



ORIGINAL ARTICLE

# Demographic and clinical characteristics of eyelid tumors in a tertiary ophthalmologic clinic: A retrospective analysis

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## Abstract

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Eyelid tumors represent a diverse group of ocular adnexal pathologies, ranging from innocuous benign lesions to highly aggressive malignant forms. Recognizing the demographic and clinical determinants associated with these tumors is crucial for improving diagnostic accuracy and selecting appropriate surgical strategies. The present study evaluates the demographic profile, histopathological spectrum, anatomical distribution, and surgical approaches for eyelid tumors managed at a tertiary ophthalmology center. A retrospective analysis was performed on 194 patients who underwent excision or biopsy of eyelid lesions between January 2020 and October 2025. Collected variables included patient age, sex, occupation, tumor laterality and anatomical site, histopathological diagnosis, surgical technique, anesthesia type, and biological behavior. Both descriptive and analytical statistical methods were applied, supplemented by visual tools such as kernel density plots, Pareto distribution charts, and malignancy risk mapping. Among the 194 cases reviewed, 97 were male and 97 females, with a mean age of 47.8 years (2–91 years). Benign tumors accounted for 128 patients (66%), whereas malignant lesions were identified in 66 individuals (34%). Chalazion, intradermal nevus, and verruca vulgaris were the

most common benign diagnoses. Basal cell carcinoma was the most common malignant tumor, followed by squamous cell carcinoma and sebaceous carcinoma. Malignant tumors occurred in significantly older patients ( $p < 0.01$ ). A greater incidence of malignancy was observed in tumors located on the lower eyelid. The majority of excisions (88.1%) were performed under local anesthesia. Eyelid tumors in our cohort demonstrated a predominance of benign lesions, though malignant tumors represented a substantial minority. Age and anatomical location were strong predictors of malignancy. Our findings underscore the importance of regional epidemiologic data in guiding clinical suspicion and surgical decision-making.

## Introduction

Eyelid neoplasms represent a clinically significant subset of ocular adnexal pathology. They comprise a wide histopathological spectrum, from benign lesions such as chalazion and papillomas to highly aggressive malignant tumors. Although benign lesions predominate, malignant eyelid tumors demand early recognition due to their potential for local invasion, recurrence, and occasional metastasis [1].

International series indicate that benign eyelid lesions account for the vast majority of excised tumors [2,3]. Nevertheless, malignant tumors are clinically relevant. Basal cell carcinoma (BCC) is by far the most common malignant tumor of the eyelid, accounting for 80–90% of cases in Western cohorts [4,5]. Squamous cell carcinoma (SCC), sebaceous carcinoma, and malignant melanoma are less frequent but carry greater morbidity and mortality [6–8]. Geographic variation exists, with sebaceous carcinoma relatively more frequent in Asian series [9].

Demographic risk factors are well established. Malignant tumors tend to occur in older patients, reflecting cumulative ultraviolet (UV) radiation exposure and genomic instability [10,11]. Anatomical distribution shows a clear pattern, with the lower eyelid and medial canthus being more frequently involved, possibly attributable to their relatively thin skin and greater exposure to ultraviolet radiation [12,13].

Although considerable knowledge exists on eyelid tumors, region-specific data remain scarce in numerous countries. Identifying local epidemiological trends and clinical characteristics is crucial for refining diagnostic judgment, enhancing accuracy, and optimizing surgical decision-making. Accordingly, this study was designed to assess the demographic profile, clinical presentation, and histopathological patterns of eyelid tumors treated at our tertiary ophthalmology center.

## Materials and Methods

This retrospective observational study was conducted in a tertiary ophthalmology clinic between January 2020 and October 2025. Approval was obtained from the Institutional Review Board of Ethics Committee of Afyonkarahisar Health Sciences University (protocol no 2025/339 and date of approval 2 May 2025), and the study adhered to the Declaration of Helsinki. Given the retrospective design of the study, the requirement for individual informed consent was deemed unnecessary according to national regulations by the ethics committee. All data were anonymized prior to analysis to ensure patient confidentiality.

## Study population

Inclusion criteria comprised patients who underwent excision or biopsy of eyelid tumors with histopathologically confirmed diagnoses and complete clinical data. Patients with insufficient pathology documentation or lesions arising outside the eyelid were excluded from the study.

## Data collection

Patient information was retrieved from electronic medical records, pathology reports, and operative notes. The dataset encompassed several variables, including:

**Demographic data:** age, sex, and occupational background.

**Tumor features:** histopathological diagnosis, classification as benign or malignant, lesion laterality, and anatomical localization.

**Surgical parameters:** excision type (simple or reconstructive), anesthesia modality (local or general), and wound closure technique.

All histopathological results were categorized based on World Health Organization (WHO) diagnostic standards as either benign or malignant.

## Statistical analysis

Continuous data were reported as mean  $\pm$  standard deviation, along with corresponding median values and range distributions. Categorical variables were expressed as frequencies and percentages. Differences in age between benign and malignant groups were analyzed using Student's t-test, and associations between categorical variables were tested with  $\chi^2$  or Fisher's exact tests. Significance was set at  $p < 0.05$ . Additionally, 95% confidence intervals (CIs) were calculated for key comparisons where appropriate. A multivariable logistic regression analysis was performed to evaluate the independent effects of age, sex, and anatomical location on the likelihood of malignancy. Odds ratios (ORs) with 95% confidence intervals were reported.

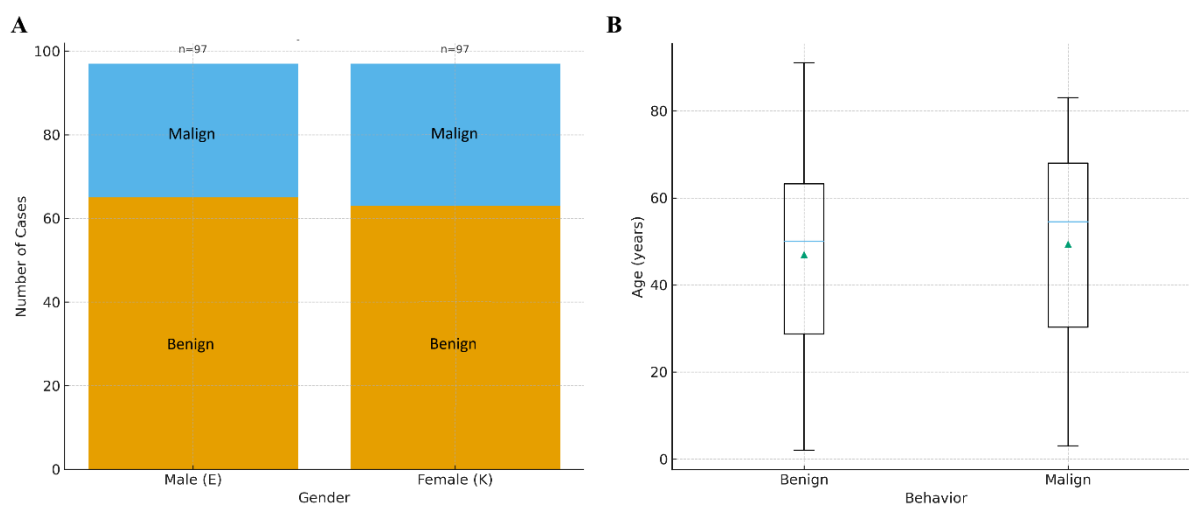
## Results

Data representation provides a comprehensive overview of the dataset, including age distribution, tumor behavior by sex, histopathological frequencies, and anatomical site correlations. The study included 194 patients, evenly divided between males and females (97 each). Figure 1A demonstrates that tumor behavior was almost evenly distributed between male and female patients, indicating no significant sex-related predisposition. Similarly, the heatmap in Figure 2A illustrates subtype frequencies across genders, revealing no notable gender-specific trends. The overall mean age of the cohort was  $47.8 \pm 22.2$  years, with a median age of 52 years (range: 2–91). The overall age distribution demonstrated a broad spread across all decades, with clustering in the fifth and sixth decades (Supp. Figure 1). Of the total 194 cases evaluated, benign tumors constituted the majority with 128 instances (66%), whereas 66 lesions (34%) were identified as malignant. Local anesthesia was used for most procedures (88.1%), while general anesthesia was predominantly selected for large resections or operations involving children. Malignant tumors more frequently required reconstructive procedures. Malignant tumors occurred in significantly older patients compared with benign lesions ( $p < 0.01$ ), as clearly depicted in the boxplot comparison (Figure 1B). Details of demographic and clinical characteristics are provided in Table 1. Multivariable logistic regression analysis demonstrated that increasing age and lower eyelid location were independent predictors of malignancy, whereas sex was not significantly associated.

**Table 1.** Demographic and clinical characteristics of patients with eyelid tumors.

Variable	Value
Age (Mean ± SD)	47.8 ± 22.2
Age (Median, Range)	52.0 (2–91)
Sex (Male)	97
Sex (Female)	97
Tumor Behavior (Benign)	128
Tumor Behavior (Malignant)	66
Local Anesthesia	174
General Anesthesia	20

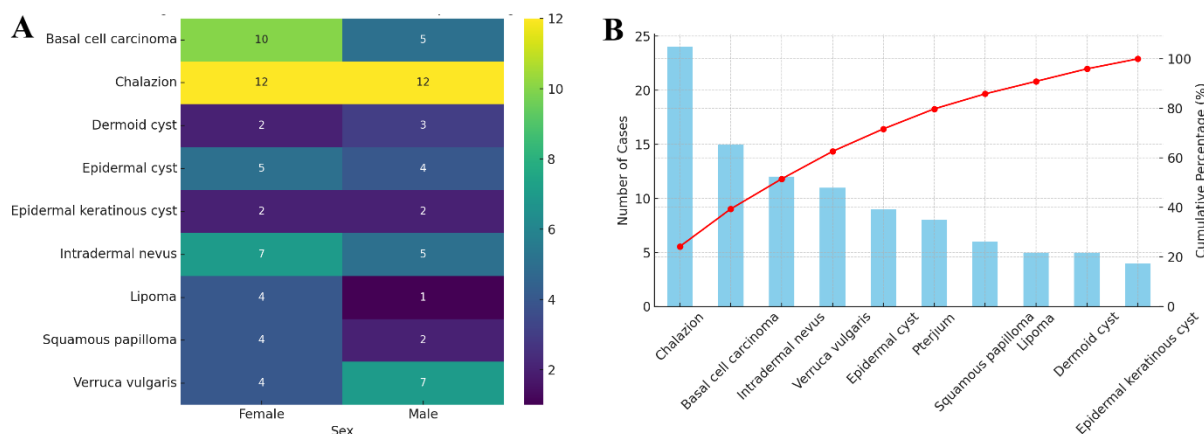
Chalazion (18%), intradermal nevus (9.4%), and epidermal cyst (7%) were the most frequent benign tumors. Basal cell carcinoma (21.2%) predominated among malignant tumors, followed by verruca vulgaris (16.7%) and malignant melanoma (6.1%). A detailed summary of the most frequent eyelid tumors and their malignant proportions is provided in Table 2, while the relative histopathological frequencies are visually demonstrated in the Pareto chart (Figure 2B).



**Figure 1.** Gender and age distribution of eyelid tumors.

**A)** Stacked bar chart showing the proportion of benign and malignant tumors among male and female patients. The distribution of tumor cases across sexes appeared nearly equivalent, with males and females presenting comparable rates of both benign and malignant lesions, indicating no notable gender dominance in our sample. **B)** The box-and-whisker plot illustrates age differences between benign and malignant groups. The box represents the interquartile range (IQR), the median is marked by the central horizontal line, and the whiskers display the minimum and maximum non-outlier values. Notably, patients with malignant tumors tended to be older than those with benign lesions ( $p < 0.01$ ). This highlights the strong association between advancing age and malignant tumor behavior.

Malignant tumors were more frequent in the lower eyelid compared with the upper eyelid. Laterality was evenly distributed. Distribution of the eyelid tumors by anatomical region and behavior are summarized in Table 3.



**Figure 2.** Heatmap of pathology distribution by sex and Pareto analysis of the most frequent histopathological diagnoses.

*A)* The heatmap provides a two-dimensional visualization of the distribution of common benign and malignant tumor subtypes categorized by sex. Increased color intensity denotes higher case frequency, allowing subtle variations to be observed, although no substantial sex-related differences were evident in our cohort. *B)* The combined bar and cumulative line chart illustrates the frequency of the ten most prevalent eyelid tumors. While the bars display the absolute number of cases for each histopathological type, the cumulative trend line indicates that these ten entities constitute more than 80% of all lesions. This concentration underscores the relevance of a limited group of diagnoses in clinical practice and supports clinicians in refining differential diagnosis priorities.

**Table 2.** Distribution of the most frequent eyelid tumors by histopathology and behavior.

Histopathology	Benign (n)	Ratio (%)	Malignant (n)	Ratio (%)	Total	Ratio (%)
<b>Chalazion</b>	23	18	1	1,5	24	12,4
<b>Basal Cell Carcinoma</b>	1	0,8	14	21,2	15	7,7
<b>Intradermal Nevus</b>	12	9,4	0	0	12	6,2
<b>Verruca Vulgaris</b>	0	0	11	16,7	11	5,7
<b>Epidermal Cyst</b>	9	7	0	0	9	4,6
<b>Pterygium</b>	8	6,3	0	0	8	4,1
<b>Squamous Papilloma</b>	4	3,1	2	3	6	3,1
<b>Dermoid Cyst</b>	4	3,1	1	1,5	5	2,6
<b>Lipoma</b>	5	3,9	0	0	5	2,6
<b>Epidermal Type Keratinous Cyst</b>	4	3,1	0	0	4	2,1
<b>Intradermal Melanocytic Nevus</b>	1	0,8	3	4,5	4	2,1
<b>Malignant Melanoma</b>	0	0	4	6,1	4	2,1
<b>Ruptured Epidermal Cyst</b>	3	2,3	0	0	3	1,5
<b>Fibroepithelial Polyp</b>	3	2,3	0	0	3	1,5
<b>Undefined</b>	51	39,8	30	45,5	81	41,8

Among the participants, 26 (13.40%) were diagnosed with a right lower eyelid mass, 8 (4.12%) with a right conjunctival mass, 25 (12.89%) with a right upper eyelid mass, 23 (11.86%) with a left lower eyelid mass, 16 (8.25%) with a left conjunctival mass, 25 (12.89%) with a left upper eyelid mass, and 71 (36.60%) with other lesions (Supp. Figure 2).

**Table 3.** Distribution of the eyelid tumors by anatomical region and behavior.

Eye Anatomical Region	Benign (n)	Ratio (%)	Malignant (n)	Ratio (%)	Total	Ratio (%)
Right lower eyelid mass	17	13,3	9	13,6	26	13,4
Right conjunctival mass	5	3,9	3	4,5	8	4,1
Right upper eyelid mass	18	14,1	7	10,6	25	12,9
Left lower eyelid mass	17	13,3	6	9,1	23	11,9
Left conjunctival mass	12	9,4	4	6,1	16	8,2
Left upper eyelid mass	18	14,1	7	10,6	25	12,9
Other	41	32	30	45,5	71	36,6

## Discussion

This study highlights the demographic and clinical spectrum of eyelid tumors in a tertiary ophthalmology clinic. Our results demonstrated that benign lesions were more frequently encountered; however, malignant tumors still represented a considerable portion of the cohort (34%). This rate exceeds that commonly observed in population-based studies, which may be attributed to the higher concentration of complex or suspicious cases typically referred to tertiary care institutions [2,14]. When compared with large registry-based datasets such as the IRIS Registry and other large institutional series, the proportion of malignant tumors in our cohort appears to be relatively higher. This difference is most likely attributable to tertiary referral bias; as specialized centers tend to receive more complex or suspicious cases requiring surgical intervention. Therefore, these findings should be interpreted with caution, as they may not fully reflect the distribution of eyelid tumors in the general population.

Histopathological, BCC was the leading malignant tumor, consistent with global patterns [4-6]. SCC and sebaceous carcinoma followed in frequency, each clinically significant. Although sebaceous carcinoma constituted a smaller subset of cases in our cohort, it remains clinically significant due to its aggressive behavior and its comparatively higher incidence reported in Asian populations [7,9]. A substantial proportion of cases were categorized as “undefined,” which reflects the limitations of retrospective data collection and variability in pathology reporting. Reclassification of these cases was not feasible without introducing potential bias.

The significant association between malignancy and advanced age was evident in our cohort. This aligns with established evidence linking UV-induced DNA damage and impaired repair mechanisms to carcinogenesis in elderly patients [10,11,16]. Age should therefore prompt heightened clinical suspicion.

Consistent with earlier publications, our analysis found no significant association between patient sex and the likelihood of malignancy [12,13]. Other studies describing slight male predominance attribute it to occupational exposure and lifestyle factors [17,18].

The anatomical distribution confirmed that the lower eyelid is at greatest risk for malignancy. This region is considered more susceptible due to its relatively thin dermal structure, increased ultraviolet exposure, and closeness to the medial canthus, an area known for elevated recurrence potential [12,19]. Consequently, early biopsy is advisable for lesions in the lower eyelid, especially among elderly individuals.

The surgical approach adopted in our series was consistent with globally accepted practices; local anesthesia was adequate for the majority of tumor excisions, whereas general anesthesia was primarily indicated for extensive reconstructive procedures or operations in children [20,21]. Malignant lesions often necessitated flap or graft reconstruction, underscoring the need to achieve complete tumor excision while simultaneously maintaining eyelid function and aesthetic integrity.

This study's strengths lie in its comparatively large patient cohort and the comprehensive collection of clinical and histopathological data. In addition, the inclusion of detailed surgical parameters and anatomical localization provides a more comprehensive clinical perspective on eyelid tumors. The use of both descriptive and analytical statistical approaches further enhances the robustness of the findings and supports the clinical relevance of the results.

### **Limitations**

This study has several limitations that should be acknowledged. First, its retrospective design may introduce selection bias and limits the ability to establish causal relationships. Second, the absence of long-term follow-up data restricts the evaluation of recurrence rates and long-term outcomes. Third, important risk factors such as ultraviolet exposure, occupational history, and lifestyle variables could not be assessed in detail due to the limitations of the available records. Additionally, as this study was conducted in a tertiary referral center, the findings may not fully represent the general population, potentially leading to an overestimation of malignant cases. Furthermore, the lack of follow-up data prevented the evaluation of surgical margins, recurrence rates, and long-term clinical outcomes. Future prospective studies incorporating standardized data collection and long-term follow-up are warranted to further validate these findings.

In summary, combining demographic, anatomical, and histopathological findings offers meaningful regional evidence that adds to the broader international literature. Although benign eyelid lesions were more prevalent, a noteworthy proportion of cases were malignant. Basal cell carcinoma represented the most common malignant tumor, whereas chalazion was the leading benign diagnosis. Higher malignancy rates were particularly associated with advanced age and involvement of the lower eyelid. Clinicians should maintain high suspicion for eyelid lesions in elderly patients and those located in high-risk anatomical sites.

### **Conclusion**

Eyelid tumors represent a broad range of pathological entities, with benign lesions comprising the majority, yet a meaningful subset demonstrating malignant behavior. In our cohort, basal cell carcinoma was the most prevalent malignant tumor type, whereas chalazion was the leading benign presentation. The clear link between malignancy and increasing age highlights the relevance of age as an important clinical indicator during diagnostic assessment. Furthermore, the lower eyelid and medial canthus were confirmed as high-risk anatomical locations for malignancy, emphasizing the need for meticulous examination of these regions. The lack of a notable sex-based difference suggests that men and women share a comparable risk profile for eyelid tumors. While local anesthesia was sufficient for the majority of surgical interventions, malignant cases frequently required reconstructive techniques to preserve eyelid structure, function, and cosmetic appearance. Overall, these observations provide region-specific epidemiological data that may aid clinicians in raising diagnostic awareness, guiding biopsy decisions, and tailoring surgical strategies to achieve optimal clinical outcomes.

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### ***Conflict of interest***

The authors declare that they have no conflicts of interest related to this study.

### ***Data availability statement***

The datasets analyzed during the current study are not publicly available due to ownership by the institution, but are available from the corresponding author on reasonable request.

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