Eye Signs in Critically Ill Patient

Essay

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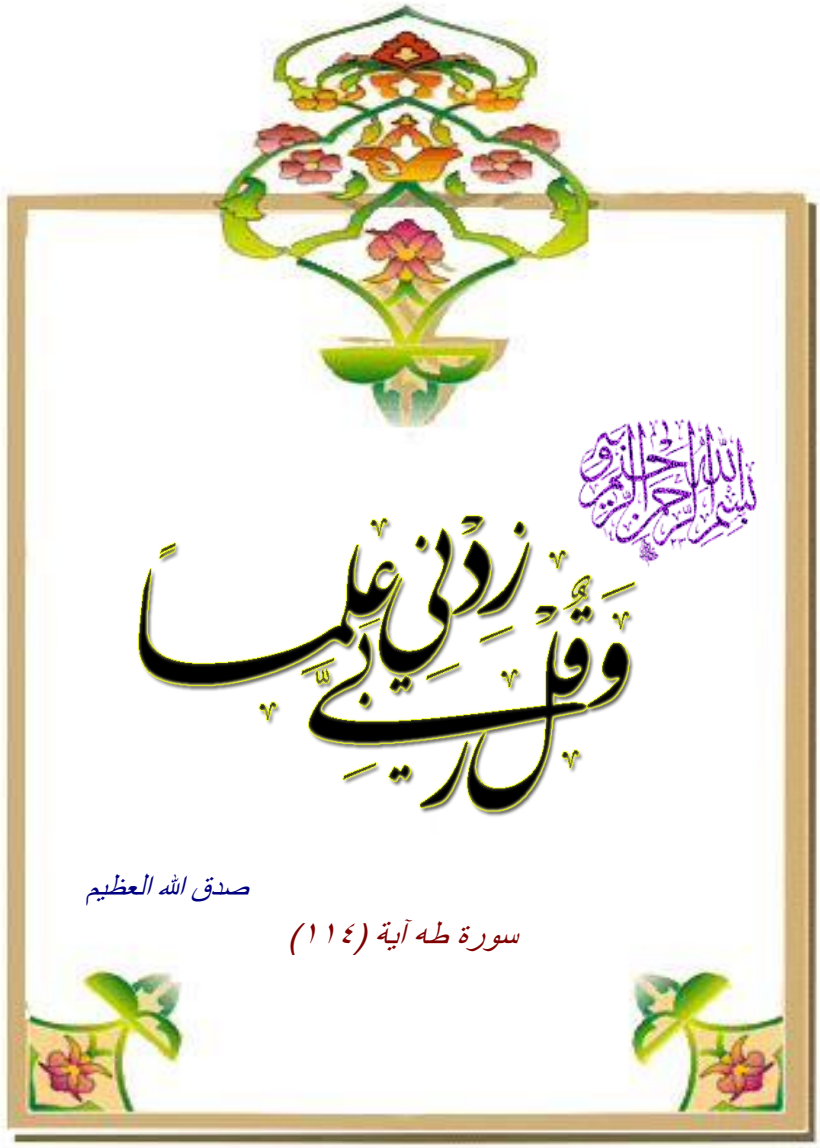

صدق الله العظيم

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Ahmed Mohammed Reyad

Contents

List of Abbreviations

ARAS	Ascending Reticular Activating System
AVR	Arteriole To Venule Ratio
CHD	Coronary Heart Disease
CRS-R	Coma Recovery Scale-Revised
CSF	Cerebro-Spinal Fluid
CSME	Clinical Significant Diabetic Macular Edema
CT	Computed Tomography
CVD	Cardiovascular Disease
DM	Diabetes Mellitus
DOC	Disorders Of Consciousness
EEGs	Electroencephalograms
Fa	Anterior Focal Point
FOUR	Full Outline Of Unresponsiveness
GABA	Gamma-Amino Butyric Acid
GCS	Glasgow Coma Scale
HTN/HT	Hypertension
IDDM	Insulin-Dependent Diabetes Mellitus

List of Abbreviations (Cont.)

MCS	Minimally Conscious State
NIDDM	Non Insulin-Dependent Diabetes Mellitus
OCT	Optical Coherence Tomography
PCR	Polymerase Chain Reaction
REMs	Rapid Eye Movements
SD-OCT	Spectral-Domain Oct Technique
SSEPs	Somatosensory Evoked Potentials
VEGF	Vascular Endothelial Growth Factor
VOR	Vestibular-Ocular Reflex
VS	Vegetative State
WCH	White Coat Hypertension

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Introduction

The eye is a special sense organ, lies in the cavity of the orbit and made up of three coats or tunics: the outer fibrous layer of connective tissue forms the cornea and sclera, provides protection for the structures within and maintains the shape of the globe, the middle vascular layer is composed of the iris, choroid and ciliary body and regulates the amount of the light entering the pupil, supplies nutrients to outer retinal layer and produces the components of aqueous humor and the inner neural layer is retina which processes and changes light energy into a signal that can be transmitted along a neural pathway. The signal passes through the retina, exits the eye through the optic nerve, and is transmitted to various parts of the brain for processing **(Remington, 2012).**

The visual system takes in information from the environment in the form of light, analyzes, and interprets it. This process of sight and visual perception involves a complex system of structures, each of which is designed for a specific purpose. The organization of each structure enables it to perform its intended function. The eye houses the elements that take in light rays and changes them to a neural signal; it is protected by its location within the bone and connective tissue framework of the orbit. The eyelids cover and protect the anterior surface of the eye and contain glands that produce the lubricating tear film **(Hall, 2011)**.

Muscles, attached to the outer coat of the eye, control and direct the globe's movement, and the muscles of both eyes are coordinated to provide binocular vision. A network of blood vessels supplies nutrients and a complex system of nerves provides sensory and motor innervation to the eye and surrounding tissues and structures. The neural signal that

carries visual information passes through a complex and intricately designed pathway within the central nervous system, enabling an accurate view of the surrounding environment. This information, evaluated by a process called visual perception, influences myriad decisions and activities **(Hall, 2011).**

The human eye, as an organ, can offer critical clues to the presence of systemic illness. Ocular changes are common in the early course of many systemic diseases that may be diagnosed in the emergency department. A careful and thorough eye examination is paramount during routine evaluation in the emergency department because it can provide primary information on otherwise undetected systemic illness and corroborative data for known problems .Eye examination can detect the presence of many diseases in the body, as it is said that there is no systemic disease which does not affect the eye and may reveal life-threatening conditions as brain tumor and AIDS and may reveal chronic illness as diabetes, hypertension and thyroid diseases **(Malla, 2006).**

Many patients, who are admitted in intensive care unit, may show failure of one organ or more. Each organ failure has characteristic eye signs as jaundice in liver cell failure, congestion and redness in respiratory failure due to increase carbon dioxide and lid edema, conjunctival pallor and uremic retinitis in renal failure **(Bajracharya et al., 2008).**

In central nervous system diseases, eye signs vary according to the etiology, which may be traumatic, inflammatory, vascular or neoplastic. Eye signs are very important in diagnosis of brain death in which there is absence of brainstem reflexes, eye movements and eye opening **(Eelco et al., 2010).**

Aim of the Work

To identify and discuss eye signs of systemic diseases and organ failure in critically ill patient, which is very helpful in diagnosis of many patients.

Chapter (1)
Anatomy and Physiology of the Human Eye

1. Anatomy of the human eye

1.1. Introduction

The eyeball, the peripheral organ of vision, is situated in a skeletal cavity, the orbit, the walls of which help to protect it from injury. The orbit also has a more fundamental role in the visual process itself, in providing a rigid support and direction to the eye and in forming the sites of attachment for its external muscles. This setting permits the accurate positioning of the visual axis under neuromuscular control, and determines the spatial relationship between the two eyes - essential for binocular vision and conjugate eye movements **(Malhotra et al., 2011).**

The eyeball is embedded in orbital fat, separated from it by a thin fascial sheath. It is composed of the segments of two spheres of different radii. The anterior segment, part of the smaller sphere, is transparent and forms 7% of the surface of the whole globe. It is more prominent than the posterior segment, which is part of a larger sphere and opaque, and forms the remainder of the globe. The anterior segment is bounded by the cornea and the lens, and is incompletely subdivided into anterior and posterior chambers by the iris. These chambers are continuous through the pupil. The anterior chamber is slightly overlapped by the sclera peripherally. The angle between the iris and cornea therefore forms an annulus of greater diameter than the limbus, the junction between the sclera and cornea **(Malhotra et al., 2011).**

The posterior chamber lies between the posterior surface of the iris and the anterior aspect of the lens and its

supporting ligament, the zonule, and is triangular in section. The apex of the triangle is the point where the iris touches the lens, and the base, or zonular region, extends among the collagenous bundles of the zonule. The posterior segment consists of the parts of the eye posterior to the zonule and lens **(Malhotra et al., 2011).**

The anterior pole is the center of the anterior (corneal) curvature, and the posterior pole is the center of its posterior (scleral) curvature; a line joining these two points forms the optic axis. (By the same convention, the eye has an equator, equidistant between the poles: any circumferential line joining the poles is a meridian). The optic axes of the two eyes, in their primary position, are parallel and do not correspond with the orbital axes, which diverge anterolaterally at a marked angle to each other. The optic nerves follow the orbital axes and are therefore not parallel; each enters its eye 3 mm medial (nasal) to the posterior pole **(Malhotra et al., 2011).**

1.2. Ocular fibrous tissue

1.2.1. Sclera

The sclera, so named from its relatively hard consistency, is a dense layer. When distended by intraocular pressure it maintains the shape of the eyeball. Its external surface is covered by a delicate episcleral lamina of loose fibrous tissue, which contains sparse blood vessels and is in contact with the inner surface of the fascial sheath of the eyeball. The anterior part is covered by conjunctiva, which is reflected onto it from the deep surfaces of the eyelids. The scleral internal surface is attached to the choroid by a delicate fibrous layer, the suprachoroid lamina, which contains numerous fibroblasts and melanocytes. Anteriorly, it is attached to the ciliary body by the lamina supraciliaris.

Posteriorly, the sclera is pierced by the optic nerve and is continuous with the fibrous nerve sheath and hence with the dura mater **(Ruskell, 2009).**

The sclera has the appearance of a perforated plate, the lamina cribrosa sclerae, where the nerve pierces it the optic nerve fascicles pass through these minute orifices. The central retinal artery and vein pass through a larger, central aperture. Numerous small apertures transmit the ciliary vessels and nerves through the sclera close to the perimeter of the cribriform plate. Just behind the equator, four larger apertures transmit the venae vorticosae **(Ruskell, 2009).**

Anteriorly, the sclera is directly continuous with the cornea at the corneoscleral junction or limbus. Near the internal surface of the sclera, there is an annular endothelial canal, the sinus venosus sclerae (canal of Schlemm), at this junction. In section, the canal appears as an oval cleft, whose outer wall grooves the sclera. Posteriorly, the cleft extends as far as a rim of scleral tissue, the scleral spur, which in there are spaces among its fibers through which aqueous humour filters from the anterior chamber to the sinus, draining peripherally to the anterior ciliary veins .Scleral vessels are few and mainly disposed in the episcleral lamina, especially close to the limbus. The sclera provides passage for nerves of the cornea and vascular autonomic nerves, but its own innervation is sparse **(Ruskell, 2009).**

1.2.2. Cornea

- **Corneal epithelium**

The corneal epithelium covers the anterior surface of the cornea and generally has five layers of cells. The deepest are columnar with flat bases and rounded apices, and large rounded or oval nuclei. Cells in the second layer are

polyhedral and resemble those in the epidermal stratum spinosum. In the more superficial layers, the cells become progressively flatter. However, unlike the cells of the epidermis, they contain flat nuclei, are not normally keratinized, and present a smooth, optically perfect surface. At the corneoscleral junction (limbus) the corneal epithelium merges with the limbal conjunctival epithelium and soon loses the regular surface of the cornea. It is of clinical significance that the cornea does not appear to possess epithelial stem cells. Cell replacement depends on the centripetal migration (from the edges of the cornea) of cells, which are the progeny of mitotic limbal stem cells **(Ruskell, 2009).**

- **Vascular supply**

The cornea contains neither blood nor lymphatic vessels; the capillaries of the conjunctiva and sclera end in loops near its periphery **(Ruskell, 2009).**

- **Innervations**

The cornea is well innervated by numerous branches of the ophthalmic nerve, which either form an annular plexus around the periphery of the cornea, or pass directly from the sclera . Upon entering the cornea, the few myelinated nerves lose their myelin sheaths. The nerves ramify throughout the corneal matrix in a delicate reticulum, and their terminal filaments form an intricate subepithelial plexus. There are no specialized end organs, the epithelial nerve fibers are devoid of Schwann cells, and they do not arborize **(Ruskell, 2009).**