



Review Article

www.ijrap.net



A REVIEW ON CONCEPT OF GLAUCOMA IN AYURVEDA AND ITS MANAGEMENT

Pravin M Bhat¹, Hari Umale², Madhukar Lahankar³

¹PhD Scholar, Department of Shalakyatantra, Government Ayurveda College & Hospital, Nagpur (M.S), India

²Professor, Department of Shalakyatantra, Govt. Ayurved College & Hospital, Nagpur (M.S), India

³Professor & HOD, Department of Shalakyatantra, Govt. Ayurved College & Hospital, Nagpur (M.S), India

Received on: 15/04/18 Accepted on: 15/05/18

*Corresponding author

E-mail: vdpravin82@gmail.com

DOI: 10.7897/2277-4343.09383

ABSTRACT

The entire world is looking at the other systems of medicine to tackle the situation and looking upon preventive ophthalmology for improving and maintaining vision. In such a scenario, a study on Glaucoma and its concept and management according to Ayurveda gains much importance. Ancient Indian traditional medicine is very rich and diverse. It is full of different formulations based on practical experiences. The concepts of Glaucoma, which have recently dawned are having striking similarities with those held in Adhimantha as per Ayurveda. Adhimantha is a dreadful disease with its cardinal feature as severe, excruciating pain in the eye associated with headache, progressive reduction in vision in short duration and severe congestion which can easily be correlated with the symptoms of Glaucoma. An objective of this review is to establish a certain terminology to the disease in modern science with references.

Keywords: Glaucoma, Adhimantha, Intraocular Pressure, Hatadhimantha.

INTRODUCTION

Glaucoma is characterized by chronic, degenerative optic neuropathy unlike other forms of acquired optic neuropathy which can be differentiated based on appearance of the optic nerve. In Glaucoma, progressive thinning of the neuro-retinal rim leads to enlargement of the optic nerve cup. This phenomenon is referred to as optic-nerve cupping. Loss of retinal ganglion cell axons, along with supporting glia and vasculature are the main causes for thinning of neuro-retinal rim. The remaining neuro-retinal rim have its normal pink color. Apart from glaucoma, in other optic neuropathies the optic-nerve tissue loses its pink color and cupping does not develop. Arteritic anterior ischemic optic neuropathy, in which cupping can occur is a rare exception¹. If untreated Glaucoma patients lose peripheral vision which may progress to complete loss of vision leads to blindness².

Although Glaucoma is a disease entity which is associated with or without an elevation of intraocular pressure. Anterior segment variation plays an important part in the disease classification. The anterior segment of the eye has its own circulatory system, which nourishes the avascular structures of eyes like crystalline lens and cornea. Aqueous humor, produced by the ciliary body, circulates throughout the anterior chamber and drains through the trabecular meshwork in the iridocorneal angle, which is the angle formed by the iris and cornea³. Elevation of the intraocular pressure does not result only from increased aqueous humor production but rather from reduced aqueous outflow.

The classification of Glaucoma depends upon the appearance of the iridocorneal angle. There are open angle, closed-angle, and developmental types, which are further classified into primary and secondary types⁴. Primary open-angle Glaucoma can occur with or without elevated intraocular pressure. The primary open angle Glaucoma, in which Intraocular Pressure is normal called as normal-tension Glaucoma. Primary open angle Glaucoma includes both adult-onset disease (occurring after 40 years of age)

and juvenile-onset disease (occurring between the ages of 3 and 40 years of age). Pseudo exfoliation or pigment dispersion syndrome are the examples of secondary open-angle Glaucoma. Closed-angle Glaucoma can be primary (e.g., pupillary block) or secondary (e.g., inflammatory or neovascular causes). Primary congenital Glaucoma and Glaucoma associated with syndromes (e.g., Aniridia or the Axenfeld-Rieger syndrome) are the developmental forms of Glaucoma.

The disease Glaucoma and Adhimantha in Ayurveda are having similarities in terms of its signs and symptoms. Adhimantha is a vision threatening disease with its clinical feature as severe, excruciating pain in the eye as if eyeball is plucked out of orbit associated with headache, progressive reduction in vision in short duration and severe redness.

As per Ayurveda the contemporary etiological factors for pathology of Adhimantha are prolonged exposure of excessive heat, spicy, pungent foods, the misuse and overuse of eye, continuous exposure to too bright light, repeated night shifts, excess stress and anger. All the above-mentioned factors will disturb the basic humors of the body called Vata and Pitta affecting metabolism, leading to obstruction and perfusion of channels in head which finally gets localized in the eyes and gives rise to Adhimantha/Glaucoma.

Adhimantha means a person suffering from severe ophthalmia (Monier William). The various etiological factors are listed as follows:

To swim immediately after roaming in sun; to observe far objects or very minute objects; to sleep in a day time and to stay up at night; to cry, get angry, or mourn often; frequent physical stress; over indulgence in sex; head injury; to ingest Shukta, Kanji (sour food items), Kulittha, Udid, stale food left over from night meals; over alcoholism; to get the eyes exposed to fumes, smokes, dust; to foment the eyes; to ignore the reflexes of tears, defecation,

micturition, passing the flatus; over performance of procedure of Vamana (Emesis by medicine); not following the seasonal regime i.e. Rutucharya, etc are etiological factors of ophthalmic diseases. These factors are responsible for elevating physiological level of Dosha and vitiates them⁵.

The vitiated Dosha will course through the vessels and will reach upwards to produce diseases in different parts of eye. According to Sushruta, Abhishyanda is the root cause for the manifestation of many ocular manifestations like Adhimantha, etc and hence advised to treat this condition as early as possible⁶. All the four forms of chronic Abhishyanda if not properly attended to and remedied at the onset, may result in different types of Adhimantha like Vataj, Pittaj, Kaphaj and Raktaj⁷. During the summer season, if one not follows proper Ritucharya and undergoes Swedana or excessive Vyadhana or improper Rakta Visravan Kriya (Bloodletting process) by which excessive blood loss, then it leads to many diseases like Adhimantha, etc.

Samprapti of Netraroga (Prognosis of the eye diseases)

Samprapti can be explained as the pathological changes evoked by the etiological factors, which manifest the signs and symptoms of diseases. Samprapti is the action of Doshas. In the Dhatus via Srotas, which in turn manifest signs and symptom. In Nija Samprapti the pathological changes not start in the eye but from other parts of the body. If Nidana is a Systemic disease, the system involved in the main disease, plays the main role. Whatever may be the starting point, in due course it reaches the ophthalmic tissue via Jatrurdhwa Srotas i.e. Srotas above the neck region⁸. The course of Samprapti can be described in three parts.

- Stage of Sirobhishyanda
- Stage of Netrabhishyanda
- Stage of Sthanasanshray

Stage of Sirobhishyanda

Nidana of endogenic eye diseases are mainly Achakshushya (harmful to sense organ of eye) factors, which vitiates Pitta⁹. Due to interconnections of Pitta and Rakta, Raktavaha Srotas also gets vitiated. As the Nidana (Etiological) factors are Achakshushya, Vitiated Pitta and Rakta have affinity towards the eye. The Raktavaha Sira carries these Vitiated Doshas to reach eye in Jatrurdhwa Srotas. Before being confined to the eye, there is a stage when Sirasrotas are deeply involved and the stage can be termed as stage of Sirobhishyanda.

In this stage the Ushna, Tikshna, Sara and Drava Guna of Pitta are increased and the properties of Raktadhatu are deranged. Vessels are dilated and become more permeable. This gives rise to the stage of 'Abhishyanda' which is the initial stage of eye diseases.

Stage of Netrabhishyanda

In Netrabhishyanda stage Samprapti heads towards the Srotas of the eye and the same changes of Sirobhishyanda develops in the Netra Srotas. In this stage, certain ocular manifestations start to appear which can be considered as the Poorvroopa (Prodromal stage). These are redness, watering, foreign body sensation, irritation and mild pain are the Poorvarooopa¹⁰.

Stage of Ashrayasthana

This is the final stage where the vitiated Dosha, disease prone area of the eye and Sthanik (Local) Dosha of that area plays important

role and actual signs and symptoms of the disease are manifested. Vitiated Vata prone to Vata predominant area (e.g. Krishnamandala i.e. cornea), vitiated Pitta prone to Pitta predominant area (e.g. vascular part) and vitiated Kapha prone to Kapha predominant area (e.g. Shuklamandala and intraocular fluid). The vitiated Dosha has an affinity towards the weak point of the eye¹¹.

Adhimantha is one among the Sarvakshi Roga which extend to all mandalas and Netra Sandhis which are the visible part of the eye, but it may also originate from iris, ciliary body, anterior and posterior chamber as well as the choroid which are not visible for naked examination. In Netrarogas, Abhishyanda is given, prime importance as it is a causative factor for many eye diseases and all Abhishyandas may give rise to Adhimantha as a complication if not treated in time or neglected¹².

The word Adhimantha means excessive churning type of pain. Tivra Vedana or excruciating pain is a common feature in all types of Adhimantha¹³. The pain is very severe as the patient feels that his eye is being extracted or plucked out from orbit and churned along half of the head. Adhimantha can also lead to blindness in addition to pain. The intake of Achakshushya is general and Pitta Prakopaka in particular will increase Mala in the head and they will get lodged in Vartma(Eyelids), Sandhi(Canthus), Sira(Vessels), Drishti (Pupillary area), and Krishnamandala(Cornea) to produce diseases. Hence loss of vision is one of the characteristic feature of this disease which differentiates it from Abhishyanda. The pain in Adhimantha radiates toward temporal region, teeth and occipital region¹⁴.

Adhimantha is characterized by excruciating pain in the eye, which seems as if the eye is being torned out, pain is extending upward to and crushing. The characteristic symptoms of Doshas involved in each case also seems to supervene¹⁵. All the Adhimantha are more troublesome than their respective Abhishyanda, causes very severe pain in the temples, teeth, cheeks and scalp. The aggravated Vata occupies the Abhyantara Siras of the eye and immediately causes loss of vision. After this the Siras become Vikruta and the eyeball is pushed outwards. It causes Shoola (Pain), Toda (Pricking Sensation), Manthana (Churning type of pain) or it may cause generalized symptom like Balanash (weakness), Agnimandya (loss of appetite) etc. Thus, it causes Akshishushkaka (sinking of the eyeball) due to atrophy of the optic nerve¹⁶.

Types of Adhimantha are as follows:

Vataj Adhimantha

Vataj Adhimantha is generated if Vataj Abhishyanda is neglected¹⁷. Severe pain of various nature like extraction/plucked out-churning, foreign body sensation, pricking sensation, tearing, splitting, bursting etc. is present in eye, eyebrows and in half of forehead. Besides this blowing type of tension, shaking, constriction like feeling, severe oedema, smoky or cloudy vision (Corneal Haziness), ringing in the ears and giddiness are also observed in Vataj Adhimantha. If not managed properly, vision is lost within 6 days. Rasadhatu has a major role in the nutrition of intraocular structures. Here Rasadhatu is decreased. So, the symptoms of Rasadhatukshaya such as Karnanada, Bhrama etc. are developed. So as a result of Rasavaha and Raktavaha Srotodushti, Rasa and Rakta Dhatu are vitiated. So, the functional capacity of intraocular structures is lost. The pain become severe and patient becomes blind¹⁸.

Treatment: Acharya Sushruta stated that treatment of Vataj Adhimantha can be done according to Vataj Abhishyanda. It

includes Siramokshana, Virechana, Basti, Vata Dosha Shamak different Anjana, Seka, Snigdha Ashyotana, Snigdha Dhoom, Snehan Nasya, etc. If symptoms don't relieve with treatment, then Daha (Agni) Karma can be done on lateral side of eyebrows¹⁹.

Vataj Adhimantha can be symptomatically equally correlated with Subacute Congestive Glaucoma.

Subacute Congestive Glaucoma

Subacute Primary Angle Closure Glaucoma occurs in eyes with a shallow anterior chamber and an occludable angle in which physiological factors such as reading in dim illumination or watching a film in a darkened cinema hall have precipitated a pupillary block. This causes a sharp rise in intraocular pressure for a short period of time—a minute to a couple of hours—followed by a spontaneous resolution of the pupillary block, possibly due to physiological miosis which may occur in sleep or otherwise. The patient complains of a unilateral headache or brow ache, blurring of vision on the same side and unbroken colored halos around lights during the episode. Between these recurrent attacks, the eyes are free of symptoms and only show signs of a narrow angle recess, clumping of pigment in the angle or occasional peripheral anterior synechiae²⁰.

Pittaj Adhimantha

This is the next stage of Pittaj Abhishyanda. Here the signs and symptoms of Pittaj Abhishyanda becomes more severe and leads to loss of vision. Because of congestion of the blood vessels of ciliary body and iris, the angle of filtration and drainage channels are blocked. As a result, intraocular pressure is suddenly increased and the nutrition mechanism is destroyed leading to structural changes in the eye. Symptoms are pain or sensation as if caustic alkali or burning coal is applied to eye, eyelids suppurated and its margins are excessively swollen, red streaks are seen i.e. severe congestion and eye appears like a color of piece of liver (reddish/brownish), lacrimation, perspiration, fainting, burning sensation in head and perceiving yellow objects—these are manifestations of Pittaj Adhimantha. If ignored vision loss occurs immediately (i.e. within 3 days). Here Pitta is the predominant Dosha. Pitta being the main functioning factor of the eye, if it is vitiated and confined to the Sira Srotas, it reflects in the eye and produces visual disturbances²¹.

Treatment: Raktamokshana by means of Siramokshana or Jaloukavacharana can be done at earliest. Virechana is beneficial for Kayashodhana and strict dietary restrictions are important. Other regime like Kshirsarpi Nasya, Seka, Lepa, Anjana, Aschyotana, treatment stated in Visarp can be done²².

Pittaj Adhimantha can be symptomatically equally correlated with Acute Congestive Glaucoma.

Acute Congestive Glaucoma

Acute or congestive angle-closure Glaucoma is caused by a sudden occlusion of the entire angle with a resultant acute rise of intraocular pressure to extremely high levels. Patients complain of a severe unilateral headache and diminution of vision in a 'red' eye. Nausea may be frequently associated. On examination, ciliary and conjunctival congestion, corneal oedema, a shallow anterior chamber, and iris bombe with a vertically oval, mid-dilated pupil are present. After resolution of the corneal oedema, a gonioscopically closed angle can be seen, i.e. extensive iridocorneal synechiae, and the optic disc may be found to be either hyperaemic or normal²³.

Raktaj Adhimantha

This is a severe stage of Pittaj Adhimantha. Severe pain of various nature like plucked out or pricking etc. feeling of bulging or tenderness, red/ coppery discoloration of eyeball resembling a Japapushpa/ Bandhujeeva flower (bright red), Krishna portion appears red like Arishtak fruit dipped in blood (due to severe ciliary congestion), eye is inflamed, surrounding is perceived as if burning, blood or blood colored discharge and darkness in front of eyes— are the features of Raktaja Adhimantha²⁴. In this stage, ciliary and iris congestion are more prominent. Ciliary and equatorial staphyloma may be formed. There is degeneration and thinning of the Shuklamandala. If ignored vision is lost within 5 days. Treatment can be done same as that of Pittaj Adhimantha²⁵. Raktaj Adhimantha can be symptomatically equally correlated with Acute Congestive Glaucoma.

Kaphaj Adhimantha

In Kaphaj Adhimantha- grittiness/ foreign body (Panshupurnata), headache, mild oedema i.e. inflamed but not excessively congested, cold lacrimation and slimy discharge, itching heaviness, horripilation, and difficulty in visualizing objects due to Avilata i.e. corneal haziness, Nasadhmana i.e. feeling of dryness in nose, depressed black and elevated white portion i.e. chemosis or staphyloma like condition, Praseka i.e. excessive salivation are the chief manifestation. If left unnoticed or untreated, the disease progresses precipitating gross impairment of vision. As the consistency of the intraocular fluids is deranged its metabolic activities are destroyed. This in turn brings out structural damages²⁶. This condition is known as Kaphadhimantha. If ignored vision is lost in 7 days.

Pitta is functioning in the fluid media of Kapha. Vata also has the function of conduction in this medium. If the Kapha is vitiated, the functions of both Pitta and Vata inside this medium is destroyed. So visual impairment is precipitated. Decrease in visual acuity, field defects etc. are important among them. As the disease progresses Kapha prevents the functions of Pitta and Vata completely and total blindness is resulted²⁷.

Treatment: Kaphashodhana is basic principle of treatment and it is conducted in four steps as the following²⁸

- General Kaphashodhana of body including Apatarpana.
- Kaphashodhana therapy for head region can be done with Nasya, Kavala, Gandoosha, etc.
- Srotoshudhi can be done by Raktamokshana.
- Localized Kaphashodhana method for eyes by means of Anjana can be done. Bidalaka with Kaphashamana drugs are also beneficial.
- Kaphaj Adhimantha symptomatically equally can be correlated with Chronic Simple Glaucoma i.e. Primary Wide Open angle Glaucoma.

Chronic Simple Glaucoma i.e. Primary Open Angle Glaucoma

POAG characteristically has an adult onset and is a bilateral, almost symmetrical disease. Ocular examination would be expected to show an open anterior chamber angle, Glaucomatous optic nerve head changes, visual field damage and an intraocular pressure of more than 21 mmHg recorded on at least a few occasions. It occurs in the elderly, rarely being seen earlier than 40 years of age, and tends to run in families. The inheritance is thought to be multifactorial and polygenic, although genetic analysis in some families with juvenile POAG has identified a

link to the long arm of chromosome 1. Patients who develop the frank disease probably inherit a number of abnormal genes. These genes appear to influence the height of the intraocular pressure, the facility of outflow and the cup: disc ratio. Diabetes mellitus and myopia also occur more frequently in persons with Glaucoma than in the general population²⁹.

An intraocular pressure of less than 21 mmHg is recorded repeatedly in about 15% of patients with all the other features of POAG. This condition is known as normal tension Glaucoma. Some individuals, physiologically, have an intraocular pressure of more than 21 mmHg, without any optic nerve head or field abnormalities and are called ocular hypertensives. Patients with optic nerve head changes suggestive of Glaucoma, but without a raised intraocular pressure or visual field changes, are termed POAG suspects.

POAG is generally asymptomatic and patients may have non-specific complaints such as headache and frequent changes in presbyopic correction. Some may notice a scotoma, especially if present in the inferior field, and some experience difficulty in dark adaptation. The main signs which are necessary to diagnose a case of Primary Open Angle Glaucoma where open angle is confirmed by Gonioscopy are:

- Intraocular pressure more than 21 mmHg and a diurnal variation in intraocular pressure of more than 8 mmHg. A difference of the intraocular pressure of more than 5 mm Hg between the two eyes.
- Cup: Disc ratio of more than 0.5, a difference between the two optic nerve heads of more than 0.2, narrowing, notching or pallor of the neuro-retinal rim, splinter hemorrhages and abnormalities of the blood vessels indicative of an acquired enlargement of the optic cup changes are suggestive of Glaucomatous damage. Optic disc appearance over many years are imperative for the review and treatment of patients. Drawing, photographs, stereo photographs or objective topography by scanning laser ophthalmoscopy can be done to keep records.

- Visual field changes consistent with Glaucomatous defects.
- Defects in the nerve fiber layer, which can be seen extending from the optic nerve head in an arc from the superior and inferior poles of the disc. These are best appreciated after dilatation of the pupil, and examination with a red-free light.

Intraocular Pressure

Aqueous humor is a clear and transparent watery fluid circulating inside the eye and it fills the portion in between lens and cornea. It nourishes the transparent structures of the eye and carries away the metabolic end products. Since it fulfils the functions of nutrition it can be considered as a derivative of Rasadhātu. It maintains the pressure inside the eyeball by means of secretion and ultrafiltration method. The production, circulation and outflow of aqueous humor are important factors in the function of eye. The initial Dhātu Rasa and Rakta are responsible for the aqueous circulation. So, any vitiation of Rasa and Rakta Dhātu directly deranges the nutritive system and thus brings out pathological changes concerned with intraocular pressure. Intraocular pressure is the pressure above atmospheric pressure maintained inside the eyeball in normal condition. Pressure of aqueous humor is directly influenced by the arterial blood of ciliary body. Rakta Dhātu is more concerned with the blood circulation and Pitta is directly influenced by Rakta. So Vitiation of Pitta deranges the circulatory system and thereby brings out changes in the intraocular pressure. So the combined functions of Pitta and Rasa Dhātu maintain the intraocular pressure and any vitiation in these factors brings out pathological changes which leads to Adhimantha which can equally correlate with Glaucoma³⁰.

Prognosis of Adhimantha if neglected

All Adhimantha are manageable if attended in time. If ignored, or patient does not follow diet and seasonal regime, visual loss occurs as follows:

Table 1: Prognosis of Adhimantha if neglected³¹

	Sushruta	Ashtang Hriday
Vataj Adhimantha	Loss of vision in 6 days	Loss of vision in 5 days
Pittaj Adhimantha	Loss of vision immediately	Immediately
Kaphaj Adhimantha	Loss of vision in 7 days	Loss of vision in 7 days
Raktaj Adhimantha	Loss of vision in 5 days	Loss of vision in 3 days

Hatadhimantha

Hatadhimantha is a complication or the end stage of all Adhimantha if neglected or untreated³². It seems that there are two stages of this disease as mentioned by Dalhanacharya as Netra Shosha and Drishti Nirgama.

Netra Shosha: If Vataj Adhimantha is ignored the entire eyeball undergoes deterioration and become shrunken with severe pain. This stage is intractable. Videha has specifically said that due to Vayu the Teja, Bala and Agni of eye reduces and results in shrunken globe like dried and plucked lotus flower. This condition can be correlated with Pthisis Bulbi.

Drishti Nirgama: If Vataj Adhimantha is ignored, the Vayu occupying Sira push the eyeball forwards. This stage is also intractable. The ulcer leading to visual loss is present on Drishtimandal along with pain of various nature. This condition

can be correlated with proptosis. In proptosis patient is unable to close the lids completely and hence cornea gets easily ulcerated causing visual loss due to exposure to atmospheric air or trauma. Both the stages of Hatadhimantha are untreatable³³.

DISCUSSION

Ayurveda explained that if Abhishyanda are neglected it leads to Adhimantha. But it is difficult to state that whether Glaucoma arises from conjunctivitis. But it can be seen that in Glaucoma there are some symptoms present as that of conjunctivitis as discharge from eyes, redness and photophobia. According to Ayurveda Adhimantha is a Sadhya i.e. curable disease. So, the treatment principles explained for Adhimantha can be applied to treat Glaucoma and are helpful to restore deteriorating vision. Also following the concept of Dinacharya and Ritucharya as per Ayurveda texts may prevent the progression of diseases³⁴. Kriyakalpa procedures explained in Ayurveda are the

boon to the modern ophthalmology which are tissue oriented and are helpful tool in Glaucoma drug research³⁵.

CONCLUSION

This Review article is a sincere effort to compile the references from different texts and correlate and compare the two terminologies. Adhimantha can be symptomatically equally correlated with Glaucoma on the basis of signs and symptoms as well as the ability of disease to destroy vision. So, the treatment protocols mentioned by ancient Acharya in Adhimantha can be implemented to treat Glaucoma and its different conditions with all precautions. The comparison between the two terminologies may be helpful for research purpose in the field of Ayurveda.

REFERENCES

1. Hayreh SS, Jonas JB. Optic disc morphology after arteritic anterior ischemic optic neuropathy. *Ophthalmology*. 2001; 108: p1586–1594. [PubMed: 11535455]
2. H Kwon, Primary Open-Angle Glaucoma, *N Engl J Med*. 2009 March 12; 360(11): 1113–1124. DOI: 10.1056/NEJMr0804630.
3. Alward WL. Biomedicine: a new angle on ocular development. *Science*. 2003; 299:1527–1528. [PubMed: 12624251]
4. Khurana A K, Comprehensive Ophthalmology, In: Arjun Khurana, Bhavana Khurana, editors. Glaucoma: Pathophysiology and Management, 4th edition. New age international (P) Ltd. Reprint 2010, p. 211
5. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Aupadravik Adhyay 1, Ver.no.26-27, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 597.
6. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Sarvagatrog Vidnyaniy Adhyay 6, Ver.no.5, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 603.
7. Vagbhata, Ashtang Hriday with commentary by Arundatta and Hemadri, In: Dr A M Kunte, Annotated. Uttartantra Sarvakshirog Vidnaniy Adhyay 15, Ver.no 3, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2011. p. 828
8. Pravin M Bhat, Ayurvedic Manifestations in systemic diseases-An Ayurvedic perspective, *World Journal of Pharmaceutical Research*. ISSN 2277-7105, Jun-2017, Vol.6 Issue 6, p. 1571-1582.
9. Vagbhata, Ashtang Hriday with commentary by Arundatta and Hemadri, In: Dr A M Kunte, Annotated. Uttartantra Vartmarog Vidnaniy Adhyay 8, Ver.no 1, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2011. p. 804
10. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Aupadravik Adhyay 1, Ver.no.21-23, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 597.
11. Vagbhata, Ashtang Hriday with commentary by Arundatta and Hemadri, In: Dr A M Kunte, Annotated. Uttartantra Vartmarog Vidnaniy Adhyay 8, Ver.no 2, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2011. p. 804
12. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Sarvagatrog Vidnyaniy Adhyay 6, Ver.no.5, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 603.
13. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Sarvagatrog Vidnyaniy Adhyay 6, Ver.no.10, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 604.
14. Vagbhata, Ashtang Hriday with commentary by Arundatta and Hemadri, In: Dr A M Kunte, Annotated. Uttartantra Sarvakshirog Vidnaniy Adhyay 15, Ver.no 15, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2011. p. 829
15. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Sarvagatrog Vidnyaniy Adhyay 6, Ver.no.10-12, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 604.
16. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Sarvagatrog Vidnyaniy Adhyay 6 Dalhantika, Ver.no.24, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 605.
17. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Sarvagatrog Vidnyaniy Adhyay 6, Ver.no.12-13, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 604.
18. A textbook of Ophthalmology in Ayurveda, In: Dr P.K.Shathakumari, editor. Diseases of Sarvakshi, 1st edition, Self-published, 2002, p. 275
19. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Vatabhishyanda Pratishedh Adhyay 9, Ver.no.3-4, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 611.
20. Parson's Diseases of eye, In: Ramanjit Sihota & Radhika Tondon, editor. The Glaucoma, 19th Edition, Butterworth-Heinemann Elsevier publication, Oxford; 2003, p. 307
21. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Sarvagatrog Vidnyaniy Adhyay 6, Ver.no.14-15, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 604.
22. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Pittabhishyanda Pratishedha Vidnyaniy Adhyay 10, Ver.no.3, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 612.
23. Parson's Diseases of eye, In: Ramanjit Sihota & Radhika Tondon, editor. The Glaucoma, 19th Edition, Butterworth-Heinemann Elsevier publication, Oxford; 2003, p. 307
24. Vagbhata, Ashtang Hriday with commentary by Arundatta and Hemadri, In: Dr A M Kunte, Annotated. Uttartantra Sarvakshirog Vidnaniy Adhyay 15, Ver.no 13-14, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2011. p. 829
25. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Raktabhishyanda Pratishedha Adhyay 12, Ver.no.3, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 616.
26. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Sarvagatrog Vidnyaniy Adhyay 6, Ver.no.16-17, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 604.
27. A textbook of Ophthalmology in Ayurveda, In: Dr P.K.Shathakumari, editor. Diseases of Sarvakshi, 1st edition, Self-published, 2002, p. 286

28. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Shleshmabhishtyanda Pratishedh Adhyay 11, Ver.no.3-4, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010, p. 614.
29. Parson's Diseases of eye, In: Ramanjit Sihota & Radhika Tondon, editor. The Glaucoma, 19th Edition, Butterworth-Heinemann Elsevier publication, Oxford; 2003, p. 302
30. A textbook of Ophthalmology in Ayurveda, In: Dr P.K.Shathakumari, editor. Diseases of Sarvakshi, 1st edition, Self-published, 2002, p. 272
31. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Sarvagatrog Vidnyaniy Adhyay 6, Ver.no.20, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 604.
32. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Sarvagatrog Vidnyaniy Adhyay 6, Ver.no.23-24, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 604.
33. Sushruta, Sushrut Samhita with commentary by Dalhanacharya, In: Vd Jadavaji Trikamaji Acharya, editor. Uttartantra Aupadravik Vidnyaniy Adhyay 1, Ver.no.29-30, Edition Reprint, Choukhambha Sanskrit Sansthan, Varanasi; 2010. p. 597.
34. Prasanta Kumar Sahoo, Sanghamitra Dash, Shamsa Fiaz. Concept of Preventive Ophthalmology in Ayurveda. Int.J.Res. Ayurveda Pharm. Mar-Apr 2016; 7 (Suppl 2): 115-119; <http://dx.doi.org/10.7897/2277-4343.07269>
35. Pravin M Bhat. A Review on Kriyakalpa: The modern approach to Ayurvedic ocular therapeutics. Int. J. Res. Ayurveda pharm. Sep-Oct 2016; 7(5):12-16 <http://dx.doi.org/10.7897/2277-4343.075186>

Cite this article as:

Pravin M Bhat *et al.* A review on concept of glaucoma in Ayurveda and its management. Int. J. Res. Ayurveda Pharm. 2018;9(3):159-164 <http://dx.doi.org/10.7897/2277-4343.09383>

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

Disclaimer: IJRAP is solely owned by Moksha Publishing House - A non-profit publishing house, dedicated to publish quality research, while every effort has been taken to verify the accuracy of the content published in our Journal. IJRAP cannot accept any responsibility or liability for the site content and articles published. The views expressed in articles by our contributing authors are not necessarily those of IJRAP editor or editorial board members.