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CLINICO-HISTOLOGICAL SCHEMA WITH IMPORTUNITY ON LAYERED ANALYSIS OF PIGMENTED DERMATOSES

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ABSTRACT: -
Introduction: Pigmented dermatoses encompass a diverse spectrum of benign and malignant conditions, necessitating a structured clinico-histological approach for accurate diagnosis and stratification. Layered analysis, integrating clinical presentation with histopathological depth, enhances diagnostic precision and guides management. This study aims to develop a clinico-histological schema for pigmented dermatological lesions, emphasizing a layered analytical approach to improve diagnostic accuracy, risk assessment, and therapeutic decision-making.
Methods: A cohort of patients presenting with pigmented dermatoses underwent detailed clinical evaluation and histopathological examination. Lesions were stratified based on morphological patterns, epidermal and dermal involvement, cellular atypia, and pigmentation characteristics. The findings were correlated with clinical parameters to establish a diagnostic framework.
Results: In toto 75 cases were studied. Pigmented dermatoses presented between the first and eighth decade with a slight female preponderance. The most afflicted site was the head and neck region. Layered analysis facilitated the differentiation between benign, premalignant, and malignant pigmented lesions. Out of the seventy five cases analysed; there were fifty two non-melanocytic and twenty three melanocytic lesions. Of all the cases encountered, benign melanocytic nevi (17.3%) were commonest followed by seborrheic keratosis (14.7%). Stratification based on histopathological depth and cellular architecture improved sensitivity in detecting malignancy and assessing disease progression. Key diagnostic patterns emerged, aiding in subclassification and prognostication.
Conclusion: The proposed clinico-histological schema, incorporating a layered analytical approach, enhances diagnostic accuracy in pigmented dermatoses. This method provides a structured framework for better lesion characterization, aiding clinicians in risk stratification and personalized treatment planning.

INTRODUCTION: -

Pigmented dermatoses encompass a diverse group of conditions characterized by either increased or decreased pigmentation of the skin. These disorders are prevalent worldwide and vary in clinical presentation, etiology, and histopathological features, posing diagnostic challenges for dermatologists(1). The spectrum includes both common entities such as melasma, post-inflammatory hyperpigmentation, and lichen planus pigmentosus, as well as rarer conditions like pigmented contact dermatitis and erythema dyschromicum perstans(2,3).

Human melanocytes are present throughout the skin, as well as in the mucous membranes, hair follicles, hair matrix, and various other organ systems, including the heart, the uveal tract of the eyes, the inner ear, and the leptomeninges. The development of melanocytes serves as an ideal model for investigating complex developmental processes. Originating from the neural crest, melanocytes follow a seemingly straightforward pathway—differentiating and migrating throughout the developing embryo to reach specific sites such as the skin, hair follicles, and various other locations in the body(4). Pigmentation disorders can result from disruptions in the migration of melanocytes from the neural crest to the skin during embryogenesis, impaired transfer of melanin from melanocytes to keratinocytes, or alterations in melanin synthesis(5). Melanocytes are diminutive in size relative to adjacent basal keratinocytes and exhibit ovoid nuclei with a prominent perinuclear halo. Their cytoplasm extends into long, dendritic processes. These cells are responsible for the synthesis of melanin, a pigment that confers photoprotection by absorbing and dissipating ultraviolet (UV) radiation(6). Disorders of hypermelanosis erupt from multi-fold mechanisms like excess of melanocytes, and overactive melanocytes(7). In

some cases, these conditions may also be accompanied by additional symptoms. In Asian populations, particularly Indians, hyperpigmentation is a common and significant cosmetic concern(8). Accurate diagnosis is vital, not only for appropriate management but also for prognostication and patient counseling. Sole reliance on clinical findings may be insufficient due to overlapping features among various pigmented conditions. In this context, histopathological examination serves as an indispensable tool, providing definitive diagnostic clues and allowing subclassification based on microscopic patterns(9). A combined clinico-histological approach enhances diagnostic accuracy, reduces misclassification, and aids in understanding the pathogenesis of pigmentary disorders(10).

Previous studies have demonstrated that a significant proportion of clinically suspected pigmented dermatoses are reclassified upon histopathological examination(11). Therefore, histopathology remains crucial, especially in chronic or atypical cases, and is considered the gold standard for establishing diagnosis when clinical ambiguity exists(12). The therapeutic approach should extend beyond clinical evaluation to include an assessment of the patient's psychological well-being. Dermatologists can enhance patient care by offering emotional support and referring for psychological intervention when appropriate(13,14). Given the psychosocial impact of pigmentary disorders, particularly in darker skin types, a systematic approach to diagnosis is warranted.

This study aims to assess the clinico-histological correlation in various pigmented dermatoses, thereby contributing to better diagnostic clarity and improved patient outcomes.

MATERIALS AND METHODS: -

This cross-sectional observational research was adopted and data collected over a 1 year period at our Department of Pathology at Saveetha Medical College and Hospital. All skin biopsy specimens were scrutinized during the study period, and clinically diagnosed pigmented skin lesions were subjected for histopathological analysis. All hypopigmented skin lesions and inadequate biopsy specimens were excluded. Institutional Ethics Committee approval was accomplished.

Skin biopsy specimens submitted for histologic diagnosis were preserved in formalin solution and accompanied by detailed clinical information provided on the request form. Demographic details, clinical history were appraised from request forms and recorded in a structured pro forma. The gross examination of the specimen included an assessment of its three-dimensional size and shape. The entire specimen was submitted for routine processing and embedded in paraffin wax. Sections measuring 3–5 micrometers in thickness were then cut from the paraffin block and were stained with Hematoxylin and Eosin for microscopic analysis. The Hematoxylin and Eosin-stained slides of the skin biopsies were reviewed and analyzed with regard to patient age, sex, anatomical site of the lesion, and histological type.

RESULTS: -

The study included 75 (7.5%) clinically and histopathologically diagnosed cases of pigmented cutaneous lesions, out of 998 skin biopsy specimens received during the entire study period. Following processing and reporting, the cases were further classified into melanocytic {Benign melanocytic nevi and Malignant Melanoma} 23 (30.6%) and non-melanocytic 52 (69.4%) pigmented lesions. Of all the cases encountered, benign melanocytic nevi 13 (17.3%) cases were commonest followed by seborrheic keratosis 11 (14.7%) cases, as depicted in figure 1. 41.3% (31/75) and 58.7% (44/75) of the cases were male and female, respectively, with an overall female to male ratio of 1.4 : 1, as illustrated in figure 2.

Figure 1 - Distribution of Pigmented Skin Lesions

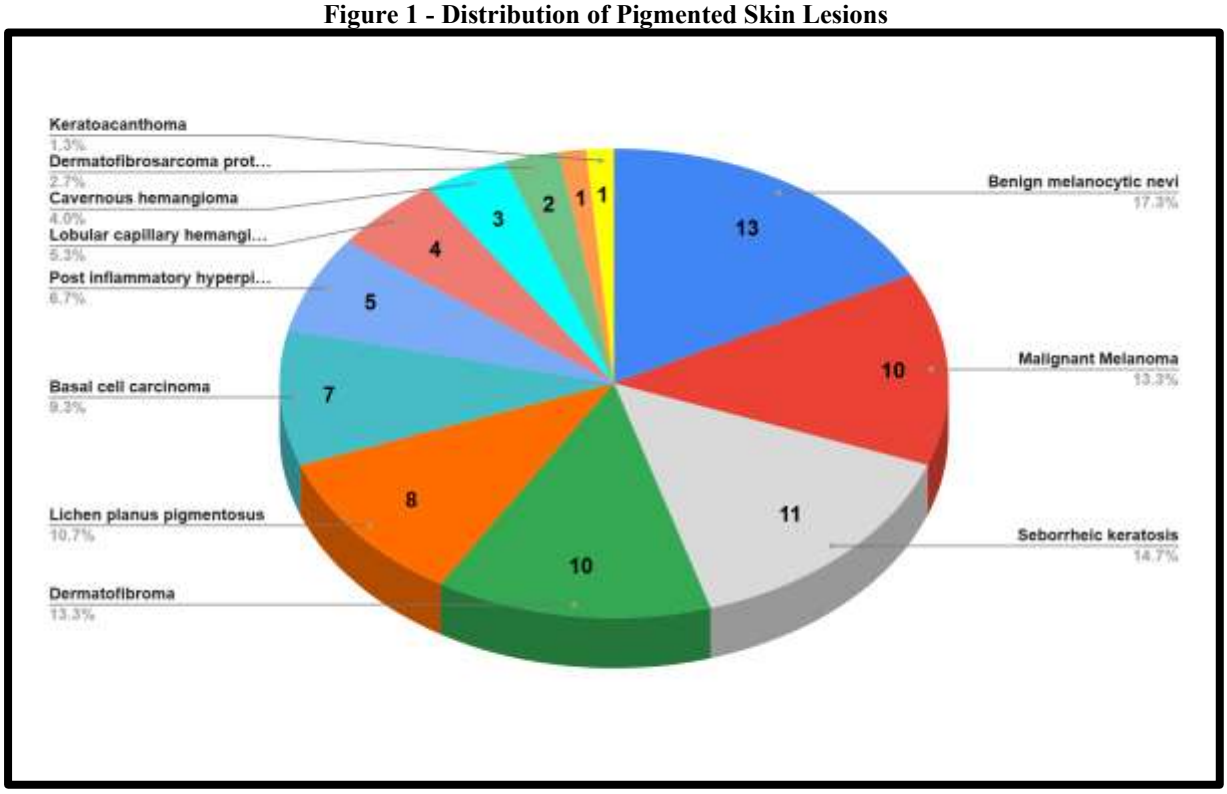
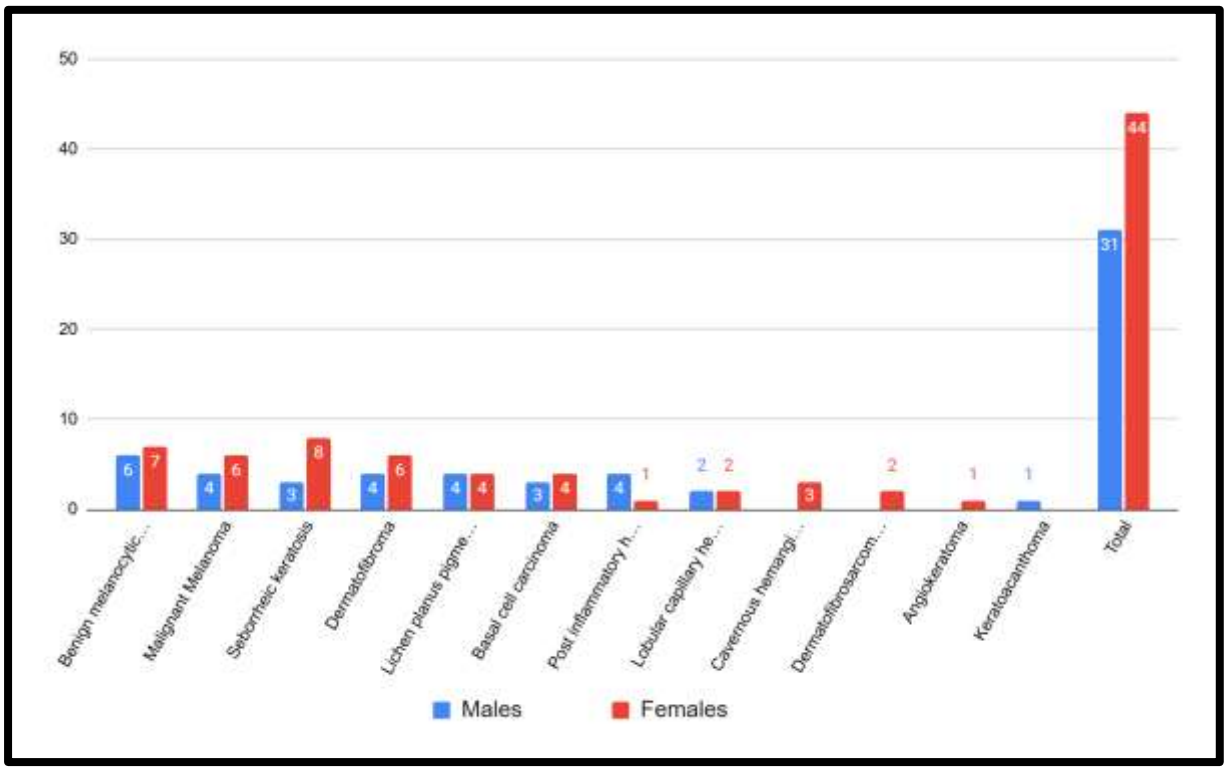


Figure 2 - Gender Distribution of Pigmented Skin Lesions



The age of the presenting patients ranged from 15 years - 75 years, with the majority of the patients, 21.3% (16/75) within 21 - 30 years old followed by 17.3 % (13/75) in the 51 - 60 years age group. The spectrum of diagnosed pigmented skin lesions according to the age bracket is represented in table 1.

Table 1 - Spectrum of Pigmented Skin Lesions amidst age groups

Pigmented Skin Lesions (n)	Age Group (Years) n (%)						
	< 21	21-30	31-40	41-50	51-60	61-70	> 70
Benign melanocytic nevi (13)	2 (15.3)	7 (53.8)	1 (7.7)	1 (7.7)	1 (7.7)	1 (7.7)	–
Seborrheic keratosis (11)	–	1 (9.1)	–	3 (27.3)	4 (36.4)	2 (18.2)	1 (9.1)
Malignant melanoma (10)	–	–	–	1 (10)	5 (50)	–	4 (40)
Dermatofibroma (10)	1 (10)	2 (20)	4 (40)	2 (20)	–	1 (10)	–
Lichen planus pigmentosus (8)	1 (12.5)	3 (37.5)	2 (25)	2 (25)	–	–	–
Basal cell carcinoma (7)	–	–	–	1 (14.3)	1 (14.3)	–	5 (71.4)
Post inflammatory hyperpigmentation (5)	1 (20)	–	1 (20)	1 (20)	1 (20)	1 (20)	–
Lobular capillary hemangioma (4)	–	2 (50)	1 (25)	–	–	1 (25)	–
Cavernous hemangioma (3)	–	1 (33.3)	1 (33.3)	1 (33.3)	–	–	–
Dermatofibrosarcoma protruberans (2)	1 (50)	–	1 (50)	–	–	–	–
Angiokeratoma (1)	–	–	–	–	–	1 (100)	–
Keratoacanthoma (1)	–	–	–	–	1 (100)	–	–
Total (75)	6 (8.0)	16 (21.3)	11 (14.7)	12 (16.0)	13 (17.3)	7 (9.3)	10 (13.3)

Out of a total 13 benign melanocytic nevi lesions in the present study, face is the most commonly affected site constituting about 84.6% (11/13) cases followed by trunk and back each constituting about 7.7% (1/13) cases. Within face, eyelid is the most common affected site constituting about 30.7% (4/13) cases, as portrayed in table 2.

Table 2 - Anatomical distribution of Melanocytic skin lesions

Anatomical site	Benign melanocytic nevi n (%)	Malignant melanoma n (%)
Scalp	1 (7.7)	–

Forehead	1 (7.7)	–
Eyebrow	1 (7.7)	–
Eyelid	4 (30.7)	–
Temporal area	2 (15.4)	–
Cheek	1 (7.7)	–
Chin	1 (7.7)	–
Neck	–	1 (10.0)
Shoulder	–	3 (30.0)
Trunk	1 (7.7)	2 (20.0)
Back	1 (7.7)	1 (10.0)
Labia	–	1 (10.0)
Foot	–	2 (20.0)
Total	13 (100)	10 (100)

Table 3 displays the proportionate anatomical distribution of non-melanocytic skin lesions without a particular affliction to a specific site.

Table 3 - Anatomical distribution of Non-Melanocytic skin lesions

Anatomical site	SK n (%)	DF n (%)	LPP n (%)	BCC n (%)	PIH n (%)	LCH n (%)	CH n (%)	DFSP n (%)	AK n (%)	KA n (%)
Scalp	2 (18.2)	--	--	--	--	1 (25)	--	1 (50)	--	--
Forehead	--	--	--	1 (14.3)	--	--	--	--	--	--
Ear	2 (18.2)	--	--	--	--	--	--	--	--	--
Temporal area	1 (9.1)	1 (10)	--	3 (42.8)	--	--	--	--	--	--
Ala of nose	1 (9.1)	--	--	1 (14.3)	--	--	--	--	--	--

Neck	--	--	--	--	2 (40)	--	--	1 (50)	--	--
Chest	--	--	--	--	--	--	1 (33.3)	--	--	--
Shoulder	--	--	1 (12.5)	--	--	--	--	--	--	--
Forearm	--	5 (50)	1 (12.5)	--	--	--	--	--	--	--
Hand	--	--	2 (25)	--	--	1 (25)	--	--	--	--
Trunk	2 (18.2)	--	--	--	1 (20)	--	--	--	--	--
Back	1 (9.1)	--	2 (25)	--	--	--	--	--	--	--
Penis	--	--	1 (12.5)	--	--	--	--	--	--	--
Scrotum	--	--	--	--	--	--	--	--	1 (100)	1 (100)
Gluteal	--	1 (10)	--	--	1 (20)	--	--	--	--	--
Thigh	1 (9.1)	1 (10)	--	2 (28.6)	1 (20)	--	--	--	--	--
Knee	1 (9.1)	--	--	--	--	--	--	--	--	--
Leg	--	1 (10)	1 (12.5)	--	--	--	2 (66.7)	--	--	--
Foot	--	1 (10)	--	--	--	2 (50)	--	--	--	--
Total	11 (100)	10 (100)	8 (100)	7 (100)	5 (100)	4 (100)	3 (100)	2 (100)	1 (100)	1 (100)

AK - Angiokeratoma, BCC- Basal cell carcinoma, CH- Cavernous hemangioma,
DF –Dermatofibroma, DFSP-Dermatofibrosarcoma protuberans,
LPP- Lichen planus pigmentosus, LCH- Lobular capillary hemangioma,
KA – Keratoacanthoma, PIH – Post inflammatory hyperpigmentation, SK – Seborrheic keratosis

Of the 75 cases, 73.3 % (55/75) cases showed concordance between the clinical and histopathological diagnoses, while 26.7% (20/75) cases demonstrated discrepancies between the two, as shown in table 4. The histopathological images are displayed in figure 3.

Table 4 - Clinico-histopathological correlation of Pigmented Skin Lesions

Pigmented Skin Lesions	No. of cases n (%)	Histopathological Diagnosis	
		Concordance with Clinical Diagnosis n (%)	Discrepancy with Clinical Diagnosis n (%)
Benign melanocytic nevi	13 (17.3)	11 (84.6)	2 (15.4) - Seborrheic keratosis
Seborrheic keratosis	11 (14.7)	9 (81.8)	2 (18.2) - Nevi
Malignant melanoma	10 (13.3)	7 (70)	1(10) - Basal cell carcinoma
			2 (20) - Nevus
Dermatofibroma	10 (13.3)	5 (50)	2 (20) - Dermatofibrosarcoma protuberans
			3 (30) - Nevi
Lichen planus pigmentosus	8 (10.7)	6 (75)	1 (12.5) - Pityriasis rosea
			1 (12.5) - Ashy dermatosis
Basal cell carcinoma	7 (9.4)	5 (71.4)	2 (28.6) - Nevi
Post inflammatory hyperpigmentation	5 (6.7)	5 (100)	—
Lobular capillary hemangioma	4 (5.3)	4 (100)	—
Cavernous hemangioma	3 (4.0)	3 (100)	—
Dermatofibrosarcoma protruberans	2 (2.7)	—	1 (50) - Neurofibroma
			1 (50) - Fibroma
Angiokeratoma	1 (1.3)	—	1 (100) - Hemangioma
Keratoacanthoma	1 (1.3)	—	1 (100) - Squamous cell carcinoma
Total	75 (100)	55 (73.3)	20 (26.7)

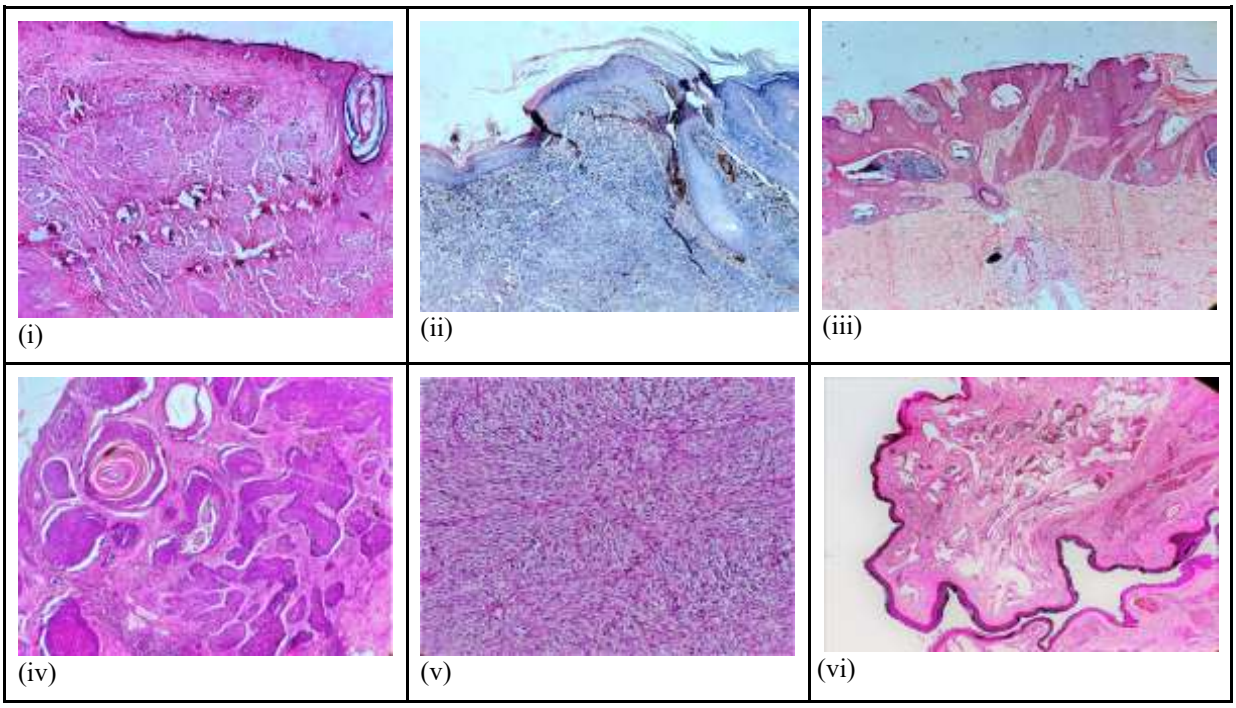


Figure 3 - Pigmented Skin Lesions - Histopathological analysis

(i) Intradermal nevus characterized by nests and cords of nevus cells with varying degrees of pigmentation located in the upper dermis (H&E) (ii) Malignant melanoma exhibiting junctional activity, presence of melanin pigment, and dermal infiltration by atypical melanocytes with maturational lack (H&E) (iii) Seborrheic keratosis with hyperplastic stratified squamous epithelium with numerous horn cysts (H&E) (iv) Basal cell carcinoma characterized by nests of basaloid cells displaying peripheral palisading, accompanied by dermal melanophages (H&E) (v) Dermatofibroma composed of proliferating fibroblasts and histiocytes, along with melanophages and numerous blood vessels (H&E) (vi) Cavernous hemangioma characterized by dilated, thin-walled vascular channels lined by a single layer of flattened endothelial cells (H&E).

DISCUSSION: -

Pigmented skin lesions are a diverse group of conditions characterized by abnormal coloration of the skin due to increased melanin production, deposition of other pigments, or vascular changes(15). These lesions range from benign entities such as melanocytic nevi and seborrheic keratoses to malignant conditions like melanoma, making accurate diagnosis crucial for appropriate management. Clinically, pigmented lesions can present with a variety of colors, shapes, and surface features, often posing diagnostic challenges(3). Histopathological evaluation remains the gold standard for definitive diagnosis, helping to distinguish between benign and malignant lesions and guiding treatment decisions. In this context, a thorough clinicopathological correlation is essential to ensure accurate diagnosis and optimal patient care.

In our study, the pigmented skin lesions constituted 7.5% (75/998) of all specimens. The majority of them were non-melanocytic pigmented lesions 69.4% (52/75) as compared to melanocytic lesions 30.6% (23/75). This dermatological spectrum is comparable to earlier studies(16–18), but contradicted by Khan et al(19) and Laishram et al(20).

Pigmented skin lesions were more commonly observed in females (58.7%) than males (41.3%), with gender distribution of 1.4:1, consistent with the impeachment by Akhavan et al(21), Avani et al(16), and Bohra et al(22). We perceived the peak incidence amongst the 21 - 30 years age bracket, in accordance with studies conducted by Avani et al(16), and Veldurthy et al(23).

Overall, benign melanocytic nevi were the most common lesion 17.3% (13/75) which showed increased preponderance among females 9.3% (7/75), which is coherent to work by Muradia et al(24), Clarke(25), and Parvathi et al(26).

The anatomical site of infliction was widely discerned to head and neck region supremely the face 38.6% (29/75), which is agreeable with work of Akhavan et al(21), Singh et al(27), Bohra et al(22) and Khan et al(19), but incongruous by Avani et al(16) and Anand et al(17), wherein the extremities were most afflicted.

In the present study, amidst the melanocytic lesions, intradermal nevi were espied to be the most common, succeeded by compound nevi and congenital melanocytic nevi in frequency. This apportionment was true to type with the findings of Jagannadham et al(28), and Singh et al(27).

Clinico-histological similarity was surveyed in 73.3% (55/75) cases, which is amicable with Singh et al(27) and Parvathi et al(26).

CONCLUSION: -

Pigmented skin lesions often present a clinical challenge due to their wide range of appearances and overlapping features between benign and malignant entities. As a result, histopathological examination becomes an essential tool in confirming the nature of these lesions. Clinico-histopathological correlation plays a pivotal role in the accurate diagnosis of pigmented skin lesions.

While clinical evaluation provides essential preliminary information, histopathological examination offers definitive confirmation, especially in differentiating benign from malignant conditions. Cases with discrepancies highlight the essence of histological assessment in all suspicious lesions to prevent misdiagnosis. Continued emphasis on integrated clinical and pathological evaluation is essential for improving diagnostic accuracy and patient outcomes in the dermatopathology sphere.

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