

Arma and Pterygium: Comparative Pathogenesis and Management—An Integrative Review

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Abstract: *Arma is a classical ocular disorder described under Shuklagata Netra Roga in Ayurveda and is characterized by a progressive fleshy growth arising from the scleral region and extending towards the cornea. In contemporary ophthalmology, pterygium is defined as a triangular fibrovascular proliferation of the bulbar conjunctiva that invades the corneal surface. Although described within different medical paradigms, both conditions exhibit remarkable similarities in anatomical location, clinical presentation, disease progression, and surgical management. This narrative integrative review critically compares Arma and pterygium with respect to their historical evolution, ocular anatomy, etiopathogenesis, clinicopathological features, diagnosis, classification, and therapeutic approaches while identifying converging concepts between Ayurveda and modern ophthalmology. Classical Ayurvedic literature, including Sushruta Samhita, Ashtanga Hridaya, Ashtanga Sangraha, Madhava Nidana, and Bhavaprakasha, was reviewed alongside standard ophthalmology textbooks and contemporary peer-reviewed literature on the molecular mechanisms and management of pterygium. Ayurveda attributes Arma primarily to Kapha–Rakta Dushti with Mamsa Vridhdhi occurring in the Shukla Mandala, whereas modern medicine explains pterygium through ultraviolet-induced oxidative stress, limbal stem-cell dysfunction, chronic inflammation, extracellular matrix remodeling, angiogenesis, and fibrovascular proliferation. Despite differences in their explanatory models, both systems recognize chronic environmental exposure, progressive corneal involvement, and surgical excision as key components of disease management. Comparative evaluation demonstrates substantial clinicopathological similarities between Arma and pterygium, suggesting that classical Ayurvedic concepts can be meaningfully interpreted in the context of current biomedical evidence. Integrating Ayurvedic principles with contemporary ophthalmic research may enhance the understanding of disease mechanisms and support the development of evidence-based integrative strategies for the prevention and management of ocular surface disorders.*

Keywords: Arma; Pterygium; Shuklagata Netra Roga; Ayurveda; Ocular Surface Disease; Integrative Ophthalmology; Comparative Pathogenesis..

I. INTRODUCTION

Ocular surface disorders are among the leading causes of chronic ocular discomfort and visual morbidity worldwide. Pterygium is a common degenerative-proliferative disorder characterized by a triangular fibrovascular growth originating from the bulbar conjunctiva and extending across the limbus onto the cornea. Its prevalence ranges from less than 2% in temperate regions to over 30% in tropical areas, where prolonged exposure to ultraviolet (UV) radiation, dust, wind, and dry climatic conditions significantly increases disease risk. Progressive lesions may induce chronic irritation, tear film instability, irregular astigmatism, corneal scarring, and visual impairment, frequently necessitating surgical intervention. Despite advances in conjunctival autografting and adjunctive therapies, postoperative recurrence remains a major therapeutic challenge.^{1–3}

Ayurveda describes ocular diseases comprehensively under Shalakya Tantra, one of the eight branches of *Ashtanga Ayurveda*. Among the seventy-six ocular disorders described by Acharya Sushruta, Arma is classified under Shuklagata



Netra Roga, involving the *Shukla Mandala* (scleral region). Classical texts describe Arma as a gradually enlarging fleshy growth extending from the sclera towards the cornea, eventually affecting vision if left untreated. Based on colour, consistency, vascularity, and prognosis, Arma is classified into five varieties, with Arma Chedana recommended for advanced lesions. Similar descriptions are preserved in *Ashtanga Hridaya*, *Ashtanga Sangraha*, *Madhava Nidana*, and *Bhavaprakasha*, indicating the long-standing clinical significance of this disorder in Ayurvedic ophthalmology.^{4–8}

Although Ayurveda and modern medicine explain disease through distinct theoretical frameworks, Arma and pterygium demonstrate striking similarities in anatomical location, clinical manifestations, progressive fibrovascular growth, and surgical management. Ayurveda attributes Arma to the vitiation of Kapha Dosha, Rakta, and Mamsa Dhatu, resulting in abnormal tissue proliferation. In contrast, modern ophthalmology considers pterygium a multifactorial ocular surface disease caused primarily by chronic ultraviolet radiation, oxidative stress, limbal stem-cell dysfunction, persistent inflammation, extracellular matrix remodeling, angiogenesis, and fibroblast activation mediated by cytokines, vascular endothelial growth factor (VEGF), transforming growth factor- β (TGF- β), tumour necrosis factor- α (TNF- α), interleukins, and matrix metalloproteinases (MMPs).^{2,3,9–11}

Recent advances in ocular surface biology have significantly improved understanding of pterygium pathogenesis; however, recurrence following surgery and the multifactorial nature of the disease continue to present therapeutic challenges. Simultaneously, increasing interest in evidence-based traditional medicine has encouraged reinterpretation of classical Ayurvedic concepts using contemporary biomedical knowledge. Comparative evaluation of Ayurvedic principles such as Nidana Parivarjana, Kriyakalpa, Rasayana, and Arma Chedana alongside current medical and surgical approaches may provide complementary perspectives for disease prevention, tissue healing, and long-term management. Therefore, this narrative integrative review aims to compare the historical concepts, anatomy, etiopathogenesis, clinicopathological features, diagnosis, classification, and management of Arma and pterygium by synthesizing evidence from classical Ayurvedic literature and contemporary ophthalmology. The review further explores converging concepts between these two systems of medicine and highlights potential opportunities for future research in integrative ophthalmology.

II. HISTORICAL EVOLUTION OF ARMA AND PTERYGIUM

Diseases affecting the ocular surface have been recognized since ancient times because of their impact on vision and quality of life. Among these, Arma in Ayurveda and pterygium in modern ophthalmology represent comparable clinical entities described within different medical systems. Although their pathogenetic concepts differ, both are characterized by progressive fibrovascular growth extending from the conjunctiva towards the cornea, reflecting remarkable consistency in clinical observations across centuries.^{12–14}

In Ayurveda, ophthalmology (*Shalakya Tantra*) is one of the eight branches of *Ashtanga Ayurveda*. The Sushruta Samhita provides one of the earliest systematic descriptions of ocular diseases, classifying seventy-six Netra Rogas and emphasizing both medical and surgical management. Within this classification, Arma is described under Shuklagata Netra Roga, involving the *Shukla Mandala* (scleral region). Sushruta describes Arma as a gradually enlarging fleshy growth arising from the conjunctival region and extending toward the *Krishna Mandala* (cornea). Advanced lesions are considered Chedya Sadhya, indicating that surgical excision (*Arma Chedana*) is the definitive treatment.^{12,13}

Sushruta further classified Arma into five varieties—Prastari, Shukla, Kshata, Adhimamsa, and Snayu Arma—based on colour, vascularity, consistency, thickness, and prognosis. This morphological classification reflects detailed clinical observation and individualization of treatment, concepts that resemble contemporary grading systems based on lesion severity and surgical complexity.^{12–14}

Subsequent Ayurvedic treatises reinforced these observations. *Ashtanga Hridaya* and *Ashtanga Sangraha* described the involvement of Kapha Dosha, Rakta, and Mamsa Dhatu in disease development while emphasizing both preventive and surgical management. *Madhava Nidana* elaborated diagnostic features and differential diagnosis, whereas *Bhavaprakasha* discussed therapeutic approaches, demonstrating continuity in the understanding of Arma throughout classical Ayurvedic literature.^{4–8}

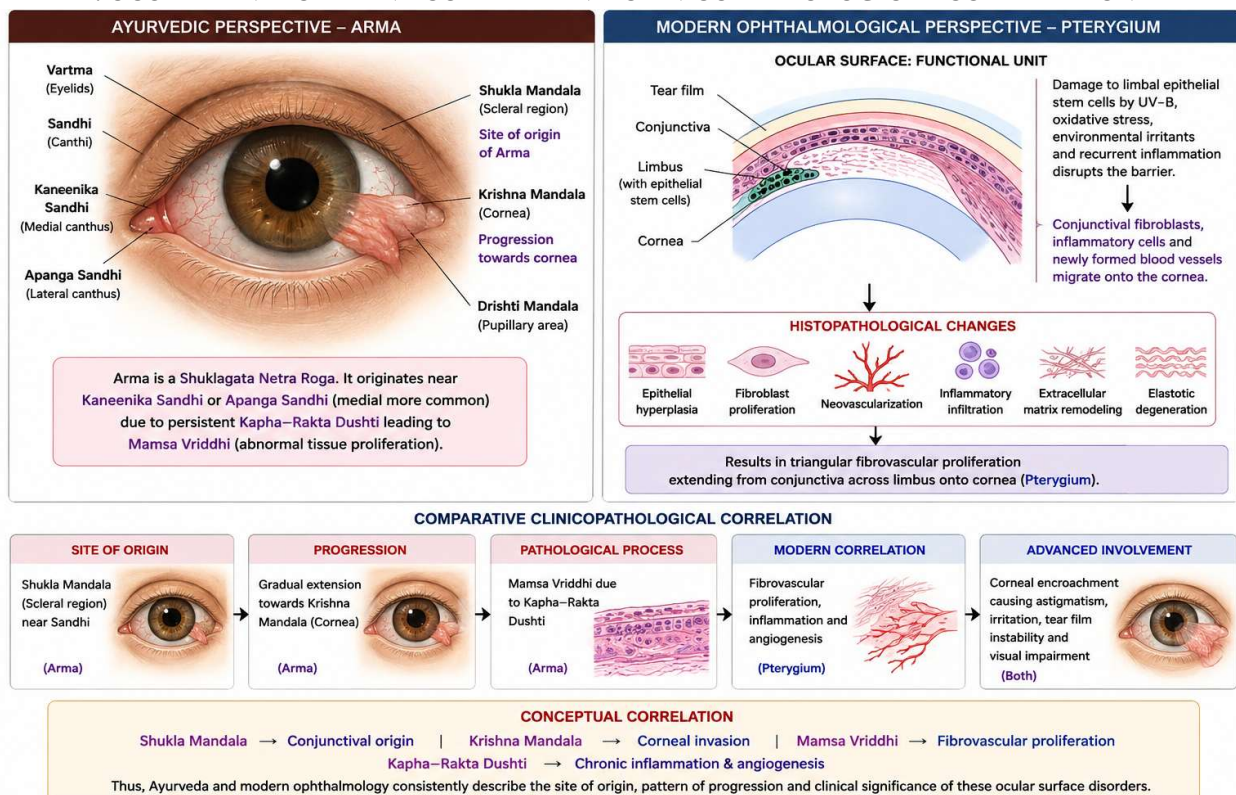


The term pterygium is derived from the Greek word *pterygion*, meaning "small wing," describing the characteristic triangular appearance of the lesion. Historically, pterygium was regarded as a degenerative conjunctival disorder associated with aging and prolonged environmental exposure. However, advances in histopathology, immunohistochemistry, and molecular biology have transformed this concept. Current evidence identifies pterygium as a multifactorial fibrovascular proliferative disease involving ultraviolet-induced oxidative stress, chronic inflammation, limbal stem-cell dysfunction, angiogenesis, extracellular matrix remodeling, and abnormal wound healing.¹⁵⁻¹⁸

Despite differences in theoretical interpretation, the clinical descriptions of Arma and pterygium show striking similarities. Both originate from the bulbar conjunctiva, most commonly on the nasal side, progressively invade the cornea, and present with redness, irritation, watering, foreign body sensation, and visual disturbance. Advanced lesions in both systems require surgical removal, while meticulous postoperative care is emphasized to reduce recurrence and preserve vision.¹⁴⁻¹⁸

The historical evolution of these concepts demonstrates that classical Ayurvedic scholars accurately recognized the morphology, progression, prognosis, and surgical management of Arma long before the molecular mechanisms of pterygium were understood. Modern ophthalmology has expanded this knowledge by explaining disease progression at the cellular and molecular levels. Integrating these complementary perspectives may strengthen future research and support evidence-based approaches in integrative ophthalmology.

III. OCULAR ANATOMY AND COMPARATIVE CLINICOPATHOLOGICAL CORRELATION



Understanding the anatomical basis of Arma and pterygium is essential for interpreting their pathogenesis and clinical progression. Although Ayurveda and modern ophthalmology use different anatomical terminology, both recognize that the disease originates on the ocular surface and progressively extends towards the cornea.¹⁹⁻²¹



According to Ayurveda, the eye (*Netra*) comprises several anatomical regions, including Vartma (eyelids), Sandhi (canthi), Shukla Mandala (scleral region), Krishna Mandala (cornea), and Drishti Mandala (pupillary area). Arma is classified as a Shuklagata Netra Roga, indicating that the lesion initially develops in the Shukla Mandala before gradually involving the cornea. Classical texts describe its origin near the Kaneenika Sandhi or Apanga Sandhi, with medial lesions being more common. Persistent Kapha–Rakta Dushti produces abnormal proliferation of Mamsa Dhatu, resulting in progressive tissue overgrowth.^{19–21}

Modern ophthalmology describes the ocular surface as a functional unit consisting of the cornea, conjunctiva, limbus, tear film, lacrimal glands, meibomian glands, eyelids, and associated immune and neural components. The limbus contains epithelial stem cells responsible for maintaining corneal transparency and preventing conjunctival tissue from invading the cornea. Damage to these limbal stem cells disrupts this barrier and initiates fibrovascular proliferation characteristic of pterygium.^{22–24}

Chronic ultraviolet-B exposure, oxidative stress, environmental irritants, and recurrent inflammation damage limbal epithelial stem cells, allowing conjunctival fibroblasts, inflammatory cells, and newly formed blood vessels to migrate onto the cornea. Histopathological changes include epithelial hyperplasia, fibroblast proliferation, neovascularization, elastotic degeneration, inflammatory cell infiltration, and extracellular matrix remodeling, producing the characteristic triangular fibrovascular lesion.^{23, 25–28}

The anatomical progression described in Ayurveda closely parallels modern clinicopathological findings. In both conditions, lesions originate from the conjunctival region, gradually extend across the limbus, and eventually involve the cornea. Progressive corneal encroachment may induce irregular astigmatism, tear film instability, chronic ocular irritation, and visual impairment. Advanced lesions can obscure the visual axis and adversely affect visual function and quality of life.^{23, 27}

These similarities permit meaningful conceptual correlation between the two systems. The Ayurvedic concepts of Shukla Mandala, Krishna Mandala, Mamsa Vriddhi, and Kapha–Rakta Dushti correspond broadly to the conjunctival origin of the lesion, corneal invasion, fibrovascular proliferation, chronic inflammation, and angiogenesis recognized in contemporary ophthalmology. Although expressed through different theoretical frameworks, both systems consistently describe the site of origin, pattern of progression, and clinical significance of these ocular surface disorders.

IV. ETIOLOGY AND COMPARATIVE PATHOGENESIS

4.1 Etiology

The development of Arma and pterygium is multifactorial, involving prolonged environmental exposure, host susceptibility, and progressive tissue changes. Although Ayurveda and modern ophthalmology explain disease causation using different conceptual frameworks, both recognize that chronic irritation of the ocular surface initiates pathological changes leading to fibrovascular tissue proliferation.^{29–32}

According to Ayurveda, the Nidana (etiological factors) of Arma primarily aggravate Kapha Dosha with secondary involvement of Rakta and Mamsa Dhatu. Classical texts identify excessive exposure to Raja (dust), Dhuma (smoke), Atapa (sunlight), and Vata (wind) as important external factors responsible for ocular diseases. Persistent irritation causes Dosha Prakopa, resulting in localized tissue overgrowth within the Shukla Mandala. Dietary and behavioural factors, including excessive intake of Guru, Snigdha, and Abhishyandi Ahara, inadequate ocular hygiene, suppression of natural urges, and improper daily regimens (*Dinacharya*), further contribute to disease progression. Continued exposure ultimately produces Kapha–Rakta Dushti, Mamsa Vriddhi, and Srotodushti, manifesting clinically as Arma.^{29–32}

Modern ophthalmology similarly identifies chronic environmental exposure as the principal cause of pterygium. Among the recognized risk factors, prolonged ultraviolet-B (UV-B) radiation is considered the most significant. Epidemiological studies demonstrate a higher prevalence among individuals residing in tropical and subtropical regions and among outdoor workers such as farmers, fishermen, and construction workers. Additional risk factors include chronic exposure to dust, dry climate, wind, smoke, advancing age, male sex, genetic predisposition, tear film instability, and recurrent ocular surface irritation.^{23, 25–28}



At the cellular level, chronic UV-B exposure generates reactive oxygen species (ROS), resulting in oxidative stress, DNA damage, lipid peroxidation, and mitochondrial dysfunction. These changes activate inflammatory pathways and stimulate conjunctival fibroblasts, vascular endothelial cells, and extracellular matrix-remodelling enzymes. Increased expression of vascular endothelial growth factor (VEGF), transforming growth factor- β (TGF- β), interleukins (IL-1 and IL-6), tumour necrosis factor- α (TNF- α), matrix metalloproteinases (MMP-1, MMP-2 and MMP-9), and altered p53 signalling collectively promote fibrovascular proliferation and increase the risk of recurrence following surgery.²⁵⁻³²

Although expressed differently, the etiological concepts of Ayurveda and modern medicine demonstrate notable similarities. Nidana Sevana leading to Dosha Prakopa and Dhatu Dushti can be conceptually correlated with chronic environmental exposure, oxidative stress, persistent inflammation, and tissue remodelling recognised in contemporary ophthalmology. Thus, both systems emphasize the cumulative effect of long-term environmental insults on the ocular surface.

4.2 Comparative Pathogenesis

The pathogenesis of Arma described in Ayurveda follows a sequential process beginning with prolonged exposure to etiological factors (Nidana Sevana) and culminating in abnormal fibrovascular tissue growth. Repeated exposure aggravates Kapha Dosha, followed by vitiation of Rakta and Mamsa Dhatu. These pathological changes become localized in the Shukla Mandala, causing Srotorodha (obstruction of microchannels) and Mamsa Vriddhi (abnormal tissue proliferation). As the lesion enlarges, it progressively extends towards the Krishna Mandala, producing redness, watering, foreign body sensation, irritation, and visual impairment in advanced stages. Classical Ayurvedic texts therefore consider Arma a progressive disorder that requires timely intervention before significant corneal involvement occurs.²⁹⁻³²

Modern research explains pterygium as a chronic fibrovascular proliferative disorder initiated by ultraviolet-induced limbal stem-cell damage. Continuous UV-B exposure disrupts the limbal epithelial barrier, allowing conjunctival epithelial cells, activated fibroblasts, inflammatory cells, and neovascular tissue to invade the cornea. Simultaneously, oxidative stress activates nuclear transcription factors and inflammatory signalling pathways, leading to increased production of cytokines, chemokines, growth factors, and matrix metalloproteinases. These mediators stimulate fibroblast proliferation, extracellular matrix deposition, angiogenesis, and degradation of Bowman's layer, ultimately producing the characteristic triangular fibrovascular lesion. Residual activated fibroblasts following surgical excision contribute significantly to postoperative recurrence.²⁵⁻³⁰

Several pathogenetic concepts described in Ayurveda closely parallel modern clinicopathological mechanisms. Kapha Dushti, characterised by heaviness and excessive tissue growth, resembles fibroblast proliferation and extracellular matrix deposition. Rakta Dushti corresponds to chronic inflammation and increased vascularity, whereas Mamsa Vriddhi parallels fibrovascular tissue proliferation. Likewise, Srotodushti may be interpreted as disruption of normal tissue architecture associated with extracellular matrix remodelling and progressive tissue invasion.²⁹⁻³²

Both systems also recognise the progressive nature of the disease. In Ayurveda, continued Dosha aggravation promotes gradual extension of Arma towards the cornea, while in modern ophthalmology chronic oxidative stress and inflammatory activation sustain fibrovascular proliferation and corneal encroachment. These processes eventually alter corneal curvature, induce irregular astigmatism, destabilize the tear film, and impair visual function.²⁵⁻³²

Despite differences in terminology and theoretical models, both Ayurveda and contemporary ophthalmology describe a disease initiated by chronic environmental exposure, followed by local tissue changes, progressive conjunctival overgrowth, corneal invasion, and visual impairment. The Ayurvedic concepts of Kapha-Rakta Dushti, Mamsa Vriddhi, and Srotodushti therefore provide a useful traditional framework that can be interpreted alongside modern molecular mechanisms of chronic inflammation, angiogenesis, oxidative stress, limbal stem-cell dysfunction, and extracellular matrix remodelling. Such conceptual convergence supports the scientific basis for integrative research and may contribute to the development of complementary therapeutic strategies for ocular surface disorders.



V. CLINICAL FEATURES, CLASSIFICATION, AND DIFFERENTIAL DIAGNOSIS

Arma and pterygium exhibit striking similarities in their clinical presentation, anatomical location, and pattern of progression. Both conditions originate as localized conjunctival lesions that gradually extend toward the cornea. The disease usually progresses slowly, although continuous exposure to environmental risk factors may accelerate fibrovascular proliferation and increase the likelihood of visual impairment.³³⁻³⁶

According to the Sushruta Samhita, Arma is characterized by an abnormal fleshy growth (*Mamsankura*) arising in the Shukla Mandala and progressively extending towards the Krishna Mandala. Patients commonly present with Raga (redness), Toda (foreign body sensation), Ashru Srava (watering), Kandu (itching), mild ocular pain, heaviness, and progressive diminution of vision when the lesion involves the cornea. Early lesions are generally asymptomatic except for cosmetic concerns, whereas advanced Arma interferes with vision and normal ocular function. The colour, thickness, consistency, and vascularity of the lesion are important clinical indicators that influence prognosis and treatment selection.²⁹⁻³³

Modern ophthalmology describes pterygium as a triangular fibrovascular growth of the bulbar conjunctiva, most commonly arising from the nasal limbus and extending across the cornea. The condition presents with chronic ocular redness, irritation, burning sensation, dryness, watering, photophobia, and foreign body sensation. Progressive corneal involvement induces irregular astigmatism, resulting in blurred vision and, in advanced cases, obstruction of the visual axis. Large lesions may also cause restriction of ocular movements, recurrent inflammation, and cosmetic disfigurement, necessitating surgical excision.³⁴⁻³⁹

Classical Ayurvedic literature classifies Arma into five varieties based on morphological characteristics and prognosis. Prastari Arma is broad, thin, and diffusely spread; Shukla Arma appears pale and relatively less vascular; Kshata Arma is reddish and highly vascular; Adhimamsa Arma is thick, fleshy, and rapidly progressive; whereas Snayu Arma is dense, fibrous, and firmly adherent, making surgical excision difficult. This classification reflects careful clinical observation and may be correlated with modern grading systems that assess lesion size, translucency, vascularity, and extent of corneal involvement.²⁹⁻³³

The differential diagnosis of Arma and pterygium includes pinguecula, pseudopterygium, ocular surface squamous neoplasia, limbal dermoid, conjunctival papilloma, conjunctival intraepithelial neoplasia, and chronic conjunctivitis. Careful slit-lamp examination, assessment of lesion mobility, corneal involvement, vascular pattern, and associated ocular surface changes are essential for accurate diagnosis. Unlike pterygium, pinguecula remains confined to the conjunctiva without crossing the limbus, whereas pseudopterygium usually develops following trauma, burns, or inflammation and may occur at any limbal location. Recognition of these distinguishing features is important because treatment strategies and prognosis differ among these conditions.³⁵⁻³⁹

Overall, the clinical descriptions of Arma in classical Ayurvedic literature closely parallel the contemporary understanding of pterygium. Both disorders demonstrate progressive fibrovascular proliferation originating from the conjunctival region, gradual extension onto the cornea, similar symptomatology, and the potential to impair vision if untreated. These clinicopathological similarities strongly support considering Arma as the closest Ayurvedic correlate of pterygium and provide a scientific basis for comparative and integrative ophthalmic research.

VI. MANAGEMENT OF ARMA AND PTERYGIUM

Management of Arma and pterygium aims to relieve symptoms, prevent disease progression, preserve visual function, and minimize recurrence. Although Ayurveda and modern ophthalmology employ different therapeutic approaches, both emphasize early intervention, elimination of causative factors, and surgical management for advanced lesions.⁴⁰⁻⁴⁹

Ayurveda advocates Nidana Parivarjana (avoidance of causative factors) as the primary step in management. Patients are advised to minimize exposure to excessive sunlight, dust, smoke, and wind while maintaining appropriate ocular hygiene and following a balanced diet that avoids Kapha-provoking foods. Such preventive measures reduce further Dosha aggravation and help slow disease progression.²⁹⁻³²



Medical management in Ayurveda is selected according to the stage of disease and predominance of Dosha. Classical texts recommend local therapies (Kriyakalpa) such as Aschyotana (eye drops), Seka (ocular irrigation), Anjana (collyrium), Tarpana, and Putapaka, together with appropriate internal medications to alleviate Kapha–Rakta Dushti, reduce inflammation, and promote ocular tissue healing. Rasayana therapy may also be employed to improve tissue nutrition and maintain ocular health. Although these therapies are traditionally recommended, further well-designed clinical studies are needed to establish their efficacy using contemporary evidence-based methodologies.^{29–32}

For advanced or progressively enlarging Arma, Arma Chedana is considered the definitive treatment. Sushruta described meticulous surgical excision with preservation of surrounding healthy tissue, adequate haemostasis, and comprehensive postoperative care to reduce recurrence and restore normal ocular function. These principles demonstrate a sophisticated understanding of ocular surgery and remain conceptually relevant to current surgical practice.^{29, 41–43}

Modern management depends on disease severity. Mild or asymptomatic pterygium is generally treated conservatively using lubricating eye drops, ultraviolet protection, and avoidance of environmental irritants. Short-term topical anti-inflammatory medications may be used to control ocular irritation and inflammation in selected patients.^{34, 44–46}

Surgical excision is indicated when pterygium causes progressive corneal encroachment, significant astigmatism, visual impairment, recurrent inflammation, restriction of ocular movements, or unacceptable cosmetic appearance. Among available techniques, conjunctival autografting is considered the gold standard because it provides the lowest recurrence rates. Other procedures include amniotic membrane transplantation, conjunctival rotational flaps, and limbal conjunctival autografts. Adjunctive therapies such as mitomycin-C, 5-fluorouracil, fibrin glue, and anti-vascular endothelial growth factor agents may further reduce recurrence in selected cases, although potential complications necessitate careful patient selection.^{44–49}

Despite advances in surgical techniques, recurrence remains the principal challenge in pterygium management because persistent inflammation, fibroblast activation, and limbal stem-cell dysfunction continue to promote fibrovascular proliferation. This highlights the importance of comprehensive postoperative care and long-term control of environmental risk factors. From an integrative perspective, combining meticulous surgery with appropriate preventive measures and supportive Ayurvedic therapies may improve patient outcomes, although robust clinical evidence is required to validate such approaches. Thus, both Ayurveda and modern ophthalmology recognize that successful management requires not only lesion removal but also long-term prevention of recurrence through control of underlying pathogenic factors.

VII. DISCUSSION

Arma described in Ayurveda and pterygium recognized in modern ophthalmology represent comparable ocular surface disorders despite differences in their conceptual frameworks. Both conditions originate from the bulbar conjunctiva, progressively extend onto the cornea, and manifest with similar clinical features including redness, irritation, watering, foreign body sensation, and visual impairment in advanced stages. The close agreement in anatomical location, disease progression, and surgical indications suggests that Arma is the closest Ayurvedic correlate of pterygium.

Ayurveda explains Arma through Kapha–Rakta Dushti, Mamsa Vridhhi, and Srotodushti, whereas modern ophthalmology attributes pterygium to ultraviolet-induced oxidative stress, limbal stem-cell dysfunction, chronic inflammation, angiogenesis, and extracellular matrix remodeling. Although these explanations differ in terminology, both describe a progressive pathological process initiated by persistent environmental exposure and culminating in fibrovascular tissue proliferation over the ocular surface. This conceptual overlap provides a scientific basis for interpreting classical Ayurvedic principles in light of contemporary biomedical knowledge.

Environmental factors constitute the principal etiological component in both systems. Classical Ayurvedic texts identify Atapa (sunlight), Raja (dust), Dhuma (smoke), and Vata (wind) as major causative factors, while epidemiological studies consistently identify ultraviolet radiation, dust, dry climate, and chronic ocular irritation as important risk factors for pterygium. This similarity indicates that ancient Ayurvedic scholars accurately recognized the influence of environmental exposure on ocular surface disorders centuries before the underlying molecular mechanisms were elucidated.



Management strategies also demonstrate important areas of convergence. Both systems emphasize early diagnosis, avoidance of causative factors, and surgical intervention for advanced disease. Arma Chedana described by Sushruta incorporates principles of careful tissue dissection, preservation of healthy structures, haemostasis, and postoperative care, which are conceptually similar to modern surgical techniques such as conjunctival autografting. Likewise, Nidana Parivarjana corresponds to current recommendations advocating ultraviolet protection, avoidance of environmental irritants, and long-term preventive care to reduce recurrence.

Despite considerable advances in understanding the molecular pathogenesis of pterygium, postoperative recurrence remains a significant therapeutic challenge. Persistent inflammation, fibroblast activation, angiogenesis, and limbal stem-cell dysfunction continue to contribute to disease recurrence following surgery. Ayurvedic interventions, including Kriyakalpa, internal medications, and Rasayana, may offer complementary supportive approaches aimed at restoring ocular surface homeostasis and promoting tissue healing. However, the available scientific evidence remains limited, and well-designed randomized controlled trials are required to establish their efficacy, safety, and role in integrative management.

The present review has certain limitations. It is based primarily on comparative interpretation of classical Ayurvedic literature and published biomedical evidence rather than direct clinical or experimental investigations. Differences in terminology and theoretical concepts also limit precise one-to-one correlation between traditional and modern disease mechanisms. Nevertheless, the consistency of clinical descriptions and therapeutic principles supports the relevance of comparative research and encourages future interdisciplinary studies integrating Ayurveda with evidence-based ophthalmology.

VIII. CONCLUSION

Arma and pterygium exhibit substantial similarities in anatomical location, clinical presentation, disease progression, and surgical management despite being described within different medical systems. Classical Ayurvedic concepts of Kapha–Rakta Dushti, Mamsa Vriddhi, and Srotodushti closely parallel contemporary mechanisms involving chronic inflammation, oxidative stress, limbal stem-cell dysfunction, angiogenesis, and fibrovascular proliferation. Both systems recognize the importance of environmental risk factors, timely diagnosis, preventive measures, and appropriate surgical intervention for preserving visual function.

Integrating classical Ayurvedic principles with modern ophthalmic knowledge may enhance the understanding of ocular surface disorders and provide a broader framework for disease prevention and management. Future multicentre clinical trials and translational studies are needed to evaluate Ayurvedic interventions using standardized outcome measures and to establish evidence-based integrative treatment strategies for Arma and pterygium.

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