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Clinico-Epidemiological Characteristics and Dermoscopic Patterns of Vitiligo in Adults: A Cross-Sectional Study

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ABSTRACT

Background: Vitiligo is a chronic depigmenting disorder with variable clinical presentation and causes a significant psychological impact. Dermoscopy has now become an important tool for the diagnosis of the disease and therapeutic prognosis. The current study aimed to evaluate the clinic-epidemiological profile and dermoscopic patterns of vitiligo in adult patients presenting to our tertiary care hospital.

Methods: This cross-sectional observational study was conducted in 50 adult cases of vitiligo. A detailed history, including family history, precipitating factors, and autoimmune comorbidities, was analyzed. Clinical subtype and distributions were recorded. The disease activity was assessed using Vitiligo Disease Activity (VIDA) scores. Dermoscopic evaluation was done to determine the characteristic patterns and their association with clinical features.

Results: The mean age of the cohort was 36.4 years with a slight female preponderance. The most frequent type of vitiligo was the non-segmental type in 84% of cases. Acrofacial and generalized subtypes were most frequently found. Stress was the predominant precipitating factor with common coexisting autoimmune comorbidity. Koebner phenomenon, mucosal involvement, and leukotrichia were observed in a significant case. Dermoscopy revealed chalky-white background, perifollicular pigmentation, micro-islands of pigment, and comet-tail borders. Perifollicular pigmentation was significantly correlated with stable disease, whereas micro-islands and comet-tail borders correlated with active disease.

Conclusion: Our study found clinic-epidemiological diversity in the distribution of diseases. Non-segmental vitiligo was the commonest subtype, and the autoimmune disease commonly associated with it was thyroid disorders. Precipitating factors were stress and trauma. Dermoscopy provided crucial insights, particularly for perifollicular pigmentation and micro-islands of pigment, which were associated with disease stability and activity.

Keywords: Vitiligo; Dermoscopy; Clinico-epidemiological study; Non-segmental Vitiligo; Autoimmune association; Disease activity

INTRODUCTION

Vitiligo is a chronic depigmentary disorder of the skin and mucous membranes. It is characterised by the development of well-demarcated depigmented macules and patches due to selective destruction of melanocytes [1]. The prevalence of this condition is in about 0.5 – 2.0% of the world's population, with no clinical evidence of racial or ethnic predisposition, although there is variation in distribution based on geographical locations [2]. Vitiligo has shown a high prevalence in India, with a range of 0.25 – 4% of the population, making it a significant dermatological condition [3]. Although medically benign, the disease tends to cause psychosocial consequences because of its visibility and cultural stigma [4]. The exact pathophysiology of the disease has not been fully elucidated; however, several hypotheses have been proposed, including autoimmune neural oxidative stress and genetic mechanisms [5]. The autoimmune hypothesis has gained popularity and support because of the coexistence of vitiligo with other autoimmune disorders such as diabetes mellitus, thyroid diseases, and alopecia areata [6]. Genetics also appears to play an important role in predisposition, with family history being a strong risk factor, and susceptibility loci have been shown by genome-wide association studies [7]. Environmental triggering factors such as physical trauma, stress, sunburn, and exposure to chemicals are known to initiate or exacerbate vitiligo in

genetically susceptible people [8]. The clinical manifestation of vitiligo occurs in various forms, which include non-segmental vitiligo (NSV), segmental vitiligo (SV), and mixed type. NSV is the most frequently observed variant found in the majority of cases, characterized by symmetrical lesions and a progressive course [9]. Segmental vitiligo has a rapid but stable course and is usually unilateral and remains localized. The clinical classification of vitiligo is crucial for management because different types show distinct epidemiological patterns and therapeutic responses [11].

Dermoscopic examination is a non-invasive diagnostic tool that has emerged as a valuable adjunctive diagnostic aid for the evaluation of vitiligo. Dermoscopy increases visibility of fine morphological detail unseen with the naked eye, allowing increased diagnostic accuracy. [12] The typical dermoscopic findings of vitiligo include altered pigment network, perifollicular repigmentation, trichrome patterns, and vascular changes [13]. Perifollicular repigmentation is typically seen as an indication of activity of the disease and its response to therapy [14]. Another important use of dermoscopy in the clinical setting is to differentiate vitiligo and other hypopigmented diseases that include pityriasis alba, post-inflammatory hypopigmentation, and nevus depigmentosus [15]. Combined clinico-epidemiological analysis of vitiligo with dermoscopic analysis gives a comprehensive understanding of the profile of the disease. Epidemiological data also aid in determining risk factors, patterns of diseases and comorbidity associations, and dermoscopy can offer useful data on disease activity, stabilization, and possible repigmentation [16]. A combination of this kind of assessment is important not only in terms of diagnostics but also in determining individual treatment plans and the assessment of their efficacy. Since vitiligo is a chronic and psychosocially intensive pathology, the main issue in its quality-of-life improvement is early diagnosis and patient education, as well as comprehensive management [17].

The clinico-epidemiological study of vitiligo, in combination with dermoscopic analysis, provides a comprehensive understanding of the disease profile in a cohort (16). Such integrated evaluation is vital not only for diagnostic accuracy but also for formulating individualized therapeutic strategies and monitoring treatment outcomes. Because of the chronic nature of the disease and its broader psychosocial implications, early diagnosis, patient education, and management are crucial for improving the quality of life of affected individuals [17]. With this background, we in the current study aimed to determine the clinico-epidemiological profile of the disease in our population, which can contribute to a better understanding of vitiligo and provide evidence-based clinical practice.

Materials and Methods

This cross-sectional observational study was conducted in the Department of Dermatology, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. Institutional Ethical approval was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language.

Inclusion criteria

1. Aged 18 years and above
2. Males and Females
3. Clinical diagnosis of vitiligo
4. At least one untreated or treatment-naïve index lesion exists

Exclusion criteria

1. Pregnant/lactating females
2. Active secondary infections on the assessment site
3. Other hypopigmented disorders pityriasis alba, tinea versicolor, post-inflammatory hypopigmentation, nevus depigmentosus)
4. Refusal to give consent

Based on the inclusion and exclusion criteria, a total of n=50 cases of adults with vitiligo were enrolled using a convenience sampling method. The selected individual was then subjected to a detailed history, disease duration, family history, and precipitating factors such as trauma, sunburn, stress, and chemical exposure were recorded. A record of existing comorbidities, such as thyroid disease, diabetes, and other autoimmunity, was noted. They were systematically subjected to clinical examination to determine vitiligo subtype (non-segmental/segmental/mixed), distribution, and presence of Koebner phenomenon, trichrome variant, confetti depigmentation, leukotrichia, and mucosal involvement. The grading of disease activity was done using the Vitiligo Disease Activity (VIDA) score (−1 to +4). The extent of involvement was quantified by the Vitiligo Area Scoring Index (VASI). Body-site involvement was recorded using standard body surface area charts. Wood's lamp examination (365 nm) confirmed depigmentation margins and selected index lesions.

Dermoscopic evaluation: Dermoscopic evaluation was done with a polarized handheld dermoscope of 10x magnification with ultrasound gel as an interface. For each patient, three index lesions were systematically evaluated. (i) one acral, (ii) one facial/cephalic (if present), and (iii) one trunk/proximal limb lesion. Standardized room lighting was maintained.
The following predefined features were recorded as present/absent and graded (focal/scattered/diffuse) wherever required. Pigmentary features: perifollicular pigmentation/repigmentation, perilesional hyperpigmentation, residual pigment

network, trichrome/quadrichrome pattern, micro-islands ("confetti") of depigmentation, starburst/comet-tail margins. Follicular/hair features: leukotrichia, perifollicular halo. Vascular/background clues: telangiectasia, erythema, chalky-white background, blue-white structureless areas. Digital dermoscopic photographs were captured with a dermoscope-camera adapter at identical settings and archived.

Reliability procedures: Two dermatologists independently scored dermoscopic images using a structured checklist, masked to clinical data. Disagreements were resolved by consensus; interobserver agreement was quantified with Cohen's kappa for key features (perifollicular pigmentation, leukotrichia, trichrome, confetti).

Statistical analysis: All the available data were refined, segregated, and uploaded to an MS Excel spreadsheet and analyzed by SPSS version 25 in Windows format. The continuous variables were recorded as mean, SD, frequency, and percentage. Categorical variables were analyzed by ANOVA for comparison between groups or the Mann-Whitney U test for differences between two groups. Values of p (<0.05) were considered statistically significant.

Results

Table 1 depicts the demographic and clinico-epidemiological characteristics of the cohort. Of the total 50 cases included in the study, the mean age of the cohort was 36.4 ± 12.8 years, with a slight female preponderance of 56% as compared to males 44%. The median disease duration was 48.5 months (IQR: 24.0–84.0). Family history of vitiligo was found to be positive in 22% of cases, and 36% of cases have reported precipitating factors such as psychological stress 20%, physical trauma suggestive of Koebner phenomenon 16% 16%), and sunburn in 8% of cases. Assessment of autoimmune comorbidities was found to be present in 14) 28% of cases that included thyroid disorders in 24% followed by diabetes in 6% and alopecia areata in 4% of cases.

Table 1: Baseline Clinico-epidemiological Characteristics of the Study Cohort (N=50)

Characteristic	*Value*
Age (years)	36.4 ± 12.8 (Mean ± SD)
Gender, n (%)	
Male	22 (44.0%)
Female	28 (56.0%)
Disease Duration (months)	48.5 (24.0 - 84.0) [Median (IQR)]
Positive Family History, n (%)	11 (22.0%)
Precipitating Factor Reported, n (%)	18 (36.0%)
Stress	10 (20.0%)
Physical Trauma (Koebner)	8 (16.0%)
Sunburn	4 (8.0%)
Associated Autoimmune Comorbidity, n (%)	14 (28.0%)
Thyroid Disorders	12 (24.0%)
Diabetes Mellitus	3 (6.0%)
Alopecia Areata	2 (4.0%)

The disease severity and clinical pattern of the vitiligo are depicted in Table 2. A critical analysis of the table shows that non-segmental vitiligo (NSV) was the most frequent type in 84% of cases, segmental vitiligo was in 12% of cases, and the remaining 4% had a mixed form of vitiligo. In the NSV cases, the distribution pattern showed acrofacial in 35.7% of cases, generalized pattern in 28.6% cases, focal in 23.8% and universal in 11.9% of cases. Important clinical signs were Koebner phenomenon (32.0% of cases, leukotrichia 38.0%, mucosal involvement 18.0%, and trichrome pattern 28.0%). Vitiligo Disease Activity Score (VIDA scoring) of the cohort showed 64.0% had active disease, while 36.0% were stable. The mean disease extent measured by the VASI score was 5.2 ± 6.8.

Table 2: Clinical Patterns and Disease Severity in Study Participants	
Clinical Feature	*n (%)*
Vitiligo Subtype	
Non-Segmental Vitiligo (NSV)	42 (84.0%)
Segmental Vitiligo (SV)	6 (12.0%)
Mixed Vitiligo	2 (4.0%)
Distribution Pattern (NSV only, n=42)	
Acrofacial	15 (35.7%)
Generalized	12 (28.6%)
Universal	5 (11.9%)
Focal	10 (23.8%)
Clinical Signs	
Koebner Phenomenon Present	16 (32.0%)
Leukotrichia Present	19 (38.0%)
Mucosal Involvement	9 (18.0%)
Trichrome Pattern	14 (28.0%)
Disease Activity (VIDA Score)	
Active (VIDA = +1)	32 (64.0%)
Stable (VIDA = 0)	18 (36.0%)
Disease Extent (VASI Score)	5.2 ± 6.8 (Mean ± SD)

Table 3 shows the features of different subtypes of vitiligo as analyzed by dermoscopic features. A uniform chalky-white background was found in 94% of cases. Perifollicular pigmentation was observed in 70% of cases, and a residual or ill-defined pigment network in 44% of cases was most frequently observed. Micro-islands (confetti pattern) of pigment were identified in 22.0% of cases, while trichrome/quadrichrome patterns were noted in 32.0% patients. The comparison of NSV and SV subtypes showed a significant difference (p=0.03). Similarly, the presence of micro-islands of pigment was found with (p=0.04), and significant other features, such as telangiectasia and erythema, did not show significant subtype associations.

Table 3: Clinical pattern and disease severity in study participants				
Dermoscopic feature	*Overall (N=50)*	*NSV (N=42)*	*SV (N=8)*	*P value*
Pigment Pattern				
Uniform chalky-white background	47 (94.0%)	40 (95.2%)	5 (83.3%)	0.30
Residual/Ill-defined pigment network	22 (44.0%)	20 (47.6%)	2 (33.3%)	0.07
Perifollicular pigmentation	35 (70.0%)	32 (76.2%)	2 (33.3%)	0.03*
Macro-islands (confetti) of pigment	11 (22.0%)	10 (21.8%)	1 (16.7%)	0.04*
Trichrome/Quadrichome pattern	16 (32.0%)	14 (33.3%)	2 (33.3%)	0.06
Vascular Pattern				
Telangiectasia	15 (30.0%)	12 (28.6%)	3 (50.0%)	0.36
Erythema	8 (16.0%)	6 (14.3%)	2 (33.3%)	0.24
Follicular Features				
Leukotrichia (dermoscopic)	20 (40.0%)	16 (38.1%)	4 (66.7%)	0.23
Perifollicular white halo	28 (56.0%)	25 (59.5%)	3 (50.0%)	0.68
** Significant*				

The correlation between dermoscopic features and disease activity is given in Table 4. The analysis of the table shows that certain dermoscopic findings were significantly correlated with VDIA scores. Sharp and well-defined "comet-tail" borders were strongly correlated with active disease (p=0.001). Similarly, micro-islands with depigmentation (confetti) were found to be more common in active disease (p=0.04). However, perifollicular depigmentation was common in stable disease (p=0.03). Although leukotrichia was common in active disease, it did not reach the level of significance (p=0.07).

Table 4: Association of Key Dermoscopic Features with Disease Activity (VIDA Score)			
Dermoscopic Feature	*Active Disease (VIDA ≥ +1) n = 32*	*Stable Disease (VIDA ≤ 0) n=18*	*p-value*
Sharp, well-defined "comet-tail" borders	25 (78.1%)	5 (27.8%)	<0.001*
Micro-islands (confetti) of depigmentation	10 (31.3%)	1 (5.6%)	0.04*
Perifollicular pigmentation (repigmentation sign)	15 (46.9%)	20 (76.9%)	0.03*
Leukotrichia	16 (50.0%)	4 (22.2%)	0.07
Telangiectasia	12 (37.5%)	3 (16.7%)	0.19
**Significant*			

The reproducibility (interobserver agreement) was analysed in Table 5. We found the chalky-white background had a kappa value of 0.91, and leukotrichia had a kappa value of 0.85, which is almost perfect agreement. Perifollicular pigmentation with a kappa value of 0.78 and trichrome pattern with a kappa value of 0.72 had good agreement values. Mico-islands (confetti) showed a kappa value of 0.58, which indicates moderate interobserver agreement

Table 5: Interobserver Agreement for Dermoscopic Features		
Dermoscopic Feature	*Cohen S Kappa (K) Value*	*Agreement Strength*
Chalky-white background	0.91	Almost Perfect
Perifollicular Pigmentation	0.78	Substantial
Leukotrichia	0.85	Almost Perfect
Residual Pigment Network	0.64	Substantial
Trichrome Pattern	0.72	Substantial
Micro-islands (Confetti)	0.58	Moderate
Telangiectasia	0.81	Almost Perfect

DISCUSSION

The current study was done to determine the clinic-epidemiological and dermoscopic spectrum of vitiligo in adults. The mean age of the cohort was 36.4 ± 12.8 years. This is in agreement with the prior studies done in this field, which found that vitiligo often begins in childhood or adolescence and most cases progress to adulthood [1 8]. The results of this study showing a slight female preponderance could be because of cosmetic and health-seeking behaviour, as previously found in Indian and Middle Eastern populations [19]. A positive family history of vitiligo was present in 22% of cases, which shows the genetic predisposition, although this frequency was slightly lower than reported by other studies, with a range from 30 – 40% familial clustering [20]. The precipitating factors, such as stress, trauma, and sunburn, may play a role as triggering agents in genetically susceptible individuals [21]. The analysis of the subtype of vitiligo commonly prevalent in this study was found to be non-segmental vitiligo (NSV) in 84% of cases. This is in agreement with epidemiological data from the world, where NSV was the common type of vitiligo [22]. The acrofacial and generalized subtypes were more prevalent in NSV, which extends findings of previous studies done in India, where acral involvement is more prevalent, perhaps because of greater mechanical pressure in these areas [23]. Segmental vitiligo was at a lesser rate (12%), because of its known lower prevalence as well as more localized and resistant course [24]. Clinically, leukotrichia was found in 38% of cases, and the Koebner phenomenon was found in 32% of cases. These are recognised parameters of chronic and progressive disease. Unstable disease and tendency towards resistance to treatment have been associated with Koebner positivity [25]. The fact that almost a one-fifth of our patients had mucosal involvement explains why hidden or less visible areas must be examined during clinical assessment.

Dermoscopy is applied in these cases to obtain additional valuable information that is beyond naked-eye examination. The results of which showed a predominant chalky white background with loss of pigment network, confirm the complete absence of melanocytes and perifollicular pigmentation, as seen in 70% of our cases, which reflects residual melanocyte reservoirs and repigmentation potential. Vora et al. [26] in their study highlighted that perifollicular pigmentation is a reliable marker of a favorable therapeutic response in cases. The existence of micro-islands of pigment, as well as trichrome pattern, shows that dermocopy is a valuable tool to delineate disease activity and melanocyte behavior. Importantly, we found comet-tail borders and confetti-like depigmentation significantly associated with active disease, while perifollicular pigmentation correlated with stable vitiligo. These findings are in agreement with studies suggesting dermoscopy as a non-invasive marker for disease activity assessment, potentially reducing the reliance on biopsy or prolonged clinical follow-up [27, 28]. Interobserver agreement across all dermoscopic features in our study was substantial to near-perfect, which highlights the replicability and reliability of the method adopted in routine practice. This translates to a high level of

applicability in clinical as well as the research context [29]. Finally, our study reinforces the value of clinical assessment combined with dermoscopy to enhance the accuracy of diagnosis and disease activity, and can aid in making prognostics in adult vitiligo. Bigger multicentric studies are needed to confirm these associations and level down-dermoscopic criteria in different populations.

CONCLUSION

In conclusion, our study found clinic-epidemiological diversity in the distribution of diseases. Non-segmental vitiligo was the commonest subtype, and autoimmune disease commonly associated with it was thyroid disorders. Precipitating factors were stress and trauma. Dermoscopy provided crucial insights, particularly for perifollicular pigmentation and micro-islands of pigment, which were associated with disease stability and activity. We also noted a substantial interobserver agreement with the use of dermoscopy. This overall emphasizes the importance of integrating dermoscopy with clinical evaluation to evaluate the disease activity, monitor progression, and guide therapeutic decision-making for adult vitiligo patients.

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