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A Deep Dive into Hyperpigmented Skin: Understanding And Addressing Dark Spots

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ABSTRACT

INTRODUCTION: Hyperpigmented skin lesions are a common clinical presentation with significant implications for patient health and quality of life. These lesions vary widely in their etiology and histopathological features, pose diagnostic challenges and carry considerable health burden, particularly in high-risk populations. This study aims to explore the histopathological spectrum of hyperpigmented skin lesions.

OBJECTIVES: To study histopathological spectrum of hyperpigmented skin lesions and to correlate the findings with clinical spectrum and demographic data.

METHODOLOGY: This is a retrospective study done in Department of Pathology, Shri Atal Bihari Vajpayee Medical College and Research Institute from January 2023 to July 2024. A total of 46 cases of hyperpigmented skin lesions were included for histopathological examination.

RESULTS: Out of 46 cases, majority 32.6% (n=15) belong to 40-50 years age. 24 cases belonged to female (52.17%). Most common site involved was back in 11 cases (23.91%). Most common hyperpigmented lesion was dermatitis in 17 (36.95%) cases, followed by lichen planus in 13 (28.26%) cases. Others are infection/inflammation (n=5), morphea (n = 3), psoriasis (n=2), intradermal nevus (n=2), bullous dermatitis (n= 1), pemphigus (n=1), keloid (n=1) and verruca (n=1). Clinico-histopathological correlation was carried out & found to be concordant in 24 cases.

CONCLUSION: In conclusion, the histopathological examination of hyperpigmented skin lesions is crucial for accurate diagnosis and effective management. Addressing the health burden associated with these lesions requires a comprehensive approach that includes patient education, regular screenings, and access to dermatological care, particularly in high-risk populations.

KEYWORDS: Hyperpigmented skin, Dermatitis, Lichen Planus

INTRODUCTION

Pigmented skin lesions refer to skin abnormalities that are brown, black, blue, or other dark hues.[1] Disease characterized by hyperpigmentation represents a heterogeneous group of conditions, encompassing a wide and often bewildering array of rare diseases. Several factors are considered

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in the clinical classification of these diseases, including the distribution, pattern, and morphology of the lesions.[2] Dermatological lesions are commonly encountered worldwide, encompassing a broad spectrum of conditions that vary not only between countries but also among different regions within the same country. The prevalence of dermatological lesions is reported to range from 6.3% to 11.16%. [3]

Disorders of pigmentation may arise due to various underlying mechanisms, including abnormal migration of melanocytes from the neural crest to the skin during embryogenesis, defective melanosome transfer to keratinocytes, or alterations in melanin synthesis (Familial progressive hyperpigmentation, Legius syndrome, Neurofibromatosis Type 1, LEOPARD syndrome, and Noonan syndrome). While a higher melanin content generally offers greater photoprotection, pigmentary disorders related to photodamage remain relatively common.[4] The microscopic examination of skin tissue is arguably the most important diagnostic technique in the evaluation and management of patients with hyperpigmented skin disorders. Therefore, a meticulous histopathological interpretation by the pathologist is essential for the accurate diagnosis and effective timely management of these lesions. [5]

MATERIALS & METHODS

Study Design: Retrospective study.

Study period: January 2023 to July 2024.

Place of study: Department of Pathology, Shri Atal Bihari Vajpayee Medical College and Research Institute, Bangalore – 560001.

Sample size: 46 cases.

Inclusion Criteria:

All hyperpigmented skin lesions diagnosed clinically are included in the study.

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Exclusion Criteria:

1. Hypopigmented skin lesions.

2. Inadequate Skin biopsies.

METHODOLOGY:

This is a retrospective study done in Department of Pathology, Shri Atal Bihari Vajpayee Medical College and Research Institute from January 2023 to July 2024. A total of 46 cases of hyperpigmented skin lesions were included for histopathological examination.

Biopsy samples taken from clinically diagnosed hyperpigmented skin lesions were received in the histopathology laboratory and fixed in 10% neutral buffered formalin. Relevant demographic information, including age and gender, along with clinical details such as provisional diagnosis, site of lesion, and evidence of pigmentation, were collected from histopathology requisition forms and patient case records. The tissue samples were adequately fixed for a duration of 12 to 24 hours, following which routine tissue processing was carried out. Paraffin-embedded blocks were prepared, and sections measuring 3–4 micrometers in thickness were cut using a microtome. These sections were routinely stained with hematoxylin and eosin (H&E) for microscopic evaluation. Special stains, were employed when necessary to aid in further characterization of the lesions. Stained sections of skin biopsies were systematically examined under light microscopy, with respect to age, gender, anatomical site of occurrence, histological type and clinicohistopathological correlation. Archived slides and corresponding tissue blocks were retrieved and meticulously reviewed under the microscope. The findings were documented and tabulated for analysis.

STATISTICAL TOOL FOR ANALYSIS:

Data collected was compiled, entered into a Microsoft Excel worksheet and were arranged in a tabulated form. The number and percentage of incidence in different age groups, between genders, among different types of lesions, and in comparison, to other studies were calculated by descriptive statistical analysis.

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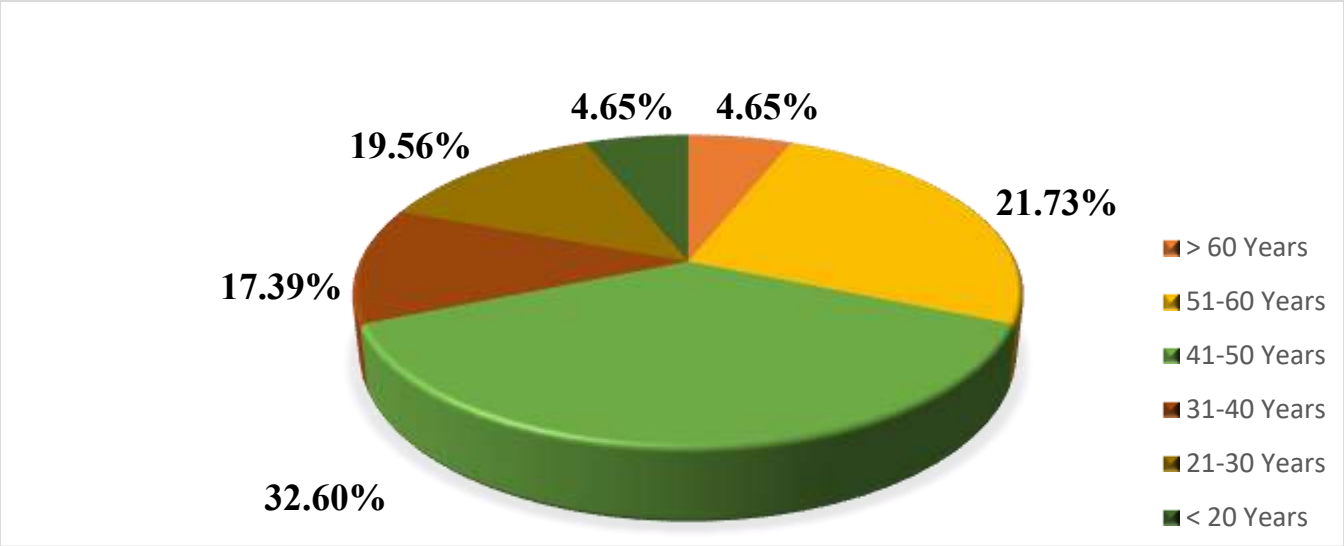
RESULTS:

The study was conducted over a period from January 2023 to July 2024. A total of 46 hyperpigmented skin lesions were obtained and analyzed.

Table 1: Age Wise Distribution



The age-wise distribution of the study population, as illustrated in the pie chart (Table 1), demonstrates that the largest proportion of participants were in the 41–50 years age group, comprising 32.60% (n = 15) of the total sample. This indicates a clear predominance of individuals in the middle-aged category. The second most represented group was the 51–60 years age range, which accounted for 21.73% (n = 10) of cases, further emphasizing the higher involvement of older middle-aged adults. Participants aged 21–30 years formed 19.56% (n = 9) of the study population, while those in the 31–40 years age group constituted 17.39% (n = 8). In contrast, the extreme age groups were minimally represented; individuals younger than 20 years and those older than 60 years each accounted for only 4.65% (n = 2) of cases. Overall, the chart highlights the age distribution reveals that hyperpigmented skin lesions were predominantly observed in the middle decades of life, with a gradual decline in frequency toward both the younger and older age extremes.

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Table 2: Age & Gender distribution:

Age (Years)	Male (n%)	Female (n%)	Total (N = 46)
> 60	2	-	2 (4.65%)
51-60	5	5	10 (21.73%)
41-50	5	10	15 (32.60%)
31-40	3	5	8 (17.39%)
21-30	6	3	9 (19.56%)
< 20	1	1	2 (4.65%)
Total	22 (47.83%)	24 (52.17)	46 (100%)

With respect to gender distribution, the study population demonstrated a near-equal representation of males and females, with a slight female predominance. Out of the total 46 participants, 24 were females, accounting for 52.17% of the cases, while 22 were males, comprising 47.83%. Female participants were more frequently represented in the 41–50 and 31–40 years age groups, whereas males were comparatively more common in the 21–30 years age group. Both genders were equally represented in the 51–60 years category, and minimal representation was observed in the extreme age groups of below 20 years and above 60 years. Overall, the gender distribution indicates a balanced study population with only a marginal predominance of females. (Table 2)

Table 3: Site of hyperpigmented skin lesion

SITE	FREQUENCY (100%)
Trunk, Back, Abdomen	15 (32.60%)
Upper limb	12 (26.08%)
Lower limb	7 (15.21%)
Neck	6 (13.04%)
Face	4 (8.69%)

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Scalp	2 (4.34%)

The distribution of lesion sites showed that the trunk, back, and abdomen were the most commonly affected areas, accounting for 15 cases (32.60%). This was followed by involvement of the upper limbs in 12 patients (26.08%). Lesions on the lower limbs were observed in 7 cases (15.21%), while the neck was affected in 6 patients (13.04%). Facial involvement was comparatively less frequent, seen in 4 cases (8.69%). The scalp was the least commonly involved site, with only 2 cases (4.34%). Overall, lesions were more frequently located on the trunk and extremities than on the head and neck regions which is shown in Table 3.

Table 4: Histopathological Diagnosis:

Histopathological Diagnosis	**Common Presentation**	**Frequency (N= 46)**
Dermatitis (Ashydermatitis, phytophotodermatitis, spongiotic, lichenoid, Psoriasiform,etc)	Itchy, hyperpigmented raised lesions	17 (36.95%)
Lichen planus & its variants	Hyperpigmented lesions	13 (28.26%)
Infection/inflammation	Itchy raised lesions	5 (10.86%)
Morphea	Itchy, dark flat lesions	3 (6.52%)
Psoriasis	Itchy, dark plaque	2 (4.34%)
Intradermal Nevus	Raised dark lesions	2 (4.34%)
Bullous dermatitis	Hyperpigmented papules	1 (2.17%)
Pemphigus	Itchy lesions	1 (2.17%)
Keloid	Itchy, painful lesion	1 (2.17%)
Verruca	Dark lesions	1 (2.17%)

In this study, the histopathological evaluation of the 46 cases demonstrated that dermatitis constituted the most frequent diagnosis, accounting for 17 cases (36.95%). This group included various subtypes such as ashy dermatitis, phytophotodermatitis, spongiotic dermatitis, lichenoid dermatitis, and psoriasiform dermatitis, which commonly presented as itchy, hyperpigmented,

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raised lesions (Figure 1). Lichen planus and its variants (Figure 2) formed the second most common category, with 13 cases (28.26%), typically manifesting as hyperpigmented lesions. Infectious and inflammatory conditions were identified in 5 patients (10.86%), most often presenting with itchy, raised lesions. Morphea (Figure 3) was diagnosed in 3 cases (6.52%) and was characterized by itchy, dark, flat lesions. Psoriasis (Figure 4) and intradermal nevus (Figure 5) were each observed in 2 cases (4.34%); psoriasis commonly presented as itchy, dark plaques, whereas intradermal nevi appeared as raised, dark lesions. Less frequent diagnoses included bullous dermatitis (Figure 6), pemphigus (Figure 7), keloid (Figure 8), and verruca, each accounting for 1 case (2.17%). Overall, inflammatory dermatoses constituted the majority of diagnoses, with pigmentation and pruritus being the most common clinical features. (Table 4)

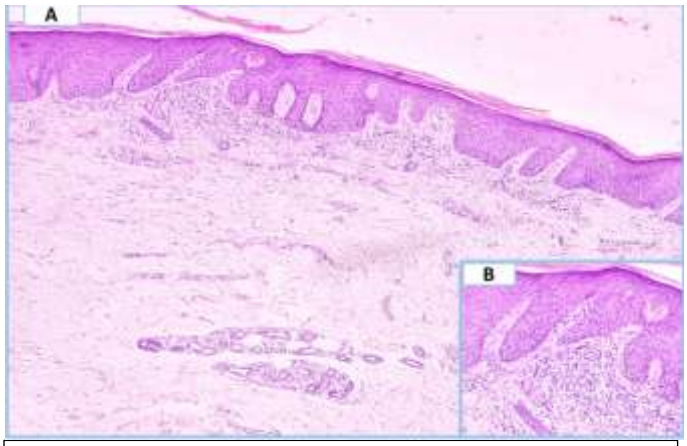

Fig. 1: Phytophotodermatitis
A) Photomicrograph showing parakeratosis, mild spongiosis, papillomatosis and acanthosis (H&E, 10X).
B) Dermis shows perivascular lymphohistiocytic infiltrate (H&E, 40X).

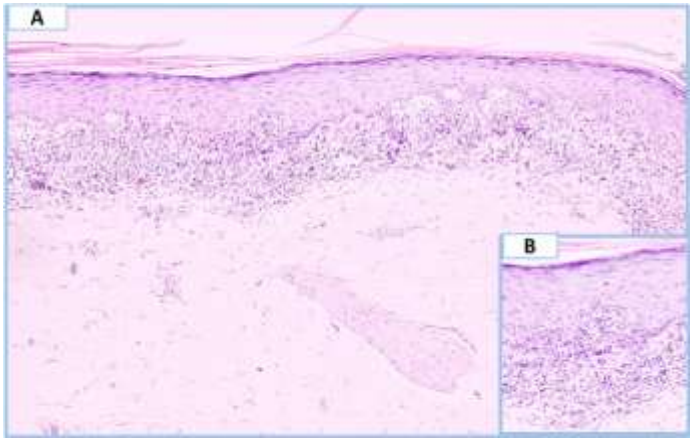

Fig. 2: Lichen Planus A, B) Photomicrograph showing epidermis with hyperkeratosis, hypergranulosis, spongiosis and band like lympho-histiocytic infiltrate at the dermo-epidermal junction. Also noted are pigment incontinence. Dermis shows perivascular chronic inflammatory cell infiltrate (H&E, 10X, 40X).

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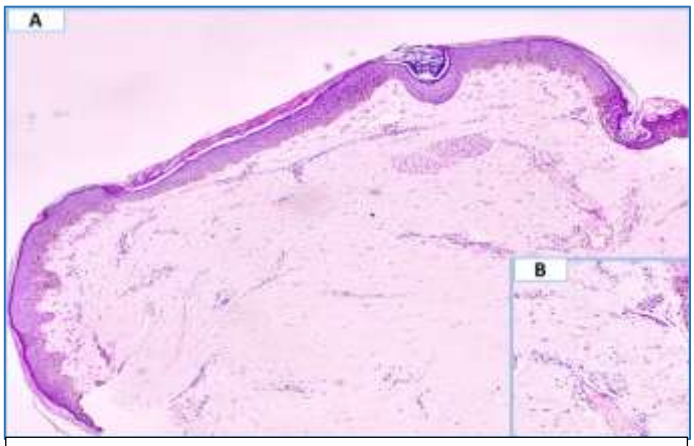

Fig.3: Morphea A) Photomicrograph showing epidermis mild acanthosis. Papillary and reticular dermis show periadnexal and perivascular inflammatory cell infiltrate (H&E, 10X).
B) Photomicrograph showing thickened collagen fibres (H&E, 40X).

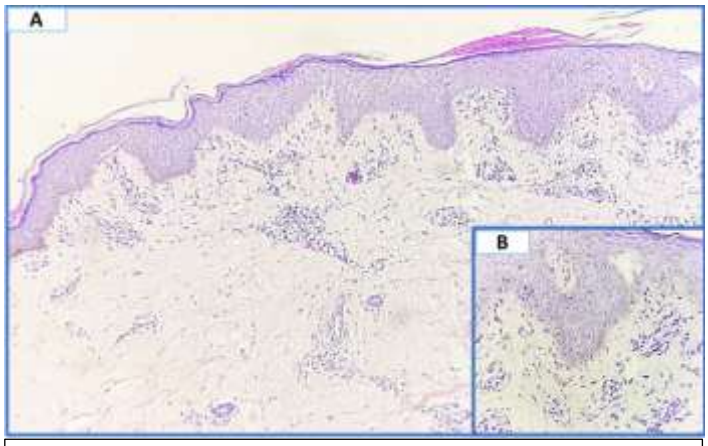

Fig.4: Psoriasis
A, B) Photomicrograph showing irregular acanthosis with focal parakeratosis and elongation of rete ridges. Dermis shows lymphocytic infiltrate. (H&E, 10X, 40X)

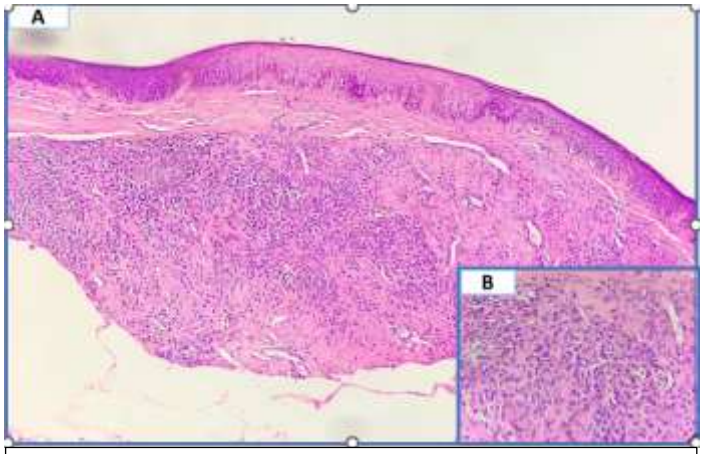

Fig.5: Intradermal Nevus
A) Photomicrograph showing epidermis lined by stratified squamous epithelium (H&E, 10X). B) Dermis shows nests, cords & clusters of round to spindle cells with small regular nuclei (H&E,

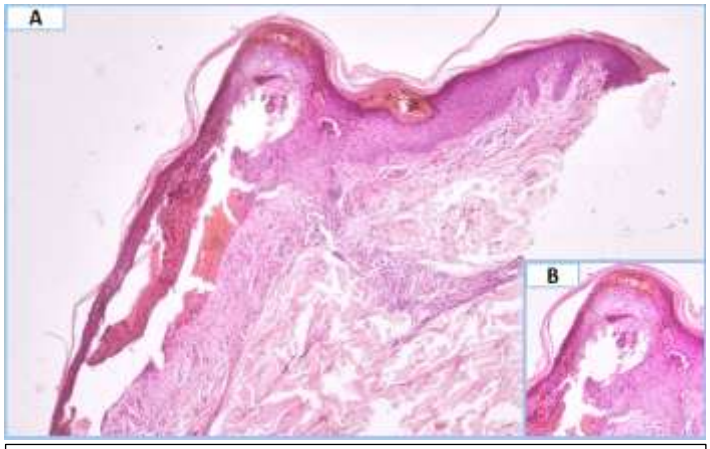

Fig.6: Bullous dermatosis
A, B) Photomicrograph showing a bullous lesion. Noted a perivascular inflammatory cell infiltrates along with congested blood vessels (H&E, 10X, 40X).

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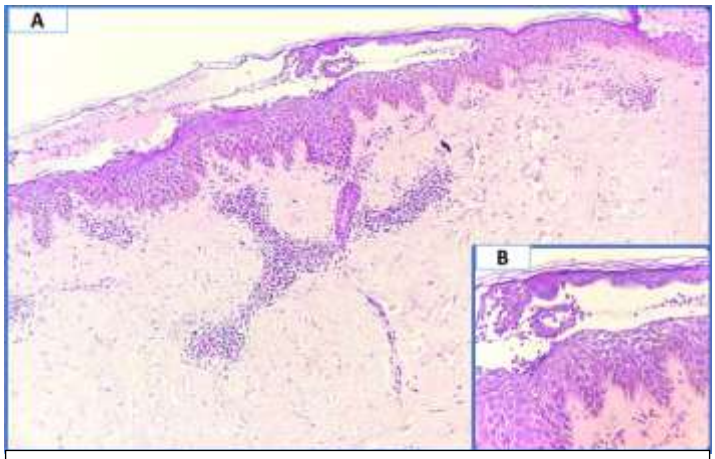

Fig.7: Pemphigus vulgaris
A, B) Photomicrograph showing suprabasilar acantholysis with bulla formation with intact basal layer containing acantholytic cells with few eosinophils and neutrophils. (H&E, 10X, 40X)

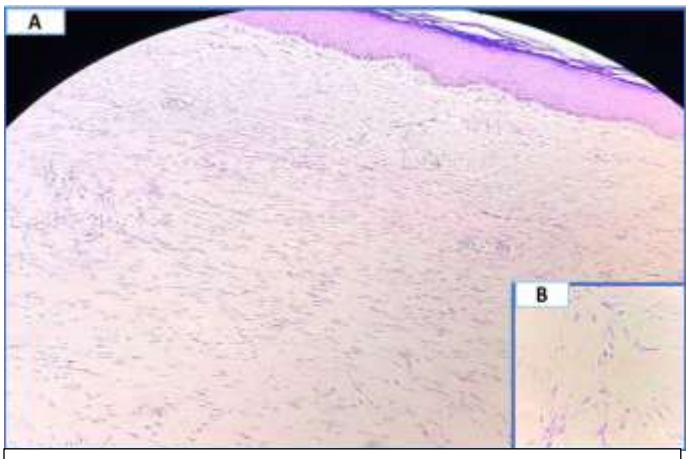

Fig.8: Keloid
A, B) Photomicrograph showing focal hyperkeratosis. Dermis shows increased collagenization (H&E, 10X, 40X)

The clinico-histopathological correlation analysis revealed an overall concordance rate of 56.52% (26 out of 46 cases), while non-concordance was observed in 43.47% (20 cases). Among dermatitis cases, 5 out of 6 cases (83.33%) showed agreement between clinical and histopathological diagnoses, indicating a high level of diagnostic accuracy, with only one case (16.66%) being non-concordant. Lichen planus constituted the largest diagnostic category with 18 cases, of which half (9 cases, 50%) demonstrated concordance, while the remaining 9 cases (50%) showed discordance. In cases diagnosed clinically as infection or inflammation, concordance was observed in only 3 of 8 cases (37.5%), with a higher rate of non-concordance (62.5%), reflecting diagnostic challenges in this group.

Morphea showed good clinico-histopathological agreement, with 3 out of 4 cases (75%) being concordant. Psoriasis also demonstrated a relatively high concordance rate, with 2 of 3 cases (66.6%) correlating with histopathological findings. Notably, intradermal nevus and bullous dermatitis showed complete concordance, with all cases (100%) correctly diagnosed clinically. Pemphigus demonstrated equal concordance and non-concordance, each accounting for 50% of cases. In contrast, clinically diagnosed mycetoma and warts showed no concordance with histopathological findings, with all cases being non-concordant. Overall, these findings highlight

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the importance of histopathological examination in confirming clinical diagnoses, particularly in conditions with overlapping clinical features.

Table 5. Clinical and Histopathological Correlation

Sl. No.	Cases	No. of cases	Concordance (n%) with clinical diagnosis	Non-Concordance (n%) with clinical diagnosis
1.	Dermatitis	6	5 (83.33%)	1 (16.66%)
2.	Lichen planus	18	9 (50%)	9 (50%)
3.	Infection/inflammation	8	3 (37.5%)	5 (62.5%)
4.	Morphea	4	3 (75%)	1 (25%)
5.	Psoriasis	3	2 (66.6%)	1 (33.34%)
6.	Intradermal Nevus	2	2 (100%)	Nil
7.	Bullous dermatitis	1	1 (100%)	Nil
8.	Pemphigus	2	1 (50%)	1 (50%)
9.	Mycetoma	1	0 %	1 (100%)
10.	Warts	1	0 %	1 (100%)
11.	**Total**	**46**	**26 (56.52%)**	**20 (43.47%)**

DISCUSSION:

Hyperpigmented skin lesions can be challenging to diagnose, as they may arise from a wide variety of etiological factors, including inflammatory, infectious, neoplastic, metabolic, and genetic causes. In Asians, skin hyperpigmentation is the commonest cosmetic problem leading to clinical and surgical intervention. The study aims to analyze the histomorphological spectrum of hyperpigmented skin lesions and to correlate with available clinical and demographic data.

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The present study, which analyzed 46 cases of clinically diagnosed hyperpigmented skin lesions, provides valuable insights into their demographic profile, clinical presentation, histopathological spectrum, and clinicohistopathological correlation, and allows meaningful comparison with previously published studies.

The present study was undertaken to evaluate the clinicohistopathological spectrum of hyperpigmented skin lesions and to compare the findings with previously published studies, including those by Sneha et al., Rajendra Prasad et al., and Smitha et al., in order to better understand demographic trends, clinical presentation, histopathological patterns, and diagnostic concordance. In the current study of 46 cases, the maximum number of patients belonged to the 41–50 years age group, indicating that hyperpigmented dermatoses were most prevalent in middle-aged individuals. This observation differs from the findings of Rajendra Prasad et al., who reported a higher incidence in the 51–60 years age group, and from studies by Smitha et al. and Sneha et al., which showed a predominance in younger adults aged 21–30 years. Such variation in age distribution may be attributed to differences in environmental exposure, occupational habits, lifestyle factors, genetic predisposition, and regional healthcare-seeking behavior [5,4,6].

A clear female predominance was observed in the present study, which is consistent with all the comparative studies reviewed. This uniform trend across multiple studies suggests that women may be more vulnerable to hyperpigmented skin conditions or are more likely to seek medical consultation due to cosmetic concerns and heightened awareness of skin changes. Hormonal influences, use of cosmetics, and greater psychosocial impact of pigmentation disorders in females may also contribute to this consistent observation.

The anatomical distribution of lesions in the present study showed a predominance of involvement of the trunk, back, and abdomen. This contrasts with facial predominance reported by Rajendra Prasad et al.,[4] limb involvement described by Smitha et al.,[6] and head and neck involvement observed by Abhishek et al. [7] These discrepancies highlight the heterogeneity of hyperpigmented lesions and suggest that factors such as sun exposure, clothing habits, occupational exposure, and regional climatic conditions may significantly influence lesion distribution. The frequent involvement of covered areas in the present study further suggests that

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inflammatory and systemic factors, rather than photo-exposure alone, may play an important role in the pathogenesis of these lesions.

Pruritus was the most common presenting symptom in the present study, a finding that correlates with observations made by Ravindran et al. [5] and Smitha et al. [6] The presence of itching underscores the inflammatory nature of many hyperpigmented dermatoses and emphasizes its impact on patient comfort and quality of life. Persistent pruritus may also contribute to lesion chronicity and post-inflammatory pigmentation due to repeated scratching.

Histopathological analysis in the present study revealed dermatitis in its various forms—including ashy dermatitis, phytophotodermatitis, spongiotic, lichenoid, and psoriasiform dermatitis - as the most frequent diagnosis. This differs from the predominance of classical lichen planus reported by Rajendra Prasad et al.,[4] lichenoid or interface dermatitis noted by Smitha et al.,[6] lichen planus and its variants described by Sneha et al.,[5] and benign melanocytic nevi reported by Abhishek et al. [7] These variations reflect the broad histomorphological spectrum of hyperpigmented skin lesions and highlight the overlap in clinical appearance among different entities. Consequently, reliance on clinical features alone may lead to diagnostic inaccuracies.

In this study, a clinico-histopathological concordance rate of 56.52% was observed, which is lower when compared with the rates documented by Rajendra Prasad et al. [4] and Sneha et al., [5] but comparable to the findings of Abhishek et al. [7] The relatively moderate concordance observed emphasizes the diagnostic challenges associated with hyperpigmented lesions due to their nonspecific clinical presentation. This reinforces the indispensable role of histopathological examination as the gold standard for definitive diagnosis. Overall, the present study highlights the need for a combined clinical and histopathological approach in the evaluation of hyperpigmented skin lesions to ensure accurate diagnosis, appropriate management, and improved patient outcomes.

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Sl No.	Data	Present study 46 cases	Rajendra Prasad et al., (2020) 88 cases	Smitha et al., (2016) 980 cases	Sneha et al., (2020) 100 cases	Abhishek et al., (2020) 75 cases
1	Age	41-50 years	51-60 years	21-30 years	21-30 years	21-30 years
2	Sex predominance	Female	Female	Female	Female	Female
3	Anatomical site	Trunk, back & abdomen	Face	Upper & lower limb	Extremities, back & trunk	Head & neck
4	Signs and symptoms	Itching	-	Itching	Hyperpigmented itchy lesion	-
5	Common histopathological diagnosis	Dermatitis (Ashy, Phytophotodermatistis, Spongiotic, Lichenoid, psoriasiform)	Classical Lichen planus	Lichenoid /Interface dermatitis	Lichen planus and its variants	Benign melanocytic nevi
6	Clinico-histopathological correlation	26 (56.52%)	75 (85%)	-	90%	55 (73.3%)

CONCLUSION:

The present study was done to show that histopathological examination of hyperpigmented skin lesions is crucial for accurate diagnosis and effective management. With the rise in cosmetologically beauty standards, patients have become more self-aware, leading to an increased demand for dermatological care. This, in turn, has drawn greater attention to the role of pathologists in diagnosing hyperpigmented skin lesions.

Addressing the health burden including the social & economic burden associated with these lesions requires a comprehensive approach that includes patient education, regular screenings, and access to dermatological care, particularly in high-risk populations.

Conflict of Interest: None

Source of Funding: None

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