

# International Journal of Research in AYUSH and Pharmaceutical Sciences

## Review Article

### A COMPARATIVE STUDY ON CORNEAL DISEASES IN AYURVEDA

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**Keywords:** *Savrana Shukra, Avrana Shukra, Akshi Pakatyaya, Ajakajata, Siraja Shukra, Cornea, Shalakyas Tantra.*

#### ABSTRACT

Cornea is a transparent anterior one-sixth outer fibrous coat of the eye ball which is called *Krishna mandala* in Ayurveda, resembles a watch-glass in the wrist watch. The diseases of Cornea are due to damage to the Cornea by various causative factors that result in loss of transparency of the Cornea and progress into different stages of disease condition. These different stages of corneal diseases stand a major role in classification of corneal diseases in Ayurveda, i.e; *Krishnagata Rogas*. Out of total 76 eye diseases mentioned by *Sushruta*, he had enumerated *Krishnagata Netra Roga* as 4 in number. *Vagbhata* had enumerated total eye diseases as 94 among them 5 types of *Krishnagata Netra Roga*. A comprehensive literary study of assorted text books of Ancient Medicine in view of analogy between Allopathic corneal disorders and Ayurvedic *Krishnagata Roga*. The purpose of this comprehensive study is paralleling of corneal diseases in both the systems of medicine. The academic Ayurvedic manuscripts had ordered the corneal ailments in a serial and accelerating manner in which one condition will lead to next reciprocal stage of the disease. In a complimentary manner, an attentive effort has been executed to parallel the corneal ailments in both the Systems of Medicine. For the comparison of corneal disorders in both the systems of medicine, the clinical symptoms, advancement of disease, prognostic causes, and management have been considered.

#### INTRODUCTION

*Shalakyas 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 described.<sup>1</sup>

*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*.<sup>2</sup>

In the Ayurvedic system of Medicine there are eight branches or specialty among these *Shalakyas Tantra* deals with diseases of Supraclavicular region<sup>3</sup> i.e. Eye (Ophthalmology), ENT (Otorhinolaryngology), Oro- Dental diseases (Oro-Dentistry), etc. When we

go through classic texts of Ayurveda Ophthalmology follows a consecutive, organized, and extensive description of disease related to various disorders of eye and its components<sup>4</sup>. First nineteen chapters of *Uttaratantra* of *Sushruta Samhita* are exclusively devoted to Ophthalmological disorders which evidently reveal that the classical ophthalmological literature well versed with exquisite details even at that time. This enlightening segment of ophthalmology is bestowed by *Vidhadhipati*<sup>5</sup> (King of *Videha* - *Raj rishi Nimi*) in academic literature. *Acharya Vagbhata* had also composed an established ophthalmological division which has elaborated 10 chapter viz. 11-20 chapters of *Astanga Sangraha Uttara sthana*. He emphasized that eye has been entitled as the main sense organ

because life without eyesight is miserable and valueless. Hence it is very important to protect vision at any cost<sup>6</sup>. Anatomy of Eye had been enumerated by *Sushruta* in first chapter of *Sushruta Samhita* i.e. *Aaupdravik Adhyaya*. *Sushruta* had enumerated total eye diseases as 76<sup>7</sup> in his classical text and *Vagbhata* had described 94 diseases in *Astanga Sangrah* & *Astanga Hridaya*<sup>8</sup>. *Sharangadhara*<sup>9</sup> followed the traces of *Vagbhata* while *Yogratnakar*<sup>10</sup> followed *Sushruta* in classification of *Netra roga* and their numbers. *Bhavprakasha*<sup>11</sup> described 78 diseases of *Netra*. The classification given in the Ayurvedic text is sequential and systematic as it encompasses the

modern system of disease classification with its relevance guided on various structure of the eyeball.

The classification of ocular disorders is based on *Ashraya Bheda* (disease located or effecting which part of the eye) as *Sandhigata*<sup>12</sup> (Diseases affecting junctional areas of eye), *Vartmagata*<sup>13</sup> (Diseases of eyelids), *Shuklagata*<sup>14</sup> (Diseases of Sclera plus Conjunctiva), *Krishnagata*<sup>15</sup> (Diseases of Cornea), *Sarvagata*<sup>16</sup> (Diseases affecting all parts of Eye), *Dristigata*<sup>17</sup> (Diseases of Lens). Ocular traumatology chapter 19th<sup>18</sup> (*Nayanabhighata*) and Ocular therapeutics - *Kriya Kalpa Vigyan*<sup>19</sup> are the high points of *Ayurvedic* ophthalmology.

**Table No. 1 Classification of *Netra Roga* by different Authors<sup>20</sup>**

Netra Rogas	Charaka (Chakrapani commentary)	Sushruta	Vagbhata	Madhava Nidhana
<i>Vartmagata</i>	27	21	24	21
<i>Sandhigata</i>	9	9	9	9
<i>Shuklagata</i>	13	11	13	11
<i>Krishnagata</i>	6	4	5	4
<i>Dristigata</i>	25	12	27	12
<i>Sarvagata</i>	16	17	16	17
<i>Bhayakaranja</i>		2		2
Total	96	76	94	76

## MATERIAL AND METHODS

A comprehensive literary study of assorted text books of Ancient Medicine in view of analogy between Allopathic corneal disorders and *Krishnagata Roga* of Ayurveda. This effort also enlightens an attentive approach to provide a delicacy correlation to obtain a compatible behavior of these comparisons.

## AIMS

The purpose of this review is to enact clinical comparison between diseases of *Krishna mandala* to diseases of cornea.

## DISCUSSION

### Cornea (*Krishna Mandala*)

Followed by *Shukla mandala*<sup>21</sup> (white circle of eye or Sclera), there is *Krishna Mandala* (Black circle of eye) known as Cornea. Size of cornea is one third of *Netra Aayaam*<sup>21</sup> (Diameter of eye). Size of Pupil is one seventh of Cornea. Size of pupil in respect of *Taraka* is 1/9<sup>22</sup>. When we establish the congruent features of *Taraka* with its possible modern structure the properties of contraction & relaxation<sup>23</sup> described in context to *Taraka* makes this structure as a potent choice to be correlated as Iris. Circumference of Iris is 1.5 mm larger than the

circumference of Cornea that's why dimension of *Drishti Mandala* (Pupil) in respect of Cornea and Iris is different i.e. 1/7 & 1/9 respectively.

The anatomical proximity between cornea and iris, common nerve innervation, sharing nature of nutrients through aqueous also play an important role in simultaneous expression of pathology of these two structure. This concept is well appreciated in modern ophthalmology as pathology of one can affect other and also their treatment needs to be extrapolated to counter the disease of both cornea and iris.

The transparency of cornea is due to (i) Uniform structure (ii) Avascularity (iii) Non-modulated nerve fibers (iv) deturgescence (The mechanism by which the stroma of the cornea remains relatively dehydrated), character of cornea, depends upon its osmotic pressure which is less than the osmotic pressure of tears and aqueous humor. The difference in osmotic pressure tends to draw out the water content of the cornea in both directions that enters through the perilimbal vessels. For the purpose of transparency, cornea remains hypo-hydrated in normal condition and its hypo-hydrated status is maintained by deturgescence of cornea. The water content of the cornea increases due to

increased IOP or due to inflammation where upon the cornea loses its transparency.<sup>22</sup>

The Classification of corneal diseases in classical Ayurvedic texts is successive and intensifying in

**Table No. 2 List of Corneal Diseases**

S.NO	Sushruta	Vagbhata	Allopathy
1	<i>Savrana Shukla</i> <sup>24</sup>	<i>Kshatta Shukla</i> <sup>25</sup> (Corneal ulcer due to trauma)	Corneal Ulcer
2	<i>Avrana Shukla</i> <sup>26</sup>	<i>Shudha Shukla</i> <sup>27</sup>	Corneal Opacity
3	<i>Ajakajata</i> <sup>28</sup>	<i>Ajaka</i> <sup>29</sup>	Prolapse of Iris
4	<i>Akshi Pakatyaya</i> <sup>30</sup>	<i>Pakatyaya Shukra</i> <sup>31</sup>	Panophthalmitis
5	—	<i>Siraja Shukra</i> <sup>33</sup>	Neovascularization of corneal ulcer

**Corneal diseases in modern literature are divided into four basic categories**

- Ulcerative diseases<sup>34</sup>
- Non – Ulcerative diseases<sup>35</sup>
- Disorders of Corneal Degenerations<sup>36</sup>
- Disorders of Corneal dystrophy<sup>37</sup>

***Savrana Shukra* (Ulcerative Keratitis)<sup>24</sup>**

When the cornea has become denuded (become edematous by losing transparency), appear to be pierced by needle (Corneal Ulcer), becomes acutely painful with warm discharge, it is called *Savrana Shukra*. As per this description, it can be interpreted that basically there are four main symptoms described in Ayurveda for *Savrana Shukra* i.e.

i. There is *corneal edema/ Loss of transparency* which ultimately leads to decreased visual acuity.

ii. *Ulceration of the cornea*

iii. *Copious discharge* which is *warm in nature* indicating acute inflammation of cornea.

iv. *Severe pain/unbearable pain* which are mostly found in deeper infection of eye mainly associated with *ciliary congestion* due to rich sensory supply of cornea.

**According to Acharya Videha<sup>39</sup>**

In corneal ulcer there is neovascularization which is having appearance like coral and the same characteristics as described by Acharya Sushruta.

*Acharya Vagbhata* has named the *Kshatta Shukra*<sup>25</sup> (Ulcerative Keratitis caused by trauma), for this disease which itself indicate Traumatic origin. In addition to the symptoms mentioned by *Sushruta*, few more symptoms were described by *Acharya Vagbhata* in this disease, they are:

1. *Toda* (Pricking sensation)
2. *Raga* (conjunctival congestion)
3. *Pakwajambunibham* (severely congested eye/ Ciliary congestion)

nature viz. one condition advancing to the next coterminous stage. *Acharya Sushruta* described 4 types<sup>22</sup> of diseases of cornea while *Vagbhata* has enumerated 5 types<sup>23</sup>.

Prognosis of *Savrana Shukra/Kshatta Shukra*: in addition to the clinical features of the *Savrana Shukra Acharyas* also described prognosis of *Savrana Shukra* on the basis of location, types, number, features etc. Ulcers having following properties are considered as curable<sup>40</sup>:

- Ulceration away from central part of cornea viz. peripheral ulcer
- Superficial ulcer (involving only the epithelial layer of cornea)
- Non discharging ulcer (Absence of secondary infection)
- Painless Ulcer
- Solitary ulcer

**Ulcers having following properties are incurable<sup>41</sup>**

- Central corneal perforations
- Corneal ulceration which are covered with granulation tissue
- Concomitant existence of healed and newly formed ulcer which is frequent presentation of protozoal corneal ulcer.
- Neovascularization of central cornea. This condition is separately described by *Acharya Vagbhata* as *Siraja Shukra*<sup>33</sup>.
- Involving two layer i.e. involvement of vascular coat along with fibrous coat result into complications and severe diminished visual acuity.
- Intraocular hemorrhage (Hyphaema/ Neovascularization).
- Having copious warm discharge with corneal abscess
- Ulcer having grey white color like wing of quail indicative of severe necrosis of corneal layer/ necrotizing corneal ulcer.

- If ulcer lies in first layer i.e. *Tejojalashrita Patala*<sup>42</sup> of eyeball it is difficult to treat
- If it involves two layers i.e. *Tejojalashrita* and *Mansashrita Patala*<sup>42</sup> then it is *Yapya* (as long as medication and proper care is taken it do not complicate)
- If it affect three layers<sup>42</sup> i.e. first two coats followed by third tunic of eye which may be taken as Cortex of the lens.

#### Corneal ulcer having following properties is incurable in nature<sup>47</sup>

- Complete loss of vision (either there is corneal perforation or intraocular contents are not in condition to visualize anything).
- Ulcer which is grey from inside sometime having red color
- Hyper granulation tissue or very deep, with copious discharge
- Presence of Sinus indicating there is continuous
- oozing of aqueous humor from this ulcerated site
- Chronic, when central portion get perforated are incurable conditions.

If there is chronic corneal ulceration or deep corneal ulcer then it will lead to Toxic Iridocyclitis<sup>43</sup> (which is involvement of second *Patala* according to Ayurveda) and chronic Uveitis would lead to Anterior Synechiae<sup>44</sup> and posterior synechiae<sup>45</sup> become Incurable. So in this case involvement of third *Patala* or after formation of Anterior and posterior synechiae ultimately leads to increased Intra ocular pressure (I.O.P.) of Eye and it will lead to further complication i.e. Secondary Glaucoma<sup>46</sup> which is still considered very difficult to treat. As a paradigm inference the cascade of complications of corneal ulcer has got close proximity with Ayurvedic opinion of disease progression in complicated corneal ulcers so much so that the incurable stages of corneal ulcer described in Ayurvedic literature can be systematically correlated with complicated corneal ulcer per se as outlined supra.

**Avrana Shukra/Shudha Shukra (Corneal Opacity)**<sup>26,27</sup>: (Non-ulcerative condition of Cornea in Ayurveda) *Avrana Shukra* means opacity without ulcer which indicates healed corneal ulcer and the size of the opacity is directly proportional to size of the ulcer. According to *Acharya Sushruta* when a white spot appears in the cornea which is caused by *Abhishyanda* (Conjunctivitis) featuring relatively painless condition, devoid of lacrimation and looks like a white cloud in the sky. In context of prognosis

he has demarcated his opinion by saying that dense, indurate and chronic in nature is said to be curable with difficulty. The innocuous corneal ulceration looks like *Shankha* (Conch shell) which is white in color and featuring *Kapha dosha* having mild/no pain. Another prominent scholar *Madhava* in his epic *Madhava Nidana* has described features of innocuous corneal ulceration like shell/moon/white lotus or thin white clouds. This condition is considered curable both by *Sushruta* and *Vagbhata*.

#### **Ajakajata (Perforated corneal ulcer) (Complication of corneal ulcer in Ayurveda).**<sup>28, 29</sup>

In this corneal disorder cornea gets perforated with prolapsed iris which has given classical resemblance with goat excreta. The clinical features of this disorder are severe pain and copious discharge. The prolapsed iris may be attributed classical black color because of reduced extirpated blood and its contact with external ambience. According to Ayurvedic texts the prolapsed iris having distinct red color, salty and thick blood mixed lacrimation with severe pain. It is *Raktaja* predominant incurable disease according to *Sushruta* while his treatise commentator *Dalhana* categorized it as *Kaphaja* predominant incurable disease<sup>48</sup>.

#### **Akshipatayaya/Pakatyaya Shukra (Endophthalmitis/ Panophthalmitis)**<sup>30,31,32</sup>

Competently vitiated *Tridosha* is manifested as white opacified cornea with excruciating pain. This stays well concurrent with complicated corneal ulcer in which eye become pus filled cavity emanating whitish hue from the cornea as in case of Hypopyon Corneal ulcer. So when corneal ulcer is secondarily infected, showing less susceptibility for healing becomes excavated leading to severe inflammatory intraocular response. Hypopyon ulcer may complicate into the stage of Endophthalmitis or Panophthalmitis which after commencement becomes incurable. The reason which can be offered for this catastrophe is that the blood aqueous barrier which plays a major role in drug distribution is disrupted and hence no drug availability is possible in infected eye. *Vagbhata* has suffixed the word *Shukra* along with *Pakatyaya* as it indicates that it is complication of *Savrana Shukra*.

Two additional features are described by *Vagbhata* are:

- Complete corneal opacity
- Classical presentation of half cotyledon of Indian broad beans appearance which is highly suggestive of Hypopyon corneal ulcer<sup>49</sup>.

*Acharya Vagbhata* has also described another disease in Pan ocular disorder as *Akshipakatyaya*.

The characteristic features of this disease are ocular edema, congested eye ball, thick discharge, Leukomatous corneal opacity, burning sensation, diminution of vision and intermittent pain. Some of the differentiating factors between *Acharya Sushruta* and *Vagbhata* regarding *Akshipatayaya* are tabulated as underneath:

**Table No.3 Features of *Akshipakatyaya***

S.No.	<i>Sushruta</i>	<i>Vagbhata</i>
1	<i>Akshipakatyaya</i>	<i>Pakatyaya Shukla</i>
2	Involvement of <i>Tridosha</i>	Involvement of <i>Tridosha</i> with <i>Rakta</i>
3	Involvement of cornea	Involvement of cornea and lens
4	Symptoms described are pain and loss of vision	Symptoms are pain, loss of vision, congestion, burning sensation, edema, and inflammation.

***Siraja Shukra* (Neo vascularization of the Cornea)<sup>33</sup>**

This condition arises due to complication of corneal ulcer and described by *Vagbhata* only. This is commonly found in chronic corneal ulcer as seen in some of the forms of keratoconjunctivitis. The disease is featured with corneal vascularization, pricking pain, burning sensation and copper colored cornea attributed to vitiated *Rakta dosha*. There is serosanguinous discharge of varied temperature of thick consistence without any cause. The disease at this particular stage shows little signs of recovery. The disease symptoms at this particular stage stays compatible with certain features of classical disorder termed as *Savrana Shukra* of *Sushruta*. The precised compatible features are vascularisation of cornea, pricking pain, burning sensation, ciliary congestion and varied temperature of lacrimation without non identifiable cause.

**CONCLUSION**

The academic Ayurvedic manuscripts had ordered the corneal ailments in a serial and accelerating manner in which one condition will lead to next reciprocal stage of the disease. *Acharya Sushruta* described 4 types of diseases of cornea while *Vagbhata* has enumerated 5 types. For the comparison of corneal disorders in both the systems of medicine, the clinical symptoms, advancement of disease, prognostic causes, and management have been considered. This compatible role of corneal disorders of *Ayurveda*

and Allopathy is justified by the clinical the clinical symptoms, advancement of disease, prognostic causes, and relevant intervention. In Allopathic system, diseases of cornea are arranged into four types: Ulcerative Keratitis, Non Ulcerative Keratitis, Corneal Dystrophies and Corneal degeneration. The last two conditions even though have lacking significant consistent pathology in Ayurvedic literature but there are overabundance of references which outfit the first two identities viz. Ulcerative Keratitis and Non Ulcerative Keratitis. The interspersed disease approach, treatment application and predicting prognosis will satisfy the resultant outcome of the disease in a more favorable perspective which will herald a better approach in managing preventable corneal blindness.

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**Cite this article as:**

Anjaneya Prasad Nandam, Akhilanath Parida, Ashu, Varun Sawant, Maneri Balaji. A comparative study on Corneal Diseases in Ayurveda. International Journal of Research in AYUSH and Pharmaceutical Sciences, 2019;3(4):334-340.

**Source of support: Nil, Conflict of interest: None Declared**

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