

Clinicopathological Analysis of Cutaneous Adnexal Tumors: A Cross-Sectional Study

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ABSTRACT

Introduction: Cutaneous adnexal tumors (CATs) are uncommon neoplasms of pilosebaceous, eccrine, and apocrine origin, characterized by diverse morphology and diagnostic overlap with other cutaneous lesions. Although most CATs are benign, malignant variants may demonstrate aggressive behavior, underscoring the importance of clinicopathological evaluation.

Methodology: This cross-sectional study was conducted in the Dermatopathology Department of Lady Reading Hospital, Peshawar, from January to December 2024. Biopsy specimens with a clinical suspicion of cutaneous tumors were included. A total of 43 cases of CATs were identified and categorized histologically according to the World Health Organization (WHO) classification. Data on age, sex, anatomical site, and histological subtype were analyzed.

Results: CATs constituted 5% of all cutaneous tumors. Patient ages ranged from 12 to 67 years (mean 40.6 years), with a male-to-female ratio of 1.2:1. The majority of cases (55.8%) occurred in the third and fourth decades of life. The head and neck region was the most common site (65.1%), followed by upper extremities (16.3%). Benign tumors accounted for 97.7% of cases, while sebaceous carcinoma represented the only malignant tumor (2.3%). Follicular differentiation was most frequent (48.8%), and pilomatrixoma was the most common tumor type (37.2%).

Conclusion: CATs are rare but clinically relevant, predominantly affecting young to middle-aged adults, with a predilection for the head and neck region. The overwhelming majority are benign, though malignant cases, albeit rare, warrant vigilant diagnosis. Histopathological examination remains indispensable for accurate classification and management.

Keywords: Cutaneous adnexal tumors, Pilomatrixoma, Histopathology, Sebaceous carcinoma, Dermatopathology

INTRODUCTION

Cutaneous adnexal tumors (CATs) are a varied collection of neoplasms that develop out of the adnexal structures of the skin, i.e., pilosebaceous units, apocrine glands, and eccrine glands.^{1,2} Though they are relatively rare, due to their broad morphological range and similarity in clinical manifestation to other cutaneous lesions, they usually introduce great diagnostic difficulty to clinicians and pathologists.³⁻⁵ The majority of adnexal tumors are benign, but malignant forms though infrequent, have an aggressive biological nature, and require accurate assessment using histopathological assessment to make management decisions and prognosis.^{6,7}

The CATs have a reported varying incidence rate, ranging between 1-5% of all cutaneous tumors, based on the geographical location and study group.^{8,9} This inconsistency is a symptom of the nonexistence of these neoplasms and also maybe an underdiagnosis as they clinically replicate more common mild skin diseases, like epidermal inclusion cysts, basal cell carcinoma or pyogenic granulomas. CTA is a well-known low but constant component of cutaneous tumors in South Asian and Middle Eastern cohorts (4 to 6 per cent CATA), which helps to reinforce the low but stellar performance of CATA in dermatopathology practice.

CATs are epidemiologically common in users of any age, but according to a number of population-based studies, a slight male predisposition is observed.¹⁰ Such gender inequality has been explained by occupational and environmental exposures such as ultraviolet radiation, persistent trauma and chemical irritants, which could contribute to tumor-causing effects. The most affected place where all populations show this to be anatomically, is the region of the head and neck. The reason behind this preference is that the areas have more adnexal structures, especially sebaceous glands and hair follicles, which are a source of most of these tumors.¹¹

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Histologically, CATs contain a wide spectrum of different lesions that the World Health Organization (WHO) assigns to many different follicular, sebaceous, apocrine, and eccrine categories.^{12,13} Pilomatrixoma follicular "neoplasm" has remained the most common adnexal lesion in the world, followed by eccrine poroma, hidradenoma and sebaceous adenoma. Malignant tumors Sebaceous carcinoma, eccrine carcinoma, and microcystic adnexal carcinoma are rare, with an overall percentage of all adnexal tumors being less than 2%.^{14,15} However, their aggressive nature, risk style, and periodic comorbidity with syndromic disorders, including the Muir-Torre syndrome make them very clinically relevant.

The careful histopathology with the help of immunohistochemistry, in most cases, is essential to accurately diagnose CATs and distinguish them with morphologic analogs.¹⁶ Immunomarkers, including cytokeratins, epithelial membrane antigen (EMA) and carcinoembryonic antigen (CEA), come in handy in these situations of diagnostic confusion. Misclassification is pronounced whether there is a lack of experience, their rarity, or histological overlap with other diagnostic methods despite the current use of other diagnostic methods that can be used to decide on disease-specific diagnosis (especially in resource-challenged environments).

Clinically, benign CATs most often will assume an indolent course and can be treated successfully with primary excision, whereas the malignant variants may require broader surgery, sentinel lymph node testing, or adjuvant therapy.¹⁷ Since they are rare, the majority of presently existing data on CATs is produced by single-center case series or retrospectives, which also reflect the necessity of region containment studies that could illuminate the demographic, anatomic distributions, and histologyfinder of various groups of people etc.

There is limited literature on the clinicopathological spectrum of CATs in Pakistan, and most studies include small sample sizes and include wide categories of tumors of the skin rather than the adnexal lesions in particular. Due to all the specified diagnostic challenges, clinical implications, and possible malignant transformation in the rare cases, there is a rush to study and catalogue such tumours in a standardized manner. These effects do not only widen the currently existing body of knowledge, but also support clinicians in developing precise differential diagnosis of the lesions in high-density adnexal as surface area like the head and neck.

The current research, therefore, aimed at the assessment of the clinicopathological features of cutaneous adnexal tumors in

diagnosing at a tertiary care hospital located in Pakistan. This study aims to provide valuable information to the local and international literature by classifying the tumours in the WHO classification system, and examining their demographic profiles, predilection with respect to their asenap-based anatomy and histological formations.

METHODOLOGY

The research was conducted in the month of Peshawar, the Jan-Dec of the current year, 2024, in the Dermato-pathology Department of a Lady Reading Hospital, in Pakistan. The study incorporated biopsy specimens submitted having some provisional diagnosis of cutaneous tumors. They were classified in the form of 43 cases of cutaneous adnexal tumors (CATs). The clinical records were obtained as the clinical information on the age, sex, and site of lesion were taken out of the clinical records submitted by the referring clinicians. All the specimens were subjected to a rigorous histopathological analysis by a multidisciplinary team comprising a dermatologist and a histopathologist to check accuracy in their diagnosis. The three large groups of tumor were classified according to the world health organization (WHO) classification system: tumor with apocrine and eccrine differentiation, tumor with follicular differentiation and sebaceous differentiation. The groups were further sub-stratified, benign and malignant. The clinical data and histological results were summarized, and the ratio of each type of tumor were worked out. The source of the sample of the biopsy was mostly general surgeons then dermatologists, plastic surgeons and finally ophthalmologists. Data analysis was done to evaluate the demographic distribution, site predilection and histological subtypes of CATs among the study population.

RESULTS

During the one-year study period, a total of 43 cases of Cutaneous Adnexal Tumors (CATs) were diagnosed, accounting for approximately 5.0% of all cutaneous tumors reported in the department. The patients ranged in age from 12 to 67 years, with a mean age of 40.6 ± 15.4 years. The highest frequency of CATs was observed in the third and fourth decades of life (n=24, 55.8%), followed by the second decade (n=9, 20.9%). The male-to-female ratio was 1.2:1, showing a slight male predominance. The head and neck region was the most frequently involved anatomical site, observed in 28 cases (65.1%), followed by the upper extremities in 7 cases (16.3%), trunk in 5 cases (11.6%), and lower extremities in 3 cases (7.0%). Regarding the source of biopsy submissions, general surgeons contributed the majority (n=28, 65.1%), followed by dermatologists (n=9, 20.9%), plastic surgeons (n=4, 9.3%), and ophthalmologists (n=2, 4.7%). Histopathological classification revealed that 97.7% (n=42) of tumors were benign, while one case (2.3%) was malignant. Tumors with follicular differentiation were the most common subtype (n=21, 48.8%), followed by those with apocrine/eccrine differentiation (n=15, 34.9%), and sebaceous differentiation (n=7, 16.3%). Among individual tumor types, Pilomatrixoma was the most frequently diagnosed (n=16, 37.2%), followed by eccrine poroma (n=6, 14.0%), sebaceous adenoma (n=4, 9.3%), and hidradenoma (n=3, 7.0%). The only malignant tumor identified was sebaceous carcinoma, arising in the periocular region of a 59-year-old female patient.

Table 1: Age and Gender Distribution of Patients with Cutaneous Adnexal Tumors

Age Group (years)	Male (n=23)	Female (n=20)	Total (n=43)	%age
11-20	6	3	9	20.9
21-30	7	6	13	30.2
31-40	6	5	11	25.6
41-50	3	2	5	11.6
51-60	1	3	4	9.3
>60	0	1	1	2.4

Table 2: Distribution of Tumors by Anatomical Site

Site	Number of Cases (n=43)	Percentage (%)
Head & Neck	28	65.1
Upper Extremities	7	16.3
Trunk	5	11.6
Lower Extremities	3	7.0

Table 3: Histopathological Subtypes of Cutaneous Adnexal Tumors

Tumor Differentiation	Benign (n=42)	Malignant (n=1)	Total (n=43)	Percentage (%)
Follicular	21	0	21	48.8
Apocrine/Eccrine	15	0	15	34.9
Sebaceous	6	1	7	16.3

Figure 1

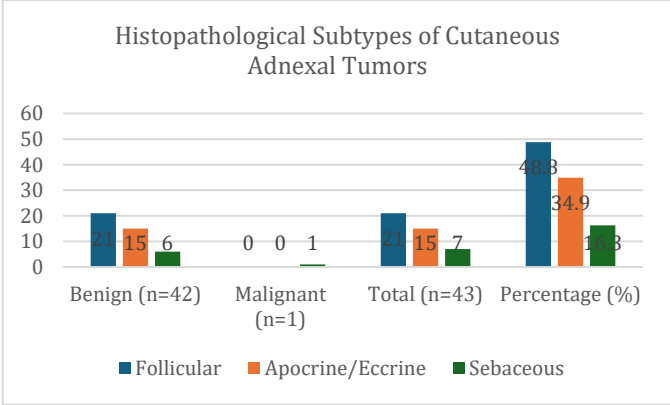
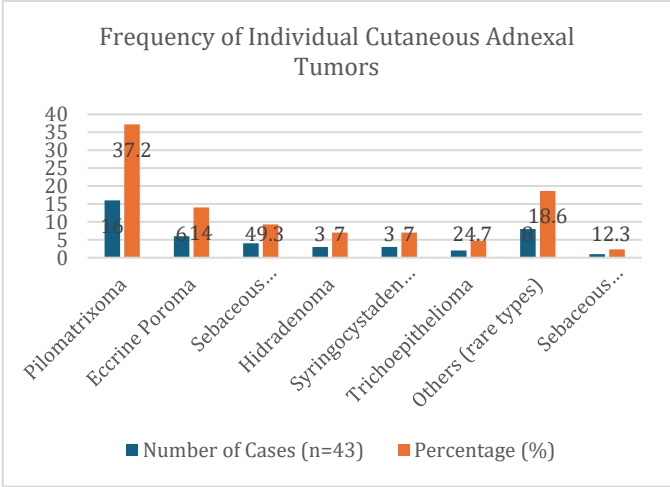


Table 4: Frequency of Individual Cutaneous Adnexal Tumors

Tumor Type	Number of Cases (n=43)	Percentage (%)
Pilomatrixoma	16	37.2
Eccrine Poroma	6	14.0
Sebaceous Adenoma	4	9.3
Hidradenoma	3	7.0
Syringocystadenoma	3	7.0
Trichoepithelioma	2	4.7
Others (rare types)	8	18.6
Sebaceous Carcinoma*	1	2.3

* Only malignant case identified

Figure 2



DISCUSSION

Cutaneous adnexal tumors (CATs) are comparatively unrelated neoplasms arising out of adnexal from the skin, and diagnosis is usually difficult due to their clinical diversity and histological variability. The current research involved 43 citations of CATs in one year of the evaluation that is almost 5 percent of all cutaneous tumor cases diagnosed during one year in a tertiary care facility. This rate is consistent with the previous reports in the south Asian and Middle Eastern groups, the adnexal tumor rates primarily are

4-6% of all the skin tumors thereby undertuning the infrequent occurrence but the constant manner in which they present in clinical practice of dermatopathology.

The demographic makeup of our cohort was a slight male preponderance, with a male:female ratio of 1.2:1 that was similar to those found in Indian and Pakistani classifications where occupational exposure to environmental conditions including ultraviolet radiation and trauma contribute to a predominance of male demographics. Mean patient age numbered 40.6 years and in the third and fourth decades, over half of the occurrences were found. These results validate the notion of CATs occurring in all people but young and middle-aged adults since it is a phenomenon observed in various regional studies as well.

The anatomy in the current study showed that the most common area of involvement was the head and neck, where almost two-thirds of cases took place. This finding correlates with the development of adnexal structures during embryology, because hair, sebaceous and sweat glands are more highly refined in this area. Similar findings have been recorded in earlier research involving Asian and Western populations, where the head and neck were found to be most favoured and the importance of involving CTs in the differentiation of lesions in these regions is emphasised. The next most frequent location was the upper extremities, but much less commonly, which was also indicative of the small population of adnexal structures in the peripheral body locations.

Histopathologically, the benign tumors represented the vast majority (97.7%), and one of the malignancies (sebaceous carcinoma) was present. This observation agrees with what the literature has indicated about malignant adnexal tumors being extremely rare, with a prevalence of less than 2% of all CATs. The lower frequency of aggressive neoplasms in our cohort contradicts the claim that the majority of adnexal neoplasms take the course of an indolent disease with good prognoses; nevertheless, implications of multiple lesions or atypical morphology have to be paid attention to. The follicular differentiation was prevalent, then the apocrine/eccrine and finally the sebaceous differentiation. The predominant type of tumors that developed in pilomatrixoma is the most common; enough to corroborate evidence on a global basis indicating this type of tumor as one of the most common benign follicular tumors. This is of importance because it has indicated the presence of one case of sebaceous carcinoma in the periocular area. Sebaceous carcinoma is now clinically important because of its aggressive potential, common association with misdiagnosis of benign eyelid lesions, and often associates with syndromic disorders, including the Muir-Torre syndrome. Early identification and histopathological confirmation are, thus, essential to be well managed.

Our research has a number of implications regarding clinical practice. To reduce overtreatment, first, there are more benign lesions, and therefore histopathological analysis should be an urgent step. Second, the fact that the cases are localized in the area of the head and neck brings out the necessity of clinicians remaining highly suspicious of the possibility of adnexal tumors in

this area. Thirdly, malignant adnexal tumors raise clinical issues, which must not be camouflaged because their detection in early stages and responding to therapy are paramount to prevent adverse consequences.

This study has some limitations as it was a single center study with a relatively narrow sample size that can limit the generalization of the findings. However, the findings are valuable to understand the spectrum of clinicopathology of CATs on the Pakistani population to supplement it with global statistics and add evidence on its distribution and behavior.

In conclusion, our findings demonstrate that cutaneous adnexal tumors are uncommon but clinically significant lesions, predominantly benign, with a marked predilection for the head and neck region. Pilomatrixoma was the most common tumor identified, while sebaceous carcinoma represented the only malignant case. These results emphasize the critical role of histopathological examination in establishing a definitive diagnosis and guiding management, while also underlining the need for continued surveillance to identify rare malignant variants.

CONCLUSION

This study highlights the clinicopathological spectrum of cutaneous adnexal tumors in a Pakistani tertiary care setting, demonstrating that although these neoplasms are relatively uncommon, they present important diagnostic and therapeutic considerations. The predominance of benign lesions, particularly pilomatrixoma, reinforces the generally favorable prognosis associated with CATs. However, the identification of a malignant sebaceous carcinoma underlines the importance of maintaining clinical suspicion, particularly for periocular lesions with atypical features or recurrent growth. The marked predilection for the head and neck region correlates with the high density of adnexal structures in this area, underscoring the need for careful histopathological examination of lesions arising in these sites. Despite the small sample size, this study contributes valuable regional data and emphasizes the necessity of early recognition and accurate classification to guide appropriate treatment and improve patient outcomes

Authors' Contribution

HK: Concept & study design, data collection, drafting and editing of the manuscript.

SB: Data entry, statistical analysis, interpretation of the results.

All authors approved the final version of the manuscript to be published.

Conflict of Interest

The authors declared no conflict of interest.

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Data Availability

Data is available with authors and can be provided on request.

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