

Original Research

Exploring Skin Adnexal Tumors: A Comprehensive Clinicopathological Investigation

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ABSTRACT:

Background: Skin adnexal tumors (SATs) comprise a diverse range of both benign and malignant tumors, showcasing differentiation towards various adnexal structures present in typical skin based on embryologic and histologic characteristics. These structures include eccrine, apocrine, follicular, and sebaceous components. Although the overall occurrence of SATs is relatively rare, their diagnosis can pose challenges. The primary objective of this study is to explore and analyze the spectrum of SATs, focusing on their microscopic features. **Methods:** A retrospective examination was carried out, encompassing all diagnosed cases of skin adnexal tumors (SAT). The study incorporated a total of 120 cases, and relevant clinical information was extracted from hospital medical records. Tissue biopsies, preserved in formalin, were processed into paraffin-embedded sections. Hematoxylin and eosin staining were then applied to these sections for the purpose of histopathological analysis. **Results:** Of the 120 cases examined, the majority (112/120) were identified as benign adnexal tumors, whereas (8/120) cases were diagnosed as malignant. The prevalence of skin adnexal tumors (SAT) was higher among females, particularly in the age group of 21–30 years (50/120). Sweat gland tumors comprised the largest subgroup, accounting for (50/120) cases, followed by hair follicle tumors (40/120). The head and neck region were the most commonly affected sites (80/120), with the face being the predominant location, followed by the trunk (30/120). Among the benign tumors, Hidradenoma papilliferum and Pilomatricoma each accounted for 24 cases, while sebaceous carcinoma emerged as the most prevalent malignant tumor (6/120). **Conclusion:** Skin adnexal tumors are relatively uncommon skin neoplasms. The head and neck region emerged as the most frequent site for these tumors, predominantly comprising benign cases. Hidradenoma papilliferum and pilomatricoma were identified as the most prevalent benign tumors in this category. Distinguishing between benign and malignant features through histopathology is crucial due to its significant implications for both therapeutic decisions and prognostic assessments.

Keywords: Pilomatricoma, adnexal tumors, pilomatricoma

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INTRODUCTION

Adnexal tumors, encompassing a spectrum of primary skin neoplasms, have their origins or differentiation pathways directed towards the pilosebaceous unit, eccrine sweat glands, or apocrine sweat glands. This diverse group of tumors is further categorized into four distinct classes, each reflecting histologic features reminiscent of hair follicles, sebaceous glands, apocrine glands, and eccrine glands. While skin adnexal tumors are relatively uncommon, they present a substantial diagnostic challenge for healthcare professionals, including dermatologists, surgeons, and pathologists.¹ The complexity arises from the fact that these tumors often exhibit more than

one line of differentiation, forming hybrid or composite tumors. This multifaceted nature adds a layer of intricacy to the classification process, making it difficult to precisely categorize these neoplasms. The origin of these skin adnexal tumors lies in multipotential undifferentiated cells within the epidermis or its appendageal structures. The histologic features exhibited by a tumor are intricately connected to the activation of molecular pathways responsible for the development of mature adnexal structures. Understanding the intricate histological and molecular aspects of these tumors becomes imperative not only for accurate diagnosis but also for guiding therapeutic decisions and predicting prognostic

outcomes. The complexities involved underscore the need for a comprehensive and nuanced approach in the study and classification of skin adnexal tumors within the realm of dermatology, surgery, and pathology. The skin, acknowledged as the body's largest and most versatile organ, serves a paramount role as a protective barrier against environmental stressors. Despite its resilience, the skin is susceptible to a myriad of diseases, and among them, skin adnexal tumors (SATs) emerge as a distinctive category of neoplasms. These tumors manifest through differentiation processes that lead them to originate from or progress toward the pilosebaceous unit, eccrine sweat glands, or apocrine sweat glands. In dissecting the diverse landscape of skin adnexal tumors, a comprehensive classification system has been established. This classification categorizes SATs into four distinct groups, aligning with their histologic features that bear a resemblance to the structures found in hair follicles, sebaceous glands, and eccrine glands. This nuanced approach not only reflects the intricate nature of these tumors but also underscores the varied cellular origins and differentiation pathways that contribute to their development. Delving into the histological characteristics of skin adnexal tumors provides valuable insights into their underlying pathogenesis. The complexity of SATs serves as a testament to the remarkable diversity within the skin as an organ, wherein its appendages give rise to a spectrum of tumors, each presenting with unique histological profiles. This understanding not only enhances our grasp of the intricacies of skin pathology but also has implications for diagnostic accuracy, therapeutic strategies, and prognostic assessments in the context of dermatology and oncology. In essence, the exploration of skin adnexal tumors unfolds a captivating narrative about the dynamic interplay between cellular differentiation, organ complexity, and the onset of neoplastic transformations within the intricate tapestry of the skin.

Certain appendageal tumors bear significance beyond their localized impact on the skin, as they can serve as markers for internal visceral malignancies. Noteworthy examples include trichilemmomas in Cowden's disease and sebaceous tumors in Muir-Torre syndrome.² These associations underscore the intricate interplay between cutaneous manifestations and systemic health, emphasizing the importance of recognizing specific skin tumors as potential indicators of underlying internal malignancies. While the majority of skin adnexal tumors are benign and tend to remain confined to their site of origin, it is essential to acknowledge that a malignant counterpart has been identified for every type of skin adnexal tumor. Malignant skin adnexal tumors, although rare, exhibit characteristics of local aggressiveness and harbor the potential for nodal involvement and distant metastasis. This malignant transformation is associated with a generally poor clinical outcome,

emphasizing the need for vigilant monitoring, early detection, and comprehensive management strategies when dealing with these less common but potentially serious neoplasms. Understanding the dual nature of skin adnexal tumors, with both benign and malignant counterparts, underscores the importance of a thorough clinical and histopathological evaluation. It highlights the necessity for a multidisciplinary approach involving dermatologists, oncologists, and pathologists to ensure accurate diagnosis, appropriate management, and timely intervention to improve overall patient outcomes.

The origin of adnexal tumors lies in multipotential undifferentiated cells that reside within the epidermis or its appendageal structures. The histologic features exhibited by these tumors are intricately connected to the activation of molecular pathways responsible for the formation of mature adnexal structures.³ This underscores the dynamic cellular processes that contribute to the development of these neoplasms, emphasizing the importance of understanding the molecular underpinnings of their pathogenesis. Clinically, adnexal tumors present a diagnostic challenge due to their diverse nature, encompassing various entities with distinct presentations. Complicating matters, these tumors often share a commonality in presenting as asymptomatic papules or nodules, making them easily overlooked in routine clinical assessments. The subtle and nonspecific nature of their clinical manifestations underscores the significance of relying on histopathological and molecular analyses for accurate diagnosis, allowing for a more nuanced understanding of the specific type of adnexal tumor and guiding appropriate clinical management. In summary, the intricate relationship between undifferentiated cells, molecular pathways, and the diverse clinical presentations of adnexal tumors highlights the complexity of these neoplasms. A comprehensive approach that combines clinical observation with histopathological and molecular insights is crucial for accurate diagnosis and effective management of these often subtle yet potentially significant skin lesions.⁴ Hence, while the anatomical location, number, and distribution of lesions offer valuable clues, histopathology stands as an invaluable tool for definitively confirming the diagnosis of skin tumors. Recognizing the importance of these factors, there is a concerted effort to comprehensively study various types of skin tumors. This endeavor is undertaken with the awareness that such insights not only inform the diagnosis but also significantly influence patient management and prognosis. By delving into the intricacies of histopathological features, clinicians and pathologists can discern the specific characteristics of each tumor, aiding in precise identification and classification. This detailed understanding, coupled with clinical observations, not only contributes to accurate diagnostic outcomes but also provides critical information for tailoring effective treatment strategies.⁵ Furthermore, the

histopathological analysis plays a pivotal role in predicting the prognosis of these skin tumors, guiding healthcare professionals in determining the appropriate course of action for optimal patient outcomes. In essence, the interdisciplinary approach that combines clinical observation with detailed histopathological examination is essential for a comprehensive understanding of various skin tumors. This approach not only enhances diagnostic accuracy but also serves as a cornerstone in shaping patient care plans and prognostic assessments, ultimately influencing the overall management of individuals with skin neoplasms.

MATERIALS AND METHODS

The present study represents a retrospective analysis conducted over the span of one year, encompassing a total of 120 cases that were reported by the Histopathology Sections within the Department of Pathology. The dataset was derived from meticulously extracted clinicopathological information found in registers and case files for the specified duration. All biopsies and resected specimens received by the histopathology section underwent standardized processing, involving fixation in 10% formalin. Gross features were systematically documented, and subsequent routine processing procedures were followed. Histological slides were then stained with hematoxylin and eosin, with additional special stains such as periodic acid-Schiff (PAS) and reticulin utilized as needed for specific cases. The classification of tumors was carried out based on the predominant pattern of differentiation. The categorization adhered to the guidelines set forth by the International Classification of the World Health Organization (WHO). Tumors were stratified into distinct groups, namely follicular, sebaceous, eccrine, and apocrine tumors. This standardized classification system, endorsed by WHO, ensures a uniform and globally recognized approach to characterizing skin adnexal tumors, facilitating clear communication and comparison of findings across the medical community. The meticulous methods employed in this study underscore the commitment to thorough investigation and classification, providing a robust foundation for further analysis and interpretation of the diverse spectrum of skin adnexal tumors.

RESULTS

In the current investigation, a gender analysis revealed a male-to-female ratio of 1:1.4, indicating a slight female preponderance. The study further highlighted that the highest incidence of skin adnexal tumors was observed in the age group of 21–30 years (50/120), followed by the age groups of 31–40 (30/120) and 41–50 (20/112) years, respectively. This age distribution underscores the relevance of considering these tumors across a spectrum of adult populations. Geographically, the head and neck region emerged as the predominant site affected, accounting for 66.6%

(80/120) of cases. This was followed by the trunk, representing 25% (30/120) of cases, and the extremities with 8.3% (10/120). Within the head and neck region (n=80), a detailed breakdown revealed that approximately 50% (40/80) of cases were located on the face, followed closely by the scalp in 45% (36/80) of cases. The neck region exhibited the least incidence at 5% (4/80). These demographic and anatomical findings provide valuable insights into the epidemiology and distribution of skin adnexal tumors. The observed female preponderance and the concentration of cases in specific age groups and anatomical locations contribute to a better understanding of the clinical profile and characteristics of these tumors, offering important considerations for diagnosis, management, and further research.

In the detailed exploration of adnexal tumors conducted in this study, a predominant occurrence of benign cases, comprising 93% (112/120) of the total, contrasted with malignant adnexal tumors, which constituted 6.7% (8/120) of the cases. Within the overarching category of adnexal tumors, a nuanced breakdown revealed that sweat gland tumors held the largest share at 41.7% (50/120), followed by hair follicle tumors at 33.3% (40/120) and sebaceous gland tumors at 25% (30/120) (see Table 1). Delving into the subtypes of sweat gland tumors (n=50), the study unveiled that hidradenoma papilliferum was the most prevalent at 48%, followed by syringoma (12%), cylindroma, chondroid syringoma, eccrine poroma, and hidradenoma, each contributing 8% of cases. Apocrine hidradenoma and syringocystadenoma papilliferum were identified in 5.4% of cases. The category of hair follicle tumors (n=40) displayed pilomatricoma as the predominant subtype, making up 60% of cases. Proliferating trichilemmal cyst accounted for 30%, while trichofolliculoma and trichilemmal carcinoma each represented 5% of cases.

Sebaceous gland tumors (n=30) demonstrated Nevus sebaceous as the most common subtype at 60%, followed by sebaceous adenoma (20%) and sebaceous carcinoma (20%). Among benign tumors, Hidradenoma papilliferum and Pilomatricoma emerged as the most frequently observed, with each subtype accounting for 24 cases. Pilomatricoma displayed a peak incidence between 11 and 40 years, predominantly affecting males, whereas Hidradenoma papilliferum was more prevalent among females aged 20–40. Within the malignant category, sebaceous carcinoma constituted 75% of cases, and trichilemmal carcinoma made up the remaining 25%. Notably, two cases presented as nodulo-ulcerative lesions, while the other two manifested as non-healing ulcers. These detailed findings provide a comprehensive understanding of the prevalence, subtypes, and clinical characteristics of adnexal tumors, thereby contributing to enhanced diagnostic precision and informed management strategies in clinical practice.

Table 1: showing age distribution among cases

Age	Present Study	Percentage
0-10	4	3.3%
11-20	12	10%
21-30	50	41.7%
31-40	30	25%
41-50	20	16.75%
>50	4	3.3%

Table 2: showing the various locations of the lesion in relation to sex distribution

S. No	Site	Male	Female	Total(N=120)	Percent
1	Head& neck				66.6%
	face	22	18	40	50%
	scalp	8	28	36	45%
	neck	2	2	04	5%
2	trunk	14	16	30	25%
3	extremities	4	6	10	8.3%

Figure1: Showing the various locations of the lesion in relation to sex distribution

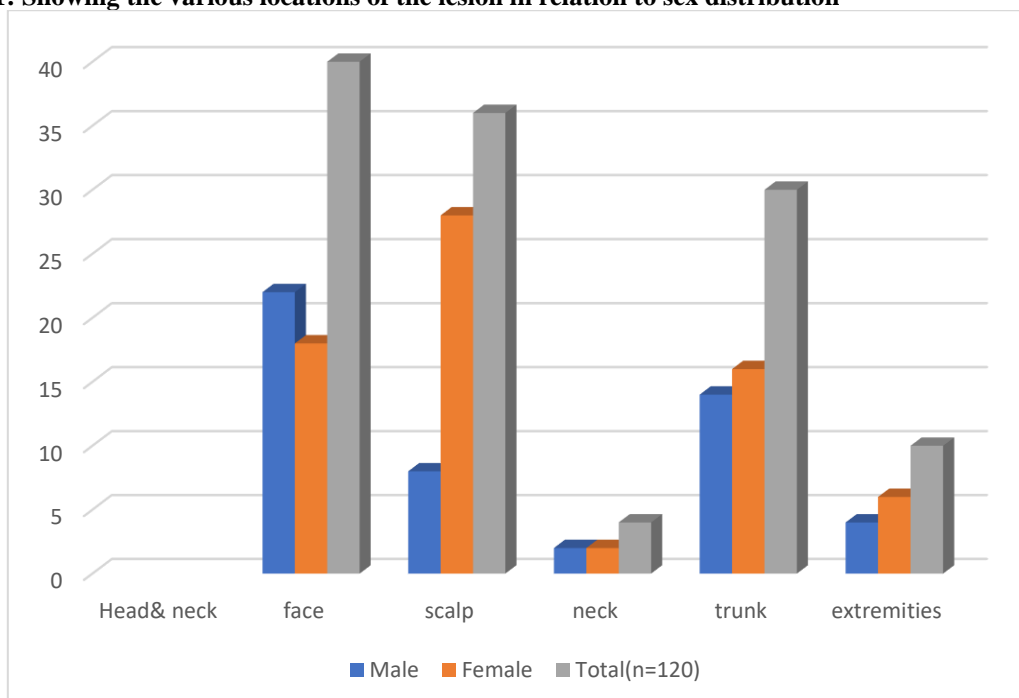
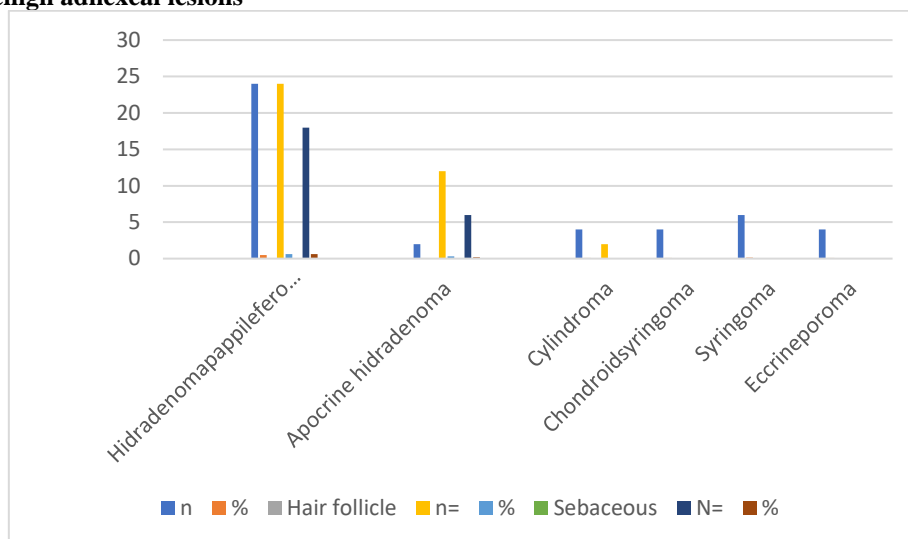


Table 4: Benign adnexal lesions

Sweat gland lesions	n	%	Hair follicle	n=	%	Sebaceous gland	N=	%
Hidradenomapappileferom	24	48%	Pilomatricoma	24	60%	Neavus sebaceous	18	60%
Apocrine hidradenoma	2	4%	Proliferating trichelemmal tumor	12	30%	Sebaceous adenoma	6	20%
Cylindroma	4	8%	trichofolliculoma	2	5%			
Chondroidsyringoma	4	8%						
Syringoma	6	12%						
Eccrineporoma	4	8%						

Figure 2: Benign adnexal lesions



DISCUSSION

Cutaneous adnexal tumors, arising from pluripotent cells with the remarkable ability to differentiate into various skin appendages, present a captivating dimension within the realm of dermatopathology. The intricate interplay of these pluripotent cells gives rise to tumors that often exhibit a mosaic of elements from different appendages, showcasing a spectrum of maturation stages. The phenomenon of combined characteristics, observed consistently in various studies, including the present investigation, further accentuates the complexity and heterogeneity inherent in these tumors. The reported incidence of such tumors, as documented in surgical specimens, serves as a benchmark for understanding their prevalence within clinical contexts.^{6,7} However, it is crucial to acknowledge a potential underestimation of the true clinical prevalence of adnexal tumors. Many of these tumors, particularly those of a benign nature, tend to remain asymptomatic, causing no cosmetic concerns and thus eluding reporting to medical facilities. This discrepancy underscores the importance of considering the underreported cases when interpreting clinical statistics related to cutaneous adnexal neoplasms. The extended duration of adnexal tumors and their manifestation as asymptomatic papules or nodules not only underscores their predominantly benign nature but also adds a layer of diagnostic challenge. Despite their rarity, the recognition of skin adnexal tumors dates back to the latter part of the 19th century, contributing to the historical narrative of dermatopathology.⁸ In unraveling the intricacies of pluripotent cell origins, the potential for combined characteristics, and the typically indolent course of these tumors, a comprehensive understanding emerges. This knowledge not only aids in the accurate diagnosis of cutaneous adnexal neoplasms but also informs appropriate clinical management. Furthermore, it emphasizes the need for heightened awareness and improved reporting mechanisms to capture the nuanced and often overlooked clinical

incidence of these intriguing skin lesions in the broader landscape of dermatological pathology. Skin adnexal tumors (SATs) are relatively infrequent occurrences in dermatology, as evidenced by the report of only 60 cases over a five-year span in a tertiary care center. This observation aligns with findings from similar Indian studies conducted by Ankit Sharma, Radhika et al., and Samaila, where the majority of SATs (93%) were classified as benign, with a smaller proportion (6.7%) identified as malignant. This consistent pattern across studies underscores the unique characteristics of these neoplasms and their diverse clinical presentations. The prevailing trend of sweat gland differentiation being the most common type of tumor, as observed in studies by Ankit Sharma et al. and Nair et al., is corroborated by the present study. Sweat gland tumors emerged as the largest subset within SATs, emphasizing the significance of understanding their histopathological features for accurate diagnosis and management. The age distribution of SATs spans a wide range, with variations noted in different studies. While Ankit Sharma et al. found a common age of presentation between 51-60 years, Radhika et al. identified the third decade as the most prevalent, and Vani et al. reported a peak occurrence in the 41-50 years age group. Intriguingly, the current study revealed the 21-30 years age group as the most commonly affected, highlighting the diversity in age-related presentations of SATs. Gender distribution in the study population exhibited a male-to-female ratio of 1:1.4, with a female preponderance. This finding resonates with observations from Radhika et al., Nair et al., Ankit Sharma et al., and underscores the importance of considering gender-specific variations in the prevalence and clinical characteristics of SATs. Anatomically, the head and neck region emerged as the predominant site of occurrence, consistent with reports from Radhika et al., Nair et al., Ankit Sharma et al., and Vani et al. This propensity for occurrence in the head and neck region emphasizes the need for

meticulous examination and consideration of this anatomical area in the clinical evaluation of skin lesions.⁹ Specific tumor types within SATs revealed notable trends, with hidradenoma papilliferum and pilomatricoma identified as the most common benign tumors, and sebaceous carcinoma as the most prevalent malignant tumor in the study. The varied presentation of these tumor types further highlights the need for a nuanced and comprehensive approach to the diagnosis and management of SATs. In conclusion, the findings from this study contribute valuable insights into the prevalence, clinical characteristics, and histopathological features of SATs. The data generated not only align with existing literature but also underscore the importance of continued research to enhance our understanding of these unique skin neoplasms. Such knowledge is fundamental for accurate diagnosis, appropriate management, and improved clinical outcomes for individuals affected by SATs.

Certain tumors exhibit a peculiar temporal evolution in their presentation. For instance, Nevus Sebaceous of Jadassohn, although present at birth, often remains inconspicuous during infancy. It is only during adolescence that these lesions undergo progressive thickening and growth, prompting individuals to seek medical attention. This delayed manifestation underscores the importance of recognizing that certain tumors may have a latent phase, becoming more noticeable only as they enlarge over time. In contrast, malignant adnexal tumors present a distinct pattern, often being reported in advanced age.¹⁰ This observation aligns with the general understanding that malignant neoplasms tend to have a higher incidence in older individuals. However, it's crucial to note that malignant adnexal tumors are relatively rare, emphasizing the complexity and diversity within this category of skin tumors. The recognition of these temporal and age-related nuances in tumor presentation underscores the importance of continuous vigilance and thorough clinical examination. Understanding the evolving nature of certain tumors allows for timely diagnosis and intervention, improving the prospects for effective management and optimal patient outcomes.

The findings from our study align with well-documented observations in dermatological literature, indicating that the head and neck region is the most common anatomical site for skin adnexal tumors. This consistent trend has been reported not only in studies from various countries but also in different states of India. The prevalence of adnexal tumors in the head and neck region can be attributed to the rich distribution of apocrine and eccrine sweat glands, along with the pilosebaceous apparatus in this area. The abundance of these adnexal structures likely contributes to the higher incidence of tumors in the head and neck region. Moreover, the consensus across studies, including our own, highlights that benign adnexal tumors are more frequently encountered than

malignant ones. This prevalence of benign lesions may be attributed to factors such as the often indolent nature of these tumors, their asymptomatic presentation, and their relatively slow growth. Understanding the predominance of benign adnexal tumors is essential for clinicians in guiding appropriate diagnostic and management strategies. Overall, these consistent patterns in the anatomical distribution and prevalence of benign versus malignant adnexal tumors underscore the importance of recognizing and studying these trends for accurate diagnosis and management in clinical practice.

CONCLUSION

The incidence of skin adnexal tumors in South India is reported to be very low. Among these tumors, benign skin adnexal tumors are more prevalent, displaying a wide age distribution. In contrast, malignant cases are less common and tend to occur predominantly in older individuals. One of the challenges in clinical practice is the difficulty in diagnosing or differentiating between benign and malignant cases based solely on clinical findings. This is exacerbated by the fact that many of these tumors present with nonspecific swellings, making clinical assessment less definitive. To address this diagnostic challenge, histopathology emerges as the gold standard for the diagnosis of skin adnexal tumors. The scanner view, in particular, plays a crucial role as it enables the assessment of architectural features. This includes evaluating irregular and infiltrative patterns of growth, identifying necrotic areas, and distinguishing malignant lesions before delving into the evaluation of cytological features. The emphasis on histopathological examination underscores the need for a detailed and comprehensive assessment to accurately classify and differentiate between benign and malignant skin adnexal tumors. In summary, the low overall incidence, prevalence of benign tumors, and the challenge of clinical differentiation highlight the critical role of histopathology, especially the scanner view, in providing a definitive diagnosis for skin adnexal tumors in South India. This approach ensures a thorough evaluation of architectural features, aiding clinicians in making informed decisions regarding patient management and treatment strategies.

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