fact that the refraction in the two eyes is not the same.

2. The presence of a central scotoma or blind spot—present for white, but more marked for colours, especially for red and green. The scotoma is fairly regular in shape, and mainly confined to the area stretching from the disc to the macula—the area supplied by the papillo-macular fibres. In certain cases of toxic amblyopia, pathological changes have been demonstrated in those particular fibres.
3. Associated symptoms—tremulous tongue, tremulous hand, and dyspepsia.
4. Ophthalmoscopic examination is negative.

DIAGNOSIS.

The only condition liable to be mistaken for it is *Retro-Bulbar Neuritis*, but in this affection—

*a.* The condition may be unilateral, and if not, both eyes are not equally affected.
*b.* While the scotoma is present, its edges are less sharply defined.
*c.* The history of the case is a guide.

PROGNOSIS.

The prognosis is good, if treatment be properly carried out. Recovery, however, is slow, and may take one to two months, depending on the duration and severity of the case.

TREATMENT.

1. Remove the cause. The tobacco or alcohol should be stopped completely.
2. Rest the eyes.
3. The administration of general nervine tonics, *e.g.*, arsenic, quinine, iron and strychnine.

# HYSTERICAL AMBLYOPIA.

This may affect one or both eyes. It may be complete, even for perception of light, or may be only partial.

## Diagnosis.

1. The condition is indicated by the varying degree of contraction of field of vision. Two perimeter tracings taken consecutively show a marked variation.

2. *The pupil reaction test.*—This serves to distinguish the condition from one of Retro-Bulbar Neuritis. In hysterical cases, the reaction to light is present and well marked, whereas in Retro-Bulbar Neuritis it is absent or very defective.

3. In cases where only one eye is affected the judicious use of lenses in front of the sound eye may prove conclusively that the condition is functional. The following tests are of service :—

    *a. The diplopia test.*—By putting a prism with its base downwards in front of the sound eye, the patient may be tricked into stating that he sees double. If so, both eyes are functionally active.

    *b. The crossed diplopia test.*—Put a prism of 10° with its base outwards before the supposed blind eye. If this eye sees, it will rotate inwards for the sake of single vision—which a blind eye would not do.

c. *A high convex lens* being placed in front of patient's sound eye, he may be directed to read small print. While he does so, the print may be drawn beyond the far point of the lens. The sound eye will thus be thrown out of action, but the patient may still go on reading—this clearly indicating that the pretended blind eye is functionally active.

## ERYTHROPSIA OR RED VISION.

This is a condition in which for a varying period—a few seconds or a few minutes—all objects appear of a deep red colour, the vision otherwise being normal. It is met with for the most part after cataract extraction. The pathology of it is unknown. It is possibly due to persons seeing their own retinal purple. (Fuchs.)

Treatment should be carried out on general principles.

## HEMIANOPSIA.

DEFINITION.

Loss of sight of one-half of the field of vision.

It may be *absolute* hemianopsia, where there is loss of preception of light, colour, and form; or *relative* hemianopsia, where there is loss either of colour alone, or of colour and form combined.

VARIETIES.

*a.* Homonymous.

*b.* Heteronymous—temporal.

*c.* Transitory.

## Homonymous Hemianopsia.

This is the commonest variety. In it the patient is unable to see objects on one or other side of him. Thus, in a case of right-sided homonymous hemianopsia, the patient does not see objects on his right, this being due to the left half of each retina being inactive. Further, this variety is occasionally found as a superior or inferior hemianopsia, in which only the upper or lower quadrant of the field is defective.

## Temporal Hemianopsia.

Here there is loss of vision on outer side of each field, due to the loss of power in the median half of each retina. The prognosis in this form must be guarded, as the lesion may be a progressive one.

## Transitory Hemianopsia.

A temporary condition, lasting a few seconds or minutes, often accompanied by luminous sensations, and followed by severe megrim headache. Occasionally, vertigo, sickness, and even slight aphasia may be present.

Treatment should be directed to the cause of the megrim.

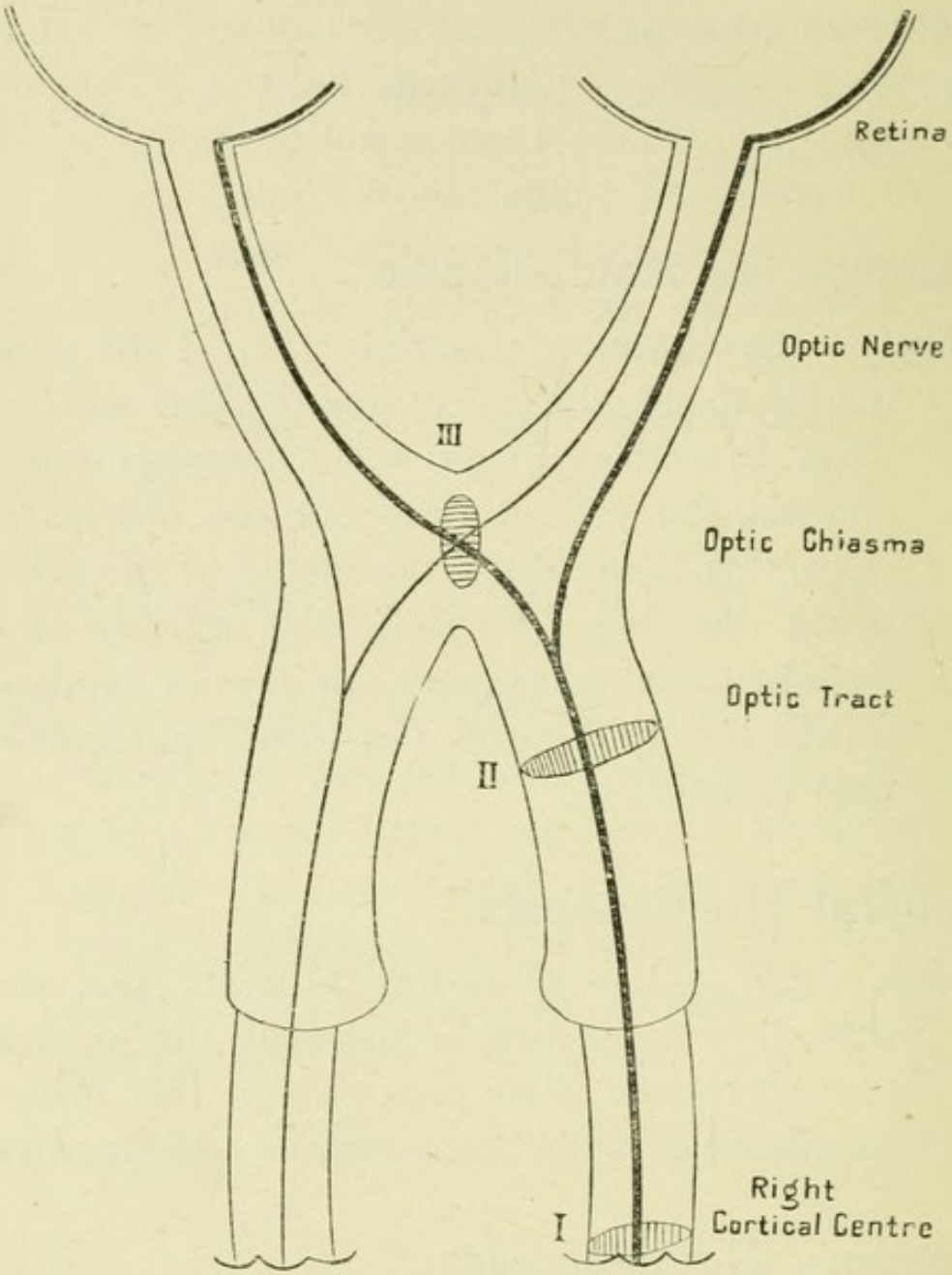



FIG. 20.

No. I. Lesion of Right Cortical Centre, causing Left Homonymous Hemianopsia.

No. II. Lesion of Right Optic Tract, causing Left Homonymous Hemianopsia.

No. III. Lesion of Chiasma, causing Bitemporal Hemianopsia.

LOCALISATION OF THE LESION.

*The half-vision centre* is situated in the occipital lobe, in some part of its mesial surface. From it, fibres pass through the optic radiation, pulvinar of optic thalamus and optic tract, to the temporal portion of one and the nasal portion of the other retina. It will thus be readily understood that the lesion causing a hemianopsia may be anywhere between the half-vision centre and the termination of the optic tract. (Fig. 20.)

The following classification is useful :—

*a.* Cortical lesion, in the occipital lobe or angular gyrus.

*b.* Subcortical lesion, in the optic radiation.

*c.* Central lesion, in the pulvinar of optic thalamus, and adjoining portion of internal capsule.

*d.* Basal lesion, in the optic tract.

*The following points may assist a differential diagnosis :—*

1. Cases due to a cortical lesion are not uncommonly associated with mind blindness, word blindness, or aphasia.

2. Central cases may be associated with evidence of involvement of some fibres of internal capsule.

3. Basal cases may show a peculiar pupil symptom known as Wernecke's pupil symptom. This symptom is the absence of contraction of the pupil when light is thrown on the amaurotic half

of the retina, and it is due to the fact that, as the lesion is on the distal side of the corpora quadrigemina, the impulse cannot reach Meynert's fibres which pass from the corpora to the centre for the third nerve. (*Vide* page 99.)

It must, however, be noted that it is frequently impossible to accurately locate the site of lesion in given cases, and that even after careful survey of all the symptoms.

## COLOUR VISION AND COLOUR BLINDNESS.

The colour sense is the power the eye has of distinguishing light of different wave lengths. There are two main theories of colour vision—

*a.* The Young-Helmholtz theory. There are three sets of colour-perceiving elements, one each for *red*, *green* and *blue or violet.*

*b.* Hering's theory of colour sense. The colour sense is dependent on chemical changes in the retina, in which there are three different "visual substances"—(*a*) a white-black ; (*b*) a red-green ; (*c*) a blue-yellow : all variations of colour are produced by the using up or restoration of these substances.

The accepted tests for colour vision are based on the Young-Helmholtz theory. These tests consist in the differentiation of different coloured wools, the patient

being asked not only to name the different colours, but also to match them from the selection of samples presented. The usual tests are as follows :—

1. Show the patient a *pale pure green* and request him to pick out from the box of samples all those similar. If he can do so his colour vision is normal, but if he has difficulty he may pick out a grey, straw-coloured, or buff-coloured skein. These are known as confusion colours.

2. Next show him a *pink* (violet), which is a combination of blue and red. If he is "red blind" he will pick out blue and violet samples, and if he is "green blind" he will pick out green or grey.

3. Next show him a *red*, and if he is "red blind" he will pick out a lightish green and darkish brown, and if he suffers from "green blindness" he will also select a green and a brown, but a darker green and lighter brown than in "red blindness."

Red blindness and green blindness always go together.

Colour blindness may be congenital or acquired; the latter is present in optic atrophy, and in toxic amblyopia.

## CHAPTER XIX.

### Diplopia—Paralysis of the Ocular Muscles.

---

# DIPLOPIA.

Some defect in the ocular muscles may be evident on mere inspection, or may only reveal itself by the diplopia or double vision to which it gives rise. The simplest way of proving the existence of diplopia is by the use of a candle flame held about ten feet distant from the patient. A coloured glass is put in front of one eye. If double vision is present two flames are seen, one of which is coloured, and the surgeon knows to which eye the coloured image corresponds. This test must be applied in nine different positions, viz., straight in front, and on either side, both above, below, and in intermediate positions.

When diplopia or double vision is complained of the images may be double, *laterally*, *vertically*, or *torsionally*, or all three combined. These various displacements result from the disturbed relationship between the various muscles. Fig. 24 illustrates the nine different positions to be tested, and also the different displacements met with.

Regarding the appreciation of the nine different positions in which the eye should be tested for diplopia, it will assist the investigation if the following points in physiology are borne in mind:—

1. The inferior oblique and superior rectus are concerned in moving the eye upwards.
2. The superior oblique and inferior rectus are concerned in moving the eye downwards.
3. The internal and external recti are concerned in moving the eye inwards and outwards.

In the various forms of ocular paralysis a faulty projection of objects is frequently present, owing to the disturbed relationship in the action of the different muscles, and this faulty projection may give rise to giddiness.

Any condition which interferes with the impressions from external objects falling on *corresponding* points in the two retinæ may lead to double vision. The two maculæ are corresponding points, and points in the retina that are equi-distant from the macula are also corresponding points. In diplopia the impressions from a given object do not fall on corresponding points, and therefore two images are seen in place of one. Diplopia may be homonymous or crossed.

## Homonymous Diplopia.

Here the image seen to the *right* corresponds to the right eye, and the image seen to the *left* to the left eye. This form of diplopia is met with in

cases of paresis or paralysis of the muscles which turn the eye outward, viz. :—

External rectus.

Superior oblique, and

Inferior oblique.

Such a paresis or paralysis being associated with *excessive convergence* of the eye. (Fig. 21.)

## Crossed Diplopia.

Here the image of the right eye appears to the left, and that of the left eye to the right. It is met with in cases of paresis or paralysis of the muscles which turn the eye inwards, viz. :—

Internal rectus.

Superior rectus, and

Inferior rectus.

This condition being associated with *excessive divergence* of the eye. (Fig. 22.)

How are these different forms of diplopia brought about? Why is the false image crossed in some forms of paralysis and not in others? The explanation is as follows :—The eyes naturally acquire the habit of mentally projecting images lying on the nasal side of the centre of the retina laterally, *e.g.*, in Fig. 21 the image C in the right eye is projected to the right (homonymous diplopia). They further acquire the habit of mentally projecting images lying to the temporal side of the centre of the retina medially, *e.g.*, in Fig. 22 the image C in the right eye is projected to the left (crossed diplopia).

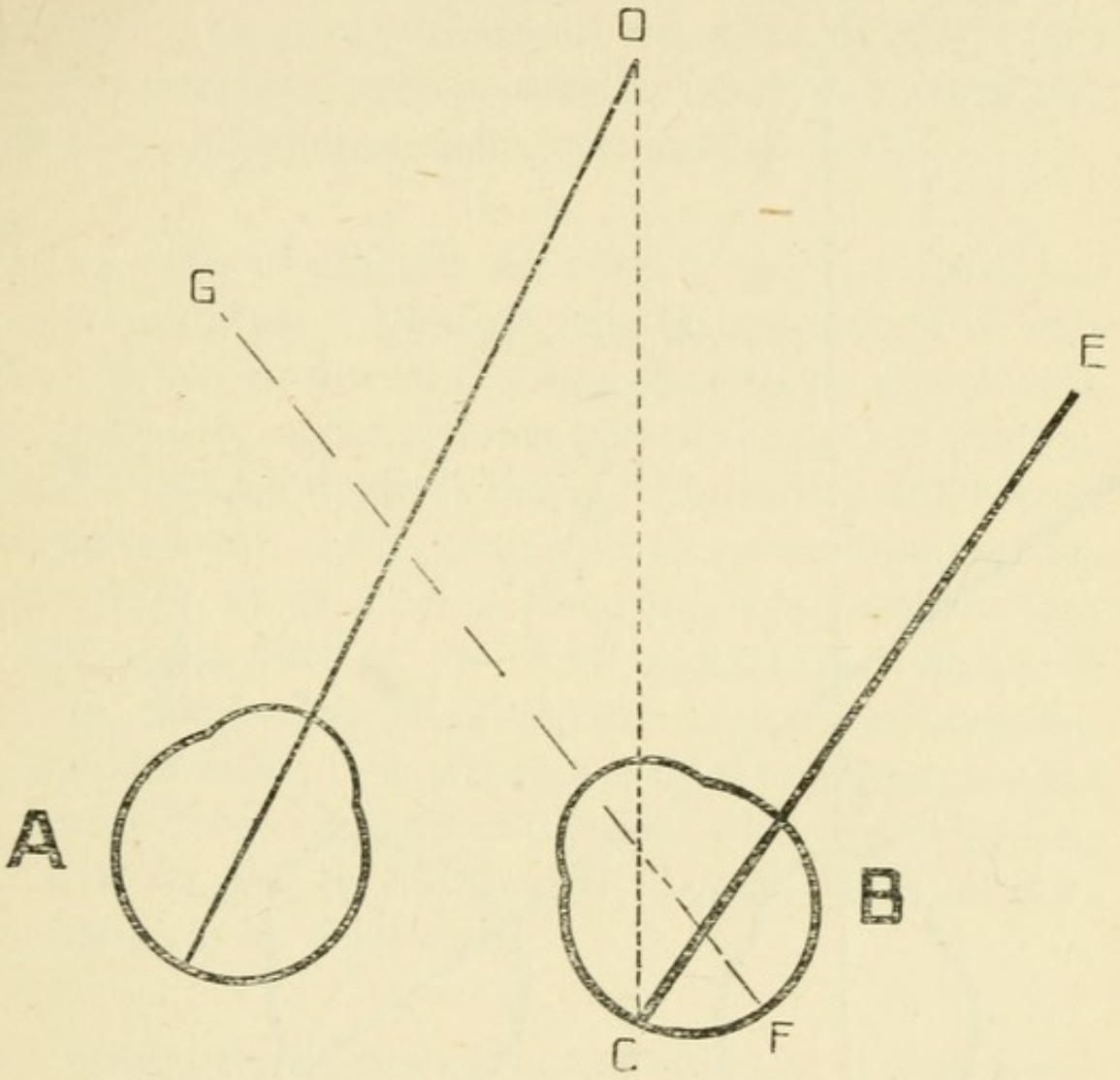



FIG. 21 (AFTER GRAEFE).

A = the fixing eye.

B = the squinting eye in a state of convergence.

G F = the visual axis of B.

NOTE.—1. O = the object fixed by the fixing eye.

2. C = the position of the image of O on the squinting eye.

3. C E = the direction in which the right eye projects the image of O.

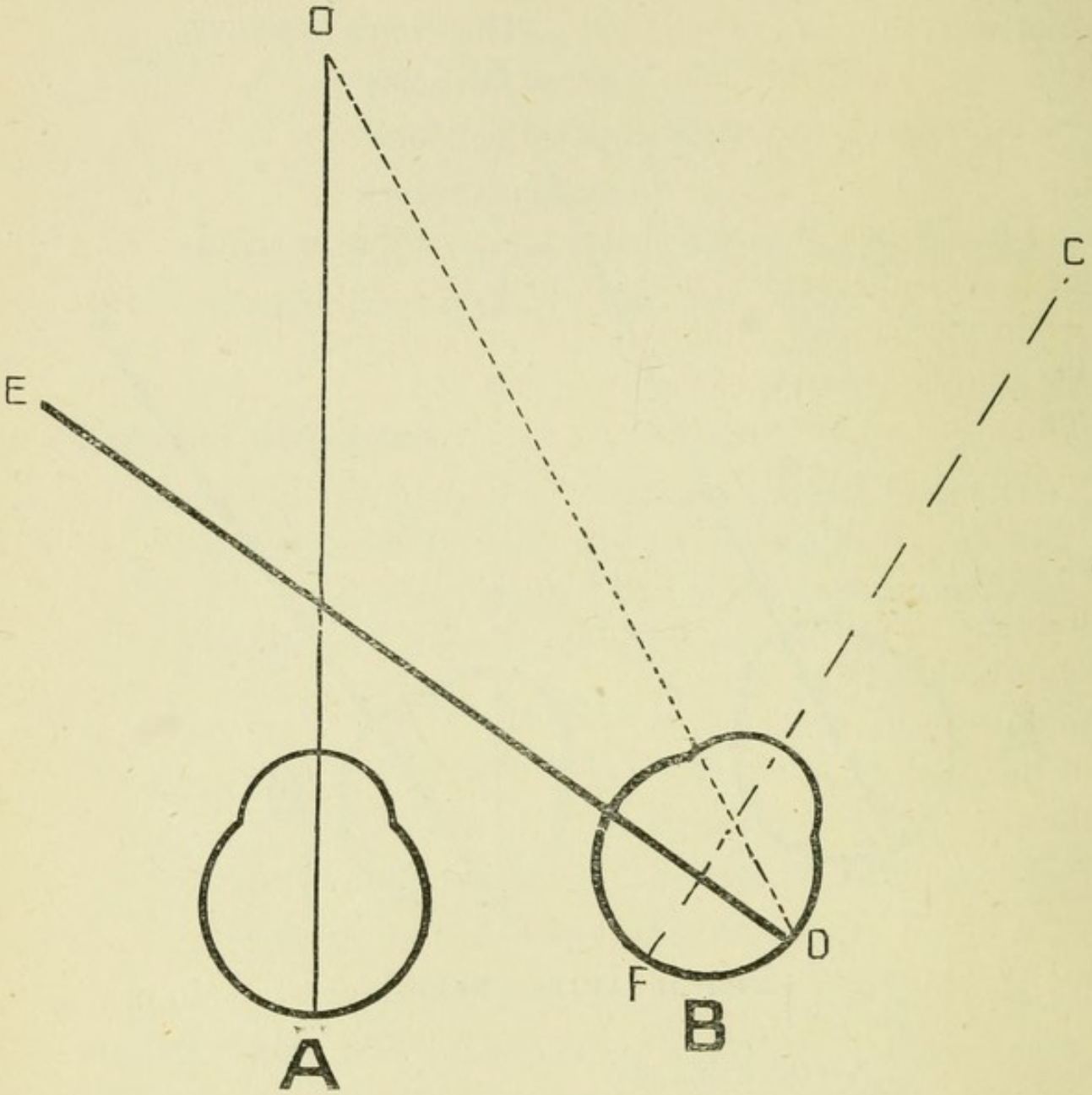



FIG. 22 (AFTER GRAEFE).

A = the fixing eye.

B = the squinting eye in a state of divergence.

C F = the visual axis of B.

NOTE.—1. O = the object fixed by the fixing eye.

2. D = the position of image of O in the squinting eye.

3. D E = the direction in which the right eye projects the image of O.

As already mentioned then, homonymous diplopia is met with in cases of paralysis of the muscles which turn the eye outwards, such a paralysis being associated with excessive convergence of the eye, and *vice versâ*.

In all cases of diplopia the false image is referred too near the observer. Diplopia may be complained of only when the patient directs the eyes upwards or downwards, viz., only in the upper or lower part of the field of fixation. Thus, in looking upwards the superior rectus and inferior oblique are called into play, and therefore diplopia, due to paresis of one or other of these muscles, is only present in the upper part of the field of fixation. Again, in looking downwards the inferior rectus and superior oblique are called into action, and therefore diplopia, due to paresis of one or other of these muscles, is only present in the lower part of the field of fixation—that is, when the patient looks downwards.

In investigating cases of double vision, it is well to put the coloured glass in front of the eye which fixes. The following points should be systematically noted:—

*a.* Is the diplopia *homonymous* or *crossed?*

*b.* Is the false image displaced vertically, that is, is it on a higher or lower level than the true? If so, the diplopia is spoken of as *vertical.*

*c.* Is the false image upright or placed obliquely to the true one? If placed obliquely, the diplopia is spoken of as *torsional.*

*d.* Under what circumstances does double vision exist? Thus—

1. Does it exist over the whole field of fixation? This is characteristic of paralysis of third nerve.

2. Is it only on one side of the field of vision? This is characteristic of paralysis of the sixth nerve.

3. Is it present only in the upper part of the field of fixation, that is, when patient looks upwards? This is characteristic of paralysis of sup. rectus.

4. Is it present only in the lower part of field of fixation, that is, when patient looks downwards? This is characteristic of a lesion affecting superior oblique.

## THE SCALE DIPLOPIA TEST.

The scale test devised by Maddox (page 189), is applicable for the estimation of the degree of diplopia. The patient is directed to stand six metres distant, and a red glass having been put in front of the defective eye, he is directed to look at the lighted candle in the centre of the scale. The patient will see two candles, the flame of one of them—the one corresponding to the defective eye—being red in colour. This false image is displaced laterally, and the degree of displacement is reckoned from the position of the false image on the graduated scale.

## Method of determining the particular nerve affected.

The position of the false image tells one the direction and amount of deviation, if it is borne in mind that the false image and the cornea deviate equally and in opposite directions. A good working formula (Priestley Smith) is as follows :—

*a.* Ascertain in which direction the images stand furthest apart; the inefficient muscle is one of those which normally turn the eye in this direction.

*b.* Ascertain which image belongs to which eye—the inefficient muscle belongs to the eye whose image stands farthest in the said direction.

## Paralysis of Third Nerve.

The third nerve supplies all the external muscles of the eye except the external rectus and the superior oblique. It also supplies the ciliary muscle and the circular fibres of the iris. The symptoms present in paralysis are therefore—

1. Ptosis.
2. Misdirection outwards of the eye, due to uncontrolled action of external rectus.
3. Inability to move the eye upwards, inwards, and downwards.
4. Impairment of near vision.
5. Dilatation and immobility of the pupil.

6. On elevation of the eyelid—double vision *over the whole field of fixation.* The diplopia is crossed, vertical, and torsional.

Paralysis of this nerve is very common and is frequently incomplete, one or more of the muscles supplied by it being alone affected. Paralysis of the internal rectus alone is one of the rarest forms of isolated paralysis, but in cases where the third nerve as a whole is paralysed, the paralysis of the internal rectus is usually more pronounced than that of any other muscle.

## Paralysis of Fourth Nerve.

The superior oblique directs the eye downwards and outwards, and also rotates it slightly inwards. Paralysis of the nerve supplying it is rare.

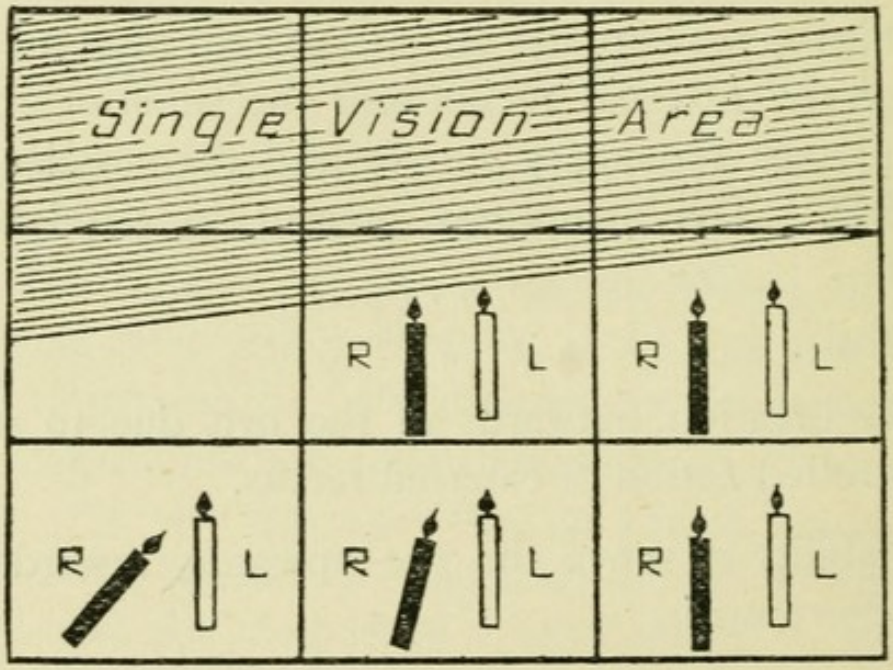



FIG. 23.—POSITION OF THE DOUBLE IMAGES IN PARALYSIS OF RIGHT SUPERIOR OBLIQUE.

*Evidence of Paralysis.*—There is restriction in the power of moving the eye downwards, most marked when the eye is directed inwards. Double vision exists, but only when patient looks downwards and to one side. The diplopia is homonymous, vertical, and torsional.

## Paralysis of Sixth Nerve.

This form of paralysis is characterised by inability to move the eye outwards. The eye may be brought a little past the middle line from the combined action of the two obliques, but the movement is an irregular one, as these two muscles are not accustomed to work in co-ordination. Patient complains of double vision—*homonymous diplopia.*

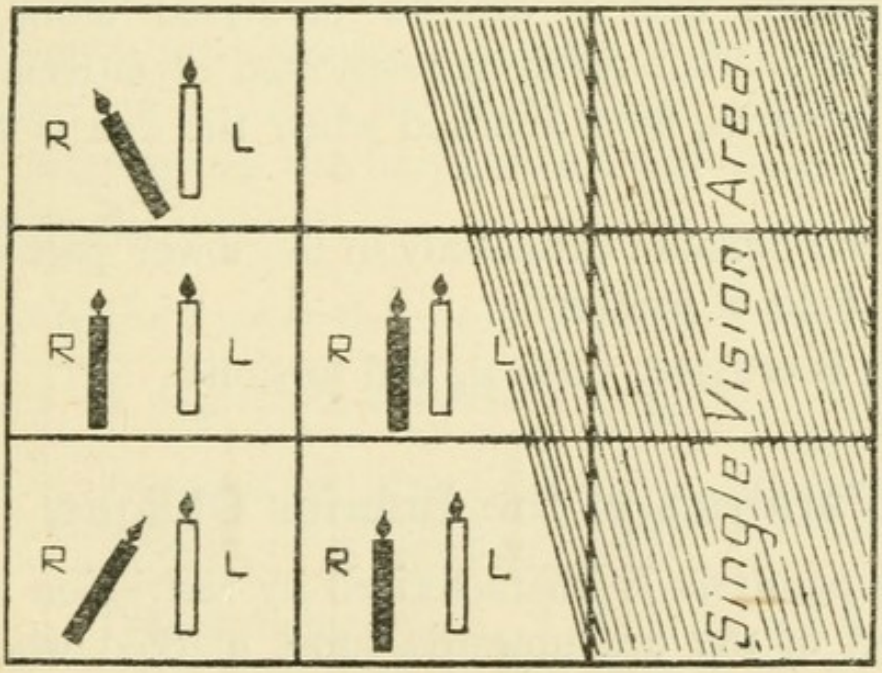



FIG. 24.—POSITION OF DOUBLE IMAGES IN PARALYSIS OF RIGHT EXTERNAL RECTUS.

This diplopia is only lateral, and (*e.g.*, in a case of paralysis of the right sixth) the separation of the images

increases with fixation to the right and diminishes with fixation to the left. The line of demarcation between the area of single vision and double vision is not straight (*vide* diagram).

## Paralysis of the Inferior Rectus.

This muscle is seldom paralysed alone. Paralysis is characterised by restriction of movement of the eye downwards, most marked when the eye is turned outwards.

1. The diplopia exists only in the lower part of the field of fixation.
2. It is crossed, vertical, and torsional.

## Paralysis of the Superior Rectus.

This muscle also is seldom paralysed alone. Its paralysis is characterised by restriction of movement of the eye upwards, most marked when the eye is turned outwards.

1. The diplopia exists only in the lower part of the field of fixation.
2. It is crossed, vertical, and torsional.

## Paralysis of the Inferior Oblique.

Such a paralysis is characterised by restriction in the movement of the eye upwards, most marked when the eye is directed inwards.

1. The diplopia only exists in the upper part of the field of fixation.
2. It is homonymous, vertical, and torsional.

## Paralysis of Associated Movements

This form of complicated paralysis is occasionally met with. The most usual form is paralysis of convergence, and in such cases the two internal recti are nevertheless capable of acting in association with the external recti. Other defects in associated movements are occasionally seen.

## Causation of Ocular Paralysis.

It may be due to a peripheral or central lesion. When due to a peripheral lesion, it may involve the nerve in the orbit or in some part of its course in the intra-cranial cavity. When due to a central cause, the lesion may be in the base of the brain, affecting the nucleus at the base of the fourth ventricle and aqueduct of Sylvius, or it may be situated in a part of the brain above the nucleus, the lesion intercepting the fibres which pass from the higher centres to the nucleus.

The following are the more common causes :—

1. A neuritis of rheumatic origin.
2. Pressure or atrophy from a tumour, hæmorrhage, or syphilitic growth.
3. Traumatism.
4. Locomotor ataxy or other degenerative spinal cord or basal lesion.
5. Congenital—a few cases appear to be due to congenital weakness.

## Prognosis.

The prognosis depends on the cause, and also on the length of time the paralysis has lasted. When the paralysis has lasted a year or so it will probably be permanent.

**Treatment.**—The treatment should be general and local.

*General.*—Consists in improving the general constitutional state, and specially treating the syphilis, rheumatism, or chronic nerve lesion.

*Local.*—The value of local treatment will depend on the nature of the exciting cause. In suitable cases the following may be tried :—

*a.* Blisters to the temple.

*b.* Electrical stimulation of the weakened muscle.

*c.* Attempt to stimulate the weakened muscle by exercise, *e.g.*, make patient fix with his two eyes a definite object; get him to carry this object gradually further and further in the direction of the area of double vision, *at the same time endeavouring to fuse the two images.*

*d.* Operative treatment, advancement of the weakened muscle to improve the relative position of the paralysed muscle and its antagonist. This should not be done within a year of the onset of the paralysis.

## OPHTHALMOPLEGIA EXTERNA.

This is a rare condition, characterised by paralysis of all the external ocular muscles. It depends on a nuclear lesion of an inflammatory or degenerative type. No treatment is of any service.

## CONJUGATE PARALYSIS.

Conjugate paralysis is a paralysis of the external rectus on one side and the internal rectus on the other, these two muscles acting in co-ordination for movement of the eye to one side.

CAUSES.

1. It is usually a central lesion situated in the lateral portion of the pons involving the sixth nucleus on that side, and also involving the fibres passing from that nucleus to the third nerve on the opposite side.
2. It is frequently present in cases of hemiplegia where the lower centres have been cut off from the higher.
3. It may result from traumatism.

CLINICAL FEATURES.

*Patient is unable to turn the eyes to one side.* Further, the side to which he cannot move his eyes is the side on which the lesion exists. The diagnosis is usually easy—other symptoms usually indicating

the situation. Functional cases are occasionally met with, but in them the eyes are directed to the side on which an organic lesion would exist.

PROGNOSIS.

The prognosis is favourable when due to injury, recovery usually taking place within two months.

It is unfavourable when due to intra-cranial non-syphilitic lesions.

TREATMENT.

For the traumatic cases iodide of potassium internally and counter-irritation locally are useful. Otherwise treatment must be directed to the cause of the condition.

## STRABISMUS

OR

## SQUINT.

Strabismus is a condition in which when one eye fixes an object the axis of the other eye does not converge upon it. Cases of strabismus are classified as follows :—

1. **Paralytic strabismus.**
2. **Non-paralytic** or **concomitant** strabismus.

They are also classified thus—

*a*. Convergent strabismus—when the axis of the deviating eye is directed inwards.

*b.* Divergent strabismus—when the axis of the deviating eye is directed outwards.

A third method of classification is as follows :—

1. Manifest strabismus.
2. Latent strabismus—a squint which reveals itself only when one eye is covered. It is referred to later.

The majority of cases seen are non-paralytic in origin. They do not depend on any paralysis of the ocular muscles, and they are called concomitant because the deviation of the eye is the same in every direction of fixation. In cases due to paralysis of one or other muscle the deviation of the eye is not the same in every direction of fixation. In connection with the term deviation of the eye, two points must be noted—

1. The term primary deviation is applied to the deviation of the affected eye when the sound eye is used for fixation.
2. The term secondary deviation is applied to the deviation which occurs in the sound eye when the affected one is used for fixation.

In concomitant strabismus the primary and secondary deviations are the same, whereas in paralytic squint the secondary deviation is greater than the primary deviation.

To recapitulate, the essential points of distinction between a paralytic and concomitant squint are as follows :—

1. In the former the extent of the squint increases in certain directions of fixation.

2. In it also the secondary squint is greater than the primary.

3. Diplopia is present in cases of paralytic squint and is not met with in concomitant cases.

A squint is said to be *absolute* when it exists for all distances of fixation, that is, when the patient looks both near at hand and far away. It is said to be *relative* when it exists only for near or distant fixations but not for both.

## Convergent Strabismus.

Convergent strabismus is commonly associated with hypermetropia. A hypermetrope in order to see clearly at any given distance must make a greater accommodative effort than is normal for that distance, and as accommodation and convergence go together, the hypermetrope tends to converge for a nearer point than that at which he desires to look. Anything which tends to over-convergence will in time tend to bring about a convergent strabismus, and this accounts for the frequency of the condition in cases of hypermetropia.

### Period of Onset and Course.

It commonly begins in childhood, when the eye is first used for near objects, as in learning to read or write. In the early period of its development it is *periodic*, being present only when the eye is engaged for near work, and it varies with the accommodative efforts made. Further, at this

period it is not infrequently alternating, affecting one or other eye according to the position of the object looked at, *e.g.*, if the object is to the right, patient fixes with the right eye and squints with the left, and *vice versâ*. Later, it becomes permanent, and the patient uses the better eye to fix and squints with the worse. If one eye is astigmatic, or the seat of a corneal opacity, or is otherwise at a disadvantage as regards distinct impressions falling on the retina, that eye will be the one to squint. The vision in the misdirected eye is suppressed so as to prevent the discomfort of double vision. Diplopia is not present in concomitant strabismus.

*Other points in the Ætiology.*

A squint occasionally develops during an attack of whooping cough, measles, or other acute illness, and also in cases where there is very little if any hypermetropia present. In such cases the condition results from a disturbance of the higher controlling centres in the brain. In a small proportion of cases convergent strabismus is associated with myopia. This may be accounted for by the fact that myopes after prolonged convergence exhibit a tendency to keep up the convergence.

## Divergent Strabismus.

Divergent strabismus is usually associated with myopia, and for the following reason :—A myope, to look

at an object at any given distance, needs to make a smaller accommodative effort than a normal-sighted person, and indeed he may see best by avoiding accommodation altogether. With this lessened accommodation there is associated an insufficient effort of convergence, and in high degrees of myopia the degree of this insufficiency may give rise to a slight but manifest divergent strabismus. Another contributing cause is found in the fact that the elongated form of a myopic eye offers an obstruction to its rotation in any given direction, and accordingly for near work the myope has to bring objects very near to the eye, and thus maintains a marked degree of convergence, the difficulties of the position become very marked. The result is that in a proportion of cases, binocular vision is given up, and the patient only uses the better eye, the worse one diverges and becomes amblyopic. The state of divergence is to the squinting eye the position of rest.

### Diagnosis and Estimation of Strabismus.

The asymmetrical position of the corneal reflex is a delicate test for squint, and is useful in doubtful cases. In performing it the patient is directed to look at a lighted candle held a short distance away from him, and the position of the reflection of the light on the two corneæ is noted.

In young children the condition of epicanthus may simulate convergent strabismus. In this condition there is a redundant fold of skin between

the eye and nose, and this fold overhangs the inner canthus and conceals most of the whites of the eyes to their inner side, thus inducing an appearance like strabismus. This appearance is at once removed by pinching up the skin at the root of the nose.

The degree of squint may be estimated by the scale test devised by Maddox. This consists of placing patient one metre or forty inches distant from a scale, the centre point of which is marked zero and the outer ends forty-two, the figures representing degrees. The figures on one side of zero are marked red, those on the other side black. At zero there is an arrangement for suspending a lighted candle, the flame of which must be on a level with the markings. The patient is then directed to look at the candle, the observer at the same time placing himself in such a position that he can observe the position of the images of the flame on the two corneæ. The observer will then note that the image of the flame on the eye that is fixing falls slightly internal to the centre of the cornea. That is as it should be. On the deviating eye, however, the position of the image will vary according to the amount of deviation present. The observer then guesses the figure on the scale to which the patient must direct his eyes in order that the image on the deviating eye may fall on its normal position. When the image has fallen in its normal position the number on the scale gives the degree of squint.

## Latent Strabismus.

This is a squint which reveals itself when one eye is covered. In a certain proportion of cases affected with strabismus, the desire for single vision is so strong that the patient makes an extra effort to bring the eyes to bear in the same direction. In consequence of this there is a marked muscular strain which produces symptoms of asthenopia (muscular asthenopia). The existence of this latent squint may be detected by the glass rod test devised by Maddox, the principle of which is so to alter one of the images that there is no longer any desire on the part of the patient to combine the two images. The presence of a latent squint and its degree may be determined by the Maddox scale test. The patient is directed to stand six metres distant and look at the lighted candle, care being taken that his head is perfectly straight. The red glass rod is then placed in front of one eye. The patient will now see two images, one of which is elongated into a long streak of red light. The position of this streak on the scale shows the nature and degree of the latent squint.

### Treatment.

In cases of paralytic squint treatment must be directed to the cause.

In concomitant strabismus the treatment is as follows :—

*a.* In the early stages—suitable glasses may cure by inducing a normal accommodative effort.

*b.* In the later stages — operative measures, tenotomy or advancement, followed by glasses.

As regards operative measures, two points should be noted—

1. Do not operate on a child under five years of age.
2. The younger the child the less should be done at the operation.

THE FOLLOWING POINTS TAKEN SYSTEMATICALLY ASSIST THE DIAGNOSIS AND PROGNOSIS :—

1. Ascertain whether the squint is paralytic or concomitant; in other words, do the eyes move unequally or equally when the patient looks in different directions?
2. Does the squint always remain in the same eye, or is it alternating?
3. Is the squinting eye able or unable to fix an object when its fellow is covered?
4. Is there any visible cause for defective vision, such as opacity of the cornea or disease of the fundus?
5. Examine the refraction by retinoscopy.
6. Was the onset associated with any obvious disturbance of the nervous system, *e.g.*, a fright, whooping cough, measles, or other illness?

*Will spectacles cure the squint?*

It is often impossible to speak definitely on this point. Cases that are periodical, and also alternating cases, are the most promising, and usually yield to glasses if constantly worn. It should be noted, however, that if the deviating eye fail to right itself when its fellow is covered, glasses will not cure. Spectacles act beneficially in two ways—

*a.* By lessening the excessive convergence.

*b.* By sharpening the retinal pictures—thus aiding single vision.

## CHAPTER XX.

### INTRA-OCULAR TUMOURS, NYSTAGMUS, CONGENITAL ABNORMALITIES.

---

# INTRA-OCULAR TUMOURS.

INTRA-OCULAR tumours are met with affecting the choroid and retina. There are two main forms—

1. Sarcoma of choroid and ciliary body.
2. Glioma of the retina.

Both of these tumours tend to secondarily invade the orbit. The former is a disease of adult life; the latter is an affection of infancy and early childhood.

# SARCOMA OF CHOROID AND CILIARY BODY.

This is a disease of adult life. The course of the disease is usually divided into the following four stages:—

1. A period of quiescence.
2. A period of irritation or inflammation.
3. A period of extra-ocular growth.
4. A period of metastasis.

*The Period of Quiescence.*—This is characterised by more or less impairment of vision without symptoms of irritation. This stage may last for a year or eighteen months.

*The Irritative, Inflammatory, or Glaucomatous Stage.*—This stage is characterised by symptoms of irritation and pain in the eye and associated increased tension. These symptoms may develop very suddenly. The ophthalmoscopic appearances vary with the stage of the disease. Detachment of the retina is produced early in the disease. The duration of this stage is usually less than a year.

*The Period of Extra-Ocular Growth.*—The tumour usually perforates posteriorly in the region of the optic nerve, or anteriorly through the sclera near the cornea. If perforation takes place anteriorly, the tumour ulcerates and is attended by a purulent discharge.

*The Final Stage of Metastasis.*—Other organs and tissues become involved. The liver is usually the first organ affected.

**Diagnosis.**—The diagnosis is often difficult in the earlier stages. The condition must be differentiated from—

*a.* Idiopathic detachment of the retina.

*b.* Idiopathic glaucoma.

From Detachment.

1. The tension is usually increased in sarcoma and diminished in detachment.

2. Central vision is better in cases of tumour than in cases of detachment, provided the site of growth is peripheral.

3. The defect in the field of vision is more sharply defined in the case of a tumour.

From Glaucoma.

*a.* In glaucoma the symptoms of irritation and increased tension occur with loss of vision, while in sarcoma the loss of vision precedes the irritative symptoms.

*b.* In glaucoma the symptoms intermit; in sarcoma they are constant.

### Prognosis.

The prognosis as to complete cure is hopeful if early removal be effected, and the optic nerve and tissues show no signs of involvement. In the third stage local recurrence is frequent, and metastasis has almost certainly taken place.

## GLIOMA OF THE RETINA.

Glioma of the retina is met with in infancy and early childhood. As the affection is a painless one, cases are not usually seen in their early stage. The growth of the tumour is usually rapid and accompanied by marked

constitutional disturbance, and later, emaciation. On examining the eye in the early stages, there is a peculiar bright metallic reflection seen from the interior. Detachment of the retina occurs early in the disease, and later, all the symptoms of secondary glaucoma are developed. Three stages of the disease are described :—

1. *The Quiescent or Non-irritative Stage.*—Characterised by blindness, and the peculiar whitish reflection from the interior of the eye already referred to.

2. *The Glaucomatous Stage.*—Characterised by symptoms of irritation and inflammation. Such cases are frequently not seen till the optic nerve has become more or less involved in the tumour growth.

3. *The Period of Extra-Ocular Growth.*—Characterised by perforation of the cornea or sclera, marked involvement of the orbital tissues, and enlargement of the nearest lymphatic glands.

## Prognosis.

The prognosis is on the whole bad. About 20 per cent. of cases make a good recovery after removal of the eye. The prognosis depends on the involvement of the optic nerve or orbital tissues. On removal of the eye the optic nerve should be carefully examined to see whether removal of the nerve is necessary. If at all gelatinous looking, it should be removed.

## PSEUDO-GLIOMA.

A condition which presents closely similar appearances to those seen in glioma. Here, however, the primary condition has been an inflammation of the iris and choroid with secondary involvement of the vitreous. On close examination, adhesions of the iris can usually be made out, *and tension is usually reduced.* If in doubt regarding such a case, the eye should be enucleated.

## NYSTAGMUS.

This is a condition characterised by involuntary oscillatory movements of the eye. The movements are usually lateral, but they may be vertical or rotatory. The pathology of the condition is obscure. It is met with under the following circumstances :—

1. It is seen in most cases of *paralysis of the external muscles* of the eye when the eye is moved in the direction of the weakened muscle. In these cases, however, its occurrence is of no imporance.

2. It is found occasionally as a *congenital condition*, and in these cases probably depends on defective education with resulting disturbed co-ordination of the centres concerned in the movements of the eye.

3. It is found in association with pyramidal cataract, and is then indicative of *previous ophthalmia neonatorum.*

4. In diseases of the central nervous system, *e.g.*, multiple sclerosis. Here the nystagmus probably depends on a lesion of the nerve centres.

5. *In miners* the condition is not infrequently seen, but in them the nystagmus is mainly present when they are directed to look in an upward direction, and it is further accompanied by the subjective sensation of rapid movement of external objects. In them it probably results from the straining of the ocular muscles when at work, and with rest it usually soon passes off.

## CONGENITAL PECULIARITIES.

### Congenital Cataract and Congenital Amblyopia

have already been referred to.

### Congenital Malformations of the Cornea.

These are rare. The following are met with :—

*a.* Microcornea—when the cornea is unduly small.

*b.* Macrocornea—when the cornea is unduly large.

*c.* Congenital opacity of the cornea.

The two former are usually accompaniments of a more general state of microphthalmos or macrophthalmos respectively.

### Congenital Anomalies of the Iris.

*Coloboma Iridis.*

A deficiency in the iris due to non-closure of the fœtal fissure. The coloboma may be small or

large, and it may be total or partial. A total coloboma is that form where the deficiency exists right back to the ciliary body. The lower part of the iris is the part which is usually deficient. Occasionally the coloboma is bridged, closure having occurred at an intermediate point. The condition is usually bilateral, and accompanied by a similar defect in the choroid or lens.

*Aniridia.*

Congenital absence of the iris. It is due to some defect in development, the exact nature being unknown. The appearance presented is like that of maximum dilatation of the pupils. It is usually associated with some defect in the lens, either of the nature of an opacity or displacement. Nystagmus is sometimes present.

*Persistent Pupillary Membrane.*

In fœtal life the pupillary membrane stretches across the pupil. All that permanently remains of it in later life is the endothelial layer of the iris. Occasionally, however, a few fine threads may remain stretched across the pupil, or there may be a larger portion of it adherent to the capsule of the lens, having filaments of attachment to the iris. In this latter case vision may be very defective.

## Congenital Anomalies of the Lens.

Coloboma of the lens is a very rare congenital defect, and when present is associated with a similar condition in the choroid.

Lenticonus is a rare congenital peculiarity, characterised by a conical protrusion of the central part of the lens.

## Coloboma of the Choroid.

This is a rare congenital deficiency found usually in the lower and inner part of the fundus. The retina at the part is usually absent, and there may be a similar defect in the iris or lens. On ophthalmoscopic examination there is seen a brilliant white reflection from the area of the coloboma, and over this area may be seen some ciliary and retinal vessels.

## Congenital Pigmentation of the Retina.

This is a rare condition characterised by the presence of pigment spots at some part of the retina.

# CHAPTER XXI.

# OPERATIONS.

---

## Preliminary Remarks.

*Cocaine* is invaluable as a local anæsthetic. A few drops of a 4 per cent. solution, dropped into the eye every few minutes for a quarter of an hour or twenty minutes, will in the great majority of cases be followed by complete anæsthesia of the cornea.

*A good light* is essential for all operations. Daylight is the best when possible, but if that is not available, the small lamp introduced by Priestley Smith is a very serviceable substitute.

*The patient's head* must be firmly held. This may be done by an assistant taking a hold of each ear.

*The instruments* must be thoroughly clean, and the knives sharp.

*The operation* must be carried out with strict aseptic precautions. Corrosive sublimate solution 1 in 3000, and boric lotion are especially useful. The surface of the eye should be thoroughly bathed with the corrosive solution preliminary to the operation.

## PERITOMY OR SYNDECTOMY.

The operation of peritomy is performed in some cases of chronic inflammation of the cornea or sclera. It is performed with fixation forceps and a pair of scissors. A portion of the conjunctiva immediately surrounding the cornea, about a quarter of an inch broad, is seized with the forceps and snipped off with the scissors. A complete circle of conjunctival tissue may be thus removed; in many cases the removal of a limited band suffices.

## SCLEROTOMY.

The operation of sclerotomy consists in making an opening through the sclera into the anterior chamber as far back as possible. It is sometimes employed in the treatment of glaucoma. The operation can be performed in several ways, one of the best being by making the incision with a large keratome. Prolapse of the iris must be prevented by the previous use of eserine, and, at the operation, the use of the caoutchouc spud. Eserine must be continued during the healing process.

## IRIDECTOMY.

The operation of iridectomy is performed under many circumstances, and for different objects, the more important being as follows:—

*a*. For the formation of an artificial pupil in cases of corneal opacity, or in cases where the pupil is occluded by adhesions.

*b.* For its beneficial effect on some forms of inflammation, especially recurrent iritis, irido-choroiditis, obstinate scleritis and hypopyon.

*c.* As a curative or palliative measure in glaucoma.

*d.* In cases of cataract, either as a preliminary iridectomy to bring about artificial ripening, or more particularly, at the time of operation, to facilitate the removal of the lens.

## THE OPERATION.

The instruments required are—spring speculum, fixation forceps, keratome, iris forceps, fine curved scissors, and an iris repositor.

The eye being well under the influence of cocaine, and its surface having been freely douched with 1 in 5000 corrosive sublimate solution, the spring speculum is introduced. The conjunctiva is then laid hold of with the fixation forceps, and the eye thus fixed. An incision is made with the keratome at the corneal margin, the point of the knife being carried well through into the anterior chamber, and then withdrawn. A complete escape of aqueous humour accompanies the withdrawal. Thereafter the iris forceps are introduced closed, and when opposite the iris they are opened, and a small or large part of the iris is laid hold of, drawn out through the incision, and snipped off with fine curved scissors. Should a very small iridectomy be required, a blunt iris hook made of platinum or soft silver is used.

The subsequent treatment consists in seeing that the cut edges of the iris are left even and regular. This is done by smoothing down the cut surfaces by means of the iris repositor in the form of a tortoise-shell spud. The dressing consists in the application of a piece of lint soaked in 1 in 2000 corrosive, and a pad of wool and a bandage. This dressing may be removed on the following day.

## IRIDOTOMY.

Iridotomy or the scissors operation is performed in cases where the pupil has become occluded owing to iritis after extraction. The instruments required are—fixation forceps, narrow keratome, and iridotomy scissors (Wecker's).

The conjunctiva having been fixed with the fixation forceps, the keratome is introduced into the anterior chamber, close to the corneo-scleral margin. A free incision should be made. After withdrawal, the iridotomy scissors are introduced, one blade being made to pierce the iris and pass well underneath it, the other being above it. Then, by a firm snip, the intervening tissues are divided, and the scissors withdrawn closed.

## CATARACT EXTRACTION.

The instruments required are—a spring speculum, fixation forceps, knife (Von Graefe), cystotome, iris forceps, fine curved scissors, tortoise-shell scoop, and

tortoise-shell spud. A wire vectis should also be at hand for the removal of the lens, should it become dislocated, or in the event of there occurring an escape of vitreous humour.

The steps of the operation are as follows :—

*a.* The incision AT OR JUST WITHIN the corneo-sclerotic junction. When made in the latter position, it is spoken of as the corneal incision.

*b.* The performance of an iridectomy.

*c.* The laceration of the capsule of the lens.

*d.* The removal of the lens.

*e.* The toilet and dressing.

## DETAILS OF THE OPERATION.

*The Incision.*—The surgeon having fixed the eye by seizing hold of the lower part of the conjunctiva with the fixation forceps, proceeds to make the corneal incision. The point of the Graefe is introduced through the corneo-sclerotic junction at a point corresponding to the junction of the middle and upper third of the cornea, and having pierced the cornea, the point of the blade is carried transversely across the anterior chamber, and a counter puncture made at the corresponding part of the corneo-sclerotic junction on the other side. The patient is then directed to look towards the ground, when the knife is cut out with a gentle sawing motion just at or a little below the corneo-scleral margin.

*The Iridectomy.*—The iris forceps are then introduced through the wound, and a small part of the iris is brought out through the wound and snipped off with scissors.

*The Laceration of the Capsule.*—The cystotome is then introduced, and its point is drawn across the surface of the lens so as to make an irregularly T-shaped opening in the capsule. The object of this is to allow of the easy removal of the lens.

*The removal of the lens is now attempted.* This is affected by gentle external pressure, the back of the scoop being applied to the lower part of the cornea. This gradually causes the wound to gape and the lens to become engaged in it, and by continuing the pressure further up the cornea the lens is finally extruded. After removal of the lens an attempt should be made to remove what cortical matters may still occupy the area of the pupil. In a few cases during the attempt to extrude the lens some of the vitreous escapes. When this occurs the speculum should be at once removed, and no further pressure put on the cornea, as that aggravates the escape of the vitreous without assisting in the escape of the lens. The vectis or lever is then used for the extraction. It is pressed well behind the lens, and withdrawn, thereby carrying the lens with it.

*The toilet of the operation* consists in douching the eye well with 1 in 5000 corrosive sublimate lotion, and seeing that the cut edges of the iris are smooth and regular, and the lips of the corneal

wound in good apposition. The spud is used to smooth out the edges of the iris. Thereafter a few drops of eserine, four grains to the ounce, are applied to the eye in order to contract the pupil and so diminish the tendency to prolapse of the iris through the corneal wound. The dressing is then applied. It consists in a piece of lint soaked in 1 in 2000 corrosive sublimate lotion, and over that two or three small pads of wool, and a bandage. Some surgeons cover both eyes. The patient is directed to lie on his back or on the sound side. The dressing is changed next day, and the eye is kept covered for three or four days, and thereafter shaded for a similar length of time. When there has been an escape of vitreous, extra care should be taken in the after-treatment.

## THE DOUBLE NEEDLING OR TEARING OPERATION.

In the majority of cases in which a cataract has been removed a further operation is called for. This is due to the fact that the area of the pupil is more or less occluded by a film of lens capsule which interferes with distinct vision. The operation consists in passing two needles through the film of lens capsule, separating their points, and thus pushing the capsule outside the pupillary area. This operation, which is known as *needling*, should not be done till at least three weeks after the extraction.

# OPERATIONS FOR CONGENITAL CATARACT.

The operation is commonly done in two stages, though in many cases one alone suffices. The two stages are—

1. Needling or discission.
2. Extraction of soft lens substance.

Before operating, the pupil should be well dilated with atropine. The eye having been fixed by seizing the conjunctiva with the fixation forceps, the handled needle is introduced through the periphery of the pupil and its point pushed down to the capsule of the lens. Thereafter by a suitable movement of the handle of the instrument, accompanied by a pushing of the needle further through the cornea into the lens substance, a vertical incision is made in the capsule of the lens. The needle is then slightly withdrawn, and by a similar manœuvre a horizontal incision is made in the lens capsule. The lens substance is then stirred up with the point of the needle, the object being to allow the aqueous humour to act on the whole of the lens substance and thus bring about its disintegration and absorption. The needle is then withdrawn and a moist dressing applied. The eye should afterwards be kept well under the influence of atropine in order to prevent adhesions between the iris and lens substance.

Frequently no further operation is called for, but when necessary, the second stage of the operation consists in

extraction of the soft lens substance. A triangular incision is made through the corneo-sclerotic margin into the anterior chamber by means of a keratome. The outer lip of the wound is then depressed by means of a small scoop, along which the aqueous humour and broken up lens substance are allowed to escape. It may be necessary to introduce the scoop into the anterior chamber in order to remove the lens substance and leave a clear pupil. A dressing is applied as before.

## OPERATIVE TREATMENT OF MYOPIA.

In cases of very high myopia, over 13 or 14 Dioptres, the removal of the lens by operation is followed by very beneficial results, provided the interior of the eye be healthy.

The operation is done in stages—

1. A needling operation, to lacerate the capsule of the lens and allow its disintegration by the aqueous.

2. Extraction of the disintegrated soft lens matter. This is performed in five or six days after the first operation, and it may have to be repeated. The steps in the operation have been described under Congenital Cataract.

# OPERATIONS FOR STRABISMUS.

## Tenotomy.

The instruments required are — a spring speculum, fixation forceps, pair of curved scissors, and a tenotomy hook. The operation here described is the one most used, and is known as subconjunctival tenotomy.

Cocaine having been applied to the surface of the eye and injected subcutaneously in the region of the insertion of the muscle to be divided, the speculum is introduced and the surface of the eye is freely douched with a solution of 1 in 5000 corrosive sublimate. The conjunctiva is then fixed with the fixation forceps, and the part of conjunctiva laid hold of is snipped through with the scissors till the point of the latter is well within the capsule of Tenon. They can be recognised to be within Tenon's capsule by the facility with which their point can be moved about. The strabismus hook is then inserted, and passed backwards till it hooks round the tendon, which is then divided. Care must be taken that all the fibres are divided. When all the fibres have been divided the hook can be brought straight forward to the corneo-sclerotic junction. A moist dressing is applied for a few hours.

## Advancement.

The steps in this operation are--

1. Exposure of the tendon by a free incision into the conjunctiva.

2. Passing of a threaded needle through the tendon, which is then divided.
3. Stitching the ends of the tendon to the conjunctiva further forward.
4. Stitching the original conjunctiva wound. A moist dressing should then be applied and kept on for twenty-four hours.

The operation of advancement is done in very bad cases of squint, and especially in those cases where a previously performed tenotomy has been inefficient to cure the condition.

## ENUCLEATION.

The instruments required are—spring speculum, fixation forceps, strong curved scissors, and strabismus hook.

The steps in the operation are as follows :—

1. Separate the conjunctiva all round at the corneo-sclerotic junction.
2. Divide the four recti and two oblique muscles.
3. Cause the eye to protrude, and divide the optic nerve.
4. Remove the eye and arrest hæmorrhage.

### DETAILS OF THE OPERATION.

It is done under chloroform, and with strict antiseptic precautions. The speculum having been introduced,

the conjunctiva at the corneo-sclerotic junction is seized with the fixation forceps, and snipped through with scissors at that point. It is then further separated from the eyeball, the same thing being done right round the corneo-sclerotic margin. The strabismus hook is then passed under the conjunctiva and the inferior rectus muscle is laid hold of and divided with scissors. The other muscles are similarly divided, the attachment of the two oblique being slightly further back than those of the recti muscles. All the muscles having been divided, the curved scissors, closed, are inserted behind the eyeball, which is thus caused to protrude. The scissors are then opened and the optic nerve is divided. The eyeball is thus pushed out of its socket, any remaining bands of connective tissue are divided, and the eye is removed. The hæmorrhage which follows is arrested by pressure with pledgets of cotton wool. The bleeding having ceased, the socket is thoroughly douched with 1 in 3000 corrosive sublimate solution. A simple dressing of lint soaked in the antiseptic solution, covered by a pad of wool, and firm pressure with a bandage, is left on for six or eight hours, when the dressing is taken off. An artificial eye should not be worn within a month.

With the view of obtaining a better socket, the method used by Bowman of approximating the two edges of the conjunctiva with a continuous suture is of great service. The suture is not tied in, the ends of it being brought up on to the forehead and fixed with sticking plaster. The use of this suture can only be carried out in cases which are not septic.

# EVISCERATION.

The operation of evisceration consists in the removal of the whole contents of the globe except the sclera. The stump left after the operation admits of a better movement in an artificial eye.

The instruments required are—speculum and fixation forceps, Graefe's knife, pair of scissors, blunt Volkman's spoon.

The first step in the operation consists in undermining the conjunctiva for a short distance all round the cornea. The anterior chamber is then transfixed by a section which completely separates the lower portion of the cornea from the sclera along the junction between them. The upper part of the cornea is then separated with scissors. The whole contents of the globe are now evacuated with the Volkman's spoon, nothing being left but the sclera. After the bleeding has been arrested, the edges of the conjunctiva only are united with sutures.

A modification of this operation, directed to diminishing the shrinking which takes place in the stump in the course of time, has been recommended by Mules. The modification consists in introducing a glass ball into the scleral cavity and uniting the conjunctiva over it. In some cases this operation has been very successful.

# OPERATIONS FOR ENTROPION.

Many operations are in use for the cure of entropion, both of the upper and lower lid. The ones here described for entropion of the upper lid are known as Streatfield's, Snellen's, and Van Millingen's operations.

**Streatfield's Operation.**—The principle of the operation is based on the fact that in cases of entropion calling for operative treatment, there is some hypertrophy, with abnormal curvature of the tarsal cartilage. The operation is known as grooving of the tarsal cartilage, and consists in the removal of a wedge-shaped piece of cartilage, the result being a straightening of the incurved cartilage, and better direction of the eyelashes.

*Steps in the operation.*—In the operation special clamp forceps are used, the narrow blade being external, the broad blade being placed between the eyeball and the lid. These forceps act beneficially in two ways, firstly, by stretching the tarsus, and secondly, by arresting the circulation.

1. An incision is made parallel to the margins of the upper lid, and at a distance of two or three millimetres from it, through the skin into the muscle.
2. A second incision is made higher up, two or three millimetres from the first, and joining it at either extremity.
3. The portion of skin thus marked out is removed, and with it the subjacent muscle fibres; the tarsal cartilage is now exposed.
4. The two incisions are then prolonged into the cartilage so as to meet near its lower surface, and a wedge-shaped portion of cartilage is removed.
5. After removal of the wedge the wound is allowed to cicatrise. The result attained is a straightening of the incurved cartilage, and a better direction of eyelashes.

**Snellen's Operation.**—The steps in this operation are as follows:—

1. A single incision is made through the skin and muscular fibres over the most prominent portion of the tarsus and parallel with the lid borders. The edges of this incision are then separated so as to lay bare a sufficient portion of the tarsus.
2. A wedge-shaped portion of tarsus is then removed as in Streatfield's operation.
3. Sutures are then used as follows—these sutures being the characteristic part of the operation:—

A silk suture with a needle at either end is prepared. One needle is passed *from within outwards* through the band of muscle and integument left at the margin of the lid. The other needle is then passed from *within outwards* through the centre of the upper lip of the wound in the tarsus, and then the same needle is passed from within outwards through the margin of the lid at a point about a quarter of an inch distant from the point of exit of the first needle. Three such sutures are employed. The ends of each of the three loops are knotted over pieces of thin drainage tubing or glass beads. After knotting, the ends of the threads are not cut short, but are turned up and secured to the forehead by plaster.

**Van Millingen's Operation.**—This consists in the transplantation of a strip of mucous membrane. An incision is made at the margin of the lid extending from the inner to the outer canthus, the edge of the lid being thus split into two parts, an upper and a lower. The upper is sutured at three places to the skin of

the lid further up. This suturing serves a double purpose, it keeps the gap open and also prevents the eyelid closing. A fold of mucous membrane taken from the lip and corresponding in size and shape is then applied to the bared surface. The dressing consists of a piece of lint covered with a thick layer of iodoform vaseline, and over this is placed a pad of cotton wool. Both eyes should be bandaged. The dressing need not be removed till the second day.

## OPERATIONS FOR ECTROPION.

Many operations are in use for the cure of ectropion, two of the most serviceable being Snellen's and Argyll Robertson's operations.

**Snellen's Operation.**—The object of this operation is to exert traction on the everted conjunctiva, so that it becomes permanently inverted and so restored to a more normal position.

The instruments required are—

1. Two strong silk threads, each with a needle at either end.
2. Two pieces of small drainage tube.

*The Operation.*—The one thread is used for the inner and the other thread for the outer half of the lid. One needle is made to perforate the everted conjunctiva at its highest point, and is then carried down below the skin and made to perforate the cheek as far as possible below the lid margin. The second needle of this thread is passed through in the same way at a little distance to the inner side of

the first, and similarly brought out through the cheek about a quarter of an inch distant from point of exit of the first needle. The other thread is then used in precisely the same way for the outer half of the lid. The ends of the loops are then firmly tied over the pieces of rubber tubing. The stitches are left in for several days, the number varying according to the severity of the case.

**Argyll Robertson's Operation.**—This operation is applicable in the more pronounced cases of ectropion. The object of the operation is to sling up the lower lid and keep it inverted by means of a belt of skin prepared and attached in the manner described. The following are the steps in the operation :—

*a.* An incision through the skin is made parallel to and immediately below the outer half of the edge of the lower lid. The incision is then carried outwards and slightly upwards for about half an inch. It is then carried downwards and slightly inwards so as to enclose a belt of skin, which is dissected off.

*b.* A suitable V-shaped portion is then removed from the bared portion of the lower lid.

*c.* The belt of skin is then drawn upwards and outwards till the edge of the lid is in good position. The portion of skin lying under the belt is then dissected off.

*d.* The belt is now accurately stitched over the raw surface.

A dressing is applied, and not removed till the second day.

## CHAPTER XXII.

# THE EYE

IN RELATION TO

# GENERAL MEDICAL DISEASES.

Eye symptoms are common in very many general medical diseases. Thus we have previously noted the occurrence of albuminuric retinitis in cases of Bright's disease, cataract in diabetes, and many others. If we attempt to classify the most frequent general diseases accompanied by eye symptoms we find the following:—

1. Diseases of the central nervous system—either of an organic or functional nature.
2. Diseases of the heart and circulation.
3. General diseases, *e.g.*, tubercle, syphilis, gout and rheumatism.

# DISEASES OF THE CENTRAL NERVOUS SYSTEM.

## CEREBRO-SPINAL SCLEROSIS.

Eye symptoms are frequently present in this disease. They may be associated with definite ophthalmoscopic

appearances or they may not. The symptoms encountered are the following :—

*a.* A central colour scotoma.

*b.* Irregular defects in the periphery of the field. These may be for form, or colour alone, or both combined.

*c.* Optic atrophy.

*d.* Derangements of the oculo-motor apparatus.

1. Nystagmus.
2. Isolated paralysis, *e.g.*, third, fourth, or sixth nerve.
3. Nuclear paralysis. This may be in the form of a conjugate paralysis, or defective convergence.

The pathology of the first three conditions is probably a degeneration of the optic nerve.

## GENERAL PARALYSIS.

Eye symptoms are very common both in the early and later stages of this disease, and in many cases are of considerable diagnostic importance. Some of these symptoms occur late, others early in the disease; some of them may occur either early or late. The various symptoms encountered are the following :—

*a.* A contracted state of the pupils. This is frequently seen in the early stages, and may be

associated with inequality in the size of the two pupils. In the later stages the pupils are dilated.

*b.* A loss of the pupil reflex to sensory (cutaneous) stimuli.

*c.* A loss of the light reflex. The "paradoxical symptom" is sometimes seen, *i.e.*, when light is projected on the eye the pupil contracts, then dilates a little, then contracts again, then oscillates to and fro for a few seconds, and finally dilates widely although the eye is still exposed to light.

*d.* Optic atrophy is frequently present. It occurs more especially in the later stages of the disease, but may be an early symptom.

*e.* Paralysis of one or other of the orbital muscles and mind blindness are met with, but are rarer symptoms.

## LEAD POISONING.

In connection with the various eye symptoms seen in lead poisoning, it must be borne in mind that these may be in a measure dependent on an associated kidney lesion. The following symptoms occur :—

1. Primary optic atrophy.
2. Transient hemianopsia or amaurosis.
3. Optic neuritis. This may be severe, and accompanied by retinal hæmorrhages.

4. A contracted state of the field of vision, with a normal fundus.

The prognosis is good, provided the fundus is healthy.

## HYDROCEPHALUS.

In acute hydrocephalus (tubercular meningitis) the fundus may show marked optic neuritis, with miliary tubercles in the choroid. Chronic hydrocephalus may be accompanied by—

*a.* Optic neuritis.

*b.* Optic atrophy.

*c.* Bi-temporal hemianopsia from pressure on the optic chiasma by the distended third ventricle.

## EPILEPSY.

Eye symptoms of importance are sometimes seen before an attack, during it, and after it. Thus, a visual aura is not infrequent, and may have some diagnostic importance. Further, it should be noted that the reflex contraction of the pupil to light is lost during the attack. This is a point of considerable diagnostic importance from hysteria, in which condition the light reflex is quite active. After an epileptic fit the field of vision is usually diminished, this depending on exhaustion of the higher centres.

# TABES.

Eye symptoms are exceedingly common in locomotor ataxy. Indeed, they are the rule rather than the excep-

tion. They may develop early, in the preataxic period, or at any later period of the disease. The symptoms mainly result from a sclerosis of the optic nerve, similar to that seen in the posterior columns. The pupillary symptoms may be dependent on a nuclear lesion. The following symptoms are met with :—

1. Optic atrophy. This is especially seen in the preataxic period.

2. Alterations in the pupil.

   *a.* Inequality of the size of the pupils.

   *b.* Myosis, due to paralysis of the pupil dilating fibres.

   *c.* The Argyll Robertson symptom.—The pupils react to light but not to accommodation.

3. Paralysis of the orbital muscles. This may be a transient or permanent condition, and may be dependent on a lesion of the nerve or its nucleus. Diplopia is a prominent feature. The sixth and third nerves are the ones most frequently paralysed. These paralyses are especially seen in the early stages of the disease.

4. Ocular ataxia. A "nystagmus"-like movement may be seen on movement of the eyes. As this is not present when the eyes are at rest, the condition is not a true nystagmus.

## GRAVES' DISEASE.

(EXOPHTHALMIC GOITRE.)

The following symptoms are seen in this disease :—

1. Exophthalmos—protrusion of the eyes.
2. The Von Graefe symptom—the loss of the association of movement of the upper lid with the eye.
3. Stellwag's sign—involuntary widening of the aperture of the lid, caused by contraction of the orbital muscle of Muller.
4. Conjunctivitis or neuro-paralytic keratitis may be met with, resulting from the exposure of the eye.

## NERVOUS AMBLYOPIA

(NEURASTHENIA.)

In cases of general nervous exhaustion or neurasthenia, defects in vision are frequently encountered. Symptoms in such cases must be differentiated from the cases of pure hysterical amblyopia described previously. The variety of symptoms met with under this heading is very great. They are seen in varying periods of life, *e.g.*, children at school or people in middle or later life. The following points are common to all such cases :—

*a*. The general health is below par, and especially the tone of the nervous system.

*b*. The fundus is healthy

The symptoms seen in this nervous asthenopia are as follows :—

1. Attacks of defective vision coming on suddenly.
2. Varying acuity of vision.
3. Weakness of accommodation.
4. Concentric contraction of the field of vision—the periphery of the retina being more readily exhausted than the central portion.
5. Fleeting scotomata are sometimes complained of.

These symptoms may be present in emmetropic individuals, but are most common in cases where there is some weakness, *e.g.*, hypermetropia, myopia, or astigmatism. In connection with these various symptoms it should always be borne in mind that actual organic disease may be attended by functional symptoms.

## MIGRAINE.

Migraine or megrim is frequently accompanied by eye symptoms. In some cases these eye symptoms are the only ones present. The following are met with :—

1. Temporary amblyopia.
2. Temporary hemianopsia, the border being brightly and variously coloured. These colours may be seen even when the eyes are closed.

These symptoms may be followed by headache. They last from a few seconds to a few minutes or more, and then disappear.

# DISEASES OF THE HEART AND CIRCULATION.

Eye symptoms may be dependent on—

*a.* Derangement of the heart.

*b.* Derangement of the vessels.

*c.* Derangement of the blood.

As examples of the more common derangements which produce eye symptoms we may note cardiac valvular disease, which may lead to embolism, or in the case of aortic incompetence, visible pulsation in the retinal artery. Again, we find such diseases as pernicious anæmia and leucocythæmia presenting typical retinal hæmorrhages. In many cases, the eye symptoms present in conditions of derangement of the heart and circulation depend on defective nutrition of the various higher centres.

# GENERAL DISEASES.

## SYPHILIS.

Eye symptoms are frequent both in inherited and acquired syphilis. The symptoms may be secondary or tertiary.

### Inherited Syphilis.

1. *Iritis* may be seen in infants from three to fifteen months old, a period corresponding to the secondary stage. It may be associated with a diseased condition of the interior.

2. *Choroiditis* and *retinitis* are met with at a later period in childhood.

3. *Interstitial keratitis* is met with between ten and fifteen years of age. The course of the disease is exceedingly tedious.

## Acquired Syphilis.

*Secondary symptoms.*

1. A gummatous iritis is met with, usually in from three to nine months after the primary sore.

2. Choroiditis or retinitis, singly or combined, occur in from six months to two years after the primary sore.

*Tertiary symptoms.* The following symptoms are met with :—

1. A gumma in the orbit.

2. Oculo-motor paralysis. This may be due to a lesion in the nerve, in the base of the brain, or in the interior of the brain.

3. Optic atrophy (locomotor ataxy). This probably depends on a sclerosis of the nerve.

## TUBERCULOSIS.

Tubercle may attack the conjunctiva, cornea, sclera, iris, and choroid. These various conditions have already been fully referred to. Special attention should always be paid to attacks of conjunctivitis or episcleritis occurring in strumous subjects.

Constitutional treatment is of the first importance in such cases.

## GOUT.

In gout there is a poison in the blood, the vessel walls are usually diseased, and the blood pressure is not infrequently increased. As a result of these conditions the eye diseases met with are—

*a.* Chronic conjunctivitis.
*b.* Recurrent iritis.
*c.* Hæmorrhagic retinitis.
*d.* A tendency to glaucoma.
*e.* An irido-cyclitis—especially seen in children of gouty parents.

Treatment should in these cases be directed to correcting the gouty habit.

## RHEUMATISM.

The poison of rheumatism may attack the more superficial structures of the eye, *e.g.*, sclerotic or iris, inducing a scleritis or iritis. In other cases it may attack the optic nerve, inducing a retro-bulbar neuritis.

# INDEX.