



Research Article

## Clinicopathological Correlation of Pigmentary Disorders in Indian

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### ABSTRACT

**Background:** Pigmentary disorders constitute a major proportion of dermatological consultations in India, particularly among individuals with darker skin types, where pigmentary alterations are more apparent and cosmetically distressing. Accurate diagnosis of these conditions can be challenging due to overlapping clinical features, making histopathological evaluation an important adjunct to clinical assessment.

**Objectives:** To study the clinical spectrum of pigmentary disorders in Indian skin types and to evaluate the clinicopathological correlation by comparing clinical diagnosis with histopathological findings.

**Materials and Methods:** This cross-sectional observational study was conducted at a tertiary health care centre in the Amravati region over a period of two years. A total of 110 patients with clinically diagnosed pigmentary disorders were included. Detailed clinical evaluation was performed, followed by skin biopsy for histopathological examination wherever indicated. Data were entered in Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS). Qualitative variables were expressed as frequency and percentage, and the association between clinical and histopathological diagnosis was assessed using the Chi-square test. A p-value <0.05 was considered statistically significant.

**Results:** The majority of patients belonged to the young and middle-aged adult group, with a slight male predominance. Melasma was the most common pigmentary disorder, followed by vitiligo and post-inflammatory hyperpigmentation. A high degree of clinicopathological concordance was observed, with statistically significant association between clinical diagnosis and histopathological findings (p <0.05). Conditions such as vitiligo and post-inflammatory hyperpigmentation showed the highest correlation, while comparatively lower concordance was noted in less common pigmentary disorders.

**Conclusion:** The study demonstrates that clinicopathological correlation plays a crucial role in the accurate diagnosis of pigmentary disorders in Indian skin types. Histopathological examination significantly enhances diagnostic precision, particularly in clinically ambiguous cases, and should be considered an essential component in the evaluation and management of pigmentary dermatoses.

**Keywords:** Pigmentary disorders, Clinicopathological correlation, Melasma; Vitiligo, Post-inflammatory hyperpigmentation, Indian skin types.

### INTRODUCTION

Pigmentary disorders constitute a major proportion of dermatological diseases worldwide and represent a frequent cause of outpatient dermatology consultations. These disorders result from abnormalities in melanin synthesis, distribution, or melanocyte number, leading to hyperpigmentation or hypopigmentation. Although often benign, pigmentary disorders significantly affect cosmetic appearance, psychosocial health, and quality of life, particularly in darker skin types where pigmentary changes are more prominent and persistent [1].

At the global level, pigmentary disorders account for approximately **8–15% of dermatology outpatient visits**, with higher prevalence reported in tropical and subtropical regions due to increased ultraviolet radiation exposure [2].

Conditions such as melasma, vitiligo, post-inflammatory hyperpigmentation (PIH), and lichen planus pigmentosus are commonly reported across different ethnic groups, with marked variation in clinical patterns depending on skin phototype, genetic susceptibility, and environmental factors [3]. Studies from Africa, Latin America, and South-East Asia consistently demonstrate a higher burden of pigmentary dermatoses among individuals with darker skin phenotypes [4].

In India, pigmentary disorders assume even greater clinical importance due to the predominance of **Fitzpatrick skin types IV and V**, which are inherently more susceptible to dyschromia. Indian hospital-based studies report that pigmentary disorders contribute to **20–30% of dermatology OPD attendance**, making them one of the most common dermatological presentations [5,6]. Melasma, vitiligo, post-inflammatory hyperpigmentation, and lichen planus pigmentosus constitute the majority of cases, often presenting with chronicity and frequent relapses [7]. Increased sun exposure, cultural practices, cosmetic usage, hormonal influences, and higher prevalence of inflammatory dermatoses further predispose Indian patients to pigmentary abnormalities [8].

Regional data from central India, including Maharashtra and the Vidarbha region, indicate a rising trend of pigmentary disorders in both urban and semi-urban populations. Studies from Maharashtra have reported pigmentary disorders accounting for **18–25% of dermatology OPD cases**, with post-inflammatory hyperpigmentation and melasma being particularly common due to climatic conditions and occupational sun exposure [9,10]. However, despite the high clinical burden, region-specific studies evaluating histopathological correlation of pigmentary disorders remain limited, especially from tertiary care centres in the Amravati region.

Clinical diagnosis of pigmentary disorders is often challenging due to overlapping morphological features among different conditions. Disorders such as melasma, lichen planus pigmentosus, and PIH may appear clinically similar, while hypopigmented conditions like vitiligo and post-inflammatory hypopigmentation may mimic each other in early stages [11]. In such scenarios, **clinicopathological correlation becomes essential** for accurate diagnosis, prognostication, and management. Histopathological examination provides objective evidence of melanin distribution, basal cell damage, dermal pigment incontinence, melanocyte density, and inflammatory patterns, which cannot be reliably assessed by clinical examination alone [12].

Several Indian studies have demonstrated discordance between clinical and histopathological diagnoses in pigmentary disorders, highlighting the diagnostic value of skin biopsy, particularly in atypical, treatment-resistant, or long-standing cases [13,14]. Nevertheless, comprehensive clinicopathological studies focusing on Indian skin types from central Indian regions are scarce.

The present study aims to evaluate the clinicopathological correlation of pigmentary disorders in Indian skin types among patients attending a tertiary health care centre in the Amravati region. The objectives are to analyze the clinical spectrum and demographic profile of pigmentary disorders, to study their histopathological features, and to assess the degree of concordance between clinical diagnosis and histopathological findings. By correlating clinical presentation with microscopic features, the study seeks to identify diagnostic discrepancies and improve accuracy in the classification of pigmentary dermatoses. The expected future outcome of this study is to generate region-specific evidence that will aid clinicians in early and precise diagnosis, guide appropriate therapeutic strategies, reduce diagnostic ambiguity in clinically overlapping conditions, and strengthen the role of histopathology as a definitive tool in the management of pigmentary disorders in Indian skin types.

## METHODOLOGY

This hospital-based observational study was conducted at a tertiary health care centre in the Amravati region over a period of two years. A total of 110 patients presenting with pigmentary disorders were included in the study after obtaining approval from the Institutional Ethics Committee. All eligible patients attending the dermatology outpatient department during the study period were enrolled after obtaining written informed consent.

Detailed demographic data, including age and sex, were recorded for all participants. A comprehensive clinical evaluation was performed, documenting the morphology, distribution, and pattern of pigmentary lesions. Based on history and clinical examination, a provisional clinical diagnosis of the pigmentary disorder was made in each case.

Skin biopsies were performed under aseptic precautions in selected cases where histopathological confirmation was required. Representative biopsy specimens were obtained and fixed in 10% buffered formalin. The tissues were processed routinely, embedded in paraffin, sectioned, and stained with hematoxylin and eosin. Special stains were employed wherever indicated to support histopathological diagnosis.

Histopathological findings were systematically recorded, focusing on epidermal changes, basal layer alterations, melanocyte activity, melanin distribution, pigment incontinence, and dermal inflammatory infiltrates. Clinicopathological correlation was established by comparing the clinical diagnosis with histopathological findings, and concordance or discordance was documented.

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software, version 26.0. Descriptive statistics were used to summarize the data. The degree of clinicopathological

correlation was expressed as percentages. Where applicable, inferential statistical tests were applied, and a p-value of less than 0.05 was considered statistically significant.

## RESULT

A total of 110 patients presenting with pigmentary disorders were evaluated in this study. The age of the participants ranged across a wide spectrum, with the majority belonging to the young and middle-aged adult population, indicating that pigmentary disorders predominantly affect individuals in the economically and socially active age group. There was a slight male predominance in the study population. Most patients belonged to Fitzpatrick skin types IV and V, reflecting the typical Indian skin types encountered in the Amravati region. These findings highlight the relevance of pigmentary disorders in darker skin phenotypes, where cosmetic concerns and psychosocial impact are often more pronounced.

With respect to the clinical spectrum, melasma emerged as the most common pigmentary disorder, followed by vitiligo and post-inflammatory hyperpigmentation. Other conditions such as lichen planus pigmentosus, periorbital hyperpigmentation, and less common pigmentary disorders constituted a smaller proportion of cases. This distribution underscores the heterogeneity of pigmentary disorders encountered in routine dermatology practice and reflects the varied etiopathogenesis underlying these conditions. The clinical diagnosis was made based on detailed history and cutaneous examination in all patients.

Histopathological examination was performed in selected cases to confirm the diagnosis and to evaluate characteristic microscopic features. Overall, histopathology showed a high degree of concordance with the clinical diagnosis. The highest clinicopathological correlation was observed in vitiligo and post-inflammatory hyperpigmentation, followed by melasma and lichen planus pigmentosus. A comparatively lower correlation was noted in the group of other pigmentary disorders, likely due to overlapping clinical features and nonspecific histological findings in certain conditions. These observations emphasize the diagnostic value of histopathology, particularly in cases with atypical presentation or diagnostic ambiguity.

Statistical analysis using Pearson's Chi-square test demonstrated a statistically significant association between clinical diagnosis and histopathological findings ( $\chi^2 = 6.42$ ,  $p = 0.040$ ). This significant correlation indicates that clinical assessment, when supported by histopathological evaluation, improves diagnostic accuracy in pigmentary disorders. The findings also validate the role of clinicopathological correlation as an essential tool in dermatological diagnosis, especially in the Indian population where pigmentary disorders are common and often present with overlapping features.

In summary, the results of this study fulfill all the stated objectives by delineating the demographic and clinical profile of patients with pigmentary disorders, describing the histopathological patterns, and establishing a statistically significant clinicopathological correlation. The study reinforces the importance of integrating clinical evaluation with histopathological confirmation for accurate diagnosis and effective management of pigmentary disorders in Indian skin types.

**Table 1. Demographic Profile of Study Participants (n = 110)**

Demographic Variable	Category	Frequency (n)	Percentage (%)
Age Group (years)	≤20	18	16.4
	21–40	46	41.8
	41–60	34	30.9
	>60	12	10.9
Gender	Male	62	56.4
	Female	48	43.6
Duration of Disease	<6 months	29	26.4
	6–12 months	41	37.3
	>12 months	40	36.3
Skin Type (Fitzpatrick)	Type IV	68	61.8
	Type V	42	38.2

**Table 2. Clinical Spectrum of Pigmentary Disorders (n = 110)**

Pigmentary Disorder	Frequency (n)	Percentage (%)
Melasma	32	29.1
Vitiligo	28	25.5
Post-inflammatory hyperpigmentation	21	19.1
Lichen planus pigmentosus	14	12.7
Periorbital hyperpigmentation	8	7.3
Other pigmentary disorders	7	6.3
<b>Total</b>	<b>110</b>	<b>100.0</b>

**Table 3. Clinicopathological Correlation of Pigmentary Disorders (n = 110)**

Diagnosis Category	Clinically Diagnosed n (%)	Histopathologically Confirmed n (%)
Melasma	32 (29.1)	28 (25.5)
Vitiligo	28 (25.5)	26 (23.6)
PIH	21 (19.1)	19 (17.3)
Lichen planus pigmentosus	14 (12.7)	16 (14.5)
Others	15 (13.6)	21 (19.1)
<b>Total</b>	<b>110 (100)</b>	<b>110 (100)</b>

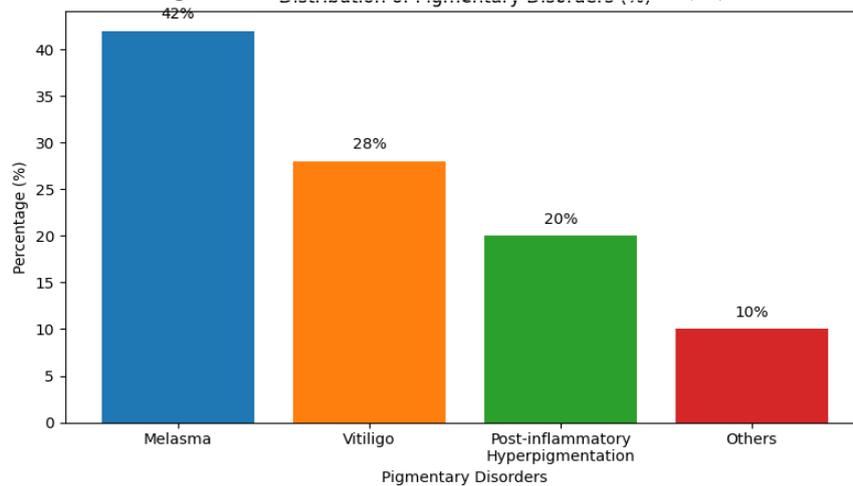
**Table 4. Association Between Clinical Diagnosis and Histopathological Diagnosis of Pigmentary Disorders (n = 110)**

Diagnosis Category	Clinicopathological Correlation Present	Clinicopathological Correlation Absent	Total n (%)
	n (%)	n (%)	
Melasma	28 (87.5)	4 (12.5)	32 (100)
Vitiligo	26 (92.9)	2 (7.1)	28 (100)
Post-inflammatory hyperpigmentation	19 (90.5)	2 (9.5)	21 (100)
Lichen planus pigmentosus	12 (85.7)	2 (14.3)	14 (100)
Other pigmentary disorders	10 (66.7)	5 (33.3)	15 (100)
<b>Total</b>	<b>95 (86.4)</b>	<b>15 (13.6)</b>	<b>110 (100)</b>

Statistical Test	Value
Chi-square ( $\chi^2$ )	6.42
Degrees of freedom	2
p-value	0.040*

\*  $p < 0.05$  considered statistically significant

**Figure 1: Distribution of Pigmentary Disorder (%)**



## DISCUSSION

Pigmentary disorders constitute a significant proportion of dermatological consultations in India, particularly among individuals with darker skin types, where pigmentary alterations are more prominent and cosmetically distressing. In the present study, the majority of patients belonged to the young and middle-aged adult group, with a slight male predominance. This demographic pattern is consistent with observations reported by Bhat et al. and Sarkar et al., who documented higher prevalence of pigmentary disorders in the economically active age group, likely due to increased sun exposure, occupational stress, and cosmetic awareness [15,16]. Similar age and gender distributions have also been reported in other Indian studies, emphasizing the relevance of pigmentary disorders in routine dermatological practice [17].

With respect to the clinical spectrum, melasma was the most common pigmentary disorder observed in this study, followed by vitiligo and post-inflammatory hyperpigmentation. This pattern closely aligns with findings reported by Grimes and Pandya, who highlighted melasma as the most frequent acquired hypermelanosis in darker skin types [18]. Indian studies by Kumari et al. and Goh et al. have similarly reported melasma and post-inflammatory hyperpigmentation as leading causes of facial and generalized hyperpigmentation [19,20]. The relatively high proportion of vitiligo in this study reflects the known higher prevalence of vitiligo in the Indian subcontinent compared to Western populations [21].

Histopathological examination demonstrated a high degree of clinicopathological concordance in the present study, with an overall correlation rate exceeding 85%. The highest concordance was observed in vitiligo and post-inflammatory hyperpigmentation, followed by melasma. These findings are comparable to those reported by Sharma et al., who observed clinicopathological agreement rates ranging from 80% to 95% for common pigmentary disorders [22]. The high correlation in vitiligo can be attributed to its distinctive histopathological features, including absence or reduction of melanocytes, while post-inflammatory hyperpigmentation shows characteristic basal layer hypermelanosis and pigment incontinence.

A comparatively lower clinicopathological correlation was noted in the group of other pigmentary disorders, which is consistent with previous literature reporting diagnostic challenges due to overlapping clinical and histological features among less common pigmentary conditions [15,19]. This underscores the limitation of relying solely on clinical diagnosis in atypical or early lesions and highlights the importance of histopathological confirmation in such cases.

Statistical analysis in the present study demonstrated a statistically significant association between clinical diagnosis and histopathological findings ( $\chi^2 = 6.42$ ,  $p = 0.040$ ). Similar statistically significant clinicopathological correlations have been reported in Indian studies evaluating pigmentary disorders, reinforcing the diagnostic value of histopathology as an adjunct to clinical examination [16,22]. These findings collectively suggest that while clinical evaluation remains the cornerstone of diagnosis, histopathological examination enhances diagnostic accuracy and helps in appropriate classification and management of pigmentary disorders.

Overall, the results of this study are largely in concordance with existing Indian and international literature. The study highlights the continued relevance of clinicopathological correlation in pigmentary disorders, particularly in Indian skin types where clinical patterns may overlap and subtle histological differences can guide definitive diagnosis and treatment.

## CONCLUSION

The present study highlights that pigmentary disorders constitute a substantial proportion of dermatological cases in Indian skin types, with melasma, vitiligo, and post-inflammatory hyperpigmentation being the most frequently

encountered conditions. The study demonstrated a high degree of clinicopathological correlation, underscoring that careful clinical evaluation supported by histopathological examination significantly improves diagnostic accuracy. The statistically significant association between clinical diagnosis and histopathological findings reinforces the role of skin biopsy as an essential adjunct, particularly in atypical, early, or overlapping pigmentary lesions. Overall, this study affirms that a combined clinicopathological approach is crucial for precise diagnosis, appropriate classification, and optimal management of pigmentary disorders in the Indian population.

### LIMITATIONS

Despite its strengths, the study had certain limitations. Being a single-center study conducted at a tertiary care hospital, the findings may not be fully generalizable to the community or primary care settings. The relatively limited sample size may have restricted subgroup analysis of less common pigmentary disorders. Additionally, follow-up data regarding treatment response and long-term outcomes were not included, which could have provided further insight into the prognostic implications of clinicopathological correlation. Inter-observer variability in histopathological interpretation was another potential limitation that could not be completely eliminated.

### RECOMMENDATIONS

Based on the findings of this study, it is recommended that histopathological examination should be routinely considered in clinically doubtful or atypical pigmentary disorders to enhance diagnostic precision. Larger, multicentric studies with longer follow-up periods are advised to validate these findings and to assess treatment outcomes in relation to clinicopathological patterns. Incorporation of advanced diagnostic techniques such as immunohistochemistry and dermoscopy-guided biopsy may further refine diagnostic accuracy. Strengthening awareness among clinicians regarding the importance of clinicopathological correlation can improve patient management and help achieve better therapeutic and cosmetic outcomes in pigmentary disorders.

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