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SELF-ASSESSMENT IN OPHTHALMOLOGY:

TESTS AND CLINICAL TASKS

Electronic Manual

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The manual includes tests and clinical cases in ophthalmology in accordance with educational program of discipline the "Ophthalmology" for the students of higher medical educational establishments. The manual was assembled as a means of self-assessment of learned material. It contains tests, multiple choice questions and clinical cases, which are classified by themes and will let user test his understanding of the material and basic diagnostic skills. The chapter “Answers and References” contains correct answers to the tests, multiple choice questions, clinical cases in each theme and reasoning for such choice. This chapter also provides a list of references that will help the user most adequately to fill his personal educational needs and enable to review the essential material.

The electronic manual is intended for the students of higher medical educational establishments, ophthalmology residents and ophthalmologists-beginners.

К 23 Самостійне оцінювання в офтальмології: тести та клінічні задачі: [електронний навчально-методичний посібник] / Карлійчук М.А. – Чернівці: БДМУ, 2025. – 174 с. – Мова англ.

Посібник містить тести та клінічні задачі з офтальмології відповідно до навчальної програмою з дисципліни «Офтальмологія» для студентів вищих медичних навчальних закладів. Посібник складений для самостійної перевірки вивченого матеріалу. Він містить тести, питання з декількома правильними відповідями та клінічні задачі, розподілені за темами, що дозволить користувачу перевірити розуміння матеріалу та основні діагностичні навички. Розділ «Відповіді та посилання» містить правильні відповіді до тестів, питань із декількома правильними відповідями, клінічних задач за кожною темою та пояснення щодо такого вибору. У цьому розділі також наведено перелік посилань, який допоможе користувачу більш адекватно поповнити його особисті навчальні потреби та полегшить перегляд необхідного матеріалу.

Електронний навчально-методичний посібник призначений для студентів вищих медичних навчальних закладів, лікарів-інтернів спеціальності «Офтальмологія» та офтальмологів-початківців.

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Preface

This book provides students and residents with the opportunity to self-assess their knowledge on main topics of the ophthalmology according to the educational program by the way of answering tests tasks and clinical cases, with the simultaneous option of improving their knowledge by reading the explanations to answers.

Ophthalmology is constantly attracting new scholars and students due to its dynamics. It includes therapy and surgery, adults and children's treatment. Many systemic disorders have ocular signs, which can be important for diagnostics. Due to the close relationship between ophthalmology and general human beings' diseases, it requires a huge volume of medical knowledge. An important fact is that ophthalmology is a rapidly evolving subject with new developments in diagnostic capabilities and treatment options taking place at a very fast pace. The subject matter of ophthalmology is challenging and sufficiently broad to ensure that everyone may find his/her niche in its variety of topics. This manual aims at giving medical majors useful skills, for their future practice.

Medical students should keep up their proficiency level and integrate current ophthalmic information into their general medical competence, and also should try to achieve a balance between theory and practice. Training means learning to perform specific tasks, when studies may bring a creative approach to medicine. I consider this manual to be of great value for the undergraduates, graduates and resident beginners in ophthalmology as an algorithm of self-assessment. Due to this algorithm and clinical case analyses you can become an expert. It may help you identify the weak points and needs for a further study and also improve your diagnostic skills.

In "Answers and References" you can find answers to the test tasks, clinical case descriptions on each topic that may stimulate your own reasoning. That is what I believe is rather efficient for students mastering ophthalmology. There are

references (bibliography of fundamental researches in ophthalmology) and suggested reading in various fields of ophthalmology.

I hope that the present manual will be a valuable adjunct to existing ophthalmology textbooks for the undergraduates, graduates and residents in ophthalmology.

Maryna Karliychuk

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Anatomical and physiological peculiarities of the visual system

***A. Tests for self-control*:**

1. The accessory apparatus of the eye are

a. Extraocular muscles and eyelids.

b. Conjunctiva and the outer fibrous layer.

c. Aqueous humour and vitreous body.

d. Iris and choroid.

2. Through which foramen does the ophthalmic artery pass?

a. Inferior orbital fissure.

b. Superior orbital fissure.

c. Optic canal.

d. None of the above.

3. The embryonic tissue, from which the lens derived, is

a. Surface ectoderm.

b. Neural ectoderm.

c. Optic vesicle.

d. All of the above.

4. The avascular structure of the eye is:

a. Choroid.

b. Lens.

c. Conjunctiva.

d. Ciliary body.

5. Which bony structures is the lacrimal sac located within?

a. Nasal, lacrimal.

b. Lacrimal, maxillary.

c. Lacrimal, ethmoid.

d. Maxillary, ethmoid.

6. The total length of the optic nerve in average is:

a. 1-1,5 cm.

b. 2-2,5 cm.

c. 2,5-3 cm.

d. 3,5-5 cm.

7. What does lie between epithelium and stroma of cornea?

a. Bowman's membrane.

b. Dua`s layer.

c. Descemet's membrane.

d. Endothelium.

8. Aqueous humour is produced by:

a. Iris.

b. Choroid.

c. Ciliary epithelium.

d. Trabecular meshwork.

9. The optic nerve head is also known as

a. Fovea.

b. Optic disc.

c. Macula.

d. Posterior pole.

10. The transition zone between the cornea and the anterior sclera is known as

a. Basement membrane.

b. Episclera.

c. Anterior chamber angle.

d. Limbus.

11. Lamina cribrosa is present in

a. Retina.

b. Ciliary body.

c. Sclera.

d. Choroid.

12. The average depth of anterior chamber in the normal adult eye is

a. 1-1,5 mm.

b. 2,5-3 mm.

c. 3,5-4 mm.

d. 1,5-2 mm.

13. The sensory nerve supply of the eye is provided by the

a. Optic nerve.

b. Facial nerve.

c. Oculomotor nerve.

d. Trigeminal nerve.

14. All of the following muscles originate from the annulus of Zinn, EXCEPT

a. Superior oblique.

b. Superior rectus.

c. Inferior rectus.

d. Inferior oblique.

15. The medial wall of the orbit includes

a. The frontoethmoidal suture line, the posterior ethmoidal foramen, the posterior lacrimal crest.

b. The ethmoid bone, the anterior ethmoidal foramen, the infraorbital foramen.

c. The lacrimal bone, the superior orbital fissure, the zygomaticotemporal foramen.

d. The lacrimal bone, the anterior lacrimal crest, the supraorbital foramen.

B. Multiple choice questions *(identify the true and false statements)**:***

1. The eyelids

a. Offer mechanical protection to the anterior globe.

b. Comprise three layers.

c. The palpebral conjunctiva is loosely attached to the tarsal plate.

d. Strong acoustic and optical stimuli "automatically" elicit an eye-closing reflex.

e. Prevent drying of the eye.

2. The conjunctiva

a. Is a thin vascular mucous membrane.

b. Forms the conjunctival sac together with the surface of the cornea.

c. The bulbar conjunctiva is closely attached to the sclera and is loosely attached to the limbus.

d. Normally is shiny and transparent.

e. The palpebral conjunctiva can be evaluated by direct inspection under a focused light.

3. The cornea

a. Has an endothelial layer (2,500-3,000 cells/mm^2), that regenerates quickly.

b. Consists of six layers.

c. The endothelial layer actively pumps water from the stroma.

d. Is an important refractive element of the eye.

e. Is nourished with nutritive metabolites from its own vessels.

4. The uveal tract

a. Consists of three structures (iris, ciliary body, choroid).

b. Lies between the sclera and retina.

c. The iris consists of three layers.

d. The ciliary muscle is responsible for accommodation.

e. The choroid has not a remarkably high blood flow.

5. The retina

a. Is ten layers thick.

b. Has ganglion cells, whose long axons form the optic nerve.

c. Has three classes of rods, responsible for color vision.

d. The neuroretina is firmly attached to the retinal pigment epithelium.

e. The retinal pigment epithelium delivers vitamin A for rhodopsin production.

6. The lens

a. Continue to grow throughout life.

b. Is surrounded by a membrane (capsule).

c. Nuclear and cortical fibres are nucleated.

d. Is avascular structure with stable water content.

e. Changes in shape with accommodation.

7. The posterior chamber

a. Is another name for the vitreous body.

b. Lies between the iris, lens and ciliary body.

c. Contains aqueous humour.

d. Is in communication with the anterior chamber.

8. The optic nerve

a. Axons leave the eyeball through the lamina cribrosa.

b. Optic disc is the area of a high concentration of photoreceptors.

c. Anteriorly is supplied by blood from the ciliary arteries.

d. Axons are not myelinated in its retrobulbar part.

e. Is formed by the nerve fibre layer of the retina.

9. The tear film

a. Is 100 μm thick.

b. Is composed of five layers.

c. An inner mucous layer is in contact with the cornea.

d. Is important in the refraction of light, entering the eye.

e. Contains lysozyme and secretory IgA.

Methods of the eye examination

***A. Tests for self-control*:**

1. Eye fundus can be examined using all of the following techniques EXCEPT

a. Direct ophthalmoscopy.

b. Indirect ophthalmoscopy.

c. Slit-lamp biomicroscopy.

d. Gonioscopy.

2. Periphery of the retina is better visualized with

a. Direct ophthalmoscopy.

b. Indirect ophthalmoscopy.

c. Retinoscopy.

d. Ultrasound diagnostic.

3. In indirect ophthalmoscopy the image is

a. Inverted, real, magnified.

b. Erect, real, magnified.

c. Erect, virtual, magnified.

d. None of the above.

4. Corneal staining is done by the following vital stain

a. Iodine.

b. Fluorescein.

c. Silver nitrate.

d. Carbolic acid.

5. Keratometry is used in the measurement of

a. Density of the corneal epithelium.

b. Curvature and diameter of the cornea.

c. Corneal sensitivity.

d. Thickness of the cornea.

6. Angle of the anterior chamber is studied with

a. Retinoscopy.

b. Gonioscopy.

c. Indirect ophthalmoscopy.

d. Exophthalmometry.

7. Direct ophthalmoscopy should be performed at a distance

a. 1 m from the patient's eye.

b. 40-50 cm from the patient's eye.

c. 20-22 cm from the patient's eye.

d. 2-3 cm from the patient's eye.

8. In direct ophthalmoscopy the image is

a. Virtual, erect, magnified.

b. Virtual, inverted, condensed.

c. Real, inverted, magnified.

d. Real, erect, condensed.

9. What is the power of the condensing lens used in focal illumination technique?

a. + 20 D.

b. + 60 D.

c. + 13 D.

d. + 78 D .

10. Ciliary congestion is most marked at the

a. Sclera.

b. Fornix.

c. Bulbar conjunctiva.

d. Limbus.

11. The most accurate method of intraocular pressure measuring is

a. Digital tonometry.

b. Applanation tonometry.

c. Gonioscopy.

d. Campimetry.

12. In a frightened man, the pupil will

a. Dilate.

b. Constrict.

c. Remain unaltered.

d. First dilate and then constrict.

13. Opacities of the cornea are diagnosed by examination with

a. A-mode ultrasound scan.

b. Exophthalmometer.

c. Slit lamp.

d. Indirect ophthalmoscopy.

14. The term *exophthalmos* means

a. Inflammation of the contents of the orbital cavity.

b. Hemispherical protrusion of the cornea.

c. Recession of the eyeball within orbital cavity.

d. Protrusion of the eyeball.

15. Which structure can not be examined with a slit-lamp without any additional aid?

a. Sclera.

b. Anterior chamber.

c. Optic nerve head.

d. Anterior part of vitreous.

B. Multiple choice questions *(identify the true and false statements)**:***

1. The ophthalmic examination

a. A complete patient's history includes only two aspects: medical and ophthalmic history.

b. The examiner can not evaluate the depth of anterior chamber by using a slit lamp.

c. Examination of the pupils begins with an assessment of the size and symmetry of the pupils in a uniform light.

d. The slit lamp is routinely used for examination of the anterior segment.

e. The term *ocular fundus* refers to the interior back surface of the eyeball.

2. Pupils

a. The term *miosis* means a constricted pupil.

b. Anisocoria means that the pupils have unequal sizes.

c. Damage to oculomotor parasympathetic fibres causes miosis.

d. A relative afferent pupillary defect indicates optic nerve disease.

e. Normal pupils dilate during convergence.

3. Instruments

a. Keratometry allows the protrusion of the eye to be measured.

b. The direct ophthalmoscope can be used for examination of the lens with passing light.

c. The exophthalmometer measures corneal shape.

d. Intraocular pressure is measured with ultrasound.

4. Lids

a. When the lid margin is turned away from the eye, this is ectropion.

b. When the lid margin is turned into the eye, this is entropion.

c. A third nerve palsy may cause ptosis.

d. Lagophthalmos is the isufficiency or weakness of eyelid closure.

5. The direct ophthalmoscope

a. Produces a magnified image of the retina.

b. Contains lenses which increase the magnification.

c. Can be used to examine the red reflex.

d. The retina can be seen by holding the instrument at a distance of 30 cm from the eye.

e. The illumination can be altered.

6. Match the drop to its action: *dilates* (mydriasis) or *constricts* (miosis) the pupil

a. Cyclopentolate.

b. Atropine.

c. Pilocarpine.

d. Tropicamide.

e. Phenylephrine.

Visual acuity and field of vision. Binocular vision. Colour and light perception

A. Tests for self-control:

1. Clear sight depends on all following essential components EXCEPT

a. A sharply focused retinal image.

b. The functional integrity of the retina.

c. The length of the optic nerve.

d. An intact visual pathway and visual cortex.

2. Campimetry is used to measure

a. Squint.

b. Angle of anterior chamber.

c. Functional state of the retina.

d. Field charting.

3. Highest visual resolution is seen in

a. Macula lutea.

b. Fovea centralis.

c. Optic disc.

d. Ora serrata.

4. Visual acuity is a record of

a. Light sense.

b. Form sense.

c. Contrast sense.

d. Colour sense.

5. Lesion of the optic tract causes

a. Homonymous hemianopia.

b. Bitemporal hemianopia.

c. Binasal hemianopia.

d. Blindness.

6. Visual centre is located in

a. Parietal lobe.

b. Frontal lobe.

c. Midbrain.

d. Occipital lobe.

7. Normal field of vision extends on the nasal side to

a. 40°.

b. 50°.

c. 60°.

d. 70°.

8. Where is the lesion that produces the homonymous left superotemporal quadrantanopia?

a. Right temporal lobe.

b. Right parietal lobe.

c. Right optic tract.

d. Right optic nerve.

9. Bitemporal hemianopia is seen with

a. Aneurysm of circle of Willis.

b. Thyroid eye disease.

c. Retinoblastoma.

d. Decreased vitamin A intake.

10. Causes of homonymous hemianopia include all of the following EXCEPT

a. Optic tract lesions.

b. Lateral geniculate body lesions.

c. Optic neuritis.

d. Lesions involving total fibres of optic radiation.

11. The optic nerve extends upto

a. Optic chiasm.

b. Optic tract.

c. Lateral geniculate body.

d. Optic radiation.

12. Peripheral field of vision is tested by

a. Campimetry.

b. Snellen chart.

c. Kinetic perimetry.

d. Indirect ophthalmoscopy.

13. Near vision is recorded at a distance of

a. 10 cm.

b. 25 cm.

c. 35 cm.

d. 50 cm.

14. Causes of bitemporal hemianopia include all of the following EXCEPT

a. Pituitary tumours.

b. Craniopharyngioma.

c. Supracellar aneurysms.

d. Tobacco amblyopia.

15. If the visual acuity is less than 1/60 (0,01), the patient

a. Is blind.

b. Is asked to distinguish the hand movements.

c. Is asked to count fingers.

d. Is asked to perceive bright light.

16. Visible spectrum extends from

a. 100-300 μm.

b. 300-650 μm.

c. 390-700 μm.

d. 720-920 μm.

17. The normal trichromatic colour vision consists of following colours

a. Red, blue, yellow.

b. Red, blue, green.

c. Red, blue, white.

d. Red, green, yellow.

18. The neuron of the 1st order in the visual pathway lies in which layer of retina

a. Inner plexiform.

b. Outer plexiform.

c. Optic nerve fibre.

d. None of the above.

19. Scotopic vision is due to

a. Cones.

b. Rods.

c. Both of the above.

d. None of the above.

20. After retinal stimulation the visual impulse reaches occipital cortex

a. 1 m sec.

b. 24 m sec.

c. 124 m sec.

d. 142 m sec.

21. The trichromatic theory of colour vision has been propounded by

a. Schiotz.

b. Von Graefe.

c. Young-Helmholtz.

d. None of the above.

22. What is the difference in light sensitivity of the rods compared with the cones?

a. Equal in sensitivity.

b. 10 times more sensitive.

c. 1000 times more sensitive.

d. 10,000 times more sensitive.

23. A patient purchased a pair of sunglasses with a dark blue tint. Which of these colours would be the hardest to see?

a. Red.

b. Blue.

c. Green.

d. Purple.

24. How long does it take for a photoreceptor to renew its outer segment?

a. 1 hour.

b. 1 day.

c. 10 days.

d. 100 days.

25. Second order neurons in the optic pathway are present in

a. Superior colliculus.

b. Retina.

c. Medial geniculate body.

d. Lateral geniculate body.

26. Day blindness occurs with all of the following EXCEPT

a. Vitamin A deficiency.

b. Central opacities of the cornea or lens.

c. Total colour blindness.

d. Albinism.

27. All of the following is the type of vision character EXCEPT

a. Binocular vision.

b. Simultaneous vision.

c. Monocular vision.

d. Poor vision.

28. In Worth's four dot test the patient has diplopia if he sees

a. Only three green lights.

b. Green and red lights alternately.

c. Two red and three green lights.

d. Only two red lights.

29. Different grades of binocular vision include all the following EXCEPT

a. Fusion.

b. Divergence.

c. Simultaneous macular perception.

d. Stereopsis.

30. Night blindness occurs with all of the following EXCEPT

a. Vitamin A deficiency.

b. Central opacities of the cornea or lens.

c. Pathological myopia.

d. Retinitis pigmentosa.

B. Multiple choice questions *(identify the true and false statements)**:***

1. Visual acuity examination

a. The term *visual acuity* refers to an angular measurement relating testing distance to the minimal object size resolvable at that distance.

b. The Snellen notation is the most common method of expressing visual acuity measurement.

c. Visual acuity is note as the highest line of letters read.

d. The notation *NLP* means total blindness.

2. Match the field defect to the possible site of disease

a. Unilateral central scotoma.

b. Congruous left hemianopia.

c. Bitemporal hemianopia.

d. Unilateral superior field defect.

e. Incongruous left hemianopia.

i Optic chiasm.

ii Visual cortex.

iii Optic nerve.

iv Optic tract.

v Retina.

3. Physiological testing of the eye

a. The Snellen chart measures visual acuity, the resolving power of the eye.

b. The Snellen chart is positioned at 4,5 metres from the patient.

c. An isoptre on a visual field chart represents the eye's ability to see a point of light of given size and brightness.

d. Field of vision is measured with an exophthalmometer.

4. The physiologic blind spot

a. Is an absolute scotoma.

b. Is an abnormal binocular defect in temporal part of visual field.

c. Locates at 15° from point of fixation temporally.

d. Corresponds to the optic nerve head centered about 15° nasally from the fovea.

5. Match the symptoms with the likely abnormal part of the retina

a. Metamorphopsia (distortion of vision).

b. Loss of superior visual field.

c. Difficulty seeing in night.

i The inferior half of the retina.

ii The macula.

iii The rods.

iv The cones.

6. Which of the following statements regarding cone dystrophies are true?

a. Cone dystrophies are characterized by decreased central vision, colour blindness, and photophobia.

b. Night blindness and loss of peripheral vision frequently develop late in the course of the disease.

c. Visual loss and photophobia usually precede clinically visible macular changes.

d. Visual acuity ranges from 0,3 (20/60) to 0,05 (20/400) with symmetric involvement of both eyes.

7. The light sense

a. Is the ability to discriminate variations in intensity of light.

b. An adaptometer can be used to determine the light intensity threshold.

c. Light adaptation occurs less quickly than dark adaptation.

d. Is increased in diseases of the optic nerve and visual pathway.

e. Is diminished in vitamin A deficiency, xerophthalmia.

8. Amblyopia

a. Refers to a developmental reduction in visual acuity.

b. May be caused by miosis.

c. May be caused by a previously unidentified difference in refractive correction between the two eyes.

d. May be caused by a squint.

e. May be treated by patching the amblyopic eye.

9. Binocular vision

a. Single binocular vision results from simultaneous stimulation of corresponding retinal elements that have the same visual direction.

b. There are two distinct levels of quality of binocular vision (simultaneous vision and stereoscopic vision).

c. The image of an object always lands on identical areas of the retina (corresponding points).

d. The first signs of binocular vision occur in a child of 2-3 years of age.

e. Worth's four-dot test is one of the method of the vision character evaluation.

10. Colour vision

a. Acquired colour vision deficiencies are not possible.

b. Congenital colour deficiencies most often occur in males.

c. Colour blindness is a reduced sensitivity to certain colours.

d. The Nagel anomaloscope allows quantitative evaluation of colour vision defects.

e. The most common form of congenital abnormal trichromatopsia in males is protananomaly.

C. Clinical cases:

1. A 30-year-old woman has had ‘migraine’ headaches for several years. She recently developed episodes of ‘flashing lights off to the right’, that affect her peripheral vision. Perimetry shows a partial right homonymous hemianopia. *Question*: What would be the next step in patient’s examination?

2. A 67-year-old woman complains of altitudinal visual field loss in the left eye over the past few weeks. She denies any eye pain, headaches, fatigue, weight loss, photopsias, scalp tenderness, jaw claudication, or malaise. She has a history of high blood pressure that is controlled with medication. Blood pressure is 160/90 mm Hg. Ocular examination: Visual acuity is 0,1 (20/200) OD and 0,5 (20/40) OS. Anterior segment examination: normal. Posterior segment examination of the right eye is significant for retinal haemorrhages in the superotemporal retina with associated macular oedema. There also are some areas of nerve fiber infarcts (‘cotton-wool spots’) in this area. There is arteriovenous nicking and arterial narrowing in both eyes. On confrontational visual fields, the patient notices a mild deficit in the inferior half or her vision. The optic nerve appears normal.
Question: What diagnosis should be considered in a patient with altitudinal visual field loss?

3. A 41-year-old woman has difficulties with tasks requiring stereopsis such as pouring water into a cup or threading a needle. When testing vision with a Snellen chart she misses the temporal letters with each eye. Also she misses objects in the periphery of the visual field. Perimetry shows a bitemporal hemianopia.
Question: What is the possible cause of such lesion and its location in visual pathway?

4. You are testing the vision of a patient with a blind eye. Five out of 15 times he says he sees the light when the light is actually off. Two out of 10 times he says the light is off when it is actually on.
Question: What is the number of true-positive responses for this patient?

5. A 32-year-old woman was admitted to the hospital with her first episode of acute asthma. During a routine review of systems, the patient complained of amenorrhea and decreased libido since the age of twenty-five. The patient denied any visual or other systemic complaints. An alert emergency room physician referred the patient for complete ophthalmic examination. The visual acuity was 1,0 (20/20) uncorrected. Colour vision and pupillary light reflexes were normal. A static computer perimetry (central threshold 30-2 test) demonstrated a bitemporal hemianopia.

Questions: What is the possible cause of such lesion? What would be the next step in patient's examination?

6. An infant is referred for poor tracking. On examination, the child does not fix or follow, there is searching nystagmus. The rest of the ocular examination is otherwise normal.

Question: Which is the most likely cause of such symptoms?

7. A 9-year-old child failed a vision screening test. Ocular examination: uncorrected visual acuity is 0,1 (20/200) OD and 0,8 (20/25) OS. Cycloplegic refraction is + 3,00 D cyl + 2,00 D ax 90° OD and sphere + 1,00 D OS. The vision does not improve in the right eye when the refraction is given to the patient. Ductions and versions are full. The patient is orthophoric at distance and near. The remainder of the examination is normal.

Question: What is the diagnosis?

Refraction and Accommodation of the eye

A. Tests for self-control:

1. Blurring of vision for near work occurs in

a. Insufficiency of accommodation.

b. Presbyopia.

c. Cycloplegia.

d. All of the above.

2. Cylindrical lenses are prescribed in

a. Presbyopia.

b. Astigmatism.

c. Myopia.

d. Squint.

3. A newborn is invariably

a. Hypermetropic.

b. Myopic.

c. Astigmatic.

d. Aphakic.

4. In retinoscopy using a plane mirror, when the mirror is tilted to the right the shadow in the pupil moves to the left in

a. Hypermetropia.

b. Myopia more than -1,0 D.

c. Emmetropia.

d. Myopia less than -1,0 D.

5. Retinoscopy is done in a dark room at a distance of

a. 1 m.

b. 2 m.

c. 3 m.

d. 6 m.

6. Astigmatism is a type of

a. Axial ametropia.

b. Index ametropia.

c. Curvature ametropia.

d. Spherical aberration.

7. Optical condition of the eye in which the refraction of the two eyes differs is

a. Mixed astigmatism.

b. Irregular astigmatism.

c. Anisometropia.

d. Compound astigmatism.

8. Accommodation is maximum in

a. Childhood.

b. Adulthood.

c. Middle-age.

d. Old age.

9. Presbyopia becomes symptomatic

a. Earlier in patients with small pupils than in patients with large pupils.

b. Earlier in men than in women.

c. In uncorrected hyperopes earlier than in uncorrected myopes.

d. In uncorrected myopes earlier than in uncorrected hyperopes.

10. When a patient wearing minus sphere lenses finds that he can improve his vision by tilting his spectacles forward, he may need

a. Compensation for anisometropia.

b. Cylindrical correction at an oblique axis.

c. Less minus in his lenses.

d. More minus in his lenses.

11. A 5-year-old boy has a cycloplegic refraction of OD sphere +5,0 D, OS sphere +1,5 D. This anisometropia should be:

a. Fully corrected.

b. Partially corrected.

c. Left uncorrected.

d. Treated by occlusion.

12. Contact lens wear results in all of the following EXCEPT:

a. Decreased oxygenation of the epithelium.

b. Decreased corneal sensitivity.

c. Decreased availability of glucose for metabolic use.

d. Corneal epithelium oedema.

13. Problems with distinct seeing distant objects are observed in

a. Presbyopia.

b. Myopia.

c. Emmetropia.

d. None of the above.

14. Distant objects form a focus behind the retina in

a. Hyperopia.

b. Myopia.

c. Emmetropia.

d. Astigmatism.

15. Changes in pathological myopia include all of the following EXCEPT

a. Chorioretinal degeneration.

b. Chronic conjunctivitis.

c. Posterior staphyloma.

d. Vitreous syneresis.

B. Multiple choice questions *(identify the true and false statements)**:***

1. Refration

a. The cornea is responsible for one-third of the focusing power of the eye, and the lens for two-thirds.

b. The cornea has a higher refractive index than air.

c. When passing from the air to the cornea the rays therefore diverge.

d. The refracting surfaces of the cornea and lens are spherically convex.

e. The average refractive power of a normal emmetropic eye is +58 to +60 D.

2. Clinical optics

a. The visible spectrum extends from 390 to 760 nm.

b. Emmetropia means that parallel rays of light are brought to a focus on the retina when accommodation is relaxed.

c. In myopia the rays are focused in front of the retina, in hypermetropia they are focused behind the retina.

d. Astigmatism suggests that the cornea is perfectly round.

e. Presbyopia refers to the loss of accommodation with age.

3. Correction of ametropia

a. A concave lens causes divergence of parallel rays and is used to correct myopia.

b. A convex lens causes convergence of parallel rays and is used to correct hypermetropia.

c. The natural lens provides 50% of the refractive power of the eye.

d. Aphakic spectacles magnify the retinal image.

e. The power of the crystalline lens decreases with accommodation.

4. Parametres of optical status of the eye

a. Optic axis is the line passing through the center of curvature of cornea and the two surfaces of lens, meets the retina at fovea centralis.

b. The nodal point of an ideal thin lens is located on the optical axis at the optical center of the lens.

c. The far point plane of the hyperopic eye lies in infinity.

d. The range of accommodation is described as the dioptric distance between the near and far points of accommodation.

e. The refractive power D (diopter) of an optical system is the reciprocal of the local length of a lens f (D=1/f).

C. Clinical cases:

1. You consulted a 5-year-old child and received the following: uncorrected visual acuity is 0,1 (20/200) OD and 0,8 (20/25) OS. Cycloplegic refraction is sphere +3,0 D cyl + 2,0 D ax 90° OD and sphere +1,0 D OS. The vision does not improve in the right eye when the refraction is given to the patient. Ductions and versions are full. The patient is orthophoric at distance and near. The remainder of the examination is normal.

Question: What is a diagnosis?

2. A 15-year-old boy complains of difficulty with reading. Ocular examination: Vision is 1,0 (20/20) OU. Extraocular eye movements are full. Manifest refraction is emmetropic OU and cycloplegic refraction is sphere +1,0 D OU. Slit lamp and eye fundus examinations are normal. The patient feels he can not see well to read.

Questions: What is a diagnosis, differential diagnosis? What further testing or examination would you do next?

Diseases of the eyelids and lacrimal system. Diseases of the orbit

A. Tests for self-control:

1. Blepharitis is an inflammation of

a. Eyelashes.

b. Moll's gland.

c. Eyelid.

d. Eyelid margin.

2. Which organism is not a usual commensal found on the lids and lashes?

a. Staphylococcus epidermidis.

b. Streptococcus viridans.

c. Haemophilus influenzae.

d. Propionibacterium acnes.

3. Which condition is caused by a virus?

a. Chalazion.

b. Atopic blepharodermatitis.

c. Angular blepharitis.

d. Herpes simplex of the eyelids.

4. Chalazion is a chronic granulomatous inflammation of

a. Zeis gland.

b. Meibomian gland.

c. Lid margin.

d. Wolfring gland.

5. The condition in which the margin of the eyelid is turned away from the eyeball is called

a. Entropion.

b. Ectropion.

c. Coloboma.

d. Blepharochalasis.

6. Trichiasis is

a. White coloured eyelashes.

b. Absence of the eyelashes.

c. Inward turning of the eyelashes.

d. An extra row of the eyelashes.

7. External hordeolum is an inflammation of

a. Meibomian gland.

b. Zeis gland.

c. Tarsal plate.

d. Eyelid margin.

8. Lagophthalmos is the condition of

a. Inability to fully close the eyelids.

b. Inward rotation of the eyelid margin.

c. Spasmodic contraction of the orbicularis oculi muscle.

d. Episodic painless periorbital oedema.

9. Most common type of eyelid carcinoma is

a. Squamous cell carcinoma.

b. Melanoma.

c. Adenocarcinoma.

d. Basal cell carcinoma.

10. Tearing (epiphora) may be caused by all of the following conditions EXCEPT

a. Occlusion of any part of the drainage system.

b. Irritation of the eyes by smoke, dust.

c. Lagophthalmos.

d. Emotional distress.

11. All of the following bacteria are commonly known to cause dacryocystitis EXCEPT

a. Staphylococcus.

b. Streptococcus.

c. Haemophilus.

d. Nocardia.

12. The treatment of choice of congenital dacryocystitis is

a. Dacryocystorhinostomy.

b. Removal of the lacrimal sac.

c. Irrigation or probing.

d. Administration of the anti-inflammatory eye drops.

13. Reduced moistening of eye surface (dry eyes) may be due to all of the following causes EXCEPT

a. Eversion of the punctum lacrimale.

b. Vitamin A deficiency.

c. Rheumatoid arthritis.

d. Sjögren's syndrome.

14. Dacryoadenitis is

a. An inflammation of the lacrimal sac.

b. An inflammation of the lacrimal gland.

c. An inflammation of the canaliculus.

d. An obstruction of the nasolacrimal duct.

15. Lagophthalmos may be caused by all of the following conditions EXCEPT

a. Ulcerative blepharitis.

b. Leprosy.

c. Facial nerve palsy.

d. Severe hypothyroidism.

16. Orbital cellulitis may occur in

a. Periocular trauma.

b. Intracranial infection.

c. Adjacent sinus disease.

d. All of the above.

17. The most dangerous complication of orbital cellulitis is

a. Optic neuritis.

b. Proptosis.

c. Cerebral involvement.

d. Diplopia.

18. Which of the following would be least helpful investigation in orbital cellulitis?

a. Full blood count, blood culture.

b. Exophthalmometry.

c. Computer tomography (orbit, sinuses, brain).

d. Temperature checking.

B. Multiple choice questions *(identify the true and false statements)**:***

1. Ptosis

a. May be congenital or acquired.

b. Acquired ptosis may be caused by neurogenic factors.

c. Congenital ptosis is rarely hereditary and affects both eyes.

d. Prompt surgical intervention in congenital ptosis can prevent amblyopia.

e. Acquired ptosis is not caused by mechanical factors.

2. Which of the following statements are correct?

a. Demodex folliculorum is a normal commensal in adults living in meibomian glands.

b. Demodex folliculorum is responsible for collarets along the base of eyelashes.

c. Demodex folliculorum and Phthirus pubis are transmitted by sexual contact.

d. Mechanical removal with forceps is effective treatment of crab lice eyelid infestation.

e. Diagnosis of demodicosis is confirmed by the presence of parasites on epilated eyelashes.

3. Abnormalities of the eyelashes

a. Distichiasis is a condition in which lashes grow posterior to the normal row of lashes.

b. Madarosis is whitening of eyelashes.

c. Trichiasis is misdirection of one or more eyelashes.

d. Trichiasis may lead to corneal opacification.

e. Trichiasis may be not successfully treated.

4. Dacryocystitis

a. Is the most frequent disorder of the lower lacrimal system.

b. Is usually resulting from stasis of tears in the drainage system and secondary infection.

c. In infants is usually caused by chronic inflammation of nasal mucosa.

d. Is bilateral in most cases.

e. In adults the treatment often requires surgery.

5. Dry eyes (keratokonjunctivitis sicca)

a. May be associated with rheumatoid arthritis.

b. Women are far more frequently affected than men.

c. Clinical signs include increased Schirmer tear test.

d. Can not be drug-induced.

e. Best treated with artificial tear solutions.

C. Clinical cases:

1. A 50-year-old woman presents with tired, itchy, sore eyes. She has noted that the eyelids may crust in the morning. Sometimes the eyelids are red. The vision is unaffected (visual acuity is 1,0 (20/20)).
Questions: What is the diagnosis? What is the most appropriate treatment for this patient?

2. A 55-year-old man presents with painless watering of the left eye, worse when outside in the wind. Sometimes there is a sticky discharge. Visual acuity is 1,0 (20/20). The eye is not inflamed. The puncta appear normal. There is no swelling over the lacrimal sac. Pressure over the left lacrimal sac causes a mucopurulent discharge to be expressed from the lower punctum. The remainder of the examination is normal.
Question: What is the most likely diagnosis?

3. A 67-year-old man complaints of a painless left lower-eyelid lump. It has been present there for 7 months and has gradually grown bigger. The patient has recently noticed crusted blood on the lump. He has no other past ophthalmic or medical history. Ocular examination: there is a raised left lower-eyelid lump with central ulceration and pearly rolled border; there are fine telangiectatic vessels on the surface of the lump.
Questions: What is the likely diagnosis? What are the treatment options?

4. A 58-year-old man presents with painless watering, discomfort and mild photophobia of the right eye for several months. The lid margin of the right eye is outrolled. Palpebral conjunctiva is visible. The patient has a vertical scar 4 mm below the right lower eyelid. He underwent an injury of the right lower eyelid 2 years ago. There is no skin laxity, tension lines in skin when lid put into position. The remainder of the ophthalmic examination is normal.
Questions: What is the most likely diagnosis? What are the treatment options?

5. A 39-year-old man presents with a rapidly progressive two-day history of red, swollen left upper and lower eyelids, and inability to open them. He feels unwell and has a high temperature. Ocular examination: Examination reveals intensive eyelid oedema, a tender globe and exophthalmos with severe chemosis and injection of conjunctiva OS. Eye movements are significantly limited in all directions. Visual acuity and colour vision are normal. Visual fields are full to confrontation OU. Cornea, anterior chamber, lens, and vitreous body are clear. Pupillary reflexes are normal. The optic disc and retina are also normal. Laboratory findings: Leukocytosis and an increased erythrocyte sedimentation rate.
Questions: What is the diagnosis? What is the management?

Diseases of the conjunctiva

A. Tests for self-control:

1. Conjunctival follicles are not seen in which of the following

a. Spring catarrh (vernal conjunctivitis).

b. Adenovirus conjunctivitis.

c. Trachoma.

d. Staphylococcal conjunctivitis.

2. Cobblestone papillae appearance of the conjunctiva is seen in

a. Trachoma.

b. Spring catarrh (vernal conjunctivitis).

c. Angular conjunctivitis.

d. Pneumococcal conjunctivitis.

3. True membranous conjunctivitis is caused by

a. Morax-Axenfeld diplobacillus.

b. Chlamydia trachomatis.

c. Corynebacterium diphtheriae.

d. Haemophilus influenzae.

4. Phlyctenular conjunctivitis is caused by

a. Pseudomonas aeruginosa (Bacillus pyocyaneus).

b. Pneumococcus.

c. Allergy to endogenous protein.

d. Allergy to exogenous protein.

5. Patients with bacterial conjunctivitis present with all of the following EXCEPT:

a. Redness of the eye.

b. Visual loss.

c. Discharge.

d. Ocular irritation.

6. Symptoms and signs of acute allergic conjunctivitis include all of the following EXCEPT:

a. Itchiness.

b. Lacrimation.

c. Conjunctival injection and swelling.

d. Severe pain.

7. The treatment of angular conjunctivitis is

a. Tetracycline ointment.

b. Zinc oxide.

c. Both of the above.

d. None of the above.

8. Which of the following is an unlikely cause of ophthalmia neonatorum?

a. Staphylococcus aureus.

b. Neisseria gonorrhoeae.

c. Chlamydia trachomatis.

d. Adenovirus.

9. The characteristic features of trachoma are all of the following EXCEPT

a. Papillae.

b. True membranes.

c. Follicles.

d. Herbert's pits.

10. Topical treatment of allergic conjunctivitis includes all of the following EXCEPT

a. Antihistamines and vasoconstrictors.

b. Mast cells stabilizers and nonsteroidal anti-inflammatory drugs.

c. Mitomycin C and steroids.

d. Artificial tears and cool compresses.

11. Small, elevated bilateral yellowish paralimbal nodular lesions on nasal side is described as

a. Pemphigoid.

b. Pterygium.

c. Phlycten.

d. Pinguecula.

12. The system of trachoma grading includes the following signs:

a. Trachomatous scarring.

b. Corneal opacity.

c. Trachomatous trichiasis.

d. All of the above.

13. Timing of onset of gonococcal neonatal conjunctivitis is

a. 4-28 day after birth.

b. Within 1-3 days of birth.

c. 1-14 day after birth.

d. 4-6 hours after birth.

14. Lymphadenopathy may be combined with

a. Viral conjunctivitis.

b. Chlamydial conjunctivitis.

c. Gonococcal conjunctivitis.

d. All of the above.

B. Multiple choice questions *(identify the true and false statements)**:***

1. Symptoms and signs of conjunctivitis

a. The important symptoms are: reddened eye, discharge, tearing.

b. Patients complain of: pain, photophobia, visual loss.

c. The important signs of conjunctivitis are: hyperaemia, lacrimation, exudation.

d. In conjunctival disease may be seen: papillae, follicles, subconjunctival haemorrhage.

e. In conjunctivitis the redness is localized to the limbus.

2. Overview of infectious conjunctivitis

a. Preauricular adenopathy, serous discharge with lid matting, pseudomembrane formation are signs of gonococcal conjunctivitis.

b. Membranous conjunctivitis is typical manifestation of ocular diphtheria.

c. Follicles occur typically in viral and chlamydial infections.

d. 'Cobblestone' conjunctival papillae are a typical sign of viral conjunctivitis.

e. The quantity and nature of the discharge do not depend on the aetiology.

3. Conjunctival degeneration and aging changes

a. The most frequently observed conjunctival changes are pingueculae.

b. Pingueculae do not cause any symptoms.

c. Conjunctival xerosis is the disiccation of the conjunctiva due to a vitamin B_2 deficiency.

d. Pterygium is a grayish-yellow thickening of the limbus.

e. Pterygium never causes symptoms, and no treatment is necessary.

4. Ophthalmia neonatorum

a. Is a conjunctivitis occuring within the first month of life.

b. Chemical conjunctivitis is caused by silver nitrate or antibiotics.

c. The commonest cause of neonatal conjunctivitis is Herpes simplex.

d. Clinical features of chlamydial neonatal conjunctivitis include subacute onset, significant mucopurulent discharge, papillae.

e. Can not cause systemic or local complications.

C. Clinical cases:

1. A 21-year-old woman presents with an abrupt bilateral onset of redness of the eyes associated with a watery discharge and sore throat. Vision is unaffected. Diffuse conjunctival redness and follicles are observed. The eyelids are swollen.

Questions: What is the diagnosis? What precautions would you take following your examination?

2. A 36-year-old patient with a history of asthma presents with an itchy watery left eye. He is mildly photophobic and the vision has become slightly blurred. Hyperaemia, chemosis, papillary hypertrophy are noted in the upper and lower conjunctiva of the left eye. Also the small subepithelial infiltrates in superior cornea are observed.

Questions: What is the most likely diagnosis? What is the treatment?

3. A 52-year-old man presents with a triangular pink-white growth on the cornea of the left eye. Sometimes he experiences foreign body sensation and painless redness

of the left eye. There is a history of prolonged exposure to sun and dry climate. Ocular examination: visual acuity is 1,0 (20/20) OU. Anterior segment: a wing-shaped fold of conjunctiva encroaching upon the nasal side of the cornea of the left eye in the area of palpebral aperture is seen.

Questions: What is the likely diagnosis? How should the patient be treated?

Diseases of the cornea and sclera

A. Tests for self-control:

1. The cornea is protected against infection by all of the following EXCEPT

a. Blinking.

b. Antibacterial properties of the tears.

c. Contact lens wear.

d. The barrier function of the corneal epithelium.

2. Following microorganisms can not penetrate the intact corneal epithelium EXCEPT

a. Staphylococcus epidermidis.

b. Staphylococcus aureus.

c. Streptococcus pneumoniae.

d. Neisseria gonorrhoeae.

3. Predisposing causes of bacterial keratitis include all of the following EXCEPT

a. A breach in the corneal epithelium.

b. Washing away of debris by the flow of tears.

c. Contact lens wear.

d. Prolonged use of topical steroids.

4. What is the commonest cause of bilateral interstitial keratitis?

a. Congenital syphilis.

b. Aquired syphilis.

c. Herpes simplex.

d. Tuberculosis.

5. Central corneal ulceration may be caused by

a. Bacteria.

b. Fungus.

c. Herpes virus.

d. All of the above.

6. Dendritic keratitis is typical form of

a. Mycotic keratitis.

b. Herpes simplex keratitis.

c. Pseudomonas aerugenosa keratitis.

d. Acanthamoeba keratitis.

7. Emergency keratoplasty is indicated to treat

a. Pseudomonas aerugenosa keratitis.

b. Exposure keratitis.

c. Perforated corneal ulcer.

d. Corneal erosion.

8. Steroids are contraindicated in

a. Corneal ulceration.

b. Allergic conjunctivitis.

c. Episcleritis.

d. All of the above.

9. Which one of the following would be least helpful in diagnosis of episcleritis?

a. Examination by direct inspection under a bright light.

b. Examination of pupillary reactions.

c. Examination of the anterior eye segment under slit lamp.

d. Recent history of upper respiratory tract infection.

10. All of the following have been associated with scleritis EXCEPT

a. Leprosy.

b. Gout.

c. Behcet's disease.

d. Tuberculosis.

11. Clinical symptoms and signs of episcleritis include

a. Acute unilateral redness.

b. Discomfort and pain on convergence.

c. Both of the above.

d. None of the above.

12. Treatment of episcleritis includes all of the following drugs EXCEPT

a. Cycloplegics.

b. Topical steroids.

c. Non-steroidal anti-inflammatory agents.

d. Analgesics.

13. The causes of posterior staphyloma include all of the following ESCEPT

a. Corneal ulcer.

b. Posterior scleritis.

c. Pathological myopia.

d. Perforating injuries.

14. All of the following have been associated with decreased corneal sensations EXCEPT

a. Neuroparalytic keratitis.

b. Viral keratitis.

c. Phlyctenular keratitis.

d. Diabetic neuropathy.

15. Which one of the following is the type of corneal opacity?

a. Calcareous.

b. Disciform.

c. Atheromatous.

d. Leucomatous.

B. Multiple choice questions *(identify the true and false statements)**:***

1. Symptoms and signs of corneal diseases

a. Include pain and photophobia.

b. Include purulent or watery discharge.

c. Vision is not impaired.

d. Superficial corneal epithelial lesions can not be examined.

e. Photophobia is less severe in herpetic keratitis.

2. Viral keratitis

a. Is frequently caused by Herpes simplex virus, Varicella-zoster virus, adenovirus.

b. A primary herpes simplex infection of the eye typically presents as keratitis.

c. Recurrent herpes infection is usually in the form of a dendritic ulceration of the cornea.

d. Corticosteroids are strongly contraindicated in herpes simplex infection.

e. Nummular keratitis (appears after 8-15 days) is a sign of adenovirus keratitis.

3. Inflammation of the episclera and sclera

a. More often involves the posterior sclera.

b. Episcleritis is inflammation of the superficial layer of the sclera.

c. Is not associated with local or systemic disorders.

d. Patients with episcleritis may complain of mild discomfort and redness.

e. Patients with scleritis complain of pain, decreased vision, and tenderness to touch.

C. Clinical cases:

1. A 28-year-old man presents with a 4-day history of redness, foreign body sensation and photophobia of his left eye. He denies ocular trauma. Slit lamp examination: moderate pericorneal injection, follicular conjunctivitis, branching epithelial lesions with terminal bulbs at their ends which are visible with after application of fluorescein dye. Corneal sensitivity is reduced.

Questions: What is the diagnosis? What is the most likely cause of this disease?

2. A 22-year-old soft contact lens wearer presents with a red painful right eye, photophobia, blurred vision. There are a purulent discharge, decreased vision, ciliary injection, a gray corneal infiltrate at the site of a break in the corneal epithelium which can be seen with the naked eye, stromal oedema around the infiltrate. There is a hypopyon in the anterior chamber.

Question: What is the most likely diagnosis?

3. A 25-year-old woman presents with segmental reddening of the right eye. There is no discharge. The redness is located in the temporal quadrant of the bulbar conjunctiva. The dilated vessels are salmon-pink, moved freely with the conjunctiva, and blanched with the application of topical epinephrine. Vision is unaffected.

Questions: What is the diagnosis? What treatment can you offer?

4. A 77-year-old woman presents with a painful rash of 2 days duration across the left side of her forehead. She complains that her left eye is red, watery, with

foreign body sensation and the vision is a little blurry on the left side. Slit lamp examination: punctate epithelial erosions and pseudodendrites.

Questions: What is the likely diagnosis? How should the patient be treated?

Diseases of the uveal tract

A. Tests for self-control:

1. Anterior uveitis is seen in association with

a. Rheumatoid arthritis.

b. Ankylosing spondylitis.

c. Reiter's syndrome.

d. All of the above.

2. Iridocyclitis is characterized by

a. Normal tension.

b. Dilated pupil.

c. Keratic precipitates.

d. All of the above.

3. The earliest feature of anterior uveitis includes

a. Aqueous cells and a flare.

b. Keratic precipitates.

c. Posterior synechiae.

d. Hypopyon.

4. Which of the following is not a possible aetiology for chronic anterior uveitis?

a. Syphilis.

b. Still's disease.

c. Fuch's heterochromia.

d. Sarcoidosis.

5. Tumours of the uveal tract may include all of the following types EXCEPT

a. Naevus.

b. Malignant melanoma.

c. Haemangioma of the choroid.

d. Basal cell carcinoma.

6. ‘Mutton fat’ keratic precipitates are typically seen in

a. Central choroiditis.

b. Granulomatous uveitis.

c. Acute anterior uveitis.

d. Juxtapapillary choroiditis.

7. Granulomatous uveitis is characterized by all of the following EXCEPT

a. Iris nodules.

b. Acute onset.

c. ‘Mutton fat’ keratic precipitates.

d. Chronic course s.

8. In complete oculocutaneous albinism the colour of the iris is

a. Brown.

b. Black.

c. White.

d. Reddish.

9. Uveitis is characterized by all of the following clinical features EXCEPT

a. Ciliary congestion.

b. Mucopurulent discharge.

c. Keratic precipitates.

d. Small pupil.

10. The symptoms of choroiditis include all of the following EXCEPT

a. Photopsia.

b. Metamorphopsia.

c. Photophobia.

d. Macropsia.

11. In juxtapapillary choroiditis, the lesions are seen in

a. Around the disc.

b. Macula.

c. Peripheral part of the retina.

d. All over the fundus.

12. The term *endophthalmitis* means inflammation of

a. Choroid.

b. Retina.

c. Internal structures of the eye.

d. All structures of the eye.

13. Drug of choice for acute iridocyclitis is

a. Antibiotic.

b. Mydriatic.

c. Carbonic ahhydrase inhibitor.

d. Immune modulator of interleukin 2.

14. The complications of anteior uveitis include all of the following EXCEPT

a. Anterior synechiae.

b. Posterior synechiae.

c. Pterygium.

d. Secondary glaucoma.

15. The most common cause of central choroiditis is

a. Sarcoidosis.

b. Toxoplasmosis.

c. Toxocariasis.

d. Syphilis.

B. Multiple choice questions *(identify the true and false statements)**:***

1. Match the description with the most likely diagnosis: a patient presents with

a. A sticky, diffusely red eye; vision is normal.

b. A red eye most marked at the limbus, with blurred vision and photophobia.

c. Sudden onset of a local red patch on the sclera, associated with slight discomfort but with unaffected vision.

d. A painful red eye and slightly blurred vision. He suffers from rheumatoid arthritis.

e. A painful red eye, very blurred vision and discharge. There is a history of contact lens wear.

i Corneal ulcer.

ii Optic neuritis.

iii Scleritis.

iv Uveitis.

v Allergic conjunctvitis.

vi Bacterial conjunctivitis.

vii Episcleritis.

viii Subconjunctival haemorrhage.

ix Posterior capsule opacification.

2. Uveitis can be an inflammation of

a. The iris.

b. The choroid.

c. The lens.

d. The ciliary body.

e. The optic nerve.

3. Uveitis

a. May be associated with infectious and noninfectious systemic diseases.

b. Is always associated with redness of the eye.

c. Can produce both anterior and posterior synechiae.

d. May be complicated by increase of intraocular pressure.

e. May cause oculomotor palsies.

4. Granulomatous uveitis

a. May be associated with tuberculosis, sarcoidosis, syphilis, leptospirosis.

b. The onset is acute.

c. Is always associated with marked redness of the eye.

d. Iris nodules usually present.

e. Typical keratic precipitates are ‘mutton fat’.

C. Clinical cases:

1. A 30-year-old woman presents with floaters and blurred vision in her left eye. Slit lamp examination shows small yellow palpebral conjunctival nodules, ‘mutton-fat’ keratic precipitates with cells in the anterior chamber, and nodules on the iris. A recent chest radiograph revealed hilar adenopathy. Posterior segment examination shows vitreous cells. There are sheating of the retinal veins and a large, elevated, yellowish subretinal lesion temporal to the optic disc.

Questions: What is the diagnosis? What is the most likely underlying cause of this disorder?

2. A 41-year-old man presents with reports of decreased vision, photophobia, and pain in his left eye for the past 2 days. Visual acuity is hand motions in the left eye. Ocular examination reveals marked conjunctival injection, a 3-mm hypopyon, and

vitreous opacities on B-scan ultrasound. Ophthalmoscopy reveals yellowish discoloration of the vitreous body. No retinal vessel is visible by ophthalmoscopy.
Questions: What is the diagnosis? What is the immediate treatment?

3. A 37-year-old man presents with ocular pain, photophobia, pain is his knees and feet, pain on urination, and aphthous ulcers. Ocular examination reveals a reduction in visual acuity, a mucoid conjunctival discharge, ciliary injection, cells and flare in the anterior chamber, small-sized white keratic precipitates, and posterior synechiae.
Questions: What is the diagnosis? What is the eye condition likely to be associated with?

4. A 12-year-old girl presents with a history of arthralgia, slightly reduced vision, a difference in the size of the pupil. These findings were first noted at a screening vision test performed at school. Ocular examination reveals mild flare in the anterior chamber, small-sized white keratic precipitates, posterior synechiae in the both eyes.
Questions: What is the diagnosis? What is the most likely underlying cause of this disorder?

Diseases of the lens

A. Tests for self-control:

1. Lens capsule is thinnest at the

a. Center anteriorly.

b. Laterally.

c. Superior pole.

d. Inferior pole.

2. Diagnostic criteria of immature cataract includes

a. Greyish.

b. Presence of iris shadow.

c. Black shadow visible against red fundal glow.

d. All of the above.

3. The aetiology of complicated cataract includes all EXCEPT

a. Disciform keratitis.

b. Iridocyclitis.

c. Retinitis pigmentosa.

d. Retinal detachment.

4. Diminished vision in daylight is seen in

a. Central cataract.

b. Peripheral cataract.

c. Zonular cataract.

d. None of the above.

5. Rosette-shaped cataract is a feature of

a. Diabetic cataract.

b. Traumatic cataract.

c. Coronary cataract.

d. Complicated cataract.

6. An opacity in the lens may cause all of the following symptoms EXCEPT

a. Painless loss of vision.

b. Glare.

c. Ciliary injection.

d. Refractive error.

7. Method of choice of aphakia correction is

a. Spectacles.

b. Contact lens.

c. Anterior chamber intraocular lens.

d. Posterior chamber intraocular lens.

8. Morgagnian cataract may cause

a. Secondary glaucoma.

b. Uveitis.

c. Both of the above.

d. None of the above.

9. Change in lens position (ectopia lentis) may be seen in

a. Trauma.

b. Metabolic diseases (homocystinuria).

c. Certain syndromes (Marfan syndrome).

d. All of the above.

10. Congenital cataract may be caused by all of the following EXCEPT

a. Glycogen storage disease.

b. Rubella.

c. Mumps.

d. Galactosaemia.

11. Systemic causes of cataract are all of the following EXCEPT

a. Diabetes.

b. AIDS.

c. Myotonic dystrophy.

d. Atopic dermatitis.

12. Nowaday preferable technique of cataract removing is

a. Reclination (couching).

b. Extracapsular cataract extraction.

c. Phacoemulsification.

d. Intracapsular cataract extraction.

13. Which one of the following would be least useful in patient before cataract surgery?

a. Search for local source of infection.

b. Assessment of levator function.

c. Retinal function tests.

d. Ultrasonography.

14. Signs of aphakia include all of the following EXCEPT

a. Four images by Purkinge image test.

b. Iridodonesis.

c. Deep anterior chamber.

d. High hypermetropia.

15. White pupillary reflex (leukocoria) may be caused by all of the following EXCEPT

a. Congenital cataract.

b. Parasitic endophthalmitis.

c. Leucomatous corneal opacity.

d. Retinoblastoma.

B. Multiple choice questions *(identify the true and false statements)**:***

1. Acquired cataract

a. The most frequent form of cataract is complicated cataract.

b. Symptoms of cataract can include blurred vision, glare and double vision.

c. Symptoms of cataract never include changes in colour perception.

d. Acquired cataracts require the urgent surgical treatment.

e. Corticosteroids may cause lens opacification.

2. Congenital cataract

a. Rubella is the commonest cause of congenital cataract due to fetal infection.

b. Metabolic disorders may result in cataracts.

c. In infants cataract may cause amblyopia.

d. Congenital cataracts do not require the urgent surgical treatment.

e. Most familial lens opacities do not impair vision and are not progressive.

3. Cataract may cause

a. Photophobia.

b. Glare.

c. A sudden loss of vision.

d. A gradual loss of vision.

e. A monocular diplopia.

C. Clinical cases:

1. A 43-year-old man presents with decreased vision in both eyes that is worse in the right eye with progression during the past 6 months. He noticed that the problem was particularly bad in bright sunshine, and that sunglasses are not helping very much anymore. The eyes were not painful or red. He is otherwise well. Visual acuity: right eye 0,1 (20/200); left eye 0,5 (20/40). Slit-lamp examination: clear corneas and anterior chamber OU. Right eye: dense opacified plaque is located in the cortex near the central posterior capsule. Left eye: similar plaque but smaller and not completely in visual axis.

Question: What is the diagnosis?

2. A 15-day-old child presents with bilateral nuclear cataracts. The child does not appear to have any obvious physical abnormalities.

Question: What is the optimum time to operate on a child?

3. A 68-year-old man complains of severe pain, worsening vision, lid swelling and redness of the right eye. She underwent uncomplicated cataract surgery to her right eye 5 days ago. She was very pleased with the results of surgery. Ocular examination: visual acuity is 1,0 (20/20) in the left eye, and hand movements in the right eye. There are right-sided eyelid oedema, marked circumcorneal congestion, corneal oedema with infiltrate associated with the wound, 3 mm hypopyon and yellowish white exudates in the vitreous seen in the pupillary area behind the intraocular lens.
Questions: What is the most likely diagnosis? What is the immediate treatment?

Glaucoma

A. Tests for self-control:

1. Shallow anterior chamber is seen in

a. Adherent leucoma.

b. After trabeculectomy.

c. Closed angle glaucoma.

d. All of the above.

2. Aqueous humour formation occurs by all means EXCEPT

a. Ultrafiltration.

b. Active secretion.

c. Passive diffusion.

d. De nove synthesis.

3. All of the following field defects are characteristic of glaucoma EXCEPT

a. Arcuate scotoma.

b. Ring scotoma.

c. Baring of blind spot.

d. Binasal quadrantinopia.

4. Which of the following is contraindicated in primary glaucoma

a. Atropine.

b. Pilocarpine.

c. Adrenaline.

d. Eserine.

5. Eyes prone to angle closure glaucoma have all the following characteristics EXCEPT

a. Hypermetropia.

b. Shallow anterior chamber.

c. Large lens.

d. Wide anterior chamber angle.

6. Which one of the following is NOT a risk factor for primary open angle glaucoma?

a. Topical corticosteroid response.

b. African American heritage.

c. Positive family history.

d. Diabetes mellitus.

7. Topical beta-adrenergic antagonists are known to be associated with all of the following side effects EXCEPT

a. Increased plazma high-density lipoprotein cholesterol levels.

b. Bronchospasm and airway obstruction.

c. Weakened myocardial contractility.

d. Exercise intolerance.

8. Glaucomatous optic neuropathy is associated with damage to which types of retinal cells?

a. Amacrine cells.

b. Ganglion cells.

c. Bipolar cells.

d. Photoreceptors.

9. Compared with plasma, aqueous humour has an increased concentration of which one of these components?

a. Protein.

b. Ascorbate.

c. Glucose.

d. Carbon dioxide.

10. Carbonic anhydrase inhibitors decrease intraocular pressure (IOP) by:

a. Increasing uveoscleral outflow.

b. Decreasing aqueous production.

c. Increasing conventional (trabecular meshwork) outflow.

d. Decreasing episcleral venous pressure.

11. Prostaglandin analogues decrease IOP predominantly by which one of the following mechanisms?

a. Increased uveoscleral outflow.

b. Enhanced aqueous outflow by stimulation of ciliary muscle contraction.

c. Reduced vitreous volume.

d. Reduced aqueous production.

12. All of the following factors may influence an optic nerve's susceptibility to glaucomatous damage EXCEPT

a. Diabetes mellitus.

b. Associated cardiovascular diseases.

c. Age-related subcapsular cataract.

d. Age and heredity.

13. In a normal population the horizontal cup/disc diameter ratio is

a. Less than 0,2.

b. Less than 0,4.

c. Greater than 0,6.

d. None of the above.

14. The right eye of a 2-year-old child appears larger than the left. Which of the following tests is unlikely to be helpful in establishing the correct diagnosis?

a. Slit-lamp examination.

b. Tonometry.

c. Ophthalmoscopy.

d. Girshberg test.

15. What is differential diagnosis of acute congestive glaucoma?

a. Acute conjunctivitis.

b. Acute iridocyclitis.

c. Secondary acute phacomorphic glaucoma.

d. All of the above.

B. Multiple choice questions *(identify the true and false statements)**:***

1. Which of the following statements are true?

a. Aqueous humour is produced by nonpigmented epithelium of the ciliary body.

b. Aqueous drains from the eye via the trabecular meshwork and into Schlemm's canal.

c. The uveoscleral pathway accounts for most of the drainage of aqueous.

d. Intraocular pressure is determined by rate of aqueous production and outflow.

e. Glaucoma is always associated with a raised intraocular pressure.

2. Symptoms and signs of congenital glaucoma include

a. Lacrimation (epiphora) and photophobia.

b. Enlargment of the cornea.

c. Corneal opacification and splits in Descemet's membrane.

d. Redness of the eye.

e. Increased intraocular pressure.

3. A 52-year-old patient has an arcuate visual field defect, an inlarged cup-to-disc ratio and elevated intraocular pressure.

a. The most likely diagnosis is acute angle closure glaucoma.

b. The most likely diagnosis is chronic open angle glaucoma.

c. Treatment is initially with pilocarpine eye drops and intravenous acetazolamide.

d. Treatment is confined to local drug therapy.

e. The corneal diameter will be increased.

4. Treatment of glaucoma

a. The aim is to reduce the intraocular pressure to the level of the target pressure.

b. Surgical treatment is the treatment of choice for primary open angle glaucoma.

c. Prostaglandin analogs, beta-blockers, carboanhydrase inhibitors are available for initial local drug treatment in primary open angle glaucoma.

d. Non-selective beta-blockers have fewer systemic side effects and minimal contraindications.

e. Filtration surgery reverses damage to the optic nerve caused by glaucoma.

C. Clinical cases:

1. Three months ago, a 68-year-old man suffered a central retinal vein occlusion in his right eye. Now he presents with a red, light sensitive, painful right eye. Ocular examination reveals visual acuity of hand motions. IOP of OD is 39 mm Hg. Slit-

lamp examination: conjunctival hyperaemia, corneal oedema, minimally shallow anterior chamber, rubeosis iridis. The fundus is obscured due to opacification of the corneal epithelium.
Questions: What is the diagnosis? What is the most appropriate treatment for this patient?

2. A 78-year-old woman had bilateral mature cataracts. After her left eye cataract was removed, she was very pleased with the visual result but decided she did not want the right eye cataract removed. Two years later she returned complaining of extreme pain in her right eye, nausea, lacrimation and photophobia. Ocular examination reveals the right eye to have an intraocular pressure of 48 mm Hg, conjunctival injection, corneal oedema, a significant inflammatory reaction and white particles of lens material in the anterior chamber aqueous, and an open anterior chamber angle. The iris has no neovascularization. It is not possible to examine the fundus because of the cataract.
Questions: What is the the most probable diagnosis? What is the management?

3. A 59-year-old woman suddenly experienced nausea, vomiting, blurred vision and halos, frontal headaches, and severe pain in the right eye. Her vision has worsened since that time and the eye has become very red. Vision is hand movements OD and 1,0 (20/20) with correction OS. Refraction is + 4,0D sphere OU. Slit-lamp examination of the right eye reveals a cloudy cornea with stromal oedema, conjunctival and ciliary injection, and a fixed, dilated oval pupil. The anterior chamber is very shallow in the right eye and moderately shallow in the left. IOP are 58 mm Hg OD and 18 mm Hg OS. No view of the OD fundus is obtained. The left eye has a 0.3 cup-to-disc ratio.
Questions: What is the diagnosis? How would you manage this patient?

4. A mother brings her 8-month-old son with excessive tearing from the both eyes for an eye examination. The child is irritable and rubs his eyes often. On

examination, the boy is noted to have photophobia, decreased corneal luster, increased corneal diameter and corneal opacification.

Questions: What is the most likely cause of these findings? What is the best course of action to take?

Diseases of the retina and optic nerve

A. Tests for self-control:

1. Degeneration of which retinal cells is the principle cause of retinitis pigmentosa?

a. Ganglion cells.

b. Retinal pigment epithelium.

c. Rods.

d. Cones.

2. The late clinical features of retinitis pigmentosa include all EXCEPT

a. Normal vision.

b. Waxy disc.

c. Sheating of disc vessels.

d. Ring scotoma.

3. Nyctalopia (night blindness) is seen in following EXCEPT

a. Retinal detachment.

b. Extensive chorioretinitis.

c. Retinitis pigmentosa.

d. Toxocariasis.

4. In retinitis pigmentosa pigmentation in retina starts at

a. Posterior pole.

b. Anterior to equator.

c. Equator.

d. The disc.

5. A ‘gun-barrel’ visual field is seen in

a. Papillitis.

b. Retinitis pigmentosa.

c. Macular oedema.

d. Age-related macular degeneration.

6. Retinoblastoma is

a. Most common in adults.

b. Not managed with radiation therapy.

c. Bilateral in 30% of cases.

d. None of the above.

7. Vision is grossly reduced in

a. Papillitis.

b. Papilloedema.

c. Pseudopapillitis.

d. All of the above.

8. Papilloedema can be differentiated from papillitis by the following features

a. Gradual onset with slow progress.

b. Bilateral.

c. Other signs of central nervous system involvement.

d. All of the above.

9. The characteristic sign of retrobulbar optic neuritis is

a. Central scotoma and normal fundus.

b. Hyperaemia of the optic nerve head with marginal bleeding.

c. Optic nerve atrophy with wedge-shaped visual field defects.

d. Sudden loss of vision and ciliary congestion.

10. The most common cause of retrobulbar optic neuritis and papillitis is

a. Diabetes mellitus.

b. Toxoplasmosis.

c. Central serous choriopathy.

d. Demyelinating diseases of the central nervous system.

11. The most important causes of secondary optic nerve atrophy are

a. Papilloedema.

b. Papillitis.

c. Both of the above.

d. None of the above.

12. All of the following may be toxic for optic nerve EXCEPT

a. Vasodilators.

b. Isoniazid.

c. Tobacco and alcohol.

d. Gentamicin.

13. Risk factors for age-related macular degeneration development include all of the following EXCEPT

a. Tobacco smoking and alcohol intake.

b. Gender (male > female) and brown eyes.

c. Gender (female > male) and blue eyes.

d. Cardiovascular diseases and increasing age.

14. Pathogenesis of dry form of age-related macular degeneration include all of the following EXCEPT

a. Loss of retinal pigment epithelium/photoreceptors.

b. Thickening of Bruch's membrane.

c. Atrophy of choriocapillaries.

d. Choroidal neovascular membrane formation.

15. Risk factors for central serous chorioretinopathy development include all of the following EXCEPT

a. Young adult males, 20-45 years.

b. Pregnancy.

c. Hypermetropia.

d. Stress.

B. Multiple choice questions *(identify the true and false statements)**:***

1. A papilledema may be caused by

a. Raised intraocular pressure.

b. Raised intracranial pressure.

c. Optic neuritis.

d. Systemic hypertension.

e. Central retinal artery occlusion.

2. Optic nerve atrophy may be seen in

a. Some retinal diseases.

b. Compression of the optic nerve.

c. Diseases of the visual cortex.

d. Toxic eye disease.

e. Poor nutrition.

3. Ischaemic optic neuropathy

a. Presents with an acute loss of vision.

b. On examination the patient has papilledema.

c. May be associated with jaw claudication and scalp tenderness.

d. Should always be treated with steroids.

e. May cause an altitudinal field defect.

4. Age-related macular degeneration (AMD)

a. Is the commonest cause of irreversible visual loss in the developed world.

b. Is associated with disorder of the retinal pigment epithelium.

c. May be associated with the growth of new blood vessels beneath the retina.

d. Is caused by a hole forming at the macula.

e. Is commonly treated with surgery.

5. Macular oedema

a. Relates to the accumulation of fluid within the macula.

b. Causes blurring of vision.

c. May be seen following intraocular surgery.

d. Is usually associated with the growth of new abnormal vessels in the retina.

e. Can be treated with inravitreal injections of vascular endothelial growth factor inhibitors.

6. A two-year-old child presents with a squint. The doctor notices that the red reflex appears white.

a. A white reflex is a normal finding in a child of this age.

b. The child may have a retinoblastoma.

c. The child has albinism.

d. Urgent referral is required.

e. The other eye needs to be assessed.

7. Optic neuritis

a. Is associated with a sudden loss of vision that does not progress.

b. Is painless.

c. May be part of a systemic neurological disease.

d. Vision rarely recovers.

e. Is associated with a reduction in colour vision.

C. Clinical cases:

1. A 11-year-old boy presents with problems seeing the chalkboard at school but not reading textbooks. He denies night vision problems and photophobia. He is healthy and takes no medications. His mother had some visual problems when she was young. Ocular examination: best-corrected visual acuity is 0,2 (20/100) in both eyes. Intraocular pressure and colour vision are normal. Visual field testing revealed a loss of central sensitivity with normal peripheral fields. Anterior segment examination is normal. Posterior segment examination shows some yellow round flecks in the macula bilaterally and loss of foveal reflex. There is also some retinal pigmented epithelium atrophy (an atrophic beaten-bronze appearance) in the macula bilaterally. The optic nerves and vessels are normal.

Question: What is the most likely diagnosis?

2. A 23-year-old woman presents with a two-day history of blurring of vision and 'washed-out' colours in the left eye. She also has pain caused by moving the eye. She has previously had an episode of weakness in the left arm one year ago. Ocular examination: the visual acuity of the left eye is 0,04 (20/500). Automated perimetry shows a central scotoma in the left eye. There are impaired colour vision and a relative afferent left pupillary defect. Slit lamp examination and funduscopy are normal.

Questions: What is the diagnosis? What examination should be performed?

3. A 67-year-old man complains of difficulty reading and slight distortion of an image. Ocular examination: the visual acuity is 0,8 (20/25) OD and 0,5 (20/40) OS. Anterior segment examination shows mild nuclear sclerosis OU. Posterior segment examination shows hard, confluent drusen and hypopigmentation in the macula bilaterally.

Questions: What is the most likely diagnosis? What treatment should be given?

4. An 11-month-old child presents with a squint. The parents notice that the child has a white pupillary reflex of the left eye. Ocular examination revealed visible leukocoria of the left eye and a large whitish-pink intraocular elevated mass at the posterior pole of the eye.

Questions: What is the most likely diagnosis? What examination should be performed? How should the patient be treated?

5. A 52-year-old man had awakened five days previously with decreased vision in the lower half of the visual field of the right eye. This decrease in vision had remained unchanged. The vision in the left eye was normal. The patient suffered from mild hypertension that had been well controlled on medication. He denied any history of headache, fever, or other systemic symptoms. On examination, the visual acuity with spectacle correction was 1,0 (20/20) OU. Examination of the pupils reveals a mild afferent pupillary defect in the right eye. Ophthalmoscopy of the right eye revealed a moderate degree of disc oedema, more marked superiorly than inferiorly. Examination of the disc on the left eye determined that no physiological cup was present. A static computer perimetry (central threshold 30-2 test) showed a dense inferior altitudinal visual field defect in the right eye. The visual field in the left eye was within normal limits.

Question: What is the most likely diagnosis?

Eye injuries. The first aid

A. Tests for self-control:

1. Possible injuries resulting from blunt trauma to the globe include

a. Iridodialysis.

b. Subluxation of the lens.

c. Retrobulbar haematoma.

d. All of the above.

2. Late sequelae of blunt ocular trauma include all of the following EXCEPT

a. Secondary glaucoma.

b. Cataract.

c. Presbyopia.

d. Retinal detachment.

3. Possible diagnostic signs of penetrating eye injuries include

a. Hypotony of the globe.

b. Shallow anterior chamber.

c. Displacement of the pupil.

d. All of the above.

4. 'Sunflower' cataract formation is associated with

a. Argyrosis.

b. Chalcosis.

c. Siderosis.

d. All of the above.

5. Intraocular foreign body that may lead to fulminant endophthalmitis is

a. Wood.

b. Iron.

c. Copper.

d. Lead.

6. The dangerous complication of penetrating eye injury is

a. Iridocyclitis.

b. Hyphaema.

c. Subluxation of the lens.

d. Sympathetic ophthalmia.

7. Clinical signs of corneal abrasion include all of the following EXCEPT

a. Hyphaema.

b. Tearing, pain and blepharospasm.

c. Area of epithelium loss observed with fluorescein stain.

d. Conjunctival injection.

8. Symptoms and signs of orbital floor blow-out fracture include

a. Ecchymosis and oedema of the eyelids.

b. Orbital and eyelid emphysema.

c. Limitation of up or down gaze with diplopia.

d. All of the above.

9. A copper intraocular foreign body can cause all of the following EXCEPT

a. Kayser-Fleischer rings.

b. Suppurative endophthalmitis.

c. Retrobulbar optic neuritis.

d. Sunflower cataract.

10. Purcher's retinopathy occurs in patients with all of the following EXCEPT

a. Measles.

b. Acute pancreatitis.

c. Fractures of long bones.

d. Severe chest compression injuries.

11. The most important steps in the treatment of acute chemical burns include all of the following EXCEPT

a. Istillation of topical anesthetic solution into the cul-de-sac.

b. Copious irrigation of all exposed tissues.

c. Administration of systemic osmotic agents.

d. Administration of topical cycloplegics, antibiotics, enzyme collagenase inhibitors.

12. Initial treatment of ultraviolet burns includes all of the following EXCEPT

a. Istillation of artificial tears into the cul-de-sac.

b. Copious irrigation of all exposed tissues.

c. Administration of antibiotic ointment.

d. Administration of oral analgesics.

13. What are the methods of localizing an intraocular foreign body?

a. Radiographic localization.

b. Ultrasonography.

c. Computer tomography.

d. All of the above.

14. What are the early features of sympathetic ophthalmia?

a. Photophobia and lacrimation.

b. Mild ciliary congestion and keratic precipitates.

c. All of the above.

d. None of the above.

B. Multiple choice questions *(identify the true and false statements)**:***

1. Blow-out fracture of the orbit may produce the following signs

a. Limitation of eye movements.

b. Diplopia.

c. Periorbital emphysema.

d. Exophthalmos in the longer term.

e. Hypesthesia of the facial skin.

2**.** Chemical injuries

a. Can be caused by acids, alkalis, detergents, solvents, irritants.

b. Acid burns cause loss of ground substance and collagen swelling.

c. The worst damage from alkali burns occurs immediately.

d. The degree of ischemia of the limbal and conjunctiva vessels determines the severity of injury.

e. Severe uveitis and glaucoma may occur.

3. First aid and treatment of chemical injuries

a. Instillation of topical anesthetic solution into the cul-de-sac.

b. Immediate irrigation and removal of particles from the conjunctival sac.

c. Débridement of necrotic conjunctiva and cornea.

d. Topical steroids are used to decrease the inflammatory response.

e. Administration of topical antibiotic eyedrops, oral vitamin C, hyaluronic acid.

4. Sympathetic ophthalmia

a. Occurs in the injured eye after penetrating injury or intraocular surgery.

b. The inflammation is non-granulomatous.

c. Patients present with pain, photophobia, and decreased vision.

d. Clinical symptoms include mutton-fat precipitates, iris nodules, anterior segment cell and flare.

e. High-dose topical and systemic steroid therapy is indicated.

C. Clinical cases.

1. While working in the chemical laboratory a man accidentally sprays his eyes with an alkali solution. He managed to immediately wash the eyes at the sink. He presents 45 minutes after the injury. The patient complains of pain, photophobia, watering, and blurred vision in both eyes. The right eye is red and there is corneal abrasions. The left eye is white, the cornea is cloudy, and flare is visible in the anterior chamber.

Questions: What is the first thing that must be done in this situation? What should you do next?

2. A 32-year-old worker presents 7 hours after noting a sudden sharp pain in his left eye while he was drilling into a metal beam without safety glasses. The patient complains of cloudy vision, redness, a mild foreign body sensation with every blink of the eye, and intermittent 'weeping' of the eye. Ocular examination: visual acuity: right eye, 1,0 (20/20); left eye, 0,04 (20/500). IOP: right eye, 17 mm Hg; left eye, 12 mm Hg. External: normal. Left eye: intensive conjunctival injection, large subconjunctival haemorrhage superolaterally. Cornea, anterior chamber, and lens are clear. Numerous free-floating opacities are present in the vitreous body. The retina is partly obscured. Right eye is normal.
Question: What immediate steps should be taken in the care of this patient?

3. A 35-year-old builder presents with a ten-day history of diminished visual acuity, photophobia, redness and pain in his left eye. Five years ago he had severe penetrating injury of the right eye. He also notes periodical irritation and pain in the blind right eye. Ocular examination OS: visual acuity 0,5 (20/40). Slit lamp examination and funduscopy: combined injection, large 'mutton fat' keratic precipitates on the corneal endothelium, cells and flare in the anterior chamber and vitreous body, nodules of inflammatory tissue on the iris, posterior iris synechiae, retinal oedema.
Questions: What is the most likely diagnosis? How should this patient be managed?

Sudden loss of vision. Urgent states in ophthalmology (acute occlusion of the central retinal artery or vein, a retinal detachment)

A. Tests for self-control:

1. Sudden loss of vision occurs in the following EXCEPT

a. Retrobulbar neuritis.

b. Papilloedema.

c. Central retinal artery block.

d. Central retinal vein occlusion.

2. Retinal detachment is associated with

a. Malignant melanoma.

b. High myopia.

c. Diabetic retinopathy.

d. All of the above.

3. Which one of the following poses the highest risk for retinal detachment?

a. Myopia.

b. Family history of retinal detachment.

c. Retinal detachment in the fellow eye.

d. Lattice degeneration.

4. Tractional retinal detachments occur in all of the following EXCEPT

a. Familial exudative vitreoretinopathy.

b. Diabetes mellitus.

c. Retinopathy of prematurity.

d. Choroidal melanoma.

5. Which one of the following is not a risk factor for central retinal vein occlusion?

a. Hypertension.

b. Diabetes.

c. Glaucoma.

d. Prostheric cardiac valves.

6. Which one of the following is the least likely aetiology of a central retinal artery occlusion in a 27-year-old woman?

a. Cardiac emboli.

b. Migraine.

c. Atherosclerosis.

d. Oral contraceptives.

7. Cherry-red spot is seen in

a. Central serous retinopathy.

b. Central retinal vein occlusion.

c. Central retinal artery occlusion.

d. Central chorioretinitis.

8. Emergency treatment of central retinal artery occlusion includes all the following EXCEPT

a. Focal laser treatment.

b. Ocular massage.

c. Instillations of topical timolol.

d. Anterior chamber paracentesis.

9. What ocular complications may result after a central retinal artery occlusion?

a. Cataract.

b. Rubeosis iridis.

c. Corneal oedema.

d. Choroidal nevus.

10. Rhegmatogenous retinal detachment may be caused by

a. Break in the retina.

b. Proliferative retinopathy.

c. Tumour.

d. Central serous retinopathy.

11. What ocular complications may result after a central retinal vein occlusion?

a. Chronic macular oedema.

b. Neovascular glaucoma.

c. Blind, painful eye.

d. All of the above.

B. Multiple choice questions *(identify the true and false statements)**:***

1. Match the description with the most likely diagnosis: a patient presents with

a. Sudden painless total loss of the vision.

b. Floaters, flashes of light and a curtain-like loss of vision.

c. A painful red eye, nausea, loss of vision.

d. Loss of vision for seconds on standing from lying down.

e. Loss of vision over a couple of days associated with pain on eye movement.

i Retrobulbar optic neuritis.

ii Retinal vein occlusion.

iii Retinal artery occlusion.

iv Retinal detachment.

v Acute-closure glaucoma.

vi Vitreous haemorrhage.

vii Orbital cellulitis.

viii Raised intracranial pressure.

ix Endophthalmitis.

2. A central retinal vein occlusion

a. Does not usually cause painless loss of vision.

b. May be associated with the formation of new abnormal vessels.

c. May be a cause of neovascular glaucoma.

d. May be associated with hypertension.

e. There are no marked signs in the retina.

3. Retinal detachment

a. Refers to the separation of the retina from the vitreous body.

b. Risk factors include myopia, trauma, lattice degeneration.

c. Symptoms include the appearance of a 'curtain' coming across the vision.

d. The most frequent form is tractional retinal detachment.

e. Requires urgent treatment.

4. Central retinal artery occlusion

a. The most common cause are emboli.

b. The symptoms include abrupt, unilateral, painful loss of vision.

c. Retinal whitening and cherry-red spot are common clinical findings.

d. Emergency treatment is often successful when initiated immediately.

e. Treatment includes ocular massage, topical β blockers, anterior chamber paracentesis, vasodilators, and fibrinolytic agents.

C. Clinical cases.

1. A 74-year-old hypertensive man awoke with sudden, painless loss of vision in the left eye. Ocular examination reveals visual acuity of hand motions and an afferent pupillary defect. IOPs are normal. Anterior segment examination is normal. Posterior segment examination of the left eye shows widespread retinal whitening with sparing of the retina between the fovea and temporal optic nerve margin. The fovea appears dark reddish-brown relative to the surrounding retina.
Questions: What is the diagnosis? What is the management?

2. A 37-year-old patient with high myopia presents with a four-day history of sudden onset of an increased number of floaters and small flashes of light in the right eye. These were accompanied by the shadow in the visual field, 'wavy' vision

and cobwebs. The general practicion examines the eye and finds a normal visual acuity, peripheral visual field defect and pigmented cells in the vitreous.
Questions: What is the previous diagnosis? What should the general practicion advise?

3. A 78-year-old woman complains of blurred vision of the right eye and distortions. She is hypertensive on treatment. Visual acuity is 0,2 (20/100) in the right and 1,0 (20/20) in the left eye. Anterior segment examination is normal. Dilated fundus examination shows dilated and tortuous veins with retinal oedema, dot and flame-shaped retinal hemorrhages in the superotemporal quadrant.
Questions: What is the likely diagnosis? What investigations will you do?

Eye movements and their disorders. Squint

A. Tests for self-control:

1. The oculomotor nerve (3rd cranial nerve) supplies all of the extraocular muscles EXCEPT

a. The superior oblique and the lateral rectus.

b. The lateral rectus and the inferior oblique.

c. The inferior oblique and the medial rectus.

d. The superior rectus and the lateral rectus.

2. Heterophoria results from

a. Cerebral trauma and encephalitis.

b. Muscular balance with parallel visual axes.

c. Muscular imbalance between the two eyes under certain conditions.

d. Retinal diseases.

3. Heterophoria can be diagnosed by all of the following tests EXCEPT

a. Cover-uncover test.

b. Hirschberg test.

c. Maddox rod test.

d. Maddox wing test.

4. Which muscle is a synergist to the inferior oblique?

a. Superior rectus.

b. Inferior rectus.

c. Lateral rectus.

d. Medial rectus.

5. All of the following are signs of congenital third cranial nerve palsy EXCEPT

a. Ptosis.

b. Esodeviation.

c. Abnormal pupillary reaction.

d. Hypotropia.

6. Concomitant strabismus is distinguished from the paralytic strabismus by all of the following EXCEPT

a. Diplopia is rare.

b. The movements of both eyes are full.

c. The angle of deviation increases in direction of pull of the paralyzed muscle.

d. Compensatory head posture is rare.

7. Concomitant strabismus has a better prognosis if the onset is

a. Between the ages of three and seven.

b. At birth.

c. Between the ages of one and three.

d. Late in life.

8. Concomitant convergent strabismus is seen in all of the following conditions EXCEPT

a. Myopia.

b. Palsy of superior rectus muscle.

c. Hyperopia.

d. Opacities in the media.

9. Diplopia is a characteristic feature of

a. Paralytic strabismus.

b. Uniocular concomitant strabismus.

c. Alternating concomitant strabismus.

d. Apparent strabismus.

10. In paralytic squint

a. The secondary angle of deviation is < than the primary angle.

b. The secondary angle of deviation = the primary angle.

c. The secondary angle of deviation is > than the primary angle.

d. None of the above.

11. Acquired ocular motility disturbances may be due to the all of the following causes EXCEPT

a. Trauma.

b. Diabetes mellitus.

c. Aplasia of the ocular muscles.

d. Intracranial tumours.

12. Exophoria is commom in

a. Hyperopia.

b. Presbyopia.

c. Aphakia.

d. Myopia.

13. All of the following are signs of paralytic strabismus EXCEPT

a. Amblyopia.

b. Diplopia.

c. Compensatory head posture.

d. No change in visual acuity.

14. Alternating divergent squint is a form of

a. Paralytic squint.

b. Concomitant squint.

c. Apparent squint.

d. Latent squint.

15. Treatment of esophoria includes

a. Correction of refractive error.

b. General improvement of health and nutrition.

c. Convergence exercises.

d. All of the above.

B. Multiple choice questions *(identify the true and false statements)**:***

1. Match the eye muscle to the nerve

a. Lateral rectus.

b. Superior rectus.

c. Inferior rectus.

d. Medial rectus.

e. Superior oblique.

f. Inferior oblique.

i Third nerve.

ii Fourth nerve.

iii Sixth nerve.

2. Heterophoria

a. Referes to a muscular imbalance between two eyes.

b. Is typified by initially parallel visual axes and full binocular vision.

c. Is a rare disorder (10-15% of the population).

d. Is diagnosed by binocular vision testing.

e. Requires treatment only in symptomatic cases.

3. Which of the following statements are true?

a. In a non-paralytic squint the movement of the eyes is reduced.

b. In a non-paralytic squint the angle of deviation is unrelated to the direction of gaze.

c. In a paralytic squint the eye movement is reduced.

d. Nystagmus refers to an oscillating movement of the eyes.

e. In a horizontal gaze palsy the patient is unable to look to one side.

C. Clinical cases:

1. A 51-year-old man presents with diplopia and headache that began suddenly two days ago. The diplopia is binocular horizontal, and worse on the right gaze. He has no past ophthalmic and drug history. Visual acuity is 1,0 (20/20). Cover-uncover test reveals esotropia in primary gaze when fixating. There is an abduction deficit of the right eye. Fundus examination reveals hypertensive angiopathy.
Question: What is the most likely diagnosis?

2. A mother notices that her 5-year-old son has a permanent inward deviation of the left eye. Visual acuity is 1,0 (20/20) OD, 0,1 (20/200) OS. The Worth four-dot test: two red lights are seen. The amplitude of eye movements is normal in both eyes. A corneal light reflection (by Hirschberg test) in the left eye is located at the pupillary margin (2 mm from the pupillary center): equal to approximately 15°

(30^{Δ}) deviation. Cycloplegic refraction is + 2,5 D sphere OD and + 6,00 D sphere OS. Anterior and posterior segment examination of both eyes is normal.
Questions: What is the most likely diagnosis? What is the most likely aaetiology? What is the treatment?

3. A 58-year-old man presents with headache, double vision for the last 8 hours and droopy left upper eyelid. He has no previous ocular history. He is on medication on hypertension but smokes 8-10 cigarettes per day. Ocular examination: binocular horizontal diplopia; ptosis on the left side; the left pupil is dilated; the left eye is abducted in the primary position; eye movements of the left eye are moderately reduced in all directions except for abduction and downgaze; anterior segments are normal; eye fundus examination reveals hypertensive angiopathy.
Questions: What is the most likely diagnosis? What investigations would you perform?

Ocular disorders associated with systemic diseases

A. Tests for self-control:

1. Ophthalmoscopically, the earliest sign of diabetic retinopathy is

a. Retinal haemorrhage.

b. Microaneurysm.

c. Soft exudates.

d. Hard exudate.

2. Which of the following is true of diabetic retinopathy

a. Always associated with hypertension.

b. Seen only in uncontrolled diabetes.

c. Incidence increases with duration of disease.

d. Determines prognosis of disease.

3. The characteristic features of acquired immune deficiency syndrome (AIDS) include

a. Cotton-wool spots.

b. Cytomegalovirus retinitis.

c. Conjunctival Kaposi's sarcoma.

d. All of the above.

4. Cataract may be caused by or associated with

a. Trauma.

b. Diabetes.

c. Hypocalcaemia.

d. All of the above.

5. Flame-shaped haemorrhages are seen commonly in the retinopathy of

a. Diabetes.

b. Hypertension.

c. Retinitis pigmentosa.

d. All of the above.

6. Which one of the following is the most common retinal finding in AIDS?

a. Cotton wool spots.

b. Cytomegalovirus retinitis.

c. Pneumocystis choroiditis.

d. Acute retinal necrosis.

7. Candle wax spots in the retina are seen in

a. Sarcoidosis.

b. Toxocarosis.

c. Syphilis.

d. Cytomegalovirus.

8. The cardinal feature of stage 4 hypertensive retinopathy is

a. Arteriovenous crossing changes.

b. Flame-shaped haemorrhage.

c. Papilloedema.

d. Soft exudate.

9. The common causes of papilloedema include

a. Intracranial tumour.

b. Grade 4 hypertensive retinopathy.

c. Subdural haematoma.

d. All of the above.

10. Uveitis occurs commonly in association with

a. Rheumatoid arthritis.

b. Systemic lupus erythematosus.

c. Reiter's disease.

d. All of the above.

11. A patient with multiple sclerosis could have all of the following EXCEPT

a. Bitemporal visual field deficit.

b. Retinal venous sheathing.

c. Skew deviation.

d. Amaurosis.

12. A 44-year-old black woman noticed a change in vision yesterday. Today, visual acuity is 1,0 (20/20) OD and 0,1 (20/200) OS. There is a left relative afferent pupillary defect and a swollen left optic nerve head. The remainder of the

examination is normal. Of the following, which is the LEAST helpful historical factor?

a. Hyperthyroidism treated 1 year ago.

b. Recent 1-month episode of left arm numbness.

c. Hilar adenopathy on recent chest radiograph.

d. Hypertension treated for 5 years.

13. Toxoplasmosis usually affects

a. Ciliary body.

b. Macula.

c. Iris.

d. Cornea.

14. Salt-and-pepper granularity of the fundus is seen in

a. Retinitis pigmentosa.

b. Toxoplasmosis.

c. Congenital syphilis.

d. Leprosy.

15. The most common cause of bilateral exophthalmos in adults is:

a. Metastatic disease.

b. Graves's disease.

c. Cavernous haemangioma.

d. Orbital tumour.

B. Multiple choice questions *(identify the true and false statements)****:***

1. Diabetic retinopathy

a. Is seen in 80% of patients who have had diabetes for 20 years.

b. Control of systemic hypertension is important in reducing the severity of the retinopathy.

c. The number of pericytes around the capillaries is increased.

d. Vitreous haemorrhage is often associated with the formation of new vessels on the retina or optic nerve head.

e. Circinate patterns of exudates are treated with scattered laser.

2. Match the description with the most likely diagnosis. A patient presents with

a. Gradual loss of vision over some months, with increasing glare in the sun.

b. Gradual loss of vision followed by more rapid loss, associated with distortion of central vision.

c. Gradual loss of vision in the right eye, associated with a relative afferent pupillary defect.

d. Gradual loss of vision in both eyes, with no relative afferent pupillary defect or media opacity.

e. Gradually increasing blurring of vision some months following cataract surgery.

i Pituitary tumour.

ii Cortical infarct.

iii Corneal ulcer.

iv Cataract.

v Age-related macular degeneration.

vi Macular oedema.

vii Optic nerve compression.

viii Retinal detachment.

ix Posterior capsule opacification.

3. In AIDS

a. Cotton-wool spots, microaneurysms and haemorrhages may be seen on the retina.

b. Cytomegalovirus retinitis causes peripheral retinal necrosis and intraretinal bleeding.

c. Oculomotor palsies may be seen.

d. Toxoplasmosis is uncommon cause of non-viral central nervous system infection.

e. Ganciclovir is used to treat cytomegalovirus retinitis.

C. Clinical cases:

1. A 44-year-old woman presents with bilateral exophthalmos, reddened dry eyes with a sensation of pressure, double vision, and chemosis. Visual acuity is 0,8 (20/25) in the both eyes. The eyelids are retracted inferiorly. The patient has an incomitant squint.

Question: What is the diagnosis?

2. A 65-year-old woman presents to the hospital for a routine diabetic examination. She has had type 2 diabetes mellitus for 15 years, and she has required insulin treatment for the past 5 years. She has noted a gradual decrease in her vision during the past 7 months. Blood pressure is 140/80 mm Hg. Visual acuity is 0,8 (20/25) OU. IOP is 15 mm Hg OU. Anterior segment examination reveals mild cortical cataracts of the both eyes without iris neovascularization. Posterior segment examination shows intraretinal haemorrhages in three quadrants OU, numerous microaneurysmus concentrated in the macula, venous beading in two quadrants, and cotton-wool spots. There is no neovascularization of the retina or optic nerve.

Questions: What is the diagnosis? How should this patient be managed?

3. A 31-year-old man without visual complaints presents to the ophthalmologist for a routine eye examination. Visual acuity is 1,0 (20/20) OU. The anterior segment is normal. The posterior segment examination reveals microaneurysms, vascular sheathing, and cotton-wool spots in the both eyes.

Questions: What laboratory testing should be performed for identifying the cause of these fundus changes? What is the most likely diagnosis?

ANSWERS AND REFERENCES

These answers and references are to help you confirm that the reasoning you used in finding the true answer was correct.

Anatomical and physiological peculiarities of the visual system.

A. Answers to the tests for self-control:

1. - a. 2. - c. 3. - b. 4. - b. 5.- b. 6. - d. 7. - a. 8. - c. 9. - b. 10. - d. 11. - c. 12 - b. 13 - d. 14. - d. 15. - a.

B. Answers to the multiple choice questions:

1. **a**-true; **b**-false (comprise four layers: skin, orbicularis muscle, the tarsal plate, the tarsal conjunctiva); **c**-false (the palpebral conjunctiva is firmly attached to the tarsal plate); **d**-true (strong acoustic and optical stimuli (such as blinding light, or sudden loud noise) 'automatically' elicit an eye-closing reflex); **e**-true (regular blinking (20-30 times/min) helps to uniformly distribute glandular secretions and tears over the conjunctiva and cornea, keeping them from drying out).

2. **a**-true (the conjunctiva is a mucous membrane consisting of nonkeratinizing squamous epithelium and goblet cells on its surface and a thin, richly vascularized substantia propria, which contains lymphatic vessels, occasional accumulations of lymphocytes, plasma cells, macrophages, and mast cells); **b**-true; **c**-false (the bulbar conjunctiva is loosely attached to the sclera and is more closely attached to the limbus of the cornea); **d**-true; **e**-false (the palpebral conjunctiva can be inspected by everting the upper or lower eyelid; the bulbar conjunctiva can be evaluated by direct inspection under a focused light).

3. **a**-false (the human endothelium does not regenerate: mitosis of the endothelium seldom occurs in humans, and the overall number of endothelial cells decreases

with age; corneal decompendation occurs if it falls < 500 cells/mm^2); **b**-true (the corneal tissue consists of epithelium, Bowman`s membrane (anterior elastic lamina), corneal stroma, pre-Descemet`s layer or Dua`s layer, Descemet`s membrane (posterior elastic lamina), endothelium); **c**-true (the endothelium cells pump out ions and the water follows osmotically; removal of water maintains corneal transparency; the water content of the corneal stroma remains constant at 70%); **d**-true (the cornea and the aqueous humour together form a positive lens of about 43 D in air and therefore constitute the main refractive element of the eye); **e**-false (the cornea is nourished with nutritive metabolites from three sources: diffusion from the capillaries at its edge, diffusion from the aqueous humour, diffusion from the tear film).

4. **a**-true; **b**-true; **c**- false (the iris consists of two layers: the anterior mesodermal stromal layer and the posterior ectodermal pigmented epithelial layer; from anterior (front) to posterior (back), the layers of the iris are: anterior limiting layer, iris stroma, iris sphincter muscle, iris dilatator muscle (myoepithelium), anterior pigment epithelium, posterior pigment epithelium); **d**- true (the ciliary muscle is responsible for changes of lens shape (thickness and curvature) during accommodation; the zonular fibres, supporting the lens, are under tension during distant viewing, flattened the lens profile; contraction of the muscle relaxes the zonule and permits the elasticity of the lens to increase its curvature and hence its refractive power); **e**-false (the choroid is highly vascularized, containing a vessel layer with large blood vessels and a capillary layer; the blood flow through choroid is the highest in the entire body).

5. **a**-true; **b**-true (the retinal ganglion cell axons form the retinal nerve fibre layer and exit the eye at the optic nerve head); **c**-false (the rods are responsible for night vision and three cone types are responsible for daylight and colour vision); **d**-false (the attachment is loose; the neuroretina separates in retinal detachment); **e**-true

(vitamin A is delivered by the retinal pigment epithelium to the photoreceptors and combined with opsin).

6. **a**-true (it continues to grow throughout life; the lens never loses any cells so that its tissue is continuously compressed throughout life, and the central part of lens (nucleus) consists of older fibres); **b**-true (the basement membrane of the lens epithelial cells forms the lens capsule, which surrounds the lens completely, and provides a surface for insertion of the zonular fibres; so, the capsule is created anteriorly by the epithelial cells and posteriorly by the cortical fibers); **c**-false (on cross section, the cortical cells are hexagonal and possess numerous interlocking fingerlike projections; the cytoplasm is homogeneous and contains few organelles; the older, deep cortical and nuclear fibres lose their nuclei and other organelles); **d**-true (the lens is avascular structure and is nourished by diffusion from the aqueous humour; the water content of the lens is normally stable and in equilibrium with the surrounding aqueous humour); **e**-true (the intrinsic elasticity of the lens capsule tends to make the lens assume a spherical shape; in unaccommodated state this is prevented by the pull of the zonule fibers).

7. **a**-false (the vitreous body is quite separate); **b**-true (the lens lies in the posterior chamber of the eye between the posterior surface of the iris and the vitreous body, and together with the iris it forms an optical diaphragm that separates the anterior and posterior chambers of the eye; numerous ciliary processes extend into the posterior chamber of the eye); **c**-true; **d**-true (communication is through the pupil, in the gap between iris and lens at the pupil margin).

8. **a**-true; **b**-false (the optic disc, or optic nerve head, is made up of nonmyelinated axons from the retinal ganglion cells, blood vessels, and astrocytes that form a thin basal lamina on its inner suface; the complete absence of photoreceptors at this site creates a gap in the visual field, which is known as the blind spot); **c**-true (this is the most important blood supply for the anterior optic nerve; the blood supply of

the optic nerve varies from one segment of the nerve to another; the prelaminar region and the lamina cribrosa are supplied by branches of the posterior ciliary arteries, while the surface of the optic nerve head is supplied by retinal arterioles, which are branches of the central retinal artery, or by branches of small cilioretinal arteries); **d**-false (they are usually not myelinated within the eye; after the axons pass posterior to the lamina cribrosa, they become myelinated, and the cross-sectional diameter of the nerve rapidly increases at the posterior surface of the sclera to approximately 3 mm as a result of this myelination); **e**-true (the optic nerve consists of more than 1 million axons that originate in the ganglion cell layer of the retina and extend toward the occipital cortex).

9. **a**-false (the tear film is 7-8 μm thick); **b**-false (the tear film is composed of an inner mucin, a middle aqueous and an outer lipid layers); **c**-true (the inner mucin layer is hydrophilic relating to the microvilli of the corneal epithelium, which also helps to stabilize the tear film); **d**-true (it provides a smooth interface for the refraction of light); **e**-true (Lysozyme, beta-lysin, lactoferrin, and gamma-globulin (IgA) are tear-specific proteins, that give the tear fluid antimicrobial characteristics).

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Methods of the eye examination

A. Answers to the tests for self-control:

1. - d. 2. - b. 3. - a. 4. - b. 5. - b. 6. - b. 7. - d. 8. - d. 9. - c. 10. - d. 11. - b. 12. - a. 13. - c. 14. - d. 15. - c.

B. Answers to the multiple choice questions:

1. **a**-false (a complete patient's history includes four aspects: family history, medical history, ophthalmic history, current history); **b**-false (it is possible to assess the anterior chamber depth by means of a slit lamp: in a chamber of normal depth, the iris can be well illuminated by a lateral light source; in a shallow anterior chamber there will be a medial shadow on the iris); **c**-true (the size of the pupils and their response to light and accommodation give important information about the function of the afferent pathway controlling the pupils, the function of

the efferent pathway, the action of drugs on the pupil); **d**-true (the slit lamp is an instrument that permits magnified examination of transparent or translucent tissues of the eye in cross-section; most of the anterior segment tissues (except the anterior chamber angle and the posterior surface of the iris) are directly visible with the slit lamp alone); **e**-true (the structures of the ocular fundus consist of the optic disc, retina (with fovea and macula), choroid).

2. **a**-true (mydriasis refers to a dilated pupil); **b**-true (anisocoria is defined as pupillary inequality of 0,4 mm or more); **c**-false (blockade of these parasympathetic fibres results in mydriasis because of the continued sympathetic dilator activity); **d**-true (a relative afferent pupillary defect, or Marcus Gunn pupil, indicates unilateral or asymmetric damage to the anterior visual pathways (e.g., optic nerve disease or extensive retinal damage); **e**-false (they will constrict).

3. **a**-false (keratometry involves the measurement of corneal curvature); **b**-true (by focusing the ophthalmoscope on the iris, opacities in the refractive media (e.g., lens) can be seen as dark shadows); **c**-false (this allows the protrusion of the eye to be measured); **d**-false (tonometers are used for measurement of intraocular pressure).

4. **a**-true; **b**-true; **c**-true; **d**-true.

5. **a**-true (the direct ophthalmoscope gives approximately 15×magnification (depending on the patient's refractive error)); **b**-false (the lenses allow the refractive error of patient and examiner to be corrected); **c**-true (to begin a basic direct-ophthalmoscopic examination, the focusing lens is set at zero (or the examiner's refractive error), and the patient's red reflex is checked); **d**-false (optimal viewing occurs 2-3 cm from the patient's eye); **e**-true (the size and colour of the illumination can be altered).

6. **a**-dilates (cyclopentolate is a parasympatholytic agent; dilation of the pupil is obtained by paralyzing the iris sphincter due to blocking its acetylcholine receptors); **b**-dilates (atropine is a parasympatholytic agent); **c**-constricts (pilocarpine is a parasympathomimetic agent; it acts on acetylcholine receptors of the iris sphincter); **d**-dilates (tropicamide is a parasympatholytic agent); **e**-dilates (phenylephrine is a direct sympathomimetic; dilation of the pupil is obtained by stimulating the iris dilator).

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Visual acuity and field of vision. Binocular vision. Colour and light perception

A. Answers to the tests for self-control:

1. - c. 2. - d. 3. - b. 4. - b, c. 5. - a. 6. - d. 7. - c. 8. - a. 9. - a. 10. - c. 11. - a. 12. - c. 13. - b. 14. - d. 15. - c. 16. - c. 17. - b. 18. - d. 19. - b. 20. - c. 21. - c. 22. - c. 23. - b. 24. - c. 25. - b. 26. - a. 27. - d. 28. - c. 29. - b. 30. - b.

B. Answers to the multiple choice questions:

1. **a**-true; **b**-true; **c**-false (visual acuity is note as the lowest line of letters read); **d**-true (the notation *NLP* means 'no light perception' or total blindness).

2. **a**-optic nerve or retina; **b**-visual cortex; **c**-optic chiasm; **d**-retina or optic nerve; **e**-optic tract.

3. **a**-true (the minimum distance between two points which can be discriminated by the visual system as two is the minimum resolvable visual acuity; this is commonly termed as visual acuity; ophthalmologists usually refer to the Snellen`s chart for testing distance visual acuity as a measure of the resolving ability of the eye); **b**-false (the Snellen chart is positioned at 6 metres (or 20 feet) from the patient); **c**-true; **d**-false (an exophthalmometer measures the distance from the lateral orbital margin to the corneal apex; perimeter is used for examination of the visual field).

4. **a**-true (the blind spot corresponds to the position of the optic nerve head, where there are no photoreceptors); **b**-false (it is the normal physiologic binocular defect

in temporal part of visual field represents the area of the fundus occupied by the optic disk); **c**-true; **d**-true (the cenral zone of the visual field contains the temporal physiologic blind spot, which corresponds to the optic nerve head centered about 15° nasally from the fovea).

5. **a**-the macula; **b**-the inferior half of the retina; **c**-the rods.

6. **a**-true; **b**-false (night blindness and loss of peripheral vision are uncommon even in advanced cases); **c**- true; **d**-true.

7. **a**-true; **b**-true; **c**-false (light adaptation occurs far more quickly than dark adaptation); **d**-false (is diminished in diseases of the optic nerve and visual pathway); **e**-true (vitamin A (retinol) is a necessary component of rhodopsin; deficiency results in impaired adaptation to darkness).

8. **a**-true (amblyopia, when unilateral, is a visual disorder defined as a difference in optically correctable acuity of more than two lines between the two eyes that results from abnormal visual input in early childhood); **b**-false (the eyes are usually aligned in some visual direction or other, so that binocular vision develops normally); **c**-true (if the images on the retina are dissimilar, with one image more blurred than the other, the brain suppresses the more blurred image); **d**-true (if the visual axes are not aligned the brain will suppress the image from one eye); **e**-false (the non-amblyopic eye is patched, to improve vision in the amblyopic eye).

9. **a**-true; **b**-false (there are three distinct levels of quality of binocular vision (simultaneous vision, fusion and stereoscopic vision); **c**-true; **d**-false (the first signs of such vision occur in a child of 2-3 months of age); **e**-true.

10. **a**-false (colour vision deficiencies may be congenital or acquired, for example in retinal (macular oedema, central serous chorioretinopathy, retinal vascular

disorders) or optic nerve (optic neuritis, optic neuropathies) diseases); **b**-true (congenital colour deficiencies most often occur in males (8% of men, 0,4% of women), because the defects have X-linked recessive transmission); **c**-false (colour blindness is a complete deficiency for certain colours; colour weakness is a reduced sensitivity to certain colours); **d**-true; **e**-false (the most common form of congenital abnormal trichromatopsia (colour weakness) in males is deuteranomaly (5%)).

C. Answers to the clinical cases:

1. Cerebral magnetic resonance imaging (MRI). According to classification of migraine by the International Headache Society among other types of migraine there are retinal migraine (transient, monocular visual disturbance; variable scotomata with retinal vessel narrowing during attack) and basilar migraine (headache follows bilateral visual disturbance, dizziness, weakness). At the same time cerebral arteriovenous malformations and tumours can mimic migraine and cause visual field loss. Therefore, neuroimaging is essential. MRI is more useful in the evaluation of soft-tissue pathology, including optic nerve, pituitary tumours, demyelinating disease, intracranial aneurysms.

2. The most common reasons for altitudinal field loss in older patients are branch retinal vein occlusions, branch retinal artery occlusions, retinal detachments, optic nerve disorders, and anterior ischemic optic neuropathies. In a patient such as this one, a branch retinal vein occlusion is the most likely cause for the vision loss based on the pattern of retinal haemorrhages, oedema, and cotton-wool spots in an area that is distal to the venous obstruction site.

3. The most common lesion is a pituitary neuroendocrine tumor (pituitary adenoma) which produces compressive lesions at the chiasm (the fibres representing the nasal retina (temporal field) are compressed as they cross in the centre of the chiasm). Other possible causes of bitemporal hemianopia are:

chiasmal lesions (meningioma, glioma, pinealoma, ependymoma, chiasmal basal arachnoiditis, chiasmal neuritis, aneurysm of the internal carotid artery), third ventricular enlargement, perisellar lesions (craniopharyngioma, meningioma, metastases), which may also cause chiasmal compression.

4. 8. You should divide the patient's responses according to whether the light is on or off and whether the patient 'sees' the light or not. The number of true-positive responses is the number of times he saw the light when it was actually on. This occurred eight times.

5. The most likely cause of such lesion is pituitary adenoma. Cerebral MRI or computer tomography must be performed.

6. When an infant presents with poor vision, searching nystagmus, and an apparently normal examination, conditions to consider include albinism, achromatopsia, and congenital Leber's amaurosis. Achromatopsia, or rod monochromatism, is an autosomal recessive disorder with total lack of cones, with colour blindness that results in 0,1 (20/200) vision, photophobia, and nystagmus. The fundus is usually normal in infancy. In albinism, the signs in infancy are often subtle and may be missed (iris transillumination defects, hypopigmented fundus). The visual acuity is generally reduced due to macular hypoplasia.

7. Anisometropic amblyopia. Amblyopia is defined as decreased best corrected vision of the magnitude of an at least two-line difference in visual acuity between the two eyes that is not due to any organic cause. Anisometropic amblyopia is associated with bilateral high uncorrected refractive errors, such as more than 4,5 diopters of hyperopia or more than 2,5 diopters of astigmatism. It is the mildest of all forms of amblyopia and often improves with the use of glasses only.

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Refraction and accommodation of the eye

A. Answers to the tests for self-control:

1. - d. 2. - b. 3. - a. 4. - b. 5. - a. 6. - c. 7.- c. 8. - a. 9. - c. 10. - d. 11. - a. 12. - c. 13. - b. 14. - a. 15. - b.

B. Answers to the multiple choice questions:

1. **a**-false (the cornea is responsible for two-thirds of the focusing power of the eye, and the lens for one-third); **b**-true; **c**-false (when passing from the air to the cornea, or from the aqueous to the lens, the rays therefore converge); **d**-true; **e**-true.

2. **a**-true; **b**-true; **c**-true; **d**-false (the refractive media of the astigmatic eye are not spherical; astigmatism is characterized by a curvature anomaly of the refractive media such that parallel incident light rays do not converge at a point but are drawn apart to form a line); **e**-true (presbyopia is a progressive loss of accommodative ability of the crystalline lens caused by the natural process of aging).

3. **a**-true; **b**-true; **c**-false (it produces about 33% of the refractive power of the eye; the maximum total refractive power of an emmetropic eye is 63 diopters: the cornea accounts for 43 diopters and the lens for 10-20 diopters, depending on accommodation); **d**-true (center thickness increases significantly in high-plus lenses; the shape factor of spectacle magnification increases with increased center thickness, adding to the magnification from the power factor due to the plus power); **e**-false (the power of the lens increases with accommodation).

4. **a**-true; **b**-true; **c**-false (the far point plane of the hyperopic eye lies behind the retina; the far point of the emmetropic eye is optical infinity, and infinity is conjugate with the retina); **d**-true (the near point is shortest distance that allows focused vision; the far point describes the farthest point that is still discernible in focus; the near and far points define the range of accommodation); **e**-true.

C. Answers to the clinical cases:

1. Anisometropic amblyopia. Amblyopia is decreased visual acuity of one eye (uncorrectable with lenses) in the absence of organic eye disease. The most

common causes of amblyopia are squint, in which the image from the deviated eye is suppressed to prevent diplopia, and anisometropia, in which an inability to focus the eyes simultaneously causes suppression of the image of one eye. Treatment of amblyopia involves appropriate correction of refractive error and then, if necessary, initiating occlusion therapy (patching) of the sound eye several hours a day, or the use of penalization (pharmacologic blurring of the better eye or optical penalization with high plus lens) daily for several weeks, visual stimulation of the amblyopic eye, dichoptic stimulation (computer-based binocular stimulation).

2. Measure the near point of convergence and convergence amplitudes. The patient has convergence insufficiency. The near point of convergence can be examined, and acts as an indicator of the strehgtn of patient's binocular single vision. A fixation target is placed about 40 cm in front of the patient. The patient is instructed to keep looking at the target as it is moved slowly towards them, and to indicate when it becomes blurred, jumps, or appears double. The examiner observes for when convergence breaks and one of the eyes diverges again. The normal near point of convergence is around 6 cm. The different diagnosis of 'eye strain' with reading includes uncorrected refractive error (hyperopia and astigmatism), accommodative insufficiency.

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Diseases of the eyelids and lacrimal system. Diseases of the orbit

A. Answers to the tests for self-control:

1.- d. 2. - c. 3. - d. 4. - b. 5. - b. 6.- c. 7.- b. 8. - a. 9. - d. 10. - c. 11. - d. 12. - c. 13. - a. 14. - b. 15. - a. 16. - d. 17. - c. 18. - b.

B. Answers to the multiple choice questions:

1. **a**-true; **b**-true (oculomotor palsy (paralytic ptosis) and lesions in the sympathetic nerve (sympathetic ptosis) in Horner`s palsy are possible neurogenic causes of acquired ptosis; generally, the acquired ptosis is usually categorized into five types based on etiology: neurogenic, mechanical, myogenic, traumatic, aponeurotic); **c**-false (congenital ptosis is usually hereditary and is primarily autosomal-dominant as opposed to recessive; the cause is frequently aplasia in the core of the oculomotor nerve that supplies the levator palpebrae muscle; congenital ptosis

generally affects one eye only; bilateral symptoms are observed far less frequently (7%)); **d**-true; **e**-false (acquired ptosis may be caused by following mechanical factors: large lid lesions pulling down the lid, lid oedema, tethering of the lid by conjunctival scarring).

2. **a**-true; **b**-false (classically, ‘sleeves’ are found at the base of lashes, indicating Demodex infestation; collarets are found more commonly with staphylococcal blepharitis); **c**-false (Demodex folliculorum is not transmitted by sexual contact; Phthirus pubis (crab louse) infests pubic hair and eyelashes and is transmitted by sexual contact); **d**-true (mechanical removal with forceps is a time-consuming but effective treatment of the infestation of the margin of the eye with crab lice; application of a 2% mercury precipitate ointment is also effective); **e**-true (they can be identified when cilia are deposited in a droplet of saline on a slide and subjected to microscopy).

3. **a**-true; **b**-false (madarosis is patchy or diffuse loss of eyelashes; poliosis is whitening of eyelashes); **c**-true; **d**-true (trichiasis may lead to corneal opacification by keratinization of the conjunctiva and cornea, vascularization and scarring of the cornea, corneal abrasion or ulcer, corneal thinning and perforation); **e**-false (the disorder may be successfully treated by cryocautery epilation or surgical removal of the follicle bed).

4. **a**-true; **b**-true (dacryocystitis is commonly associated with nasolacrimal duct obstruction and subsequent stagnation of tears, debris, and bacteria in the lacrimal sac); **c**-false (causes of infantile dacryocystitis include incomplete canalization of the nasolacrimal duct, with an obstructing membranous remnant; nasolacrimal duct atresia; facial cleft; and dacryocele. Approximately 6% of newborns have a stenosis of the mouth of the nasolacrimal duct due to a persistent mucosal fold (lacrimal fold or valve of Hasner); the resulting retention of tear fluid provides ideal growth conditions for bacteria); **d**-false (is unilateral in most cases); **e**-true

(when the acute infection has subsided the definitive treatment is a dacryocystorhinostomy procedure).

5. **a**-true (secondary Sjogren syndrome occurs most commonly in rheumatoid arthritis but can also occur in other connective tissue diseases); **b**-true (as a result of hormonal changes in menopause, women are far more frequently affected (86%) than men); **c**-false (clinical signs of dry eyes include reduced Schirmer tear test (< 5 mm in 5 minutes with anesthetic); purpose of Schirmer testing is to identify those patients with reduced tear production); **d**-false (may be drug-induced (such as oral contaceptives, phenothiazines, antihistamines, anticholinergics)); **e**-true.

C. Answers to the clinical cases:

1. The patient has blepharitis. The treatment depends on the cause of the disorder. There are often several contributing causes. The constitution of the skin, seborrhea, refractive anomalies, hypersecretion of the eyelid glands, and external stimuli such as dust, smoke, and dry air in air-conditioned rooms often contribute to persistent chronic inflammation. The scales and crusts can usually be softened with warm olive oil and then easily removed with a cotton-tipped applicator. In more severe cases, recommended treatment includes expressing the glands of the eyelid and local application of antibiotic ointment. Heat and lid massage can restore oil flow. Treatment with topical steroids may be indicated under certain conditions.

2. The most likely diagnosis is a blocked nasolacrimal duct. Irrigation of saline via the puncta to assess lacrimal system patency may be helpful in this patient. Lacrimal dilation and irrigation will identify a blocked nasolacrimal duct and may clear out minor blockages in the process of the test. Diagnostic lacrimal probing is used to determine the location of a canalicular stenosis.

3. The diagnosis is basal cell carcinoma of the left lower eyelid. This is the commonest lid malignancy (90% of lid malignancies). Risk factors include

increasing age, white skin, sun-exposure and some cutaneous syndromes (xeroderma pigmentosa, basal cell naevus syndrome). It is locally invasive but very rarely metastasizes. An incisional or excisional biopsy is necessary to confirm clinical suspicion of basal cell carcinoma. There are a variety of treatment options available: surgical excision, radiotherapy, or cryotherapy. Wide local excision may be achieved by Mohs' micrographical technique (especially for morpheiform type) or by excisional biopsy ideally with frozen section control.

4. The diagnosis is ectropion of the right lower eyelid due to hypertrophic scar. Ectropion is abnormal eversion of the eyelid (usually the lower) away from the globe. This disruption frequently causes irritation and may threaten the integrity of the ocular surface. It may occasionally be congenital, but is usually acquired as a result of involutional, cicatricial, machanical, or paralytic processes. The treatment of choice in this case is a Z-plasty (Z-incision with middle stroke excising scar gains vertical height) or skin graft to the scar to relieve the tension and consequent ectropion.

5. The patient has left orbital cellulitis. This is a serious problem and can be life-threatening due to spread into the meninges. An otolaryngologist should be consulted to evaluate the paranasal sinuses; urgent computer tomography scan of the orbits and brain should be performed. Most common cause of orbital cellulitis is Staphylococcus aureus, Streptococcus pneumoniae, Streptococcus pyogenes, or Haemophilus influenzae from the adjacent sinuses (but may result from preseptal cellulitis, dacryoadenitis, dacryocystitis, or trauma (for example, from an orbital fracture). Treatment: consists of high-dose broad-spectrum intravenous antibiotic therapy, monitoring of visual acuity and pupillary reactions. Surgical drainage should be performed if there is poor response to antibiotics, loss of visual function, or abscess formation. Treatment of underlying sinusitis is indicated in applicable cases. Ocular complications of orbital cellulitis include raised intraocular pressure,

occlusion of the central retinal artery or vein, keratopathy due to corneal exposure, and endophthalmitis.

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Diseases of the conjunctiva

A. Answers to the tests for self-control:

1.- d. 2. - b. 3. - c. 4. - c. 5. - b. 6.- d. 7.- c. 8. - d. 9. - a. 10. - c. 11. - d. 12. - d. 13. - b. 14. - d.

B. Answers to the multiple choice questions:

1. **a**-true; **b**-false **(**conjunctivitis alone is rarely associated with anything more than mild discomfort; pain indicates something more serious such as corneal injury or infection; if there is photophobia, the cornea is probably also affected; visual loss occurs when the central cornea is affected**); c**-true; **d**-true; **e**-false (if the redness is localized to the limbus (a ciliary flush) the following should be considered: keratitis, uveitis, acute-closure glaucoma).

2. **a**-false (preauricular adenopathy, serous discharge with lid matting, pseudomembrane formation are signs of epidemic keratoconjunctivitis); **b**-true (true membranes are continuous with the conjunctival epithelium and cannot be removed without traumatizing the conjunctiva; causes include Corynebacterium diphtheriae and Streptococcus pyogenes); **c**-true; **d**-false (papillae appear as polygonal “cobblestone” conjunctival projections are a typical sign of allergic conjunctivitis); **e**-false (the quantity and nature of the discharge (watery, mucoid, or mucopurulent) depend on the aetiology of conjunctivitis).

3. **a**-true (the harmless thickening of the conjunctiva is due to hyaline degeneration of the subepithelial collagen tissue; advanced age and exposure to sun, wind, and dust foster the occurrence of the disorder); **b**-true (only occasionally pingueculae become inflamed (pingueculitis) and irritated due to surface drying); **c**-false (conjunctival xerosis is the disiccation of the conjunctiva due to a vitamin A deficiency; due to the high general standard of nutrition, this disorder is very rare in the developed world; however, it is one of the most frequent causes of blindness

in developing countries; vitamin A deficiency results in keratinization of the superficial epithelial cells of the eye; the keratinized epithelial cells die and are swept into the palpebral fissure by blinking, where they accumulate and create characteristic white Bitot's spots); **d**-false (pterygium is a triangular fold of conjunctiva that usually grows from the medial portion of the palpebral fissure toward the cornea); **e**-false (a pterygium produces symptoms when its head threatens the center of the cornea and with it the visual axis; treatment is necessary when the pterygium produces these symptoms; surgical removal is indicated in such cases).

4. **a**-true; **b**-true (silver nitrate drops are commonly used in some parts of the world as a protective measure against ophthalmia neonatorum; while effective against gonococcal infection they are of limited use against other bacteria and are of no use against chlamydia or viruses; in the majority of neonates the drops cause red watering eyes from 12 to 48 hours after instillation); **c**-false (Chlamydia trachomatis is the commonest cause of neonatal conjunctivitis in developed countries; in many developing countries gonococcal infection still continues to be a problem; Herpes simplex ophthalmia neonatorum is a rare condition); **d**-true; **e**-false (ophthalmia neonatorum is potentially sight-threatening and may cause systemic complications; untreated cases, especially of gonococcal ophthalmia neonatorum, may develop corneal ulceration, which may perforate rapidly resulting in corneal opacification or staphyloma formation; systemic (uncommon but may be fatal) complications of Herpes simplex neonatal conjunctivitis are: jaundice, hepatosplenomegaly, pneumonitis, meningoencephalitis, disseminated intravascular coagulopathy; systemic (uncommon) complications of chlamydial neonatal conjunctivitis are rhinitis, otitis, pneumonitis).

C. Answers to the clinical cases:

1. The patient has viral conjunctivitis. This form of conjunctivitis is highly contagious. Special hygiene precautions should be taken when examining patients

with viral conjunctivitis in ophthalmologic care facilities and doctors' offices to minimize the risk of infecting other patients. Patients with viral conjunctivitis should not be seated in the same waiting room as other patients. Examination should be by indirect means only, avoiding applanation tonometry, contact lens examination, or gonioscopy. After examination, the examiner should clean his or her hands and the work site with a surface disinfectant.

2. The most likely diagnosis is allergic conjunctivitis. The redness, papillae and corneal lesion are typical of severe vernal keratoconjunctivitis. Although its incidence is decreasing among the white population it is increasing in Asians. It is commoner in warm climates and is usually seasonal (spring/summer). Over 80% have an atopic history. Although there is type I hypersensitivity involvement there is also a cell-mediated role with a predominantly Th2 cell type. Treatment consists of administering antihistamines (e.g. emedastine, levocabastine 0,05%), mast cell stabilizers (e.g. sodium cromoglicate 2%, lodoxamide tromethamine 0,1%), combined H-1 receptor antagonist and mast cell stabilizers (olopatadine hydrochloride 0,1%), topical steroids (e.g. dexamethasone 0,1% or fluoromethalone 0,1%), nonsteroidal anti-inflammatory agents (ketorolac tromethamine 0.5%), cooling compresses, oral antihistamines (cetirizine, fexofenadine, loratadine), artificial tears (to dilute allergens). The cardinal rule in management is to avoid the causative agent.

3. The diagnosis is pterygium of the left eye. Pterygium is degenerative condition of subconjunctival tissue. Histologically it is akin to pinguecula with elastotic degeneration of collagen, but with additional destruction of Bowman's layer by fibrovascular ingrowth. Topical treatment include artificial tears for ocular surface irritation; if actively inflamed – short course of weak topical steroids. Pterygium excision surgery is usually requested for cosmesis. It is also indicated in the following circumstances: 1) chronic/recurrent redness and irritation; 2) blurred vision from induced astigmatism; 3) progressive growth towards the visual axis.

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Diseases of the cornea and sclera

A. Answers to the tests for self-control:

1.- c. 2. - d. 3. - b. 4. - a. 5. - d. 6.- b. 7.- c. 8. - a. 9. - b. 10. - c. 11. - c. 12. - a. 13. - a. 14.- c. 15. - d.

B. Answers to the multiple choice questions:

1. **a**-true (since the cornea has many pain fibres, most corneal lesions, superficial or deep, cause pain and photophobia); **b**-true (purulent discharge is typical of bacterial forms of keratitis; viral forms produce a watery discharge); **c**-false (since the cornea serves as the window of the eye and refracts light rays, corneal lesions usually blur vision, especially if centrally located); **d**-false (staining with sodium fluorescein or rose bengal can outline a superficial epithelial lesion that might otherwise be impossible to see); **e**-true (photophobia in corneal disease is the result of painful contraction of an inflamed iris; dilation of iris vessels is a reflex phenomenon caused by irritation of the corneal nerve endings; photophobia, severe in most corneal disease, is minimal in herpetic keratitis because of the hypesthesia associated with the disease).

2. **a**-true; **b**-false (primary ocular herpes simplex is infrequently seen but is typically manifested as a unilateral vesicular blepharoconjunctivitis, characterized by vesicles on the skin of the eyelids, follicular conjunctivitis, hyperaemia, preauricular adenopathy, sometimes with corneal involvement (punctate keratitis), and usually occurs in young children; it is generally self-limited, without causing significant ocular damage); **c**-true (the most characteristic lesion is the dendritic ulcer; however, epithelial ulceration can occasionally assume an amoebic or a geographic form; between 10% and 20% of patients with herpetic corneal ulceration subsequently develop stromal inflammation, stromal scarring, or both); **d**-false (both necrotizing and non-necrotizing stromal herpetic keratitis without associated epithelial defect may be treated with topical corticosteroids and oral or topical antiviral agents because of the severity of the inflammatory response); **e**-true (in epidemic keratoconjunctivitis, which is due to adenovirus serotypes 8, 19

and 37, the subepithelial infiltrates are round and grossly visible; they appear 7-14 days after onset of the conjunctivitis).

3. **a**-false (inflammation of the episclera and sclera more often involves the anterior sclera (episcleritis and anterior scleritis) than the posterior sclera (posterior scleritis); **b**-true (episcleritis is an acute, relatively mild, and non-sight-threatening inflammation involving the episclera (loose vascular connective tissue between Tenon's capsule and the surface of the sclera)); **c**-false (an associated local or systemic disorder, such as ocular rosacea, gout, atopy, collagen-vascular diseases, or infection, is present in up to one-third of patients); **d**-true (symptoms of episcleritis include redness, mild irritation or discomfort, and pain on convergence due to pulling at the insertion of the muscle of the inflamed area); **e**-true (patients with scleritis almost always complain of pain, which is typically severe and boring in nature; the globe is frequently tender; visual acuity is often slightly reduced).

C. Answers to the clinical cases:

1. The diagnosis is dendritic keratitis of the left eye caused by Herpes simplex virus. After primary herpes infection, recurrent disease is usually in the form of a dendritic ulceration of the cornea. Primary infection is usually with a blepharoconjunctivitis. Following this the virus ascends the sensory nerve axon to reside in latency in the trigeminal ganglion. Viral reactivation, replication, and retrograde migration to the cornea results in recurrent keratitis (superficial punctate keratitis → stellate erosion → dendritis ulcer → geographic ulcer).

2. The most likely diagnosis is a bacterial corneal ulcer. Bacterial infection of the cornea is a sight-threatening process. Corneal ulceration, stromal abscess formation, and anterior segment inflammation are features of the disease. A particular feature of bacterial keratitis is its rapid progression; corneal destruction may be complete in 24 to 48 hours. Commonly, predisposing factors exist, such as

contact lens wear (especially overnight wear), trauma, contaminated ocular medications, impaired defense mechanism, or altered ocular surface.

3. The diagnosis is episcleritis of the right eye. This common condition is a benign, recurrent inflammation of the episclera. It is commonest in young women. Episcleritis is usually self-limiting and may require little or no treatment. If symptoms warrant, short courses of topical steroids or nonsteroidals, lubricants are reasonable therapies. If there is lack of response, systemic nonsteroidal anti-inflammatory agents should be prescribed. A careful history is required to rule out the possibility of any systemic disease (around 10% may have a connective tissue disease). If any present, this should be treated appropriately, immediately and vigorously. Episcleritis does not result in long-term complications or visual loss but is often recurrent.

4. The diagnosis is herpes zoster ophthalmicus with secondary epithelial keratitis. Primary infection of the varicella zoster virus results in chicken pox (varicella). Reacivation of virus dormant in the sensory ganglion results in herpes zoster of the innervated dermatome. Involvement of the ophthalmic branch of the trigeminal nerve occurs in 15% of herpes zoster cases and results in herpes zoster ophthalmicus. Epithelial keratitis develops within the first few days of the onset of the rash. It is characterized by punctate epithelial erosions and pseudodendrites (it differs from herpes simplex virus dendrites in being more superficial with tapered ends that lack terminal bulbs). Treatment: systemic antiviral therapy with acyclovir 800 mg 5 times/day (alternatively valacyclovir 1 g 3 times daily) for 7 days is indicated as soon as tha rash starts; topical 3% acyclovir 5 times/day is indicated in acute disease, topical unpreserved lubricants.

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Diseases of the uveal tract

A. Answers to the tests for self-control:

1.- d. 2. - c. 3. - a. 4. - a. 5. - d. 6.- b. 7.- b. 8.- d. 9. - b. 10. - c. 11. - a. 12. - c. 13. - b. 14. - c. 15. - b.

B. Answers to the multiple choice questions:

1**. a**-bacterial conjunctivitis; **b**-uveitis; **c**-subconjunctival haemorrhage; **d**-scleritis; **e**-corneal ulcer.

2. **a**-true; **b**-true; **c**-false; **d**-true; **e**-false.

3. **a**-true (multiple underlying causes include immune dysregulation (non-infectious causes) and infection); **b**-false (eye redness is uncommon in strictly posterior uveitis but can be seen in diffuse uveitis; also the eye is usually white in children with uveitis associated with juvenile arthritis); **c**-true (anterior synechiae are adhesions between the iris and posterior surface of the cornea; posterior synechiae are adhesions between the iris and lens); **d**-true (anterior synechiae can disrupt aqueous outflow at the chamber angle and cause glaucoma; posterior synechiae, when extensive, can cause secondary glaucoma by producing pupillary seclusion and forward bulging of the iris (iris bombé)); **e**-false (the uveitis affects the eye only).

4. **a**-true (granulomatous uveitis is a chronic proliferative inflammation which typically occurs in response to different etiological non-infectious or infectious factors; the common organisms which excite this type of inflammation are those responsible for tuberculosis, leptospirosis, brucellosis, syphilis, leprosy, etc.); **b**-false (the onset of granulomatous uveitis is insidious); **c**-false (the ciliary congestion is minimal); **d**-true (iris nodules may be present at the iris margin (Koeppe nodules), on the iris surface (Busacca nodules), or in the anterior chamber

angle (Berlin's nodules)); **e**-true ('mutton fat' keratic precipitates typically occur in granulomatous uveitis and are composed of epithelioid cells and macrophages; they are large, fluffy, thick, lardaceous, having a waxy or greasy appearance; the are usually few (10-15) in number and located inferiorly in a wedge-shaped region known as Arlt's triangle).

C. Answers to the clinical cases:

1. The patient has a chronic diffuse uveitis of the left eye. The clinical description of a chronic diffuse uveitis with evidence of a choroidal granuloma and hilar adenopathy is highly suggestive of sarcoidosis. Sarcoidosis is a systemic inflammatory disease characterized by the development of noncaseating epitheliod cell granulomas in tissues and organs throughout the body. The cause of sarcoidosis is unknown; there is polymerase chain reaction evidence for several agents (including atypical mycobacteria) which may trigger the disease in susceptible individuals. Uveitis occurs in approximately 25% of patients with systemic sarcoidosis. Of these, anterior uveitis occurs in 60%, posterior segment disease occurs in 25% of patients. As with tuberculosis, any form of uveitis can occur, but sarcoid deserves special consideration when the uveitis is granulomatous or when retinal phlebitis is present, particularly in black patients (African-Americans are affected 10 times more frequently than whites). The diagnosis can be supported by an abnormal chest X-ray, especially when hilar adenopathy is present, or by elevated serum angiotensin-converting enzyme, lysozyme, or calcium levels. The strongest evidence comes from histopathologic comfirmation of noncaseating granulomas in affected tissues such as lung, skin or conjunctiva.

2. The patient has endophthalmitis of the left eye. Endophthalmitis is defined as intraocular inflammation, and clinically, the term has come to mean intraocular infection that involves the vitreous body. The diagnosis of endophthalmitis is usually made on clinical grounds. Vitreous inflammation greater than expected is the key diagnostic finding that should lead to the suspicion of endophthalmitis.

Acute endophthalmitis is a serious and vision-threatening intraocular infection that requires emergent treatment. Injection of intravitreal antibiotics is the mainstay of treatment for exogenous endophthalmitis. Systemic treatment and occasionally vitrectomy and intravitreal antibiotics are required for endogenous endophthalmitis.

3. The patient has anterior uveitis. The triad of nongonococcal urethritis, arthritis of the large joints, and conjunctivitis or anterior uveitis has described classic Reiter's syndrome. Uveitis develops in 25% of patients with Reiter's disease. Infection with Chlamydia trachomatis, Shigella, Salmonella, Yersinia, Ureaplasma urealyticum, or Campilobacter spp. may trigger attacks of Reiter's disease. Ocular manifestations of Reiter's disease include acute, recurrent, unilateral, nongranulomatous iridocyclitis; bilateral, mucopurulent conjunctivitis; and subepithelial or anterior stromal corneal infiltrates.

4. The patient has a chronic bilateral nongranulomatous iridocyclitis. About 20% of children with the pauciarticular form of juvenile idiopathic arthritis (JIA) develop a chronic bilateral nongranulomatous iridocyclitis. JIA presents in children younger than 16 years of age. Girls are affected four to five times more commonly than boys. Approximately 70% of cases show bilateral involvement. When iridocyclitis is present, the joint involvement is most commonly of the pauciarticular type (90% of cases). The anterior chamber inflammation in chronic JIA is characterized by a mild variable degree of anterior chamber inflammatory reaction (cells or/and flare). The conjunctiva is generally quiet. Patients suspected of having JIA should be evaluated by a rheumatologist and tested for a positive antinuclear antibody titer.

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Diseases of the lens

A. Answers to the tests for self-control:

1. - a. 2. - d. 3. - a. 4. - a. 5. - b. 6. - c. 7. - d. 8. - c. 9. - d. 10. - a. 11. - b. 12. - c. 13. - b. 14. - a. 15. - c.

B. Answers to the multiple choice questions:

1. **a**-false (senile cataract is by far the most frequent form of cataract, accounting for 90% of cataracts; complicated cataract can occur as a complication of any protracted intraocular inflammation, especially chronic iridocyclitis, retinal vasculitis, and retinitis pigmentosa); **b**-true (common clinical presentations include different changes in vision: reducing acuity, contrast sensitivity, or colour appreciation, glare, monocular diplopia, or ghosting); **c**-false (symptoms of cataract may include changes in colour perception – increasing sclerosis of the lens causes lens nucleus to yellow, resulting in loss of colour perception, particularly in blue end of spectrum); **d**-false (acquired cataracts do not require the urgent surgical treatment; surgical assessment is based on the location, size, and density of the cataract; there is no need to wait for the cataract to 'ripen' and cause major visual loss; the test is whether or not the cataract produces sufficient visual symptoms to reduce the quality of life); **e**-true (corticosteroids administered over a long period of time, either systemically or topically (in form of eye drops or ointments), can cause lens opacities; steroid-induced cataract is usually posterior subcapsular).

2. **a**-true (the most frequent cause of cataract is a rubella infection contracted by the mother before the ninth week of gestation); **b**-true (metabolic disorders such as galactosemia, hypoglycemia, and galactakinase deficiency may result in cataracts); **c**-true (in infants cataract may cause amblyopia (a failure of normal visual development) because the retina is deprived of a formed image); **d**-false (both cataractous lenses require urgent surgery; unilateral infantile cataracts that are dense, central, and larger than 2 mm in diameter will cause permanent deprivation

amblyopia if not treated within the first 2 months of life and thus require surgical management on an urgent basis); **e**-true (this also applies to rare lens opacities involving the capsule such as anterior and posterior polar cataracts, anterior pyramidal cataract, and Mittendorf's dot (remnant of the embryonic hyaloid artery on the posterior capsule of the lens).

3. **a**-false; **b**-true (one of the earliest signs of cataract; particularly bothersome in patients when driving at night due to oncoming headlights); **c**-false (the change in vision is gradual); **d**-true (loss of lens transparency results in blurred vision (without pain) for both near and distance; also distance vision may decrease while near vision improves (second sight)); **e**-true (irregular refractive changes within the lens may result in monocular diplopia due to two focal points in the lens).

C. Answers to the clinical cases:

1. Posterior subcapsular cataract.

2. The main aid of congenital cataract treatment is the prevention of stimulus-deprivation amblyopia. To maximize the chances of success, treatment must be performed as soon as possible, even within the first few weeks of life. The critical period of visual development is the first 2 months of life. Visual deprivation during this period can result in profound and irreversible amblyopia. Retinal fixation and cortical visual responses develop within the first 6 months of life. This means that children who undergo surgery after the age of 1 year have significantly poorer chances of developing normal vision. Bilateral visually significant cataracts can cause irreversible amblyopia and sensory nystagmus. In the past, intraocular lens (IOL) implantation was performed as a secondary procedure in children. Increasingly, IOLs are implanted during the primary cataract extraction procedure. The globe continues to grow until approximately 10 years of age. Implantation of an IOL of fixed power results in dynamic changes in refractive status with ocular growth. As with adult cataract surgery, refractive outcomes can be planned.

3. The diagnosis is acute postoperative endophthalmitis of the right eye. It is a sight-threatening medical emergency requiring rapid assessment and treatment. Onset is usually 1-7 days after surgery. The most common microorganisms are Staphylococcus epidermidis, Staphylococcus aureus, and Streprococcus species. Microbiological specimens should be obtained from both the anterior chamber and vitreous with simultaneous intravitreal antibiotics (consider vancomycin 1 mg in 0,1 ml combined with either amikacin 0,4 mg in 0,1 ml or ceftazidime 2 mg in 0,1 ml). Subconjunctival injections of antibiotics should be given daily for 5-7 days. Topical antibiotics should be started immediately and used frequently (every 30 minute to 1 hourly). There is evidence for vitrectomy if visual acuity is perception of light or worse at the time of presentation, or if the patient does not improve with intensive therapy for 48 to 72 hours.

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Glaucoma

A. Answers to the tests for self-control:

1. - d. 2. - d. 3. - d. 4. - a, c. 5. - d. 6. - a. 7. - a. 8. - b. 9. - b. 10. - b. 11. - a. 12. - c. 13. - b. 14. - d. 15. - d.

B. Answers to the multiple choice questions:

1. **a**-true (the endoplasmatic reticulum and Golgi complex present in the cells of nonpigmented epithelium play an important role in aqueous humour formation); **b**-true (most aqueous humour leaves the eye by this passive pressure-sensitive route; around 75% of outflow resistance is due to the trabecular meshwork itself, with the major component being the outermost (juxtacanalicular) portion of the trabecular meshwork; onward transport into Schlemm's canal is achieved by pressure-dependent transcellular channels and paracellular pores); **c**-false (the uveoscleral pathway receives about 15% of the outflow; the trabecular meshwork (the

conventional pathway) receives about 85% of the outflow, which then drains into the canal of Schlemm); **d**-true; **e**-false (some patients exhibit typical glaucomatous visual field loss and optic nerve damage but have an intraocular pressure within the normal range).

2. **a**-true (the hallmark symptoms of congenital glaucoma are tearing and photophobia); **b**-true (up to the age of 12 years, the sclera and cornea are far more distensible than in the adult eye; the enlarged corneal diameter is a characteristic finding); **c**-true (the cornea will appear whitish and opacified due to epithelial oedema; usually horizontally or circumferentially oriented splits in Descemet's membrane (Haab's striae) lead to corneal oedema); **d**-false; **e**-true (in primary congenital glaucoma inappropriate development of angle structures leads to raised intraocular pressure (IOP)).

3. **a**-false (acute angle closure glaucoma causes severe pain and sudden vision loss); **b**-true; **c**-false (pilocarpine eye drops and intravavenous acetazolamide are used in acute angle closure glaucoma); **d**-false (although medical therapy is the treatment of choice for primary open angle glaucoma, laser and surgical treatments are also possible where medical therapy fails; selective laser trabeculoplasty as a first-line therapeutic option for primary open angle glaucoma has propelled into several healthcare systems); **e**-false (increased corneal diameter is seen only in congenital glaucoma).

4. **a**-true (the target pressure needs to be determined individually for each patient as a specific IOP level low enough to prevent the progression of visual field loss and glaucomatous optic nerve damage); **b**-false (medical therapy is the the treatment of choice for primary open angle glaucoma; surgery is indicated only where medical therapy fails (is inadequate), when the patient does not tolerate medical therapy (allergy, ciliary spasms, pain, ptosis), or when the patient has lack of compliance or a lack of dexterity in applying eyedrops); **c**-true (the choice of

medication depends on the efficacy, side effects and contraindications of different drugs); **d**-false (non-selective beta-blockers carry the risk of precipitating asthma through their beta-2 blocking action, following systemic absorption, or they may exacerbate an existing heart block through their beta-1 action; non-selective beta-blockers should be avoided in patients with obstructive respiratory disease, heart failure and myasthenia gravis)**;** **e**-false (no treatment is known to reverse the damage of glaucoma, but the rate of progression can be reduced with treatment; a permanent reduction in IOP is achieved in 80-85 per cent of drainage surgery).

C. Answers to the clinical cases:

1. The patient has secondary neovascular glaucoma of the right eye after a central retinal vein occlusion. Posterior segment ischemia drives neovascularization of the angle leading to a fibrovascular membrane. Initially, this overlies the trabecular meshwork so that the angle appears open, but with time peripheral anterior synechiae form and the membrane contracts to zip the angle shut. Central retinal vein occlusion and diabetes each account for around a third of the cases of neovascular glaucoma. Treatment requires control of the IOP with topical and oral medications as in primary open-angle glaucoma (myotics such as pilocarpine are contraindicated because they increase inflammation and can make the angle closure worse). The definitive treatment is to destroy areas of ischemic retina in the eye by panretinal photocoagulation, or panretinal cryotherapy if the retina can not be visualized, and intravitral injection of inhibitor of antivascular endothelial growth factor.

2. The patient has secondary phakolytic glaucoma of the right eye. The ultimate treatment is len removal after the control of IOP. The condition is initially managed medically to reduce the level of IOP and inflammatory reaction with topical aqueous suppressants (β-blockers, carbonic anhydrase inhibitors), steroids and cycloplegics. The cataractous lens should be extracted expediently within a few days.

3. Acute angle-closure glaucoma of the right eye. An acute glaucoma attack is an emergency, and the patient requires immediate treatment by an ophthalmologist. The underlying causes of the disorder require surgical treatment, although initial therapy is conservative. The goals of conservative therapy are: decrease intraocular pressure, allow the cornea to clear, relieve pain. Acetazolamide (500 mg) is administered intravenously and subsequently orally, together with topical pilocarpine 1% to 2%, beta-blocker (such as timolol 0,5%), and alpha 2-agonist (briminidine 0,2%). Symptomatic therapy with analgesic agents, antiemetic agents, and sedatives can be initiated where necessary. Subsequent management requires that a small hole (iridotomy or iridectomy) be made in the peripheral iris to prevent subsequent attacks. This can be done with a YAG laser or surgically.

4. This is classic for bilateral congenital glaucoma. In primary congenital glaucoma angle dysgenesis causes reduced aqueous outflow. Measuring of intraocular pressure, gonioscopy, and evaluation of the optic disc are important in making the diagnosis. Assessment generally requires examination under general anesthesia. Medical treatment is unsatisfactory but may be used while awaiting surgery. Preferred surgical technique is angle surgery, either goniotomy, or trabeculotomy, or trabeculectomy, to lower intraocular pressure by improving aqueous outflow.

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Diseases of the retina and optic nerve

A. Answers to the tests for self-control:

1. - c. 2. - a. 3. - d. 4. - c. 5. - b. 6.- c. 7. - a. 8. - d. 9. - a. 10. - d. 11. - c. 12. - a. 13. - b. 14. - d. 15. - c.

B. Answers to the multiple choice questions:

1. **a**-false (a chronic rise in pressure will produce pathological cupping of the optic disc); **b**-true (swelling of the optic nerve head secondary to raised intracranial pressure is defined as papilledema); **c**-true (this is then called papillitis; but the optic nerve head appears normal in retrobulbar neuritis); **d**-true (but only in severe or accelerated hypertension); **e**-false (it is seen in a central retinal vein occlusion and in ischemic optic neuropathy).

2. **a**-true (it may be seen for example in retinitis pigmentosa); **b**-true; **c**-false (disc pallor will only be seen in lesions anterior to the lateral geniculate body); **d**-true (e.g. tobacco-alcohol or ethambutol toxicity); **e**-true (an example is vitamin B_{12} deficiency).

3. **a**-true (the usual presentation is sudden, painless, unilateral loss of vision with no preceding visual symptoms); **b**-true (ophthalmoscopy reveals segmental or generalized pale disc swelling with peripapillary flame-shaped haemorrhages); **c**-true (the condition may be a feature of giant cell arteritis; it is important to think of this in any senior patient, but there are also non-arteritic vascular causes); **d**-false (if it is associated with giant cell arteritis this is the immediate treatment; non-arteritic disease does not respond to steroids); **e**-true (the inferior visual field is preferentially involved).

4. **a**-true; **b**-true (loss of central vision occurs following the deposition of material in Bruch's membrane (drusen), beneath the retinal pigment epithelium; vision is not affected unless there is an associated loss of pigment and atrophy of the retinal pigment epithelium, degeneration of the choriocapillaries and photoreceptor atrophy); **c**-true (choroidal neovascularization may develop and grow through

defects in Bruch's membrane into the sub-retinal pigment epithelium or subretinal spaces); **d**-false (this is a separate condition, a macular hole); **e**-false (it is most often untreatable; in some patients with wet age-related macular degeneration laser treatment, treatment with intravitreal vascular endothelial growth factor inhibitors (anti-VEGF), and rarely retinal surgery may be used).

5. **a**-true; **b**-true (it causes blurry vision, especially with reading; distortion); **c**-true (cystoid macular oedema is more common after surgical complications, e.g. posterior capsule rupture with damage to the vitreous); **d**-false; **e**-true (depending on the cause, duration and severity of macular oedema, indicated treatments may include inravitreal injections of anti-VEGF, oral medications (non-steroidal anti-inflammatory drugs, corticosteroids or acetazolamide), intravitreal steroids, laser treatment and vitrectomy).

6. **a**-false (leucocoria always requires urgent examination and investigation; retinoblastoma is a life-threatening possibility); **b**-true (leucocoria is the most common presenting sign in young children with retinoblastoma; strabismus is also common, and occurs when fovea is involved or obscured; other possible causes of leukocoria are: retinopathy of prematurity, cyclitic membrane, coloboma of choroid, congenital cataract, persistent hyperplastic primary vitreous, Coats disease, toxocariasis, retinal astrocytoma, retinal detachment, endophthalmitis); **c**-false (in albinism the red reflex would be present); **d**-true; **e**-true (retinoblastoma may be bilateral).

7. **a**-false (the visual loss usually progresses over a couple of days); **b**-false (there may be pain on eye movement in retrobulbar neuritis); **c**-true (it may be due to demyelination and be part of multiple sclerosis); **d**-false (there is usually some degree of recovery); **e**-true (this is a useful test in assessing optic nerve disease; patients often describe reduction in perceived light intensity and 'washed-out' colours; colour vision and contrast sensitivity are usually impaired).

C. Answers to the clinical cases:

1. This patient has an autosomal, recessively inherited macular dystrophy – Stargardt disease. Children with Stargardt disease may still be able to read despite a significant decrease in visual acuity; this is because children have very large amplitudes of accommodation and will simply hold books closer to obtain greater magnification. There is no treatment for this condition. But there are several ongoing gene therapy (the goal is to introduce a functional *ABCA4* gene that can produce an adequate amount of the standard, active transporter protein in the photoreceptor cells, thus preventing disease progression) and drug therapy (that can reduce lipofuscin accumulation) trials going on. Low vision and other rehabilitative services may be beneficial and genetic counseling should be considered.

2. The patient has retrobulbar optic neuritis of the left eye. Full neurological examination should be performed. The current recommendation for all patients with an initial episode of optic neuritis is to undergo magnetic resonance imaging (MRI). MRI is useful in determining whether patients are at high risk of developing multiple sclerosis, with two or more white-matter lesions present on scanning being highly predictive of developing clinically definite multiple sclerosis in the future. A neurologist may also suggest performing a lumbar puncture (oligoclonal bands in cerebrospinal fluid but not serum are suggestive of central nervous system demyelination). With the possibility of a previous neurological episode it is likely that the patient has multiple sclerosis. Other investigations may include additional blood tests – to exclude differential diagnosis (diabetic optic neuropathy, toxic optic neuropathy), and visual evoked potentials – increased latency and decreased amplitude are characteristic of optic neuritis.

3. The patient has age-related macular degeneration (dry form). It is characterized by drusen (hard or soft) and retinal pigment epithelium changes (focal hyperpigmentation or atrophy). Histologically there is loss of the retinal pigment

epithelium/photoreceptor layers, thinning of the outer plexiform layer, thickening of Bruch's membrane, and atrophy of choriocapillaris exposing the larger choroidal vessels to view. No effective treatment for dry AMD has been found. Patientes should be encouraged consume fruit on a daily basis and to give up smoking. The Age-Related Eye Disease Study (AREDS) research group reported that the antioxidants vitamin C (500 mg), vitamin E (400 IU), lutein 10 mg, zeaxanthin 2 mg, as well as zinc oxide (80 mg) and copper (2 mg), provided some reduction in the risk of progressing to advanced age-related macular degeneration in patients with intermediate AMD (AREDS 2 formula). Some studies have suggested that cholesterol-lowering medication is beneficial.

4. Retinoblastoma of the left eye. The appropriate use of indirect ophthalmoscopy, B-scan ultrasonography, computer tomography, optical coherence tomography, and magnetic resonance imaging are used to exclude differential diagnosis (Coats disease, coloboma, toxocariasis, vitreous haemorrhage, etc.), detect calcification, measure tumour dimensions and delineate extraocular extension or metastases. Retinoblastoma is the commonest primary malignant intraocular tumour of childhood. The tumour arises from primitive retinoblasts of the developing retina with loss of function of the *RB1* tumour suppressive gene (Ch13q14). The inactivation of this gene leads to uncontrolled proliferation of the retinal cells. Over 90% cases are sporadic (with no family history). In most of these cases the mutation is somatic (arising sufficiently late not to be heritable) and gives rise to isolated unilateral disease. Tumours less than four pupil diameters can be managed with radiation therapy and cryotherapy. Larger tumours require enucleation of the eye. Tumors less than 3 mm in greatest diameter, without vitreous seeding or optic nerve involvement, may be amenable to laser photocoagulation or transpupillary thermotherapy. For larger tumors, systemic chemotherapy is often used to shrink the neoplasm before applying focal treatments, a strategy known as chemoreduction. Metastatic disease is treated with high-dose chemotherapy. Intraarterial chemotherapy has revolutionized

retinoblastoma treatment by delivering chemotherapy directly into the ophthalmic artery.

5. The diagnosis is anterior ischemic optic neuropathy of the right eye. The pattern of visual loss noted by the patient is characteristic for this disease. The absence of physiologic cupping of the left optic disc is suggestive of idiopathic (nonarteritic) anterior ischemic optic neuropathy as patients with this disorder often have no physiologic cup. Although a wide variety of visual field defects can be seen with anterior ischemic optic neuropathy, altitudinal defects are most common. It is proposed that an insufficient circulation to a crowded optic nerve head may lead to local oedema, causing further vascular compromise and subsequent infarction. The main risk factors appear to be diabetes, hypertension, and disc morphology ('disc at risk' – crowded disc with a small cup). Other proposed risk factors include smoking, hyperlipidaemia, hypotension, anaemia, hypermetropia.

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Eye injuries. The first aid

A. Answers to the tests for self-control:

1. - d. 2. - c. 3. - d. 4. - b. 5. - a. 6. - d. 7. - a. 8. - d. 9. - c. 10. - a. 11. - c. 12. - b. 13. - d. 14. - c.

B. Answers to the multiple choice questions:

1. **a**-true (there may be swelling of the orbital contents, or the muscle; or orbital tissue may become tethered in the orbital fracture); **b**-true (impingement of the inferior rectus muscle can result in diplopia, especially in upward gaze); **c**-true (emphysema develops due to collapse of the ethmoidal air cells; the crepitus is caused by air entering the orbit from the paranasal sinuses); **d**-false (the eye is usually recessed into the orbit (enophthalmos); enophthalmos may also result from incarceration of orbital tissues into the maxillary antrum with resultant cicatrization); **e**-true (hypesthesia in the distribution of the infraorbital nerve is very common and involves the lower eyelid, cheek, and anterior (incisor) teeth on the affected side).

2. **a**-true; **b**-false (chemical burns with acids cause denaturation and precipitation of proteins, which limits ocular penetration); **c**-false (acids differ from alkalis in that they cause immediate coagulation necrosis; alkalis can penetrate by hydrolyzing structural proteins and dissolving cells – liquefactive necrosis; that is why in alkali injuries severe intraocular damage often manifests itself only several days later); **d**-true (the greater the ischemia of the conjunctiva and limbal vessels, the more severe the burn will be); **e**-true (severe uveitis, anterior segment neovascularization, glaucoma, symblepharon formation, and cataract are all later complications).

3. **a**-true; **b**-true (the most important step in the treatment of acute chemical burns of any type is prompt, copious irrigation of all exposed tissues and removal of particles by irrigation, or by rolling a moistened cotton-tipped applicator across the conjunctiva); **c**-true (débridement of necrotic conjunctiva and corneal epithelium should be performed as they may harbor more chemical); **d**-true (topical steroids are useful to suppress the inflammatory response; but their use should be limited to the first 7-10 days after injury as they may potentiate the action of collagenases leading to continued stromal loss); **e**-true (vitamin C neutralizes cytotoxic radicals,

hyaluronic acid promotes corneal re-epithelialization and stabilizes the physiologic barrier).

4. **a**-false (sympathetic ophthalmia occurs in an otherwise unaffected eye even years after penetrating injury or intraocular surgery in the fellow eye); **b**-false (the inflammation is granulomatous); **c**-true (the earliest symptoms include limited range of accommodation and photophobia; later there is diminished visual acuity and pain); **d**-true; **e**-true (aggressive systemic corticosteroid therapy is the cornerstone of the treatment of sympathetic ophthalmia).

C. Answers to the clinical cases:

1. The patient should then be taken to an eye emergency clinic. The most important part of the treatment is thirty minutes copious irrigation of the eyes with saline or lactated Ringer's. It is also important to irrigate under the upper and lower lid to remove solid particles. Double-evert the lid to remove debris from the fornices. Topical anaesthesia should be applied and particulate matter removed with forceps or a swab. Check pH after irrigation and continue irrigation until pH is neutral. Instill cycloplegic and antibiotic drops. It is important to assess the degree of limbal ischemia. The left eye is white because of ocular surface ischemia secondary to severe chemical injury. In the initial stages the aim of treatment is to promote epithelization, relieve pain, control intraocular pressure, and limit damage due to inflammatory mediators.

2. Order radiographs in two planes or CT scan to determine whether there is a foreign body in the eye. Every patient with an open globe injury should be imaged to rule out intraocular foreign body or intraorbital foreign body. CT scan allows precise localization of the foreign body and can also image radiolucent foreign bodies such as Plexiglas. Any patient who gives a history of possible ocular trauma from a projectile object should undergo imaging if complete examination of the eye is not possible, even if globe penetration is not clearly visible on examination.

3. The patient has sympathetic ophthalmia of the left eye. The injured eye is known as the exciting eye and the fellow eye is the sympathizing eye. The main aim of treatment is to minimize ocular damage by suppressing the immune response. Many patients are commenced on a combination of oral prednisolone with topical steroids and mydriatics. An alternative ocular treatment is a sub-Tenon injection of triamcinolone. Consideration is given to other immunosuppressive medications (e.g. ciclosporin, or methotrexate) when corticosteroids are ineffective or poorly tolerated. If severely injured, unsalvageable eye with poor vision must be enucleated to eliminate the antigen. Enucleation of exciting eye after the onset of inflammation in the sympathizing eye is probably not beneficial.

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Sudden loss of vision. Urgent states in ophthalmology (acute occlusion of the central retinal artery or vein, a retinal detachment)

A. Answers to the tests for self-control:

1. - b. 2. - d. 3. - c. 4. - d. 5. - d. 6. - c. 7. - c. 8. - a. 9. - b. 10. - a. 11. - d.

B. Answers to the multiple choice questions:

1. **a**-retinal artery occlusion; **b**-retinal detachment; **c**-acute-closure glaucoma; **d**-raised intracranial pressure; **e**-retrobulbar optic neuritis.

2. **a**-false (the patient complains of a sudden partial or complete painless loss of vision, although onset may be less acute than that of arterial occlusion); **b**-true (this happens if the retina has become ischemic as a result of the vein occlusion; abnormal new vessels may grow on the retina and optic nerve head; in ischemic retinal vein occlusion abnormal new vessels may grow on the iris, causing neovascular glaucoma); **c**-true (the most common causes of neovascular glaucoma are central retinal vein occlusion and proliferative diabetic retinopathy); **d**-true (central retinal vein occlusion is frequently associated with systemic diseases, particularly hypertension, arteriosclerosis, diabetes, and hypercoagulation or vasculitic disorders); **e**-false (the retinal veins are swollen and tortuous, and there

are extensive retinal haemorrhages; retinal and optic disc oedema may also be present).

3. **a**-false (retinal detachment refers to the condition where the neurosensory retina lifts off and separates from the underlying retinal pigment epithelium, to which normally it is loosely attached); **b**-true (risk factors include myopia, trauma, lattice degeneration, retinal detachment in opposite eye, pseudophakia, aphakia, etc.); **c**-true (symptoms include photopsias and floaters, loss of peripheral vision, the appearance of a 'curtain' or blind coming down over vision, reduced visual acuity if macula is involved); **d**-false (the most frequent form is rhegmatogenous retinal detachment; exudative, tractional and tumour-related retinal detachments are encountered far less frequently); **e**-true (a retinal detachment in which the macula is not yet involved is an ocular emergency needing treatment within 24 hours; if the macula has already detached, then treatment is still urgent – 48-96 hours).

4. **a**-true (emboli from the carotid arteries or heart are the most common cause; less frequent causes include inflammatory conditions (giant cell arteritis, collagen vascular diseases) and coagulation disorders (polycythemia and antiphospholipid syndrome); **b**-false (the typical symptoms include abrupt, severe, unilateral, painless loss of vision); **c**-true (within a few hours of central retinal artery occlusion, swelling of the retinal nerve fibre layer causes retinal pallor; a cherry-red spot appears in foveola (where the nerve fibre layer is thinnest, allowing visualization of the vascular choroid beneath)); **d**-false (unfortunately, treatment of this condition is unsatisfactory, with minimal evidence to suggest that it improves prognosis); **e**-true (ocular massage, medications that reduce intraocular pressure (acetazolamide and/or topical β-blockers), and anterior chamber paracentesis are applied in an attempt to dislodge the embolus); vasodilators and fibrinolytic agents).

C. Answers to the clinical cases:

1. The patient has a central retinal artery occlusion of the left eye. There is no treatment that is proved to be effective. Ocular digital massage (or by direct visualization of the artery by means of a contact Goldmann lens) for 15-20 minutes, anterior chamber paracentesis, medications that reduce intraocular pressure (for example, 500 mg of acetazolamide), are applied as a means to attempt dislodgment of emboli. Calcium antagonists or hemodilution are applied in an attempt to improve vascular supply. Also treatment includes methods to provide more oxygen to the ischemic retina (inhalation with 95% oxygen and 5% carbon dioxide (in the absence of this mixture, rebreathing into a paper bag can be considered)), increasing perfusion of the retina (vasodilatory drugs (systemic papaverine, sublingual nitroglycerin)), and fibrinolytic agents (administered through the supraorbital artery). Femoral artery catheterization with thrombolysis (injection of urokinase into the internal carotid artery) is performed in some centres.

2. The previous diagnosis is retinal detachment of the right eye. The general practicion should arrange for an urgent ophthalmic examination. A detailed specialized evaluation of the retina using biomicroscopy and indirect ophthalmoscopy with scleral indentation is needed. A retinal detachment is a separation of the neurosensory retina from the retinal pigment epithelium. Rhegmatogenous retinal detachment (RRD) is the commonest form of retinal detachment and arises from a break in the retina. Risk factors for rhegmatogenous retinal detachment include myopia (40% of RRDs), cataract surgery (40% of RRDs), ocular trauma (10% of RRDs), herpetic necrotizing retinitis, senile retinoschisis, miotic eye drops. Surgical repair is recommended for the vast majority of RRDs and involves localization and closure of all retinal breaks by scleral indentation or intraocular tamponade.

3. The diagnosis is branch retinal vein occlusion of the right eye. Hypertension is the commonest association with branch retinal vein occlusion. Necessary investigations: check blood pressure, full blood count, erythrocyte sedimentation rate, glucose, lipid profile, prothrombin time/partial thromboplastin time, hypercoagulable panel (e.g. protein C and S activity, homocysteine, antiphospholipid antibody, factor V Leiden, antithrombin III), urea and electrolytes, electrocardiogram, fundus fluorescein angiography (to determine extent of capillary non-perfusion if in doubt), optical coherence tomography (for objective diagnosis and monitoring of macular oedema).

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Eye movements and their disorders. Squint

A. Answers to the tests for self-control:

1.- a. 2. - c. 3 - b. 4. - c. 5. - b. 6. - c. 7.- d. 8.- b. 9. - a. 10. - c. 11. - c. 12. - d. 13. - a. 14. - b. 15. - d.

B. Answers to the multiple choice questions:

1. **a**-sixth nerve; **b**-third nerve; **c**-third nerve; **d**-third nerve; **e**-fourth nerve; **f**-third nerve.

2. **a**-true (refers to a muscular imbalance between two eyes that leads to misalignment of the visual axes onlu under certain conditions); **b**-true; **c**-false (this disorder occurs in 70-80% of the population; the incidence increases with age); **d**-false (is diagnosed by the uncover test; the uncover test focuses on the response of the previously covered eye immediately after being uncovered; once uncovered,

the eye makes a visible adjustment to permit fusion and recover binocular vision); **e**-true.

3. **a**-false (the eye movements are full but only the dominant eye is directed towards the fixation target); **b**-true; **c**-true (paralytic strabismus is the term used if there is a problem with the extraocular muscles, orbital disease or a nerve palsy); **d**-true (nystagmus refers to bilateral involuntary rhythmic oscillations of the eyes; the movements can be horizontal, vertical, torsional, or combinations of all three); **e**-true (supranuclear coordination is affected; this may be seen in a patient with an acute cardiovascular accident).

C. Answers to the clinical cases:

1. Isolated right sixth cranial nerve palsy. The sixth cranial nerve supplies the ipsilateral lateral rectus muscle, resulting in abduction defects when innervation is impaired. Etiology: microvascular diseases (e.g. diabetes, hypertension), raised intracranial pressure, stroke, tumour, trauma, sarcoidosis, demyelination, meningeal infection (e.g. neurosyphilis, Lyme disease), vasculitis, idiopathic. Typical presentation is with binocular, horizontal diplopia that is worse for looking into the distance and in the direction of affected lateral rectus muscle; esotropia of affected eye in primary position; limitation of abduction; compensatory face turn to the ipsilateral side to relieve diplopia.

2. The patient has concomitant unilateral convergent strabismus of the left eye; hyperopia of the both eyes; anisometropia (there is a difference in refractive power between the both eyes); suppression of the left eye; refractive amblyopia (a partial or complete loss of visual acuity in the absence of ophthalmoscopic or other objective signs) with strabismus of the left eye. The etiology of the strabismus in this patient may be associated with a refractive error which prevents the formation of a clear image on the retina. If the refractive error is dissimilar in the two eyes (anisometropia) one retinal image will be blurred. The image created in the

deviating eye is not as sharply focused as the image in the leading eye and is suppressed. Constant suppression in strabismus in the form of a central and fixation scotomas can lead to severe amblyopia, especially in children below the age of six. Treatment: correction with eye-glasses and occlusion therapy.

3. This patient has left third cranial nerve palsy. The third cranial nerve supplies the levator muscles, and all the extraocular muscles (except the lateral rectus and superior oblique). Typical clinical features: binocular diplopia, ptosis, affected eye abducted and usually depressed, reduced action in all other gaze movements, pupil dilatation, reduced accommodation, aberrant regeneration. Etiology: ischemic microvascular disease, trauma, aneurysm, cavernous sinus syndrome, tumour, demyelination, vasculitis, idiopathic. The investigations: urgent magnetic resonance imaging or magnetic resonance angiography and neurological review; blood pressure control; laboratory analysis for vascular risk factors (full blood count, erythrocyte sedimentation rate, glucose, lipids, C-reactive protein).

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Ocular disorders associated with systemic diseases

A. Answers to the tests for self-control:

1. - b. 2. - c. 3. - d. 4. - d. 5. - b. 6. - a. 7. - a. 8. - c. 9. - d. 10. - d. 11. - d. 12. - a. 13. - b. 14. - c. 15. - b.

B. Answers to the multiple choice questions:

1. **a**-true; **b**-true (important factors in the development of diabetic retinopathy include: duration of diabetes, glycemic and cholesterol control, arterial hypertension, smoking); **c**-false (the number of pericytes around the capillaries is decreased); **d**-true (new vessels originate as endothelial proliferations, which pass through defects in the internal limiting membrane of the retina and become attached to the posterior vitreous cortex; the vitreous then serves as a scaffold for new vessel and fibrous tissue growth; the new vessels leak fluid and are prone to haemorrhage – into either the vitreous or the potential space between the internal

limiting membrane and the rest of the retina (often termed ‘preretinal or subhyaloid haemorrhage’)); **e**-false (the laser is applied to the site of leakage).

2. **a**-cataract; **b**-age-related macular degeneration; **c**-optic nerve compression; **d**-pituitary tumour; **e**-posterior lens capsule opacification.

3. **a**-true (the typical sign of human immunodeficiency virus (HIV) retinopathy is multiple cotoon-wool spots; retinal haemorrhages and microaneurysms are less common); **b**-true (signs of fulminant cytomegalovirus (CMV) retinitis include confluent, pale patches, well-demarcated areas of retinal necrosis with associated haemorrages, resembling a ‘pizza pie’ or ‘cheese and ketchup’; it tends to occur along the vascular arcades and over weeks gradually extends along the vessels in a ‘bushfire-like’ pattern); **c**-true; **d**-false (toxoplasmosis is the most common cause of non-viral central nervous system infection leading to toxoplasmic encephalitis); **e**-true (specific anti-CMV treatment involves ‘induction’ and ‘maintenance’ therapy; commonly used agemts include systemic antiviral (e.g. ganciclovir, valganciclovir), intravitreal implants (ganciclovir) or injections (ganciclovir and/or foscarnet) or a combination).

C. Answers to the clinical cases:

1. The patient has thyroid-related orbitopathy (Graves’s disease). It is an autoimmune disorder with orbital involvement, frequently associated with hyperthyroidism. Disorders of the thyroid gland can be associated with an infiltration of the extraocular muscles with lymphocytes and the deposition of glycosaminoglycans. Cardinal symptoms include exophthalmos, periorbital oedema, limited ocular motility, eyelid retraction. The clinical diagnosis of Graves’s disease is supported by thickening of the extraocular muscles identified in ultrasound or CT studies. The further diagnostic work-up requires the cooperation of an internist, endocrinologist, and radiologist.

2. The patient has moderate nonproliferative diabetic retinopathy. Treatment includes intensive blood glucose, blood lipids and blood pressure control, dietary modification and physical exercise under supervision of primary care physician. Lowering blood pressure has been shown to decrease diabetic retinopathy progression, although strict goals (systolic blood pressure <120 mmHg) do not impart additional benefit. Various pharmacologic agents have been used to treat diabetic retinopathy, the past use of drugs like clofibrate, calcium dobesilate, aspirin, and aldose reductase inhibitors largely reflected the prevalent thinking regarding the possible causes of retinopathy. In individuals with dyslipidemia, early diabetic retinopathy progression may be slowed by the addition of fenofibrate. Panretinal laser photocoagulation therapy is indicated to reduce the risk of vision loss in individuals with high-risk proliferative diabetic retinopathy and, in some cases, severe nonproliferative diabetic retinopathy. Patients with nonproliferative diabetic retinopathy need regular examinations to evaluate for progression of disease or the development of macular oedema, which may be treatable.

3. The patient needs laboratory evaluation for human immunodeficiency virus. The most likely diagnosis is HIV retinopathy – the most common retinal manifestation in patients with AIDS, occurring in 50% to 80% of patients. Ophthalmoscopic findings in HIV-associated retinopathy include haemorrhages, microaneurysms, teleangiectasia, and cotton-wool spots. Direct involvement of vascular endothelial cells in HIV infection or immune-complex-mediated damage to endothelial cells and vascular structures is thought to play a role. Detectable antibody to HIV develops in the overwhelming majority of infected individuals within 6 months of exposure. The enzyme-linked immunosorbent assay (ELISA) is used for screening. Western blot, immunofluorescent antibody studies, p24 antigens determinations, qualitative DNA PCR studies, viral cultures and other techniques are used to evaluate suspected false-positive and false-negative test results.

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APPENDIX

Table 1. Embryology of the eye

Stage of growth	Development
2,6 mm (3 weeks)	Optic pits appear on either side of cephalic end of forebrain
3,5 mm (4 weeks)	Primary optic vesicle invaginates; lens plate begins to form
5,5-6 mm	Development of embryonic optic fissure
10 mm (6 weeks)	Retinal layers differentiate, lens vesicle formed and separated
20 mm (9 weeks)	Sclera, cornea and extraocular muscles differentiate
25 mm (10 weeks)	Lumen of optic nerve obliterated
50 mm (3 months)	Optic tracts completed, pars ciliaris retina grows forwards, pars iridica retina grows forward
60 mm (4 months)	Hyaloid vessels atropthy, iris sphincter is formed
230-265 mm	Fetal nucleus of lens is complete
8^{th} month	All layers of retina nearly developed, macula starts to differentiate
265-300 mm (9^{th} month)	Except macula, retina is fully developed, infantile nucleus of lens begins to appear, pupillary membrane and hyaloid vessels disappear

Table 2. Visual acuity equivalence table

United State notation (feet)	Metres	Tenths (by Snellen and Sivtsev)
20/200	6/60	0,1
20/160	6/48	0,125
20/125	6/37	0,16
20/100	6/30	0,2
20/80	6/24	0,25
20/60	6/18	0,33
20/50	6/15	0,4
20/40	6/12	0,5
20/30	6/9	0,67
20/25	6/7	0,8
20/20	6/6	1,0
20/15	6/4,5	1,33
20/10	6/3	2,0

Table 3. Visual acuity notations and abbreviations

VA	Visual acuity
OD or RE	Right eye
OS or LE	Left eye
OU	Both eyes
CF or FC	Count fingers or finger counting
HM	Hand motion
LP ĉ proj	Light perception with projection
LP ŝ proj	Light perception without projection
NLP	No light perception

Table 4. Features of indirect and direct ophthalmoscopy

Feature	Indirect ophthalmoscopy	Direct ophthalmoscopy
Condensing lens	Required	Not required
Examination distance	At an arm's length	As close to patient's eye as possible
Image	Real, inverted	Virtual, erect
Magnification	3-5 times	About 15 times
Area of field focus	About 8 disc diopter	About 2 disc diopters
Illumination	Bright, useful for hazy media	Not so bright, not useful in hazy media
Stereopsis	Present	Absent
Accessible fundus view	Up to ora serrata	Slightly beyond equator
Examination through hazy media	Possible	Not possible

Table 5. Anatomic features of the posterior pole

Term	Clinical description	Histologicdefinition
Macula	Area about 5,5 mm in diameter, centered 4 mm temporal and 0,8 mm inferior to the center of the optic disc; the zone within the temporal vascular arcades might be darker	Central retinal area containing two or more ganglion cell layers and xanthophyll pigment, often associated with heavily pigmented retinal pigment epithelial cells
Fovea centralis	A central retinal depression approximately 1,5 mm (one disc diameter) in diameter, surrounded by an oval, halo-like light reflex	A depression in the inner retina, where the retina slopes from its thickest dimension toward its thinnest
Foveola	The central foveal area approximately 0,35 mm in diameter that lies just within the angiographic capillary-free zone	The central floor of the fovea where the inner nuclear layer and the ganglion cell layer are absent and all photoreceptors are cones

Table 6. Relative action of mydriatic and cycloplegic eye drops

Drug	Concentration	Maximal action	Duration of action
Atropine sulfate	1%	40 minutes – mydriasis; 1-2,5 hours - cycloplegia	7-10 days
Homatropine hydrobromide	2,0%, 5,0%	30-50 minutes	1-3 days
Cyclopentolate hydrochloride	0,5%, 1,0%, 2,0%	25-60 minutes	1-2 days
Tropicamide	0,5%, 1,0%	20-40 minutes	4-6 hours
Phenilephrine hydrochloride	2,5%, 10,0%	60-90 minutes - mydriasis; almost no cycloplegic effect	5-7 hours

Table 7. Terms used to describe visual field defects

Monocular field defects	Binocular field defects
Localized defects • Wedge-shaped temporal field defect • Arcuate nasal field defect • Central scotoma • Enlarged blind spot • Cecocentral scotoma • Annular scotoma *Generalized defects* • Generalized depression • Peripheral constriction	*Homonymous hemianopias* • With macular splitting • With macular sparing • With unilateral sparing of temporal crescent *Bitemporal hemianopias* *Binasal hemianopias* *Quadrantanopias*

Table 8. Functions of the ocular muscles

Muscle	Primary action	Secondary actions
Lateral rectus	Abduction	None
Medial rectus	Adduction	None
Superior rectus	Elevation	Adduction, intorsion
Inferior rectus	Depression	Adduction, extorsion
Superior oblique	Intorsion	Depression, abduction
Inferior oblique	Extorsion	Elevation, abduction

Table 9. Forms of amblyopia

Forms of amblyopia	Cause	Treatment
Amblyopia with strabismus	Suppression of the deviating eye	Occlusion therapy
Deprivation amblyopia	Organic disease, such as ptosis or cataract	Early surgery and occlusion therapy in applicable cases
Refractive amblyopia	Different refractive errors	Correction with eye-glasses or contact lenses and occlusion therapy in applicable cases
Bilateral amblyopia	Nystagmus, astigmatism, late correction of refractive errors	None

Table 10. Types of nystagmus

Early onset nystagmus	Late onset - conjugate	Late onset - disconjugate
Idiopathic congenital Manifest latent Sensory deprivation	Peripheral vestibular Central vtstibular Upbeat Downbeat Periodic alternating Gaze evoked	Superior oblique myokymia Internuclear ophthalmoplegia associated Acquired pendular See-saw nystagmus

Table 11.Differential diagnosis between concomitant and paralytic strabismus

Differential criterion	Concomitant strabismus	Paralytic strabismus
Cause	Uncorrected refractive error, hereditary, perinatal injury	Injury or disease of ocular muscles, supplying nerves, or nuclei
Onset	At an early age, initially only periodically	At any age, sudden onset
Diplopia	None	Diplopia is present
Compensatory head posture	None	Constant
Visual acuity	Usually unilaterally reduced visual acuity	No change in visual acuity
Angle of deviation	Constant in every direction of gaze	Increses in the direction of pull of the paralyzed muscle

Table 12. Common abnormalities of the eyelids, eyelashes, and eyebrows

Abnormal eyelid position or function	
Lagophthalmos	Insufficiency or weakness of eyelid closure
Blepharospasm	Involuntary contraction of the orbicularis oculi muscle
Blepharoptosis	Abnormal droopping of the eyelid (owing to congenital, mechanical, myogenic, aponeurotic, or neurogenic causes)
Ectropion	Outward turning of he eyelid margin
Entropion	Inward turning of the eyelid margin
Abnormal eyelashes or eyebrows	
Trichiasis	Misdirection of one or more eyelashes
Madarosis	Patchy or diffuse loss of eyelashes
Poliosis	Whitening of lashes
Distichiasis	Extra row of lashes
Abnormal eyelid fold	
Dermatochalasis	Redundant eyelid skin
Blepharochalasis	Chronic lymphedema with wrinkled eyelid skin
Epicanthus	Vertical fold at the medial canthus
Epiblepharon	Horizontal fold near the lower eyelid margin

Table 13. Differentiation of the common types of conjunctivitis

Clinical findings	Viral	Bacterial	Chlamydial	Allergic
Itching	Minimal	Minimal	Minimal	
Hyperaemia	Generalized	Generalized	Generalized	Generalized
Tearing	Profuse	Moderate	Moderate	Moderate
Exudation	Minimal	Profuse	Profuse	Minimal
Preauricular adenopathy	Common	Uncommon	Common only in inclusion conjunctivitis	None
Associated sore throat and fever	Occasionally	Occasionally	Never	Never

Table 14. World Health Organization (WHO) classification of trachoma

TF	Trachomatous inflammation: follicular	> 5 follicles on upper tarsus
TI	Trachomatous inflammation: intense	Tarsal inflammation sufficient to obscure > 50% of the tarsal vessels
TS	Trachomatous scarring	Conjunctival scarring
TT	Trachomatous trichiasis	Trichiasis
CO	Corneal opacity	Corneal opacity involving at least part of the pupillary margin

Table 15. Anatomical classification of uveitis

Type	Includes	Primary site of inflammation
Anterior uveitis	Iritis, iridocyclitis, anterior cyclitis	Anterior chamber
Intermediate uveitis	Pars planitis, posterior cyclitis, hyalitis	Vitreous
Posterior uveitis	Focal, multifocal, or diffuse choroiditis; chorioretinitis, retinochoroiditis, retinitis, neuroretinitis	Retina or choroid
Panuveitis		Anterior chamber, vitreous and retina, or choroid

Table 16. Differentiation of non-granulomatous and granulomatous uveitis

Symptoms and signs	Non-Granulomatous	Granulomatous
Onset	Acute	Insidious
Pain	Marked	None or minimal
Photophobia	Marked	Slight
Blurred vision	Moderate	Marked
Circumcorneal flush	Marked	Slight
Keratic precipitates	Fine white	Large gray (‘mutton fat’)
Pupil	Small and irregular	Small and irregular
Posterior synechiae	Sometimes	Sometimes
Iris nodules	None	Sometimes
Course	Acute	Chronic
Recurrence	Common	Sometimes

Table 17. Differential diagnosis between ciliary and conjunctival congestion

Symptoms and signs	Ciliary congestion	Conjunctival congestion
Colour of the congested area	Purplish or pinkish	Brick red
Pain	Usually present	Usually absent
Photophobia	Usually marked	Usually absent
Location	More intense circumcorneally	More marked in fornices and in the tarsal conjunctiva
Course of vessels	Straight, radiating from cornea	Irregular and tortuous

Mobility of vessels	Can not be moved over the eyeball by traction on the conjunctiva	Can be moved over the surface of the eyeball
Blanching by vasoconstrictors	Not blanched by instillation	Blanched by instillation
Blanching by pressure	Blanched for a second or two after pressure with eyelid or with glass spatula against the eyeball	Not blanched by pressure; vessels anastomose freely so that vessels emptied by pressure refill at once
Discharge	Absent	Pathognomonic when present (but may be absent)
Pupil	Usually contracted	Unaffected
Iris	Usually congested	Unaffected
Tenderness (near cornea)	Usually present	Usually absent

Table 18. Causes of vision loss

Causes of sudden painful loss of vision	Causes of sudden painless loss of vision	Causes of gradual painless loss of vision
Trauma	Vitreous hemorrhage	Refractive errors
Acute keratitis	Central retinal artery occlusion	Keratoconus
Acute angle closure glaucoma	Branch retinal artery occlusion	Corneal degenerations/dystrophies
Acute anterior uveitis	Central retinal vein occlusion	Pterygium
	Branch retinal vein occlusion	Cataract
	Retinal detachment	Open angle glaucoma
	Central serous chorioretinopathy	Age-related macular degeneration
	Optic neuritis (except retrobulbar)	Retinal dystrophies
	Cortical blindness	Compressive lesions in the brain

Table 19. Glaucoma classification according to etiology

A. Primary glaucoma 1. Open-angle glaucoma a. Primary open-angle glaucoma b. Normal-tension glaucoma 2. Angle-closure glaucoma a. Acute b. Subacute c. Chronic d. Plateau iris **B. Congenital glaucoma** 1. Primary congenital glaucoma 2. Glaucoma associated with other developmental ocular abnormalities a. Anterior chamber cleavage syndromes	3. Due to lens changes (phacogenic) a. Dislocation b. Intumescence c. Phacolytic 4. Due to uveal tract changes a. Uveitis b. Posterior synechiae (seclusio pupillae) c. Tumour d. Ciliary body swelling 5. Iridocorneoendothelial (ICE) syndrome 6. Trauma a. Hyphema b. Angle contusion/recession c. Peripheral anterior synechiae

Axenfeld's syndrome Reiger's syndrome Peter's syndrome b. Aniridia 3. Glaucoma associated with extraocular developmental abnormalities a. Sturge-Weber syndrome b. Marfan's syndrome c. Neurofibromatosis I d. Lowe's syndrome e. Congenital rubella **C. Secondary glaucoma** 1. Pigmentary glaucoma 2. Exfoliation glaucoma	7. Postoperative a. Ciliary block glaucoma (malignant glaucoma) b. Peripheral anterior synechiae c. Epithelial downgrowth d. Following corneal graft surgery e. Following retinal detachment surgery 8. Neovascular glaucoma a. Diabetes mellitus b. Central retinal vein occlusion c. Intraocular tumor 9. Raised episcleral venous pressure a. Carotid-cavernous fistula b. Sturge-Weber syndrome 10. Steroid-induced

Table 20. Differential diagnosis of iritis and acute glaucoma

Differential criteria	Acute iritis	Acute glaucoma
Symptoms	Dull pain and photophobia	Intense pain and vomiting
Vision	Slightly reduced	Markedly reduced
Discharge	Tearing	No discharge
Conjunctiva	Combined injection	Combined injection
Cornea	Clear	Opacified, edematous
Anterior chamber	Normal depth; may contain cells, floating opacities, fibrin	Shallow
Iris	Iris markins indistinct or muddy; posterior synechiae may be present	Congested, displaced forward
Pupil	Contracted (reactive miosis)	Dilatated, sometimes oval
Tension	Normal pressure or low	"Rock hard"

Table 21. Pharmacological groups of intraocular pressure lowering agents

Group	Mode of action	Systemic and local side effects	Active ingredients (examples)
Prostaglandin analogues	Increase uveoscleral aqueous humour outflow	Bronchospasm (rare) Conjunctival hyperaemia Increased pigmentation of the iris Lengthening and darkening of the lashes	Latanoprost 0,005%, Travoprost 0,004%, Bimatoprost 0,03%, Tafluprost 0,0015%, Latanoprostene Bunod 0,024%
β-blockers	Decrease aqueous humour production	Bronchospasm Bradycardia Hypotension Heart block	*Non-selective* Timolol 0,25/0,5% Levobunolol 0,5% *β1-selective*

		Glucose intolerance Lethargy	Betaxolol 0,25/0,5%
Carbonic anhydrase inhibitors	Decrease aqueous humour production; increase local circulation	Metallic taste Nausea, malaise Depression Anorexia Hypokalaemia Decreased libido	Dorzolamide 2% Brinzolamide 1% Acetazolamide
Adrenergic agonists	Decrease aqueous humour production; increase uveoscleral outflow by reducing episcleral venous pressure	Bradycardia Hypotension Irritability Gastrointestinal system disturbance Redness of the eye	Brimonidine 0,2% Dipivefrine 0,1% (epinephrine derivative) Apraclonidine 0,5/1%
Miotics	Increase trabecular outflow by contraction of the ciliary muscle and tension on the trabecular meshwork and scleral spur	Myosis Worsening of night vision Nausea Headache Bradycardia Sweating	Pilocarpine 0,5-4% Carbachol 0,75-3%
Osmotic agents	Create an osmotic pressure gradient	Hypertension Vomiting Hyperglycaemia (mannitol) Heart failure	Mannitol 20% intravenous Glycerol 50% oral

Table 22. The 'glaucoma triad' and diagnostic features

Evidence for glaucoma	Diagnostic features
Raised intraocular pressure	> 21 mm Hg
Abnormal disc	Cup:disc ratio asymmetry Large cup:disc ratio for disc size Thinning of neuroretinal rim (ISNT rule) Nasal displacement of the blood vessels Disc haemorrhage Peripapillary chorioretinal atrophy (β-zone)
Visual field defect	Nasal step, arcuate scotoma Altitudinal scotoma Residual central or peripheral temporal island of vision

Table 23. Differential diagnosis between papilledema, papillitis, and pseudoneuritis

	Papilledema	Papillitis	Pseudoneuritis
Media	Clear	Vitreous opacities common	Clear
Colour of disc	Red and cloudy	Red and cloudy	Red but not cloudy
Swelling of disc	Marked and progressive	Usually slight and temporary	Usually slightly elevated
Margins of optic disc	Fairly well defined	Indistinct in relation to amount of swelling	Somewhat indistinct
Vessels and hemorrhages	Marked disproportion between veins and	Arteries unchanged. Veins broad and	Veins broad and tortuous. No

	arteries. Veins enlarged and tortuous. Arteries small. Haemorrhages may be present	tortuous. Hemorrhages usually present Present	hemorrhages
Peripapillary oedema	Present	Rapid loss of vision: more marked than ophthalmoscopic appearance might suggest	Absent
Vision	Often unaffected. Gradual loss of vision usually observed after edema is present for some time. Transitory attacks of blurred vision are common	Not characteristic	Usually normal with correction
Refraction	Not characteristic		Usually high hyperopia and astigmatism
Visual fields	Concentric contracion but slight in relation to amount of swelling. Enlargement of the blind spot. Colours only slightly affected. Central scotomas rare	Central scotoma. Peripheral fields may or may not be affected. Peripheral contraction. Enlargement of the blindspot marked in relation to degree of swelling. Colour field affected more than in papilledema	Blind spot may be smaller than the normal average

Table 24. Grading of severity of alkali injuries (Hughes' classification)

Grade	Corneal appearance	Limbal ischaemia	Prognosis
Grade I	Clear cornea	No limbal ischaemia	Good
Grade II	Hazy cornea, visible iris detalis	Less than 1/3 of limbus	Good
Grade III	Opaque cornea, total loss of corneal epithelium, iris details obscured	Between 1/3 and 1/2 of limbus	Guarded
Grade IV	Opaque cornea iris details obscured	More than 1/2 of limbus	Poor

Table 25. Keith-Wagner-Barker classification of hypertensive vascular changes

Stage	Characteristics
Grade I	Mild to moderate arteriolar narrowing
Grade II	Moderate to severe arteriolar narrowing: exaggerated light reflex; arteriovenous crossing changes, Gunn's crossing sign
Grade III	Retinal arteriolar narrowing and focal constriction; retinal hemorrhages, hard exudates, cotton-wool spots, retinal oedema
Grade IV	All of the above and with papilloedema

Table 26. Scheie classification of arteriosclerotic and hypertensive vascular changes

Arteriosclerosis	
Grade I	Minimal widening of arteriolar light reflex
Grade II	Increased light reflex
Grade III	Copper-wire arterioles (copper-coloured arterial reflex)
Grade IV	Silver-wire arterioles (silver-coloured arterial reflex)
Hypertension	
Grade I	Minimal arteriolar narrowing
Grade II	Obvious arteriolar narrowing with focal irregularities
Grade III	Arteriolar narrowing with retinal haemorrhages and exudates
Grade IV	All of the above with papilloedema

Table 27. Causes of embolus in retinal artery occlusion

Type of embolus	Source of embolus
Calcium emboli	Atheromatous plaques from the carotid artery or cardiac valves
Fibrin-platelet emboli	In atrial fibrillation, myocardial infarction, heart surgery
Cholesterol emboli	Atheromatous (Hollenhorst) plaques from the carotid art
Myxoma emboli	In atrial myxoma
Bacterial or mycotic emboli	In endocarditis and septicemia

Table 28. Associations of central retinal artery occlusion

Atherosclerotic	Hypertension, diabetes mellitus, hyperholesterolaemia, smoking
Embolic sources	Carotid artery disease, aortic disease, cardiac valve vegetations, cardiac tumours, arrhytmias, post-intervention
Haematological	Protein S, protein C, or antithrombin deficiency, antiphospholipid syndrome, lynphoma, leukaemia
Infective	Syphilis, toxoplasmosis, mucormycosis
Inflammatory	Giant cell arteritis, polyarteritis nodosa, Wegener's granulomatosis, systemic lupus erythematous, Kawasaki's disease
Pharmacological	Oral contraceptive pills, cocaine
Ophthalmic	Trauma, optic nerve drusen, migraine

Table 29. Associations of central retinal vein occlusion

Atherosclerotic	Haematological	Inflammatory	Ophthalmic
Hypertension Diabetes mellitus Hypercholesterolaemia Smoking	Protein S deficiency Protein C deficiency Antithrombin deficiency Antiphospholipid syndrome Myeloma Factor V Leiden	Sarcoidosis Behcet's disease Systemic lupus erythematous Polyarteritis nodosa Wegener's granulomatosis	Primary glaucoma Trauma Orbital pathology

Table 30. Types of central retinal vein occlusion (CRVO)

Features	Nonischemic CRVO	Sschemic CRVO
Incidence	70%	30%
Vision	> 0,1	< 0,1
Pupil	Relatively normal	Relative afferent pupillary defect
Cotton wool spots	Few	Numerous
Hemorrhages	Dot and blot	Flame shaped
Retina	Relatively normal	Edematous
Retinal nonperfusion	<10 disk diameters	>10 disk diameters
Risk for neovascularization	Low	High
Prognosis	Good	Bad

Table 31. Stages of diabetic retinopathy

Stage of retinopathy	Retinal changes
Non-proliferative diabetic retinopathy	
Mild	Microaneurysms only
Moderate	Microaneurysms, dor and blot haemorrhages, hard exudates, cotton-wool spots, mild intraretinal microvascular abnormalities (IRMA)
Severe	One feature of the 4-2-1 rule: intraretinal haemorrhages in all four quadrants; venous beading in two quadrants; moderate intraretinal vascular abnormalities in one quadrant
Very severe	Two features of 4-2-1 rule
Proliferative diabetic retinopathy	
Low risk	Neovascularization of the optic disc (NVD) less than one-quarter to one-third disc areas with no vitreous haemorrhage
High risk	Mild NVD with vitreous haemorrhage; moderate to severe NVD (more than one-quarter to one-third disc areas); new vessels elsewhere more than one-half disc areas with vitreous haemorrhage
Diabetic maculopathy	
Focal	Well circumscribed areas of leakage with oedema and full/part rings of perifoveal exudates often surrounding a microaneurysm
Diffuse	Generalized leakage with oedema
Ischemic	Decreased visual acuity with relatively normal macular appearance
Mixed	Features of oedema and ischemia at the macula
Clinically significant diabetic macular oedema	Thickening of the retina at or within 500 μm of centre of

	the macula; hard exudates at or within 500 μm of centre of the macula if associated with adjacent retinal thickening; retinal thickening of >1 disc area any part of which is within 1 disc diameter of the centre of the macula

Table 32. Differential diagnosis of exophthalmos

Symptom/ sign	Thyroid eye disease	Pulsating exophthalmos	Tumour of orbit	Inflammation of orbit	Emphysema of orbit
Onset	Gradual	Sudden	Gradual	Sudden	Sudden
Pain	Painless	Pain in orbit	May be present	Acute pain	May be present
Visual acuity	Unaffected	May or may not be affected	May be affected in later stages	Gradual loss if nerve affected	Unaffected
Mobility of eye	Good; convergence limited	Good	Limited	Limited	Good
Direction and behavior of proptosis	Forward displacement-gradual increase	Proptosis which pulsates	Eyeball displaced in any direction depending on situation of tumour	Eyeball displaced laterally as well as forward	Proptosis increased by straining, blowing nose; eyeball can be pressed back into orbit
Associated symptoms and signs	Lid retraction (upper>lower), lid lag (on downgaze), conjunctival injection/chemosis, restrictive myopathy, optic neuropathy, keratopathy, diplopia	Optic neuritis, marked dilatation of retinal veins, paralysis of third and fourth nerves and bruit (relieved by compression of the carotid artery on the same side)	X-rays, B-scan, computer tomography, or magnetic resonance imaging findings	Eyelid swelling; conjunctival injection, chemosis, restrictive myopathy,	Fracture of the orbit; Diplopia may be present in the affected eye; elevation or depression deficit

Table 33. Inflammatory diseases affecting the orbit

Isolated	Diffuse	Idiopathic orbital inflammatory disease
		Idiopathic sclerosing inflammation of the orbit
	Focal	Myositis
		Dacryoadenitis
		Tolosa-Hunt syndrome

Systemic	Thyroid eye disease Wegener's granulematosis Sarcoidosis

Table 34. Eyelid signs in thyroid eye disease

Eyelid sign	Explanation
Dalrymple sign	Lid retraction in primary gaze (upper eyelid is retracted with visible sclera superior to the limbus)
Kocher sign	Fixed gaze (frightened appearance on attentive fixation)
Von Graefe	Retarded descent of the upper lid on down-gaze (upper eyelid retracts when the eye depresses)
Stellwag sign	Rare blinking
Gifford sign	Upper eyelid is difficult to evert (due to eyelid oedema)

Table 35. Ophthalmic manifestations of HIV/AIDS

	Infective	Neoplastic	Other
Adnexae	Herpes zoster ophthalmicus Molluscum contagiosum Preseptal cellulitis	Kaposi sarcoma Squamous cell carcinoma	Conjunctival microvasculopathy
Orbit	Orbital cellulitis	Non-Hodgkin lymphoma	
Anterior segment	Viral keratitis Bacterial keratitis Protozoan keratitis		Conjunctival microvasculopathy Vortex keratopathy Dry eye Anterior uveitis
Posterior segment	Cytomegalovirus retinitis Varicella zoster virus retinitis Herpes simplex virus retinitis Toxoplasma, syphilis, tuberculosis, pneumocystis, cryptococcal choroiditis	Ocular-central nervous system non-Hodgkin lymphoma	Retinal microvasculopathy Ischemic maculopathy Immune recovery uveitis
Neuro-ophthalmic		Ocular-central nervous system non-Hodgkin lymphoma	Optic neuritis Optic atrophy Ocular motility disorders

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