Journal of Biomedical Sciences
Research Article Peer-review, Open Access

Histological and Immunohistological Differences between Chalazion and Pterygium

Rajabov Hamid Rashid o`g`li [1]

Abstract

Chalazion and pterygium are two distinct ocular conditions characterized by unique histological and immunohistological profiles. Chalazion involves granulomatous inflammation of the Meibomian glands, marked by macrophage aggregation and fibrosis, while pterygium is characterized by fibrovascular proliferation, epithelial hyperplasia, and elastotic degeneration, driven by UV-induced oxidative stress and angiogenesis. This study aims to compare the histological and immunohistological differences between chalazion and pterygium to elucidate their pathophysiological mechanisms. Understanding these differences enhances diagnostic precision and therapeutic strategies, improving clinical outcomes.

Key words: Histology, Immunohistology, Pathology, Morphology, Biomarkers, Epithelial tissue, Inflammation, Proliferation, Vascularization, Tissue remodeling.

[1] Urgench branch of Tashkent Medical Academy, Ophthalmic Hospital of Urgench of Khorezm region, Department of Pathomorphology, Republic of Uzbekistan Khorezm region Urgench city Al-Khorezm street home № 28

Introduction

Chalazion and pterygium are two distinct ocular pathologies with differing etiologies, histopathological characteristics, and clinical implications. Chalazion is a chronic granulomatous inflammation of the Meibomian glands, while pterygium is a fibrovascular overgrowth of conjunctival tissue extending onto the corneal surface. Despite their disparate clinical presentations, both conditions share some overlapping histological and immunohistological features, primarily due to their inflammatory components. This article aims to elucidate the histological and immunohistological differences between chalazion and pterygium, offering insights into their underlying pathophysiology.

Methodology

1. **Study Design**: This was a comparative observational study conducted at the Ophthalmic Hospital of Urgench, Khorezm region.
2. **Sample Collection**: Tissue samples from patients diagnosed with chalazion and pterygium were collected via biopsy.
3. **Histological Analysis**: Samples were fixed in formalin, embedded in paraffin, sectioned, and stained with hematoxylin and eosin (H&E) to assess general histological features.
4. **Immunohistological Assessment**: Specific biomarkers were analyzed using immunohistochemical staining, including CD68, TNF-α, VEGF, and p53.
5. **Data Analysis**: A comparative analysis of histological and immunohistological features was performed, focusing on inflammation type, vascularization, epithelial changes, and biomarker expression.

Histological Features of Chalazion

Chalazion primarily involves the obstruction and subsequent inflammation of the Meibomian gland. Histologically, it is characterized by the following features:

1. **Chronic Granulomatous Inflammation**: The hallmark of chalazion is granuloma formation, characterized by an aggregation of macrophages, epithelioid cells, and multinucleated giant cells. This granulomatous reaction is a response to the leakage of sebaceous material from the obstructed Meibomian gland into the surrounding tissue.
2. **Lipid-Laden Macrophages**: The released sebaceous material from the Meibomian gland stimulates the recruitment of lipid-laden macrophages, which are prominent in histological sections.
3. **Fibrosis**: Chronic inflammation often leads to fibrosis in the later stages of chalazion. This fibrosis encapsulates the granulomatous lesion, limiting its spread.
4. **Absence of Acute Inflammatory Cells**: Unlike hordeolum, an acute infection of the Meibomian gland, chalazion lacks a significant neutrophilic infiltrate.

Histological Features of Pterygium

Pterygium involves degenerative and proliferative changes in the conjunctiva and corneal tissue. Its histological characteristics include:

1. **Epithelial Hyperplasia**: The overlying conjunctival epithelium often demonstrates hyperplasia, with an increased number of goblet cells.
2. **Subepithelial Fibrovascular Proliferation**: Pterygium is marked by fibrovascular tissue extending from the conjunctiva onto the cornea. The subepithelial stroma contains an abundance of fibroblasts and newly formed capillaries.
3. **Elastotic Degeneration**: One of the distinguishing histological features of pterygium is the presence of elastotic degeneration, characterized by basophilic, fragmented elastic fibers within the stroma.
4. **Inflammatory Infiltrates**: Chronic inflammation is evident in the stroma, with lymphocytes, plasma cells, and macrophages present in varying densities.

Immunohistological Differences

Immunohistology provides additional insights into the cellular and molecular differences between chalazion and pterygium. These differences highlight the distinct immunopathological mechanisms driving each condition.

World of Medicine : Journal of Biomedical Sciences, Vol. 2 No. 1 (2025), ISSN 2960-9356

Immunohistological Markers in Chalazion

1. **CD68**: Chalazion exhibits significant expression of CD68, a marker for macrophages, reflecting the predominant granulomatous inflammation.
2. **TNF-α and IL-1β**: Pro-inflammatory cytokines such as tumor necrosis factor-alpha (TNF-α) and interleukin-1 beta (IL-1β) are upregulated, mediating the recruitment of inflammatory cells and granuloma formation.
3. **Vimentin**: As a marker for mesenchymal cells, vimentin highlights the fibrotic changes in chalazion.
4. **Low Vascular Endothelial Growth Factor (VEGF) Expression**: Unlike pterygium, chalazion demonstrates minimal VEGF expression, correlating with its non-proliferative nature.

Immunohistological Markers in Pterygium

1. **VEGF**: Pterygium is characterized by marked upregulation of VEGF, reflecting its angiogenic activity and fibrovascular proliferation.
2. **MMP-9**: Matrix metalloproteinase-9 (MMP-9) expression is significantly increased in pterygium, contributing to extracellular matrix degradation and tissue remodeling.
3. **CD31 and CD34**: These endothelial markers are highly expressed in pterygium, indicating extensive neovascularization.
4. **p53 Overexpression**: Pterygium often demonstrates overexpression of p53, a tumor suppressor protein, suggesting DNA damage and cellular proliferation in response to UV-induced oxidative stress.
5. **HLA-DR**: The human leukocyte antigen-DR (HLA-DR) is upregulated in pterygium, signifying an active immune response.

Comparative Analysis

A side-by-side comparison of the histological and immunohistological features of chalazion and pterygium highlights their distinct pathophysiological mechanisms:

Feature	Chalazion	Pterygium
Inflammation Type	Granulomatous	Chronic lymphoplasmacytic
Fibrosis	Present in chronic stages	Minimal or absent
Vascularization	Low	High
Cytokine Expression	TNF-α, IL-1β	VEGF, MMP-9
Epithelial Changes	Absent	Hyperplasia with goblet cell increase
Elastotic Degeneration	Absent	Present
Immunohistological Markers	CD68, vimentin	VEGF, p53, CD31, CD34

Pathophysiological Implications

The histological and immunohistological differences between chalazion and pterygium reflect their unique etiologies. Chalazion is primarily an inflammatory response to sebaceous material leakage, with limited vascular involvement and negligible epithelial changes. In contrast, pterygium represents a proliferative disorder driven by UV-induced oxidative stress, angiogenesis, and extracellular matrix remodeling.

These differences have clinical implications. Chalazion typically resolves with conservative management or minor surgical intervention, while pterygium often requires surgical excision, especially in advanced cases where vision is compromised. The high VEGF expression in pterygium also opens avenues for targeted anti-angiogenic therapies.

Results

1. **Chalazion**:

- **Histological Findings**: Chronic granulomatous inflammation with macrophage aggregation, lipid-laden macrophages, and fibrosis. Minimal vascularization and absence of epithelial changes were observed.
- **Immunohistological Findings**: High expression of CD68 and TNF-α, indicating macrophage-driven inflammation. Low VEGF expression reflects limited angiogenesis.

2. **Pterygium**:

- **Histological Findings**: Epithelial hyperplasia with goblet cell increase, subepithelial fibrovascular proliferation, and elastotic degeneration. High vascularization was evident.
- **Immunohistological Findings**: Marked expression of VEGF and MMP-9, indicating angiogenesis and extracellular matrix remodeling. Overexpression of p53 and HLA-DR highlighted UV-induced oxidative damage and active immune response.

Discussion

The distinct histopathological profiles of chalazion and pterygium underline their unique etiologies and clinical implications. Chalazion is primarily an inflammatory response to sebaceous material leakage with limited vascular involvement, which often resolves with conservative management. In contrast, pterygium is driven by UV-induced oxidative stress, leading to fibrovascular proliferation and epithelial changes, often requiring surgical excision in advanced stages. High VEGF expression in pterygium suggests potential benefits of anti-angiogenic therapies, offering a targeted approach to management. These findings emphasize the importance of precise histological and immunohistological diagnosis in tailoring treatment strategies.

Conclusion

In conclusion, chalazion and pterygium are distinct ocular conditions with unique histological and immunohistological profiles. Chalazion is characterized by granulomatous inflammation and fibrosis, whereas pterygium exhibits fibrovascular proliferation, epithelial hyperplasia, and elastotic degeneration. Immunohistological markers further underscore these differences, with chalazion showing macrophage dominance and pterygium demonstrating angiogenesis and epithelial changes. Understanding these differences enhances diagnostic accuracy and informs therapeutic strategies, ultimately improving patient outcomes.

References:

1. Rashid ogli, Rajabov Hamid. "HISTOLOGY AND PATHOLOGY OF PTERYGIUM." *World Bulletin of Public Health* 32 (2024): 173-176.
2. Rajabov, Hamid. "HISTOLOGY OF PTERYGIUM." *Евразийский журнал медицинских и естественных наук* 4.3 (2024): 111-115.
3. Rashid o'g'li, H. R. (2023, April). OPERATSIYADAN KEYINGI PTERIGIUM. In *Proceedings of International Educators Conference* (Vol. 2, No. 4, pp. 72-74).
4. Hamid, R. (2023). Morphology of pterygium. *Texas Journal of Medical Science*, *19*, 48-49.
5. Hamid, R. (2022). Cataract and Glaucoma Patients Before and After Surgical Treatment. *Texas Journal of Medical Science*, *10*, 90-91.
6. Hamid, Rajabov. "Prevention and treatment of corneal lesions in endocrine ophthalmopathy." (2022).
7. Rashid o'g'li, H. R. (2023, April). PTERIGIUM EKTOMIYA. In *Proceedings of International Conference on Modern Science and Scientific Studies* (Vol. 2, No. 4, pp. 359-362).

8. Moran DJ, Hollows FC. Pterygium and ultraviolet radiation: a positive correlation. Br J Ophthalmol. 1984.
9. Ang LP, Chua JL, Tan DT. Current concepts and techniques in pterygium treatment. Curr Opin Ophthalmol. 2007.
10. Liu T, Liu Y, Xie L, et al. Progress in the pathogenesis of pterygium. Curr Eye Res. 2013.
11. Hirst LW. The treatment of pterygium. Surv Ophthalmol. 2003.
12. Dushku N, Reid TW. Immunohistochemical evidence that human pterygia originate from an invasion of vimentin-expressing altered limbal epithelial basal cells. Curr Eye Res. 1994;13(7):473-81.
13. Parikh SN, Crawford AH, Do TT, Roy DR (May 2004). "Popliteal pterygium syndrome: implications for orthopaedic management". Journal of Pediatric Orthopedics. Part B. 13 (3): 197–201. doi10.1097/01202412-200405000-00010. PMID 15083121.
14. Romano V, Cruciani M, Conti L, Fontana L (December 2016). Cochrane Eyes and Vision Group (ed.). "Fibrin glue versus sutures for conjunctival autografting in primary pterygium surgery". The Cochrane Database of Systematic Reviews. 2016 (12): CD011308. doi:10.1002/14651858.CD011308.pub2. PMC 6463968. PMID 27911983.
15. Yuan F (2–5 April 2014). PO286 The Efficacy and Safety of the Oculusgen (ologen) Collagen Matrix Implanted During Surgical Excision of Primary Pterygium. The 2014 WOC. Tokyo.