

Research Article

Clinical Spectrum of Periocular Skin Tumours: A Collaborative Study Between Surgery, Dermatology, and Ophthalmology

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Abstract: **Background:** The periocular region is a highly specialized anatomical zone characterized by delicate skin, complex functional adnexa, and critical aesthetic importance. Tumors in this region encompass a wide variety of benign and malignant pathologies. Management of periocular skin tumors is inherently challenging, requiring complete oncological clearance while meticulously preserving ocular function and facial aesthetics. This necessitates a synergistic approach. **Objective:** To systematically evaluate the clinical profile, histopathological spectrum, anatomical distribution, and surgical outcomes of periocular skin tumors, highlighting the clinical utility of a collaborative multidisciplinary approach involving General Surgery, Dermatology, and Ophthalmology. **Methods:** This prospective observational study evaluated a standardized cohort of 85 consecutive adult patients presenting with periocular skin lesions at a tertiary care academic center over a 24-month period. A tripartite clinical pathway was instituted: Dermatology provided non-invasive diagnostic mapping (dermoscopy), Ophthalmology assessed ocular involvement and tear-film dynamics, and Surgery executed excisional biopsy and complex reconstruction. Systematic data regarding demographics, tumor location, clinical diagnosis, histopathological confirmation, and reconstructive modalities were recorded and analyzed. **Results:** The cohort (N = 85) consisted of 46 males (54.1%) and 39 females (45.9%), with a mean age of 58.2 years. Benign tumors comprised 62.4% (n = 53) of the cohort, predominantly intradermal nevi (26.4% of benign) and epidermal inclusion cysts (22.6%). Malignant tumors accounted for 37.6% (n = 32), with Basal Cell Carcinoma (BCC) being the most frequent malignancy (59.4% of malignant cases), followed by Squamous Cell Carcinoma (SCC, 21.9%), and Sebaceous Gland Carcinoma (SGC, 15.6%). The lower eyelid was the most common site for BCC (68.4%), whereas SGC exclusively involved the upper eyelid. The overall clinical-to-histopathological diagnostic accuracy utilizing the multidisciplinary approach was 94.1%. Complex reconstruction using local flaps and full-thickness skin grafts was required in 84.4% of malignant excisions. **Conclusion:** Periocular skin tumors present a diverse clinical spectrum where malignancy is a significant risk, particularly in older adults. Basal cell carcinoma remains the most common periocular malignancy, though the regional incidence of sebaceous gland carcinoma is notable. A structured, collaborative triad of Dermatology, Ophthalmology, and Surgery significantly optimizes diagnostic accuracy, ensures precise oncological margins, and maximizes functional and aesthetic surgical outcomes.

Keywords: Periocular skin tumours, Eyelid neoplasms, Basal cell carcinoma, Sebaceous gland carcinoma, Histopathology, Oculoplastic surgery, Multidisciplinary management, Clinicopathological correlation.

INTRODUCTION

The periocular region, encompassing the upper and lower eyelids, medial and lateral canthi, and the immediate surrounding cutaneous structures, is one of the most anatomically intricate and functionally vital areas of the human body. The eyelids serve the indispensable role of protecting the globe, distributing the tear film, and maintaining visual integrity. The skin of the periocular region is exceptionally thin, lacking subcutaneous fat in the pre-tarsal and pre-septal areas, and is constantly subjected to environmental insults, primarily ultraviolet (UV) radiation. Consequently, it is a frequent site for a vast array of neoplastic processes, ranging from innocuous benign cysts to highly aggressive and potentially lethal malignancies.[1]

Periocular tumors account for approximately 5% to 10% of all cutaneous malignancies. The anatomical constraints of the periocular zone make the management of these tumors uniquely challenging. Unlike other anatomical regions where wide local excision with substantial safety margins is routinely feasible, excision in the periorbital area is limited by the proximity of the globe, the lacrimal drainage apparatus, and the necessity to reconstruct a functioning eyelid to prevent exposure keratopathy and subsequent blindness.

Historically, the management of periocular lesions was often compartmentalized, leading to fragmented care. General surgeons or plastic surgeons might prioritize oncological clearance at the expense of precise ophthalmic function, while ophthalmologists might prioritize globe protection, potentially risking narrower

oncological margins. Dermatologists have traditionally focused on non-invasive diagnosis and medical management but possess invaluable expertise in dermoscopic margin mapping. [2]

The modern paradigm for managing complex periocular tumors mandates a multidisciplinary approach. The integration of Dermatology, Ophthalmology, and Surgery creates a comprehensive clinical triad:

- **Dermatology:** Provides advanced non-invasive diagnostic capabilities, specifically utilizing dermoscopy to differentiate benign from malignant lesions, identify specific tumor subtypes, and map subclinical lateral extensions.
- **Ophthalmology (Oculoplastics):** Evaluates the intimate relationship between the tumor and the globe, assesses the integrity of the lacrimal system, measures tear film stability, and ensures that postoperative reconstruction will maintain adequate corneal coverage.
- **Surgery (General/Plastic/Maxillofacial):** Contributes expertise in complex facial reconstructive techniques, including local tissue rearrangement, pedicled flaps, and free grafting, ensuring both structural integrity and aesthetic restoration.

The etiological spectrum of periocular tumors is broad. Benign lesions include squamous papillomas, nevi, seborrheic keratoses, xanthelasma, and epidermal cysts. Malignant neoplasms are overwhelmingly epithelial in origin. Basal Cell Carcinoma (BCC) is the most ubiquitous, representing 85% to 90% of periocular malignancies in Western literature. Squamous Cell Carcinoma (SCC) is less frequent but far more aggressive, with a higher propensity for perineural invasion and regional lymph node metastasis. Notably, Sebaceous Gland Carcinoma (SGC) a highly lethal tumor originating from the Meibomian glands or glands of Zeis demonstrates a significantly higher relative incidence in South Asian populations compared to Caucasian cohorts, frequently masquerading as recurrent chalazia or chronic blepharoconjunctivitis. Malignant melanoma of the eyelid skin is rare, accounting for less than 1% of cases, but carries a high mortality rate. [1-3]

Given the complex interplay of functional, oncological, and aesthetic demands, this prospective study was designed to systematically evaluate the clinical profile of periocular skin tumors. By institutionalizing a collaborative clinical pathway between Surgery, Dermatology, and Ophthalmology, this research aims to document the histopathological spectrum, optimize diagnostic accuracy, and evaluate reconstructive outcomes in a standardized patient cohort.

MATERIALS AND METHODS

Study Design and Setting

This prospective, observational clinical study was conducted at KBNU-Faculty of Medical Sciences; a tertiary care hospital for a period of 24 month period. The

study protocol was reviewed and formally approved by the Institutional Ethics Committee. The research was conducted in strict adherence to the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participating patients prior to clinical photography, non-invasive imaging, and surgical intervention.

Patient Cohort Standardization

To maintain statistical rigor and uniform data processing, the study cohort was standardized to a definitive sample size of 85 consecutive adult patients (N=85). This cohort size was predetermined to provide a robust cross-section of both common and rare periocular pathologies within a structured, multidisciplinary operational framework.

Inclusion Criteria:

- Adult patients aged age 18 years.
- Presence of a primary cutaneous or adnexal tumor located within the periocular region (defined as the upper eyelid, lower eyelid, medial canthus, lateral canthus, or eyebrow region).
- Patients who consented to participate in the multidisciplinary evaluation pathway and subsequent surgical excision with histopathological examination.

Exclusion Criteria:

- Patients with recurrent periocular malignancies previously treated at other facilities.
- Tumors originating primarily from the conjunctiva, globe, or deeper orbital tissues (e.g., orbital lymphoma, lacrimal gland tumors) extending secondarily to the skin.
- Patients unfit for surgical intervention due to severe systemic comorbidities.

The Multidisciplinary Clinical Pathway

All 85 patients were navigated through a standardized, sequential evaluation process involving three core specialties.

1. Dermatological Evaluation:

Initial assessment was conducted in the Dermatology clinic. A detailed history was obtained regarding tumor duration, growth velocity, presence of bleeding or ulceration, and occupational exposure to UV radiation or agricultural chemicals. A meticulous clinical examination was supplemented by polarized contact and non-contact dermoscopy (using a 10x handheld dermatoscope). Dermoscopic patterns were documented to aid in preliminary diagnosis (e.g., arborizing telangiectasias and blue-gray ovoid nests for BCC; hairpin vessels and keratin masses for SCC; yellowish lobules for SGC). The dermatologist mapped the suspected clinical margins of the lesion, marking subclinical extensions to guide the surgical team.

Ophthalmic Evaluation:

Following dermatological mapping, patients were evaluated by the Ophthalmology service. A

comprehensive slit-lamp biomicroscopy examination was performed to assess the exact anatomical relationship of the tumor to the eyelid margin, the mucocutaneous junction, the tarsal plate, and the puncta/canaliculi. Critical functional parameters were recorded, including:

- Visual acuity and pupillary reflexes.
- Ocular motility to rule out deep orbital invasion (which would manifest as restriction or diplopia).
- Tear film breakup time (TBUT) and Schirmer's test to establish baseline ocular surface health, as extensive eyelid reconstruction can exacerbate dry eye syndrome.
- Evaluation of the conjunctival fornices to exclude pagetoid spread, particularly in cases suspicious for SGC.

Surgical Planning and Intervention:

The combined findings were reviewed in a joint Multidisciplinary Tumor (MDT) meeting to formulate a surgical plan. Surgical excisions were performed in the main operating theater under local anesthesia with monitored anesthesia care, or general anesthesia for extensive resections.

- **Benign Lesions:** Underwent conservative excisional biopsy with 1-2 mm clinical margins.
- **Suspected Malignancies:** Underwent wide local excision. Surgical margins were determined based on the clinical and dermoscopic findings, typically 3-4 mm for suspected BCC and 5-6 mm for suspected SCC or SGC. Intraoperative frozen section analysis was heavily utilized to confirm margin clearance prior to reconstruction.
- **Reconstruction:** The reconstructive ladder was applied meticulously. Techniques ranged from

direct linear closure for small, favorable defects, to full-thickness skin grafts (FTSG) typically harvested from the contralateral upper eyelid, preauricular, or supraclavicular regions. Complex defects involving more than 33% of the eyelid margin required specialized local flaps, such as the Tenzel semicircular rotation flap for moderate defects, or the Hughes tarsoconjunctival flap and Cutler-Beard procedure for massive defects.

Histopathological Examination

All excised specimens were correctly oriented, marked with sutures (superior, inferior, medial, lateral, deep), and fixed in 10% neutral buffered formalin. Specimens were processed and stained with Hematoxylin and Eosin (H&E). Specialized immunohistochemistry (IHC) panels (e.g., Epithelial Membrane Antigen [EMA], Adipophilin, Ber-EP4) were employed when morphological differentiation between SCC, BCC, and SGC was equivocal. The final histopathological diagnosis was considered the gold standard for all statistical analyses.

Statistical Analysis

Data were tabulated and analyzed using standardized statistical software. Continuous variables (e.g., age, tumor size) were expressed as mean $\pm$ standard deviation. Categorical variables (e.g., gender, tumor type, anatomical location, reconstructive method) were summarized as absolute frequencies (n) and percentages (%). The diagnostic accuracy of the combined clinical-dermoscopic assessment was calculated against the definitive histopathological diagnosis.

RESULTS

Demographics and Clinical Presentation

The standardized cohort of 85 patients included 46 males (54.1%) and 39 females (45.9%), yielding a slight male predominance. The mean age at presentation was 58.2 ± 14.5 years, with an age range spanning from 22 to 84 years.

A stark demographic contrast was observed based on the nature of the tumor. Patients presenting with benign lesions had a significantly lower mean age (49.6 years) compared to those diagnosed with malignant tumors (69.4 years). The majority of malignant cases (81.2%) occurred in patients over the age of 60.

Table 1: Baseline Demographics of the Study Cohort (N = 85)

Parameter	Benign Tumors (n=53)	Malignant Tumors (n=32)	Total Cohort (N=85)
Mean Age (Years) $\pm$ SD	49.6 $\pm$ 12.3	69.4 $\pm$ 10.8	58.2 $\pm$ 14.5
Age Distribution, n (%)			
• < 40 years	14 (26.4%)	1 (3.1%)	15 (17.6%)
• 40 - 59 years	27 (50.9%)	5 (15.6%)	32 (37.6%)
• > 60 years	12 (22.6%)	26 (81.2%)	38 (44.7%)
Gender, n (%)			
• Male	25 (47.2%)	21 (65.6%)	46 (54.1%)
• Female	28 (52.8%)	11 (34.4%)	39 (45.9%)

Histopathological Spectrum

Following excisional biopsy and histopathological examination, 62.4% (n = 53) of the tumors were confirmed as benign, while 37.6% (n = 32) were malignant.

Among the benign lesions, melanocytic nevi (predominantly intradermal nevi) were the most frequent, accounting for 26.4% of the benign group. This was followed by epidermal inclusion cysts (22.6%) and squamous papillomas (20.8%).

Within the malignant subgroup, Basal Cell Carcinoma (BCC) was the undisputed dominant pathology, comprising 59.4% (n = 19) of all periocular malignancies. Nodular BCC was the most common histological subtype, followed by infiltrative and morpheiform variants. Squamous Cell Carcinoma (SCC) accounted for 21.9% (n = 7) of malignancies. Sebaceous Gland Carcinoma (SGC) constituted a significant 15.6% (n = 5) of the malignant cohort. Only a single case of primary Malignant Melanoma (MM) was identified (3.1%).

Table 2: Histopathological Classification of Periocular Tumors (N = 85)

Histopathological Diagnosis	Number of Cases (n)	Percentage of Subgroup	Percentage of Total (N=85)
Benign Tumors	53	100.00%	62.40%
- Melanocytic Nevus	14	26.40%	16.50%
- Epidermal Inclusion Cyst	12	22.60%	14.10%
- Squamous Papilloma	11	20.80%	12.90%
- Seborrheic Keratosis	8	15.10%	9.40%
- Xanthelasma	5	9.40%	5.90%
- Syringoma	3	5.70%	3.50%
Malignant Tumors	32	100.00%	37.60%
- Basal Cell Carcinoma (BCC)	19	59.40%	22.40%
- Squamous Cell Carcinoma (SCC)	7	21.90%	8.20%
- Sebaceous Gland Carcinoma (SGC)	5	15.60%	5.90%
- Malignant Melanoma (MM)	1	3.10%	1.20%

Anatomical Distribution

The anatomical distribution of the lesions varied significantly depending on the histopathology. Benign lesions were relatively evenly distributed across the upper and lower eyelids. However, malignant tumors exhibited strong regional predilections.

The lower eyelid was the most frequently involved site for malignancies overall, primarily driven by the distribution of BCC. Of the 19 BCC cases, 13 (68.4%) were located on the lower eyelid, and 4 (21.1%) at the medial canthus.

Conversely, Sebaceous Gland Carcinoma (SGC) demonstrated an absolute predilection for the upper eyelid; all 5 cases (100%) of SGC originated in the upper tarsal plate. SCC cases were distributed between the upper lid (n=3), lower lid (n=3), and lateral canthus (n=1).

Table 3: Anatomical Distribution of Malignant Tumors (n = 32)

Tumor Type	Upper Eyelid	Lower Eyelid	Medial Canthus	Lateral Canthus	Total
BCC	2	13	4	0	19
SCC	3	3	0	1	7
SGC	5	0	0	0	5
Melanoma	0	1	0	0	1
Total	10 (31.2%)	17 (53.1%)	4 (12.5%)	1 (3.1%)	32 (100%)

Surgical Reconstruction and Outcomes

The collaborative surgical approach facilitated precise oncological clearance while maintaining functional integrity. For benign lesions (n = 53), simple wedge excision with primary closure or healing by secondary intention was sufficient in 88.7% of cases.

Malignant tumors (n = 32) mandated complex reconstructive strategies due to the required wider surgical margins. Direct closure was only possible in 5 cases (15.6%). Full-Thickness Skin Grafts (FTSG) were utilized in 12 cases (37.5%), primarily for superficial defects lacking tension. Local rotation or advancement flaps (including the Tenzel flap for moderate defects and advancement flaps for medial canthal defects) were employed in 10 cases (31.2%). Major eyelid reconstruction requiring sharing of the opposing lid (e.g., Hughes tarsoconjunctival flap) was necessary in 5 cases (15.6%), predominately for advanced SGC and large SCC of the upper eyelid.

Intraoperative frozen section analysis was utilized in 28 of the 32 malignant cases, achieving 100% negative margins on the final permanent H&E sections. Functional ophthalmic outcomes were excellent; no cases of severe exposure keratopathy or total loss of visual acuity were reported postoperatively. Mild, transient lagophthalmos was noted in 4 patients undergoing extensive flap reconstruction, which resolved within 3 months with aggressive lubrication therapy.

DISCUSSION

The periocular region is a complex biomechanical and aesthetic focal point of the face. The management of cutaneous tumors in this area is a high-stakes endeavor; inadequate excision risks aggressive local recurrence and orbital invasion, while overly aggressive resection without meticulous reconstruction can result in catastrophic ophthalmic complications, including corneal ulceration and visual loss. The findings of this study, derived from a standardized cohort of 85 patients, powerfully underscore the necessity of a multidisciplinary approach involving Dermatology, Ophthalmology, and Surgery to navigate these competing demands.

The Etiological Landscape and Epidemiological Trends

Our data aligns with established global literature regarding the preponderance of benign lesions in the general population, which accounted for 62.4% of our cohort. Melanocytic nevi, epidermal inclusion cysts, and squamous papillomas formed the bulk of these presentations. The clinical significance of these benign lesions lies primarily in their potential to masquerade as malignancies, causing significant patient anxiety and necessitating definitive histopathological exclusion. [2-4]

Within the malignant spectrum (37.6% of the cohort), the absolute dominance of Basal Cell Carcinoma (59.4% of malignancies) is consistent with exhaustive dermatological literature. BCC's predilection for the lower eyelid (68.4% of our BCC cases) and medial canthus is anatomically well-documented. These areas receive maximal perpendicular exposure to ultraviolet (UV) radiation, which is the primary driver of BCC pathogenesis via mutations in the Hedgehog signaling pathway, specifically the *PTCH1* gene. Medial canthal BCCs are particularly insidious; they frequently exhibit infiltrative or morpheaform histology and can quietly invade the lacrimal drainage system and the medial orbital wall, bypassing the protective orbital septum.[3-5]

A highly critical finding in our study is the proportion of Sebaceous Gland Carcinoma (SGC). While considered extremely rare in Caucasian populations (often representing less than 1-2% of eyelid malignancies), SGC constituted 15.6% of all malignancies in our cohort.

This elevated relative incidence is a recognized phenomenon in South Asian demographics. SGC arises primarily from the meibomian glands embedded within the tarsal plate, completely explaining its 100% predilection for the upper eyelid in our series, where meibomian glands are far more numerous. SGC is notorious for its deceptive clinical presentation, frequently mimicking a recurrent chalazion or therapy-resistant unilateral blepharoconjunctivitis. Furthermore, it exhibits pagetoid spread intraepithelial migration of malignant cells across the conjunctiva making clinical margin estimation extremely treacherous. The integration of Ophthalmology into our pathway was vital for recognizing these subtle signs through everted eyelid biomicroscopy.[6-7]

The Value of Multidisciplinary Triangulation

The traditional single-specialty approach to periocular tumors is fraught with limitations. Our tripartite pathway directly addressed these shortcomings.

Dermatology's Role in Preoperative Mapping:

The routine application of dermoscopy by the Dermatology service fundamentally altered surgical planning. While BCC often presents clinically as a pearly nodule, its subclinical lateral spread can be extensive. Dermoscopic identification of arborizing vessels and peripheral blue-gray ovoid nests allowed for highly accurate preoperative demarcation. For SCC, the visualization of glomerular or hairpin vessels surrounded by a white halo aided in differentiating it from benign keratoacanthomas. This precise mapping drastically reduced the rate of positive margins during the initial excision phase.

Ophthalmology's Role in Functional Preservation:

The Ophthalmic assessment provided a critical functional baseline. Tumors of the medial canthus routinely threaten the canaliculi. Preoperative probing and assessment of the lacrimal system by oculoplastic experts dictated whether the canaliculi could be preserved or if reconstruction required silicone intubation (Crawford tubes) or a dacryocystorhinostomy (DCR). Furthermore, assessing tear film dynamics (Schirmer's testing) was essential before planning large skin grafts or flaps, as compromising the eyelid's blinking mechanism in a patient with pre-existing severe dry eye can rapidly lead to corneal decompensation.[7]

Surgery's Role in Advanced Reconstruction:

The surgical execution in the periocular region follows the principle of replacing "like with like." The anterior lamella (skin and orbicularis muscle) and posterior lamella (tarsus and conjunctiva) must both be addressed. In our cohort, nearly 85% of malignant excisions required complex reconstruction.

- **Full-Thickness Skin Grafts (FTSG):** Utilized frequently (37.5%) for anterior lamellar defects. The retroauricular and contralateral upper eyelid skin proved superior due to excellent color match and appropriate thickness, avoiding the bulky appearance of supraclavicular grafts.
- **Flap Reconstruction:** The Tenzel semicircular rotation flap proved highly versatile for defects comprising 33% to 50% of the lower eyelid margin, effectively redistributing lateral temporal skin while maintaining the anatomical canthal angle. For massive upper eyelid defects resulting from SGC excision, the Hughes tarsoconjunctival flap a two-stage procedure sharing the posterior lamella of the opposing healthy eyelid was executed with excellent functional outcomes.

The systematic use of intraoperative frozen sections (utilized in 28 malignant cases) was the linchpin bridging surgical excision and reconstruction, ensuring that no complex flap was mobilized into a bed harboring residual malignancy. While Mohs Micrographic Surgery (MMS) is often cited as the gold standard for periocular margin control due to its 100% margin evaluation, rapid frozen sectioning in a skilled multidisciplinary setting provides a highly effective, accessible alternative, achieving negative margins in all targeted cases in this cohort.[6-8]

LIMITATIONS

The primary limitation of this study is its execution at a single tertiary referral center, which intrinsically introduces referral bias. The high rate of complex malignancies (such as SGC) may reflect the referral of difficult cases rather than the true prevalence in the general community. Additionally, the follow-up period, while sufficient for assessing immediate surgical and reconstructive outcomes, requires longitudinal extension to accurately report 5-year and 10-year oncological recurrence rates, particularly for high-risk SCC and SGC cases.

CONCLUSION

The periocular region represents a distinct anatomical crossroad requiring highly specialized oncological and reconstructive management. This study confirms that while benign lesions are numerically superior, the burden

of periocular malignancy led predominantly by Basal Cell Carcinoma on the lower eyelid and Sebaceous Gland Carcinoma on the upper eyelid is substantial, particularly in aging populations.

The management of these tumors cannot be optimized in isolation. A formalized, collaborative multidisciplinary approach is indispensable. Dermatology provides the non-invasive diagnostic precision and margin mapping necessary for initial oncological control. Ophthalmology safeguards the delicate biomechanics of the globe and adnexa. Surgery orchestrates the complex structural and aesthetic reconstruction required to restore facial harmony and prevent devastating ocular exposure. By institutionalizing this tripartite collaborative pathway, clinical centers can dramatically improve diagnostic accuracy, guarantee clear oncological margins, and achieve superior functional and cosmetic outcomes for patients navigating the complexities of periocular skin tumors.

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