



Histopathological Study Of Ocular Adnexal Tumours In Central Rajasthan

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Abstract

Introduction: Ocular adnexa include – Eyelids, Conjunctiva, Lacrimal apparatus, Extra ocular muscles, Bony orbit except eye and optic nerve. We aimed to study histomorphology, evaluate the pattern of prevalence, classify benign and malignant ocular adnexal tumours and find out their age and sex ratio.

Methodology: The study was carried out in Department of Pathology, JLN Medical College, Ajmer and Associated group of Hospitals, both retrospective (January 2022 to December 2022) and prospective (January 2023 to December 2024) over a period of 3 years. Biopsies were subjected to tissue processing techniques followed by Hematoxylin & Eosin stains.

Results: A total of 117 histologically confirmed ocular adnexal tumors were obtained. Of these, 83 cases were benign, 34 cases malignant. Prevalence was slightly higher in females (60 cases) and 57 males. The highest prevalence of benign tumors was in the (11-20) years age group, followed by young adults (21-40 years) and malignant tumors occurring in (61-70) years age group. Eyelid was the most common site with 62 cases (49 benign, 13 malignant). 45 were from the conjunctiva (25 benign, 20 malignant), 6 were from the orbit (5 benign, 1 malignant) and 1 benign case of lacrimal cyst from lacrimal apparatus. In conjunctiva, Nevus was the most common benign tumor and Squamous cell carcinoma was the most frequent malignant tumor. While in eyelid, Nevus being the most common benign and Sebaceous gland carcinoma being the most common malignant tumor. Among orbital tumors, one case of Adenoid cystic carcinoma was recorded in malignant and Capillary hemangioma being the most common benign tumor.

Conclusion: Histopathological examination of excised or incised ocular adnexal lesions is absolutely mandatory for each case to come to a definitive diagnosis and further care of patients in management.

Keywords: Ocular adnexa, histopathology, eyelid tumours, conjunctival tumours, sebaceous carcinoma, nevus

Introduction

The ocular adnexa comprises a complex anatomical region including the eyelids, conjunctiva, lacrimal apparatus, extra ocular muscles and orbit. These structures are susceptible to a wide variety of benign and malignant neoplasms arising from diverse tissue types[1][2]. The orbit is an anatomically complex structure containing the globe, extraocular muscles, glandular tissues, vessels, nerves, fat, and connective tissues. It is a limited bony space where even small

pathological reactions can disturb the complex arrangement of orbital structures and impair vision[2].

The eye is composed of three coats enclosing three transparent structures. The outermost fibrous tunic consists of the cornea and sclera. The middle vascular tunic (uvea) includes the choroid, ciliary body, and iris. The innermost layer is the retina, which receives circulation from both choroidal and retinal vessels [3]. Eye formation in the human embryo begins at

approximately 3 weeks of embryonic development and continues through the 10th week[4]. The eye is derived from surface ectoderm, neuroepithelium, and extracellular mesenchyme consisting of both neural crest and mesoderm[5].

A wide variety of cell types in and around the eye spawn benign and malignant neoplasms, and the frequency with which different cell types become neoplastic varies immensely[6]. The soft tissues of the lid, conjunctiva, ocular surface, various layers of the eyeball, and orbital soft tissues are unique in many ways. The neoplastic lesions of these tissues display much more variation than similar tissues in other parts of the body[7].

Tumours of the eyelids, conjunctiva, and lacrimal gland form an important group of ophthalmic neoplasms that can impair vision[8][9]. Common benign eyelid lesions include dermoid cyst, epidermal inclusion cyst, capillary and cavernous haemangioma, intradermal nevus, and neurofibroma, while common malignancies include basal cell carcinoma, squamous cell carcinoma, malignant melanoma, and sebaceous carcinoma[10]. The common benign lesions of conjunctiva include pterygium, dermoid cysts, nevus, papilloma, haemangioma, and pyogenic granuloma, progressing to precancerous lesions like ocular surface squamous neoplasm (OSSN) and aggressive malignancies such as malignant melanoma, squamous cell carcinoma, or Kaposi's sarcoma[11].

Recent epidemiological studies have shown an age- and sex-adjusted incidence rate of ocular adnexal tumours of approximately 59.7 per 100,000 per year, with most tumours being eyelid lesions (99.0%), predominantly benign (67.8%)[12]. Ocular adnexal lymphomas represent a specific subset, accounting for a significant proportion of orbital masses, with marginal zone lymphoma being the most common histological subtype[13].

Adequate management of patients depends upon histopathological diagnosis, without which clinical diagnosis alone may sometimes misguide treatment[14]. Ophthalmic lesions, more precisely orbital and ocular tumours or tumour-like lesions, mostly require surgical treatment. Hence, a correct preoperative provisional diagnosis and confirmation by histopathological examination of the specimen plays an enormous role in treating both benign and

malignant ocular and orbital lesions in patient care[15].

The knowledge of normal ocular anatomy is necessary to interpret many of the diverse pathologic changes that involve these structures. Awareness of proper techniques for processing ocular specimens is also essential for successful evaluation by the surgical pathologist[16]. Orbito-ocular tumours are very rare, and there are only a few composite studies of these tumours[17]. The information about the pattern of ophthalmic adnexal tumours in Ajmer and particularly in Rajasthan is limited. Hence, we aim to study the morphological and clinicopathological correlation of benign and malignant tumours of the ocular adnexa prevalent in central Rajasthan region.

Aims and Objectives

1. To study the histopathology of ocular adnexal tumours
2. To classify benign and malignant ocular adnexal tumours according to WHO classification
3. To find out the age and sex ratio in benign and malignant ocular adnexal lesions
4. To assess the utility of histopathology in correctly diagnosing ocular adnexal neoplasms
5. To know the pattern of prevalence of ocular adnexal tumours in our hospital and to compare the data with similar studies

Materials And Methods

Study Design and Setting

This was a combined retrospective and prospective observational study carried out in the Department of Pathology, JLN Medical College, Ajmer, and associated group of hospitals over a period of 3 years. The retrospective component covered January 2022 to December 2022, while the prospective component spanned January 2023 to December 2024.

Study Population

Inclusion Criteria

All ocular biopsy specimens received during the study period in the Department of Pathology, JLN Medical College, Ajmer, were included.

Exclusion Criteria

1. Inadequate biopsy material (only fibromuscular tissue)
2. Autolysed tissue
3. Blood clots without diagnostic tissue

Specimen Collection and Processing

For the retrospective study, blocks were retrieved from the histopathological section and re-examined. For the prospective study, biopsy specimens were received in 10% buffered formalin with properly completed surgical pathology requisition forms containing patient identification, age, sex, essential clinical data, and tissue submitted. Specimens were fixed in 10% buffered formalin for 12-14 hours at room temperature. Gross features including size, shape, colour, external surface, cut surface, consistency, and colour of cut section were noted and recorded. The thin sclera permits penetration of fixatives without making incisions into the globe. Formalin was not injected into the eye to prevent artifactitious retinal detachment and distortion of ocular anatomy. The intact ocular globe was submerged in sufficient fixative to cover the globe for 24 hours before sectioning.

Grossing was done as per the institute protocols. Following sections were taken

1. Optic nerve section
2. Anterior segment (pupil)
3. Zones of pathology
4. In tumours, particularly retinoblastoma: cross-section of surgical margin of optic nerve
5. In suspected malignant melanoma: samples from vortex veins from each of four quadrants

All ocular specimens were processed routinely and stained with haematoxylin and eosin (H&E) using the Harris haematoxylin method.

Special Stains were used when required and indicated.

1. **Periodic Acid-Schiff (PAS) Staining:** Used to demonstrate glycogen, mucin, reticulin, fibrin, and fungi. The procedure involved oxidation with

periodic acid solution, Schiff reagent application, and haematoxylin counterstaining.

2. **Fontana-Masson Procedure:** Employed for melanin demonstration using working silver solution, followed by gold chloride and nuclear-fast red counterstaining. Melanin appeared black and nuclei red.
3. **Melanin Bleach Procedure:** Used to confirm melanin pigment. The procedure utilized potassium permanganate solution for 2-4 hours, followed by 1% oxalic acid for 1-2 minutes. If the pigment was melanin, it would not be present on the bleached slide.

Detailed microscopic examination of biopsy specimens was performed to arrive at a histopathological diagnosis.

Data Analysis

Data were compiled and analyzed for distribution according to site, nature of lesion, age, sex, and histopathological type. Descriptive statistics including frequencies, percentages, and means with standard deviations were calculated.

Ethical Considerations

The study was conducted in accordance with institutional ethical guidelines. Patient confidentiality was maintained throughout the study period.

Results

In the present study, a total of 135 ocular biopsies were performed during the study period. Of these, 10 biopsies (7.4%) were from the eye, while 125 biopsies (92.5%) were from the ocular adnexa. Out of 125 ocular adnexal biopsies, 117 cases (93.6%) were neoplastic, while 8 cases (6.4%) were non-neoplastic.

Among the 117 neoplastic lesions identified in the ocular adnexa, 83 cases (70.34%) were benign tumours and 34 cases (29.66%) were malignant tumours (Table 1).

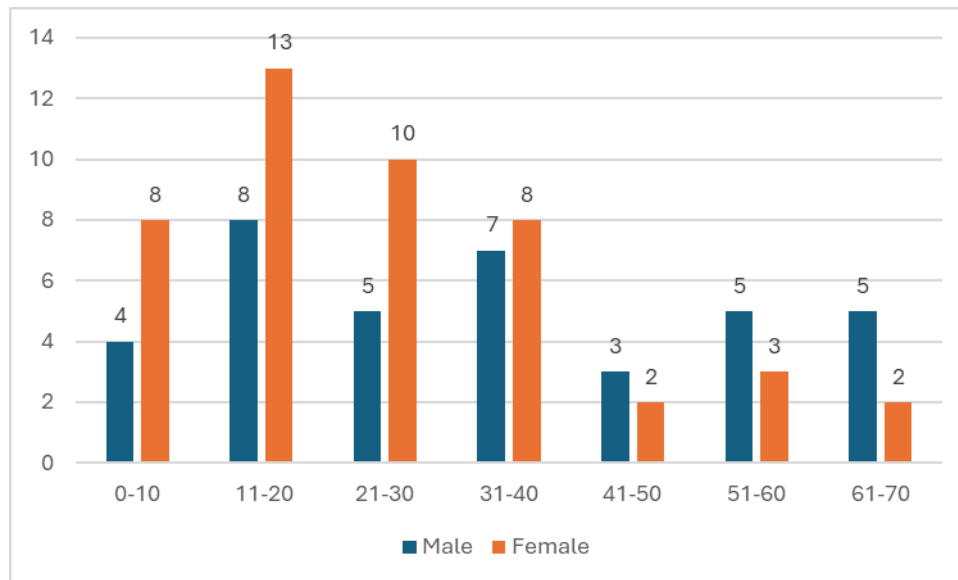
Table 1: Distribution of neoplastic lesions of ocular adnexa

Ocular Adnexal Tumours	No. of cases	Percentage (%)
Benign	83	70.34
Malignant	34	29.66
Total	117	100

The overall sex distribution showed 57 cases (48.72%) in males and 60 cases (51.28%) in females, indicating a slightly higher prevalence in females with a male-to-female ratio of 1:1.06. Among benign tumours, 37 cases (44.58%) were in males and 46 cases (55.42%) were in females. Conversely, malignant tumours showed 20 cases (58.83%) in males and 14 cases (41.17%) in females, demonstrating a higher prevalence of malignancy in males. (Fig. 1)

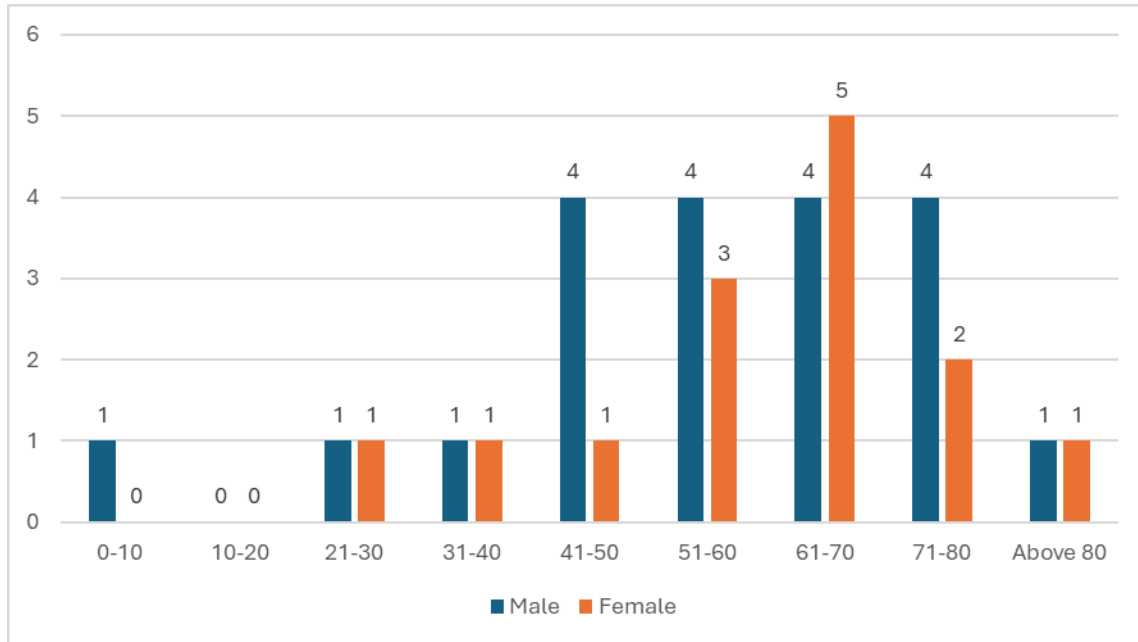
The age distribution of benign tumours showed the highest incidence in the 11-20 years age group with 21 cases (25.30%), followed by 21-30 years and 31-40 years, each with 15 cases (18.07%). The 0-10 years age group accounted for 12 cases (14.45%). (Fig. 1) The mean age for benign tumours was 29.93 ± 18.30 years. The youngest patient was 6 months old.

Fig 1: Distribution of benign ocular adnexal tumours according to age and sex



Malignant tumours showed a different age distribution pattern. The highest number of cases was observed in the 61-70 years age group with 9 cases (26.47%), followed by 51-60 years with 7 cases (20.58%) and 71-80 years with 6 cases (17.64%). The mean age for malignant tumours was 56.08 ± 19.91 years. Only 1 case (2.94%) was recorded in the 0-10 years age group. The oldest patient was 89 years old (Fig. 2).

Fig 2: Distribution of malignant ocular adnexal tumours according to age and sex



The eyelid was the most commonly affected site with 49 benign cases (59.03%) and 13 malignant cases (38.23%). Conjunctiva showed 25 benign cases (30.12%) and 20 malignant cases (58.82%), demonstrating a high proportion of malignancy. Orbit had 5 benign cases (6.02%) and 1 malignant case (2.94%). Lacrimal apparatus showed only 1 benign case (1.20%) with no malignant cases. No tumours were recorded in extraocular muscles.

Among the 83 benign tumours, melanocytic tumours (nevus) were the most common, accounting for 20 cases (24.09%). Cystic lesions comprised 20 cases (23.67%), including epidermal keratinous cyst, infected cyst, and conjunctival cyst. Vascular tumours (capillary haemangioma) accounted for 12 cases (14.45%). Epithelial tumours (squamous papilloma) were observed in 8 cases (9.63%). Hamartomas and choristomas (dermoid cyst, limbal dermoid, dermolipoma) comprised 11 cases (13.23%). Adnexal tumours (chondroid syringoma) and mesenchymal tumours (osteoid osteoma, ossifying fibroma) each accounted for 2 cases (2.40%) and 2 cases (2.40%), respectively (Table 2).

Table 2: Distribution of common benign tumours occurring in ocular adnexa

Tumours	Number of cases (%)
Cystic lesions	
Epidermal keratinous cyst	15 (18.07%)
Infected cyst	2 (2.40%)
Conjunctival cyst	2 (2.40%)
Lacrimal cyst	1 (1.20%)
Epithelial Tumours	
Squamous papilloma	8 (9.63%)
Adnexal Tumours	
Chondroid syringoma	2 (2.40%)

Melanocytic Tumours Nevus	20 (24.09%)
Vascular Tumours Capillary haemangioma	12 (14.45%)
Hamartomas and Choristomas Dermoid cyst Limbal dermoid Dermolipoma	7 (8.43%) 2 (2.40%) 2 (2.40%)
Mesenchymal Tumours Osteoid osteoma Ossifying fibroma	1 (1.20%) 1 (1.20%)
Tumour-like lesion Pterygium	1 (1.20%)

Histopathological Distribution of Malignant Tumours

Among the 34 malignant tumours, precancerous lesions (ocular surface squamous neoplasia) were the most common, observed in 11 cases (32.35%). Epithelial tumours comprised 10 cases (29.41%), with squamous cell carcinoma being most frequent (6 cases, 17.64%), followed by basal cell carcinoma (3 cases, 8.82%) and adenoid cystic carcinoma (1 case, 2.94%). Adnexal tumours accounted for 7 cases (20.59%), including sebaceous cell carcinoma (6 cases, 17.64%) and eccrine porocarcinoma (1 case, 2.94%). Melanocytic tumours (malignant melanoma) were observed in 2 cases (5.88%) (Table 3).

Table 3: Distribution of common malignant tumours occurring in ocular adnexa

Tumours	Number of cases (%)
Precancerous Ocular surface squamous neoplasia	11 (32.35%) 11 (32.35%)
Epithelial Tumours Squamous cell carcinoma Basal cell carcinoma Adenoid cystic carcinoma	10 (29.41%) 6 (17.64%) 3 (8.82%) 1 (2.94%)
Adnexal Tumours Sebaceous cell carcinoma Eccrine porocarcinoma	7 (20.59%) 6 (17.64%) 1 (2.94%)
Melanocytic Tumours Malignant melanoma	2 (5.88%) 2 (5.88%)

On site specific analysis of tumors we observed,

Eyelid Tumours

A total of 62 eyelid tumour cases were recorded. Neoplastic lesions included epithelial tumours (12 cases, 19.35%), adnexal tumours (20 cases, 32.25%), melanocytic tumours (17.74%), soft tissue tumours (9.67%), hamartomas and choristomas (9.67%), and others (1.61%). Among benign tumours, epidermal keratinous cyst and compound nevus were most common (17.74% each). Among malignant tumours, sebaceous gland carcinoma (9.67%) was most frequent. Benign tumours were most common in the 11–20 years age group (11 cases, 22.45%), while malignant tumours were most frequent in the 71–80 years group (5 cases, 38.46%). No malignant tumours occurred below 40 years. The mean age was 40.33 years. (Table 4).

Table 4: HISTOPATHOLOGICAL DISTRIBUTION OF EYELID TUMOURS

Eyelid Tumours	No. of cases (n=62)	Percentage (%)
1) Epithelial Tumours – I) Benign :- Squamous papilloma	6	9.67%
II) Malignant:- Basal cell carcinoma	3	4.83%
Squamous cell carcinoma	3	4.83%
2) Adnexal Tumours – Benign:- Cystic lesions a. Epidermal keratinous cyst	11	17.74%
- Chondroid Syringoma	2	3.22%
Malignant:- Sebaceous gland carcinoma	6	9.67%
Eccrine porocarcinoma	1	1.61%
3) Melanocytic Tumours – Compound Naevus	11	17.74%
4) Tumours of soft tissue • Vascular Tumours – Capillary hemangioma	6	9.67%
5) Hamartomas and choristomas Dermoid cyst	6	9.67%
6) Others Xanthogranulomatous Cyst	1	1.61%

Conjunctival Tumours

A total of 45 conjunctival tumour cases were recorded. Among epithelial tumours, ocular surface squamous neoplasia was most common (11 cases, 24.44%), followed by squamous cell carcinoma (7 cases, 15.55%). Ocular surface squamous neoplasia (24.44%) was the most common precancerous lesion identified in the study. Among malignant tumours, squamous cell carcinoma (15.55%) was the most frequently observed. Among melanocytic tumours, compound nevus was most frequent (5 cases, 11.11%). Vascular tumours (capillary haemangioma) accounted for 4 cases (8.88%). Benign tumours were most common in the 11–20 years age group (7 cases, 28%), while malignant tumours were most frequent in the 61–70 years group (6 cases, 30%). The mean age was 29.64 ± 19 years, with male predominance (M:F = 1.43:1) (Table 5)

Table 5: Histopathological Distribution Of Conjunctival Tumours

Conjunctival Tumours	No. of cases (n=45)	Percentage (%)
1) Epithelial Tumours –		
1) Benign Cytic lesions-		
Epidermoid cyst	4	8.88%
Conjunctival cyst	2	4.44%
2) Benign: –		
Squamous papilloma	2	4.44%
3) Precancerous:-		
Ocular surface squamous neoplasia	11	24.44%
4) Malignant:-		
Squamous cell carcinoma	7	15.55%
2) Melanocytic Tumours –		
I) Benign:-		
Compound nevus	5	11.11%
junctional nevus	3	6.66%
intradermal nevus	2	4.44%
II) Malignant:-		
Malignant melanoma	2	4.44%
3) Tumours of soft tissue		
Vascular Tumours –		
Capillary hemangioma	4	8.88%

Orbital Tumours

A total of 6 orbital tumour cases were recorded: 5 benign (83.34%) and 1 malignant (16.66%). Capillary haemangioma was the most common benign tumour (2 cases, 33.34%). Adenoid cystic carcinoma was the only malignant tumor observed. Benign tumours mainly affected the 0–10 years age group, while the malignant case occurred in a 51–60-year-old female.

Lacrimal Apparatus Tumours

Only one case was recorded—a benign lacrimal cyst in a 9-year-old female affecting the left eye.

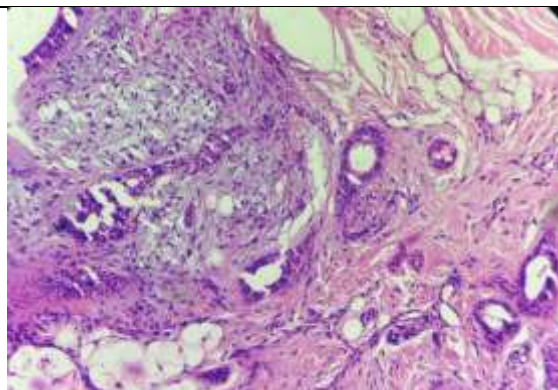


FIGURE 3 (A): Chondroid syringoma-Biphasic with both epithelial and stromal components (H&E, 200x)

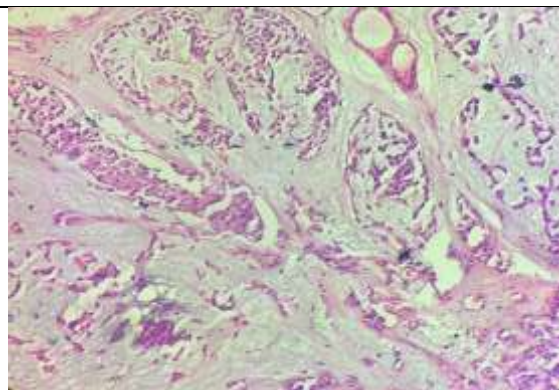


FIGURE 3 (B): Chondroid syringoma-Prominent chondromyxoid stroma enveloping benign bland appearing epithelial and myoepithelial cells that are forming secondary structures like glands, ducts, cysts and nests. (H&E, 400x)

FIGURE 4: Ocular surface squamous neoplasia - Stratified squamous epithelium showing acanthosis, moderate dysplastic changes with loss of polarity, hyperchromatic pleomorphic nuclei with small occasional mitosis. (H&E, 200x)

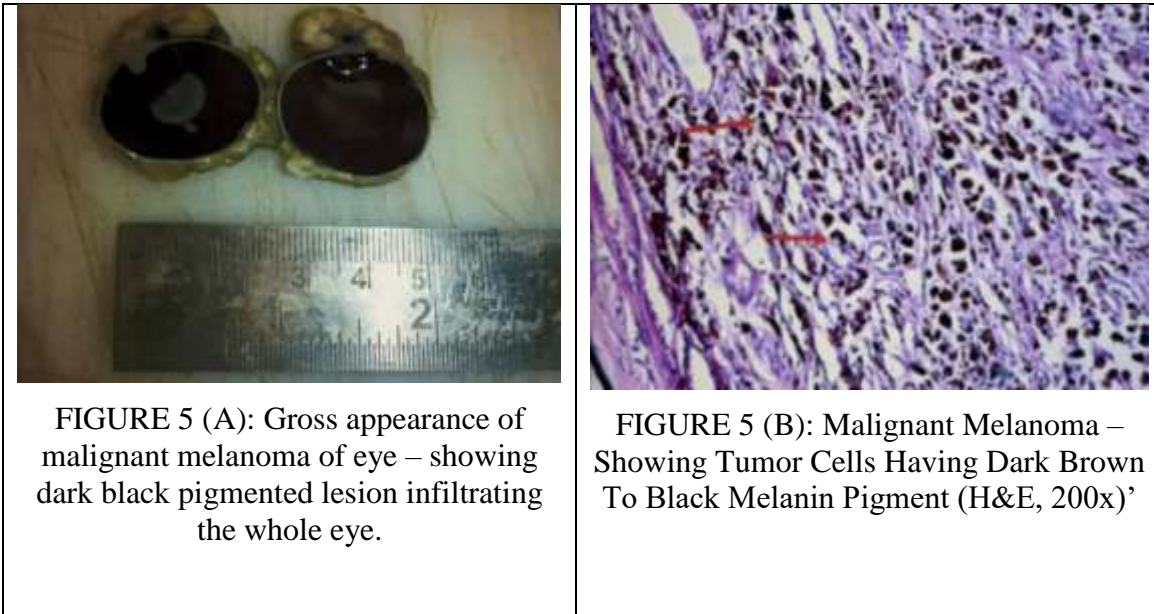
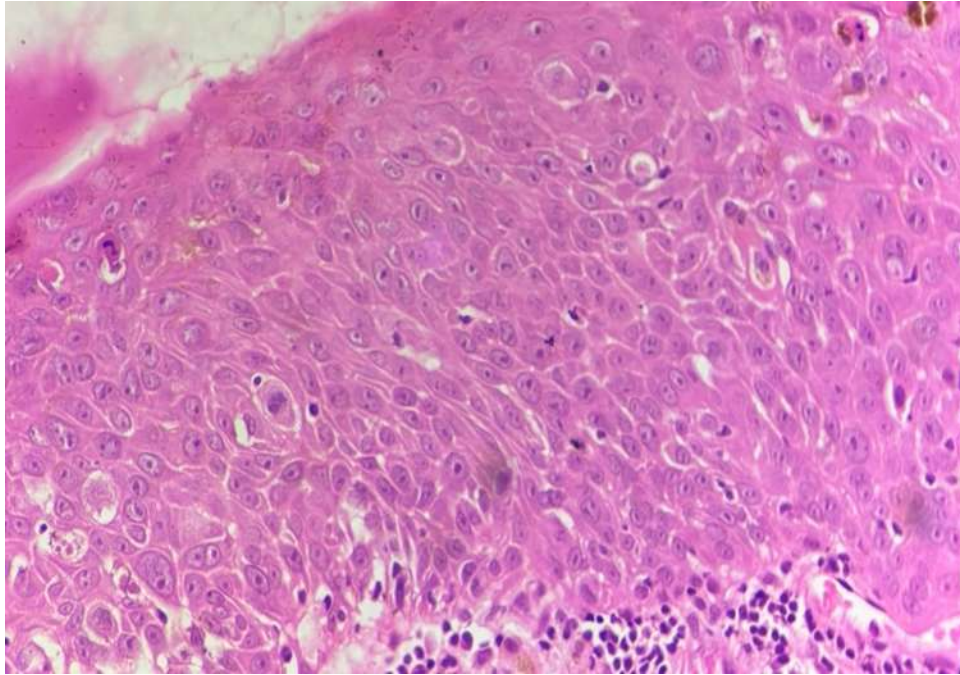


FIGURE 5 (A): Gross appearance of malignant melanoma of eye – showing dark black pigmented lesion infiltrating the whole eye.

FIGURE 5 (B): Malignant Melanoma – Showing Tumor Cells Having Dark Brown To Black Melanin Pigment (H&E, 200x)

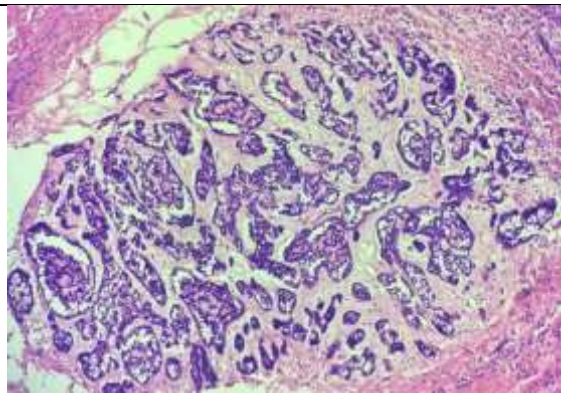


FIGURE 6 (A): Adenoid cystic carcinoma- biphasic tumor composed of ductal and myoepithelial cells, showing cribriform pattern. (H&E, 200x)

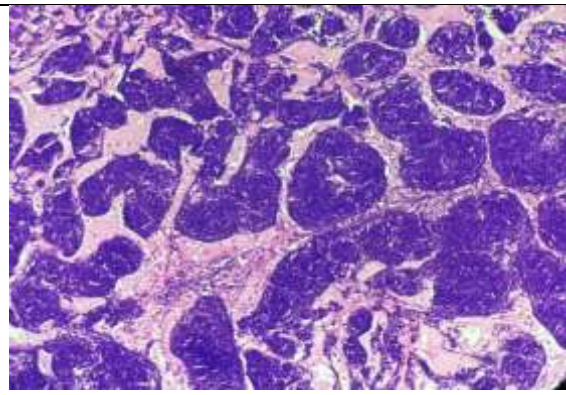
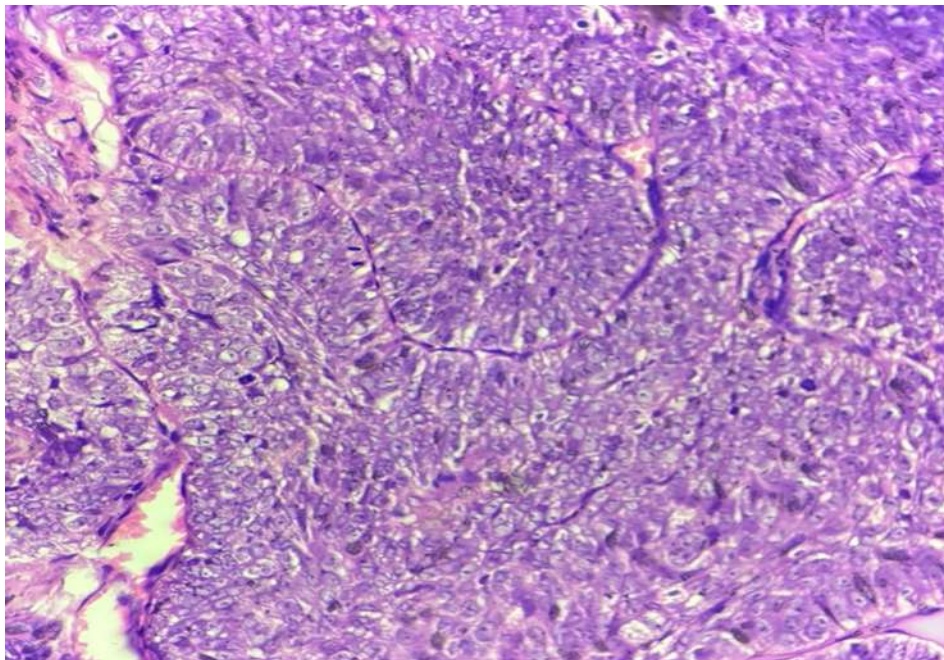


FIGURE 6 (B): Adenoid cystic carcinoma- cells arranged in trabeculae and nests separated by stroma. (H&E, 400x)

FIGURE 7: Sebaceous cell carcinoma – showing nests of neoplastic cells with abundant foamy, finely vacuolated cytoplasm and well defined cellular borders. (H&E, 400x)



Discussion

The present study analyzed the distribution of various ocular adnexal tumours prevalent in the Ajmer region of Central Rajasthan. A total of 125 ocular adnexal biopsies were received over a 3-year period (January 2022 to December 2024), of which 117 cases (93.6%) were neoplastic. Among neoplastic cases, 83 (70.94%) were benign and 34 (29.06%) were malignant. The findings were compared with similar studies from

India and abroad, revealing both concordant and contrasting results.

Age Distribution

In our study, the highest age incidence (17.95%) was in the 11-20 years age group, with a mean age of 36.5 ± 4 years (29.93 ± 18.30 years for benign tumours and 56.08 ± 19.91 years for malignant tumours). This finding is consistent with earlier Indian studies by R

Gogi et al (1979)[1] and Palaniswamy Sunderraj et al (1991)[17], who observed maximum incidence in the 0-10 years age group at 32.80% and 37%, respectively. N. Ud-Din et al (2001)[2] also found the highest frequency (30%) in the 1-15 years age group.

However, contrasting results were observed in the study by R. Kumar et al (2008)[18], where the elderly age group (51-60 years) was most commonly affected (25.42%), suggesting regional variations in age distribution.

Sex Distribution

Our study demonstrated a slight female preponderance with a male-to-female ratio of 1:1.06 (57 males vs. 60 females). This female preponderance aligns with findings from P Bastola et al (2010)[19] (M:F ratio 1:1.04) and Imran Y Shaikh et al (2012)[20] (M:F ratio 1:1.07). Recent large-scale studies have also reported similar patterns, with ocular adnexal lymphomas showing a female predominance (male-to-female ratio 0.7)[13].

However, most international studies reported male preponderance, including Sao Bing Lee et al (2000)[21] (M:F ratio 1.15:1), C-Y Cheng et al (2004)[22] (M:F ratio 1.23:1), Fonthip Na Pombejara et al (2009)[23] (M:F ratio 1.57:1), Dominic Chinda et al (2012)[24] (M:F ratio 1.8:1), and Shastry Shrikanth et al (2014)[25] (M:F ratio 1.38:1). These variations may reflect genetic, environmental, or lifestyle factors influencing tumour incidence across populations.

Benign vs. Malignant Distribution

The predominance of benign tumours (70.94%) in our study is consistent with most comparative studies. P Bastola et al (2010)[19] reported 79% benign tumours, while Kwang Kook Roh et al (1988)[26] and Imran Y Shaikh et al (2012)[20] found 63.6% and 52.23% benign tumours, respectively. Recent population-based studies confirm that most ocular adnexal tumours are benign (67.8%)[12].

Contrastingly, N. Ud-din et al (2001)[2] and Levaju P et al (2009)[27] reported higher proportions of malignant tumours (61.5% and 58.26%, respectively), possibly reflecting referral patterns or differences in study populations.

Site-wise Distribution

The eyelid was the most commonly affected site in our study (52.99%), followed by conjunctiva (38.46%),

orbit (5.13%), and lacrimal apparatus (0.85%). These findings are consistent with P Bastola et al (2013)[19], who reported eyelid as the most common site (57%), and Imran Y Shaikh et al (2012)[20], who found eyelid involvement in 37.96% of cases. Recent epidemiological data confirms that eyelid lesions constitute 99.0% of ocular adnexal tumours[12].

However, some studies showed different patterns. R Gogi et al (1979)[18] observed orbital lesions as most common (36.38%), while Fonthip Na Pombejara et al (2009)[23] and other international studies reported varying proportions of conjunctival and lacrimal gland involvement.

Eyelid Tumours

In our study of 62 eyelid tumours, benign lesions accounted for 79% and malignant lesions for 21%. The mean age was 40.33 years, with an age range of 2-89 years. The male-to-female ratio was 1:1.16, showing female preponderance. Most other studies also demonstrated female preponderance, except Fouzia Farhat et al (2010)[28], who reported male dominance.

Among benign tumours, epidermal keratinous cyst (17.74%) and compound nevus (17.74%) were most common, followed by squamous papilloma (9.67%), capillary haemangioma (9.67%), and dermoid cyst (9.67%). These findings align with Indian studies by Krishnamurthy H et al (2014)[29] and Mohan B P et al (2017)[30], who also identified epidermal cyst and nevus as the most common benign lesions.

Among malignant eyelid tumours, sebaceous gland carcinoma was most frequent (17.64%), occurring mainly in the 55-65 years age group with a mean age of 59.16 years. Females showed higher frequency (M:F ratio 1:1.6), and the left lower eyelid was most commonly involved. This finding contrasts with Western literature, where basal cell carcinoma (BCC) is the most common eyelid malignancy, accounting for 80-90% of all eyelid cancers[31]. However, in Asian populations, including India, sebaceous carcinoma shows higher prevalence[32][33]. Our study aligns with Krishnamurthy H et al (2014)[29], who also reported sebaceous gland carcinoma as the most common malignancy.

Conjunctival Tumours

A total of 45 conjunctival lesions were analyzed. Benign lesions accounted for 55.56%, while malignant

lesions comprised 44.44%. The mean age was 29.64 ± 19 years, with an age range of 5-81 years. Males showed predominance with a male-to-female ratio of 1.43:1, consistent with most studies from India and abroad.

Among benign conjunctival tumours, nevus was most common (22.21%), followed by epidermoid cyst and capillary haemangioma. This finding is supported by N Ud-Din *et al* (2001)[2]. However, other studies reported squamous papilloma as the most common benign conjunctival tumour, including Santosh K Mondal *et al* (2014)[34] and Fahimeh Asadi Amoli *et al* (2015)[35].

Among malignant conjunctival tumours, squamous cell carcinoma was most frequent, occurring mainly in the 40-55 years age group with a mean age of 56.5 years and male preponderance. This finding is consistent with all similar studies of N Ud-Din *et al* (2001) [2], Imran Y Shiakh *et al* [20], and Kohli M *et al* [36]. Ocular surface squamous neoplasia (OSSN), representing the precancerous spectrum, was observed in 11 cases (24.44%), emphasizing the importance of early detection and treatment to prevent progression to invasive carcinoma.

Orbital and Lacrimal Apparatus Tumours

Orbital tumours comprised only 6 cases (5.13%), with 5 benign (83.34%) and 1 malignant (16.66%). Capillary haemangioma was most common among benign orbital tumours (33.34%), predominantly affecting children (0-10 years age group). One case of adenoid cystic carcinoma was recorded in a 51-60 years female, representing a rare orbital malignancy.

Only 1 case of lacrimal apparatus tumour was observed—a benign lacrimal cyst in a 9-year-old female. The paucity of lacrimal gland tumours in our study (0.85%) aligns with literature reports indicating that lacrimal gland lesions comprise 5-18% of orbital masses [36].

Strengths and Limitations

This study provides comprehensive data on ocular adnexal tumours in Central Rajasthan, a region with limited published literature. The combination of retrospective and prospective design allowed for robust data collection over a 3-year period. Systematic histopathological examination with special stains enhanced diagnostic accuracy.

However, limitations include single-center design, which may not represent the entire population of Rajasthan. Long-term follow-up data were not available to assess recurrence rates and patient outcomes. Molecular and immunohistochemical studies, which could provide additional diagnostic and prognostic information, were performed in limited cases.

Conclusion

This histopathological study of ocular adnexal tumours in Central Rajasthan provides valuable insights into the spectrum of benign and malignant lesions affecting this anatomically complex region. Benign tumours predominated (70.94%), with nevus being the most common. Among malignant tumours, ocular surface squamous neoplasia and squamous cell carcinoma were most frequent. The eyelid was the most commonly affected site (52.99%), followed by conjunctiva (38.46%).

Significant Findings Include:

1. Female preponderance overall (M:F ratio 1:1.06), with benign tumours more common in females and malignant tumours more frequent in males
2. Benign tumours predominantly affected younger age groups (peak 11-20 years), while malignant tumours primarily occurred in elderly patients (peak 61-70 years)
3. Sebaceous gland carcinoma was the most common eyelid malignancy in our population, contrasting with Western literature where basal cell carcinoma predominates
4. High proportion of ocular surface squamous neoplasia (32.35%) emphasizes the importance of early detection and treatment

Histopathological examination remains the gold standard for accurate diagnosis and classification of ocular adnexal tumours. Adequate tissue processing, systematic examination, and appropriate use of special stains are essential for optimal diagnostic accuracy. The knowledge of normal ocular anatomy and awareness of proper grossing techniques are crucial for successful pathological evaluation.

Future studies with larger sample sizes, multi-center design, long-term follow-up, and incorporation of molecular and immunohistochemical markers will further enhance our understanding of ocular adnexal tumours and improve patient outcomes.

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