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Ocular Morbidity in Population of Uttarakhand

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ABSTRACT

The visual system is the portion of the central nervous system through which human organism is able to see. Eye is very sensitive organ of our system so the care is very important. The task of the visual system is a big one. This system must have an almost innumerable amount of available information and extract only the useful information. Most important special sense in human being is the vision. For normal physical, mental, psychological development and education, vision should be normal. The aim of this review is to evaluate the ocular morbidity in the population of Uttarakhand. This study is a literature review of published studies from 2013 to 2017, held in the different journal and article and websites. Refractive error was the commonest ocular morbidity followed by disorders of conjunctiva, congenital malformations of eye, disorders of eyelid, lacrimal system and orbit, injury of eye and orbit, superficial injury of eye, disorders of sclera, cornea, iris and ciliary body, disorders of choroid and retina and presence of functional implant. Most common complaint among children was watering of the eye followed by discharge from eyes, redness of eye and headache, diminished vision, itching and inability to see clearly in dim light. Prevalence of ocular morbidity was significantly associated with age. Commonest causes of injury were contact lens wear, road traffic accidents, sports playing & recreational activities and occupational. Delay in presentation was associated with complications. Stable intervention programs targeting refractive errors, allergic conjunctivitis, infections of lid and adnexa and trauma are used to decrease the burden of ocular morbidity.

Keywords: Visual System, Vision, Visual pathway, Visual Defects, Epidemiology, Ocular Morbidity

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INTRODUCTION

The primary organ of vision is the eye in which each one of the two eyeballs is situated in the orbit, where it takes up about one-fifth of the orbital volume. The remaining space is taken up by the extraocular muscles, fascia, fat, blood vessels, nerves and the lacrimal gland. The eye is embryologically an extension of the central nervous system. Many common anatomical and physiological properties are shared by the eye with the brain. Visual system is the part of the central nervous system which is required for visual perception – receiving, processing and interpreting visual information to build a representation of the visual environment. It consists of the eye, retina and fibers that conduct visual information to the thalamus, the superior colliculus and parts of the cerebral cortex.[1,2]

Light is reflected off an object that enters the eye through the cornea, and continue the visual axis to the center of the retina, the fovea. This light is converted into electrons by the receptors in the retina that are then transmitted to the visual cortex in the brain, where the image is "seen." The task of the visual system is a big one. This system must have an almost innumerable amount of available information and extract only the useful information. The visual system appears to be a combination of several visual subsystems that is one dedicated to color, another to form, and a third to motion and depth.[3]

Most important special sense in human being is the vision. For normal physical, mental, psychological development and education, normal vision is very important. Before the age of 20 years about 30% of blind population of India lose their eyesight and many of them are under 5 when they become blind. For the prevention of permanent disability this need early detection and treatment. The causes of blindness vary widely in different parts of the world although nutritional factors and infections are more common in developing countries and in countries with better standards of living and health care services; hereditary factors, developmental disease and the consequences of prematurity are more frequent causes of blindness. Trachoma, xerophthalmia, congenital cataract, glaucoma, optic atrophy, retinopathy of prematurity and uncorrected refractive errors are leading causes of blindness in developing countries. Fortuitously most of the causes (75%) are either preventable or curable. It is pleasurable to know that WHO and Indian government have agreed for the prevention and control of blindness and visual impairment and included it in "Vision 2020". [4]

The visual system

Vision system plays an important role in our lives. It consists of two parts. The eyes act as an

image receptor which captures light and convert it into signals. After that these signals are transmitted to an image processing center in the brain and this build an "internal picture" of the scene being viewed. Brain process consists of partly of simple image processing and partly of higher functions which build and manipulate an internal model of the outside world. [5]

Visual pathway

The ability to see the things depends on clarity and processing of images reaching to the brain. Therefore, without any interruption to the retina, the optical system must transmit the images clearly, which then transforms light into electrochemical signals for transmission through the visual pathway to visual cortex. In this, the visual pathway is made up of axons, which connect the retina to the occipital lobes of the brain at the level of the visual cortex. The pathway starts at the retina and proceeds from the orbit through the optic disc, along the optic nerve to join with the optic nerve of the other eye at the optic chiasm. Information then passes to the lateral geniculate body, and at the last to the occipital cortex. Any interruption on this path will result in a visual field defect. [2]

Visual pathway from the retina may be divided into six levels as follows: -

Optic Nerve: - It consists of about 1 million axons arising from the ganglion cells of the retina. The nerve fiber layer of the retina is comprised of these axons and they converge to form the optic nerve and the orbital portion of nerves travels within the muscle cone to enter the bony optic foramen for gaining access to the cranial cavity. The optic nerve is consisting of visual fibers (80%) and afferent pupillary fibers (20%).

Optic Chiasm: - To form the optic chiasm, optic nerves from each of the eye join after a 10mm intracranial course. At the optic chiasm the nasal fibers, cross over to run in the optic tract of the opposite side which constituting about three-fourths of all the fibers.

Optic Tract: - To correspond with their position in the lateral geniculate body, crossed nasal fibers and uncrossed temporal fibers from the chiasm are rearranged. All of the fibers which receive impulses from the right visual field are projected to the left cerebral hemisphere and from the left field to the right cerebral hemisphere. Around the hypothalamus and the cerebral peduncle, each optic tract sweeps to end in the lateral geniculate body with a smaller portion carrying the pupillary impulses continuing to the pretectal area and the superior colliculi.

Lateral Geniculate Nucleus: - In this, the visual fibers synapse in the lateral geniculate body. Through the cell bodies of this structure, the geniculocalcarine tract (final neuron of the visual pathway) rise.

Optic Radiation: - Through posterior limb of the internal capsule, the geniculocalcarine tract passes and then fans into the optic radiation which traverses parts of temporal and parietal lobes end route to the occipital cortex.

Visual Cortex: - Optic radiation fibers representing superior retinal quadrants ends on the superior lip of the calcarine fissure and those fibers which representing inferior retinal quadrants end in the inferior lip. The macula is represented in a large region posteriorly, and retinal areas close to the macula are represented more anteriorly.[6,7]

Types of vision

There are two types of vision which are follows:

vision: - Having cone cells which is used for discrimination of fine details for critical observation. The cone cells are densely packed and processes sharp images of the objects. These cells have low sensitivity below 0.01 ft lamberts and cease to function < 0.001 ft lamberts. It must be mentioned that by definition 2 1 1 lambert is candles / m π and 2 1 1 ft lambert is candles / ft π

Scotopic vision: - Having Rods cells to take over when brightness < 0.01 ft lambert. This vision doesn't have the ability to discriminate colors. Most of the images have gray in appearance which are viewed as silhouettes lacking sharp details. Eyes are capable to change from one to other. This shift in Luminosity and ability of eye to adjust is known as Purkinjee effect. By a decrease in Pupil size, intensity of illumination increases which produce clearer images with greater and fine details. Pupils diameter varies in the range of 1.2 – 2 mm. [8]

Epidemiology of visual impairment

The prevalence of visual impairment is to be between 1.5 and 3.4 million visually impaired adults (40 and older) in the United States. The incidence of visual impairment increases with age. More than two thirds of persons with low vision are over the age of 65.19. Statistical data regarding the prevalence of visually impaired school-age children5 and younger adults46 is lacking, however this remains an important population in need of vision rehabilitation care and services.[9] The estimated number of people who are visually impaired in the world is 285 million, 39 million blind and 246 million having low vision; 65 % of people visually impaired and 82% of all blind are 50 years and older.[10]

Risk factors for visual impairment due to eye diseases

- **Age:** Visual impairment is unequally distributed across age groups. More than 82% of all blind people are 50 years of age or older and people in this age group represent only 19% of the world's population. The prevalence of blindness among children is about 10 times

lower than that among adults. Because of the expected number of years to be lived in blindness, childhood blindness remains a high priority.

- **Gender:** Studies indicate that females in every region of the world and of all ages have a significantly higher risk for being visually impaired than males. It is because of their longer life expectancy and, in poorer societies, because of their lack of access to services.
- **Socioeconomic status:** More than 90% of the world's visually impaired people live in developing countries.

Other risk factors include tobacco use, exposure to ultraviolet radiation, vitamin A deficiency, high body mass index and metabolic disorders.[11]

Vision defects

Many of us have some vision problems. There are many difficulties in vision which are seeing may be minor inconveniences or major short comings in our ability to see clearly. These difficulties may appear early or late in our lives. Fortunately, there are many methods available to make corrections to our natural optical (ocular) system which are eye glasses and contact lenses to surgery. Before to make any corrections, eye specialists must know very precisely what the problem is. Three eye problems are common that is nearsightedness, farsightedness and astigmatism. To understand the physics behind these vision defects, the simulation or the eye model can be used.

- **Exploring vision defects with the eye model:** For creating an eye model with a vision defect, separate the two halves and add a small Styrofoam ring between the halves of the sphere. The accommodating lens must have average thickness – not too thick or too thin. Objects which are different distances away, the lenses are pointed on it. By stating the approximate distance from the eye and the quality of the image on the model retina, the results are recorded.

  Repeat this experiment recording distance and image quality, but this time the distance is short from the lens to the retina. It can do by turning the hemisphere with the retina backwards so that it is closer to the lenses.

- **Exploring vision defects with computer simulations:**

  In the computer eye model, it allows you to move the location of retina and by this it creates an eye model with a vision defect. The vision difficulties are created by movement of retina. Firstly, move the retina to the location which is farthest from lens. Now move the objects so that there are many different distances from eye. The results are

recorded by stating distance from the eye and the quality of the image on the model retina. Make note of where the focal point is in relation to the retina (behind or in front). Now, move the retina in the position which is close to the lens. Repeat the experiment and record the distance and image quality and focal point location. [12]

Aspects of vision loss

From the different points of view, most of the events or conditions can be approached and same holds for vision loss. When discussing the causes and consequences of Vision Loss, it is helpful to distinguish four main aspects of vision loss, which is described in the WHO Classification of Impairments, Disabilities and Handicaps and its successor, the WHO Classification of Function, Disability and Health. Two of the aspects refer to the organ system. The first aspect is that of anatomical and structural changes in which defects are described as diseases, disorders or injuries. The second aspect is that of functional changes at the organ level in which defects are described as impairments. The other two aspects are based on individual. One aspect describes the skills and abilities of the individual in which defects are described as ability loss. The last aspect describes the social and economic consequences in which defects are described as handicaps and as lack of participation. To minimize the functional effect (impairment) of various disorders, medical and surgical care can be very helpful. If there any visual impairment, visual aids and devices can used to reduce the ability loss and improve the ability to perform various activities.[13]

Ocular morbidity in Uttarakhand

A study was conducted to determine the pattern of eye diseases and the socio-demographic factors responsible for the ocular morbidity among the patients aged 5 to 16 years from Kumaon region, who presented to the Department of Ophthalmology, Government Medical College, Haldwani, Uttarakhand, between October 2014 and October 2016. A sample size of 400 was taken. A pre-designed proforma was used to document the patient particulars, history, examination and the diagnosis. The study found that overall the disorders of ocular muscles, binocular movement, accommodation and refraction was the most common (37.25%) cause of ocular morbidity followed by Disorders of conjunctiva (25.75%), Congenital malformations of eye (7%), Disorders of eyelid, Lacrimal system and orbit (6.50%), Injury of eye and orbit (3%), Superficial injury of eye (1.50%), Disorders of sclera, cornea, iris and ciliary body (1%), Disorders of choroid and retina (0.75%) and Presence of functional implant (IOL) (0.5%). In this study, most causes of ocular morbidity were avoidable and refractive error. To decrease the

burden of ocular morbidity in this region, stable intervention programs targeting refractive errors, allergic conjunctivitis, infections of lid and adnexa and trauma may be used.[14]

A cross sectional study was conducted to know the ophthalmic morbidities in school children in 3 schools of Thatyur block in Tehri District of Uttarakhand in August 2012. Total 705 students were enrolled in this study. Out of these, 406(57.6%) were males and 299(42.4%) were females. Response rate was 97.5%. the study found that watering of the eye (12.8%) was the most common complaint amongst children followed by discharge from eyes (8.6%), redness of eye and headache (7.2% each), pain in the eye (6.8%), diminished vision (5.3%), itching (3.2%) and inability to see clearly in dim light (2.1%). Half of the children did not report any eye or related complaints when examined. On examination, 141(20%) subjects were identified to be suffering from some form of ocular morbidity. Refractive errors were found in 3% of the examined children. The most common cause of preventable blindness identified was related to vitamin A deficiency (7.5%). Other preventable causes of blindness included blepharitis (3.6%), Conjunctivitis (2%), trachoma (1.3%) and chalazion (0.1%).[15]

A prospective study was conducted in eye department of Government Doon Medical College, Dehradun, Uttarakhand, India between April 2016 to May 2016. The patients were seen in eye OPD by ophthalmologists. Proper anterior and posterior segment evaluation was done and patients were treated accordingly. The mean age of male patients was 43 years and for females was 41.33 years. In this study, refractive error (20.97%) was the commonest ocular morbidity followed by cataract (20.02%), follow ups of cataract surgeries and allergic conjunctivitis. Besides refractive errors total 137 (10.88%) patients were presbyopic. This study shows allergic conjunctivitis was third commonest cause of ocular morbidity in may be due to windy weather. The high prevalence of refractive errors and cataracts shows that hospital still requires an improved infrastructure with spectacle provision to the patients.[16]

A study was conducted to know the prevalence of ocular morbidity in school going children of government and private schools of Haldwani. Total 1355 school children were included in the study. Data was collected with the questionnaire and detailed ophthalmic examination was done using appropriate charts and instruments. Study found that prevalence of ocular morbidity was found to be 23.3%. Refractive error was the most common ocular morbidity (15.6%) followed by colour blindness (2.4%) and vitamin A deficiency (1.1%). Prevalence of overall ocular morbidity and refractive errors were found significantly associated with age of the study participants. (p value < 0.05).[17]

A study was done to determine the pattern of ocular trauma among patients presenting in Dr. Sushila Tiwari Government Hospital, Haldwani. Retrospective review of records of 165 patients with ocular trauma were seen using a structured format. Ocular trauma accounted for 165(1.03%) of the 15,970 ocular patients seen at OPD and Emergency. Of the studied 165 cases, 93 patients were below 30 years of age. M: F ratio was 10:1. 21(12.7%) patients presented to hospital within 2-7 days of injury. Duration of presentation has significant association with the presence of infection & other complication ($p<0.05$). The cause of injury were road traffic accidents, sports playing & recreational activities and occupational in 54(32.7%), 42(25.5%) and 33(20%) respectively. Closed globe injuries accounted for 54(32.7%) and open globe for 75(45.4%) and adenexal injuries constituted 36(21.8%). Delay in presentation was associated with complications.[18]

CONCLUSION

According to literature review, we found that in Uttarakhand region, refractive error was the commonest ocular morbidity followed by disorders of conjunctiva, congenital malformations of eye, disorders of eyelid, lacrimal system and orbit, injury of eye and orbit, superficial injury of eye, disorders of sclera, cornea, iris and ciliary body, disorders of choroid and retina and presence of functional implant. Most common complaint among children was watering of the eye followed by discharge from eyes, redness of eye and headache, diminished vision, itching and inability to see clearly in dim light. Prevalence of ocular morbidity was significantly associated with age. Commonest causes of injury were contact lens wear, road traffic accidents, sports playing & recreational activities and occupational. Delay in presentation was associated with complications. Stable intervention programs targeting refractive errors, allergic conjunctivitis, infections of lid and adnexa and trauma are used to decrease the burden of ocular morbidity.

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