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CRITICAL REVIEW ON ANATOMY OF EYE EXPLAINED IN SUSHRUTA SAMHITA

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Abstract

Netra (eye ball) is important sense organ. It is describe by Sushruta in detail. Sushruta has written nineteen chapters in uttarantra to explain the medical , surgical and preventive aspect of netra. Various other references of netra are also scattered in entire Sushruta samhita. The period of Sushruta samhita is 6th B.C and his concepts related to netra are clear , but due to passage of time , some terminology of netra are difficult to understand. This article is honest attempt to explore the different terminology`s of netra with reference to modern anatomy.

Key word: netra, sharira, anatomy, eye, Sushruta samhita

Introduction

Sushruta samhita is considered to be the last word in the field of ‘ayurvedic sharir’. Therefore we said ‘sharire Sushruta shrestha’!. Anatomical description of various body organs are accurately found in Sushruta samhita only. This article will discuss about Sushruta’s concepts and observations of ‘netra sharir’.

‘Shalaky tantra’ is a branch of ashtang ayurveda in which the anatomy, physiology, pathogenesis, treatment part of eye, ear, mouth etc. organs present above the jatru (clavicle bone) are studied and described¹.

Importance of eye:

‘Netra’ is an important organ for ‘Indriya janya gyana’ (sensory knowledge) which is considered as a source of ‘pratyaksha gyana’ (direct perception). We acquire doubtless knowledge with the help of indriya(sense organ) and out of five indriya, the important most is the ‘Netra’².

Sushruta has mentioned six sadhanas (instruments) for the examination of a patient, which includes five sense organs and an art of proper history taking. One could examine the upachaya (anabolism), apachaya (catabolism), bala (strength, power), shotha (swelling), varna (colour) with the help of netra³. ‘Netra’ is part of head⁴. It is included in the bahirmukha srotasa (external apertures). These bahirmukha srotasa are used as a route of drug administration⁵. Netratarpana, anjana, ashchotana, seka, putapaka, bidalaka etc. are the different types of treatment, used in eye diseases, psychological disorders, hysteria, epilepsy, coma etc^{6,7,8}.

Embryology of eye ball:

Objects can be observed or seen only in the presence of light. Light is very important for perception of knowledge through eye, absence of light is thus the cause for lack of knowledge. This was observed by our acharyas and therefore they mention ‘surya’ (sun) as the god of



netra⁹. Ancient Indian philosophy is of opinion that all materials, living or non-living are made up of five fundamental elements called panchamahabhutas. And all parts of body are also made up by the combination of these mahabhutas. In case of netra, there is a dominance of 'teja mahabhuta' therefore netra organ has always a threat from 'kapha dosha', which has exactly opposite qualities that of teja mahabhuta.

Though there is a dominance of teja mahabhuta, other four mahabhuta also contribute in the formation of eyeball in developing embryo¹⁰.

- 1) Mamsa-muscle, fascia are from prithvi mahabhuta
- 2) Rakta – blood vessels are from teja mahabhuta.
- 3) Krishna bhaga- cornea is from vaayu mahabhuta.
- 4) Shweta bhaga- sclera is from aapa mahabhuta.
- 5) Ashrumarga- lacrimal apparatus is from aakasha mahabhuta.
and the entire eye ball is appeared to be a bubble of water¹¹.

Surface anatomy of eye ball:

- 1) Nayanantar i.e., distance between right and left inner canthus is 2 anguli (individuals finger breadth)¹².
- 2) Drishti antara i.e., distance between right and left pupil is 4 anguli¹³.
- 3) Length of antapraveshyamana (within orbit) eyeball is 2 anguli.
- 4) Breadth of eyeball from outside is swangustha udara pramana (i.e. maximum width of individual thumb)¹⁴.

Size of eye ball:

Sushruta described two shapes of eyeball, one is suvrutta (perfect spherical) and another is gostanakar (nipples of Cow)¹⁵. These references can be correlated as follows

- 1) Suvrutta = perfect spherical eye ball
- 2) Gosatanakar = eye ball with optic nerve covered by Tenon's capsule¹⁶.

Measurements of eyeball:

Sushruta has mentioned that as the eyeball is perfect spherical, it's all diameters are exactly alike¹⁷.

- 1) Vertical diameter – 2 ½ anguli
- 2) Anteroposterior diameter – 2 ½ anguli
- 3) Horizontal diameter – 2 ½ anguli

Anguli measures approximately 13mm. that means 2 ½ anguli measures about 32.5mm (approx). So according to Sushruta all diameters of eyeball are 32.5mm (approx). But in modern ophthalmology the human eyeball measures 25mm¹⁸. This difference in measurement can be explained by considering the dissection method adopted by Sushruta. Sushruta has mentioned 'hydro-dissection' method, in which dead body is kept in fresh flow of water for seven days; this could cause the organs to swell¹⁹.

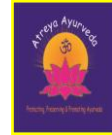
Muscles related to eyeball:

There are two peshis (muscles) which covers eyeball²⁰. The surgeon must take oblique incision over these muscles²¹.

Asthi related to eyeball:

While describing types of asthi (i.e., bone), Sushruta mentioned 'tarunasthi'(cartilage) related with akshikosha (orbit)²². We can correlate this 'tarunasthi' with periorbita i.e. periosteum of the orbit of the eye. It is continuous with dura matter and the sheath of the optic nerve. The periorbita is made up of dense connective tissue and can be easily detached from the bones of the orbit²³.

Parts of netra:



Sushruta has described that the eyeball is made up of five mandals, six sandhis and six patalas²⁴.

- 1) Mandal – ‘mandal’ means rounded, spherical in shape. The parts which appears to be circular or rounded are described as mandal^{25,26}.
 - I. Pakshma mandal – eye lashes
 - II. Vartma mandal – eye lids
 - III. Shweta mandal – sclera
 - IV. Krishna mandal – cornea
 - V. Drushti mandal – pupil
- 2) Sandhi- means joint. Sushruta classified sandhi into two types. Those which can be counted and are between the bones. Another type of joints are countless as these are the joints or junctions between peshi (muscles), snayu (tendons), sira (vessels)²⁷. Later type of junction is present in netra and are described as sandhi.

Joints between five mandalas forms six sandhis as follows

- i. Kaninaka sandhi – inner canthus
- ii. Apanga sandhi – outer canthus.
- iii. Pakshma-vartma gata sandhi – junction where eye lashes are attached to the eyelids.
- iv. Vartma –shweta gata sandhi – fornix- where palpebral conjunctiva meets bulbar conjunctiva.
- v. Shweta- krishna gata sandhi – sclero – corneal junction.
- vi. Krishna – drushti gata sandhi – pupillary margins²⁸.

Netragata patal:

In Sushruta samhita, there is a very brief description about patala. He described six patalas related to netra, out of which two patalas are bahya²⁹ (externally situated) ,and remaining four

patalas are abhyantara (i.e. internally situated). These are as follows

- i) Urdhwa vartma – upper eyelid these are bahya patalas.
- ii) Adho vartma – lower eyelid
- iii) Tejojalashrit patal
- iv) Pishitashrit patal
- v) Medoshrit patal
- vi) Asthyashrit patal

To point out these patalas anatomically, is a very difficult thing as Sushruta has not described the shape, position, colours etc of patalas. But he has given the symptoms of the diseases caused by affecting these patalas. By reviewing and comparing these symptoms with modern concepts of eye diseases, we can have some conclusions about these abhyantara patalas.

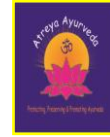
When dosha occupy the fourth patal (i.e. asthyashrit patal), that stage is called as ‘lingnash’. In which the patient becomes completely blind, but he is only aware of light³⁰. In the treatment of kaphaj lingnash, Sushruta had described a surgical procedure to remove this kapha with the point of shalaka and remove the remnants by blowing out violently the air after closing the nostril of opposite side³¹. This description matches with mature cataract. Therefore we can conclude that the concept of abhyantar patal is mainly related to the lens and affliction of doshas in various patalas are nothing but different types and stages of cataracts.

Pratham patal (i.e. tejojalashrit patal) gata dosha symptom is a mild blurring of vision (avyakta rupa), which is found in early stage of cataract^{32,33}.

Dwitiya patal gata (i.e. pishitashrit patal) dosha symptoms³⁴ -

In this disease, patient can experiences spots, threads, cobwebs like things floating before his eyes, his sight becomes more cloudier , his distance vision is affected but has a clear vision for closer substance or

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vice versa. Sushruta has also described that this patient is unable to see needle hole. This indicates that there is a loss of accommodation as in presbyopia. All these symptoms are related to incomplete cataract³⁵.

Tritiya patal gata (medoshrit patal) dosha symptoms³⁶:

When doshas are aggravated in third patal, symptoms are like sight is covered by some clothes, diplopia, difficulty in identifying colours and changes in contrast, reading and recognizing faces appears. This is also the worsen stage of cataract before a complete opacity of the lens³⁷.

Applied anatomy:

1. Important aid for direct perception – netra is very sensitive and important sense organ.

About 80% of our knowledge is based on visual perception, therefore it is an essential aid for pratyaksha gyan (~ direct perception).³⁸

2. To assess the prakruti (body constitution) of an individual – special characteristic features of an eye is helpful in assessing the prakruti of the person. Vata traits include small and dry eyes, restless eyes. Pitta traits include penetrating and bright eyes. Kapha traits have large, clear and friendly eyes.³⁹

3. Marmasthana (~vital energy points) – outer canthus of an eye is known as apangamarma and a point just above the junction of inner 2/3 and outer 1/3 of an eyebrow is known as aavartamarma .Injury or trauma to these points will leads to complete blindness or visual deformity.⁴⁰

4. Drug reaction – inappropriate use of vatsanabha (aconitum ferox) will immediate leads to peetnetra (yellow eye).⁴¹

5. Congenital deformity of eye ball – according to sushruta application of eye

ointment by a pregnant during pregnancy period may cause the vikrutakshata (structural eye deformity) or

complete loss of vision in foetus.⁴²

6. Route of drug administration – netra is bhaya srotus (~ externally opened channel) and is used for administration of various drugs in various diseases .^{43, 44}

7. Diseases of netra – in uttarantra , sushruta describe diseases of different parts of an eye .

a) pakshmagata roga (diseases of an eyelash)- e.g. pakshmakopa(trichiasis)⁴⁵

b) vartmagata roga (diseases of eyelids) – e.g. pothaki (trachoma) , kumbhika (stye) kukunaka (ophthalmia neonatorum)⁴⁶

c) shuklagata roga (diseases of sclera) – e.g. arma (pterygium), shuktika (bitot`s spot)⁴⁷

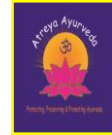
d) krushnagata roga (diseases of cornea) – savrana shukra (corneal ulcer) avrana shukra (corneal opacity)⁴⁸

e) sarvagatanetra roga (inflammatory disease of an eye) – abhishanda(conjunctivitis) adhimantha (glaucoma)⁴⁹

8. Aahar (food) and vihar (life style) for healthy eye sight – sushruta describe number of food items good for eye, e.g. cow`s ghee, garlic , green gram , rock salt, honey .⁵⁰ He particularly mention agastipushpa (flowers of sesbania grandifolia) for night blindness .⁵¹ Regular application of eye ointment, head and foot massage, gargling, foot bath by cold water, nasal drops are also beneficial to eye.

Conclusion:

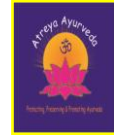
By observing and comparing symptoms as above it is very obvious to conclude that all these patal gata vyadhies are nothing but the different stages of cataract. And all abyantara patalas are



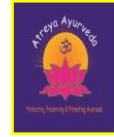
related to the lens. It is very surprising to us while knowing the fact that all these descriptions were made by only keen observations and without any use of equipment. Though this information is very vague while comparing to the current knowledge of eye, we must understand that Sushrutacharya had never explained only anatomical view. In ayurvedic samhitas, all the anatomical structures are described with its physiological aspects. So ayurvedic sharir rachana does not resemble with modern anatomy in every aspect as it is a more physiological anatomy. Sushruta described each and every subpart of eyeball. Based on this physiological anatomy of eyeball, he further mentioned different forms of treatment, do's and don'ts to restore eye health. In eye surgery, Sushruta mentioned 'the god created hole' (daivakruta chhidra) which is bloodless and an easy approach towards lens³⁸. There is a need of further clinical and surgical research in the field of ayurvedic netrasharir to explore the concept of Sushruta.

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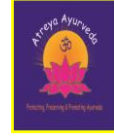
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