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Long-Term Effect of Phototherapy on Skin Histopathology in Psoriasis: An Observational Cohort Study

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Abstract

Psoriasis is a chronic inflammatory skin condition characterized by abnormal keratinocyte proliferation and immune dysregulation. Phototherapy, including narrowband ultraviolet B (NB-UVB) and psoralen plus ultraviolet A (PUVA), is a widely used treatment for psoriasis. This observational cohort study aims to evaluate the long-term effects of phototherapy on skin histopathology in patients with psoriasis. An observational cohort study was conducted involving psoriasis patients who underwent phototherapy at a teritiary care hospital. Skin biopsies were taken before treatment, immediately after completing the phototherapy regimen Histopathological changes, including epidermal thickness, inflammatory cell infiltration and keratinocyte proliferation, were evaluated. The study included 150 patients with psoriasis. Significant improvements in skin histopathology were observed immediately after phototherapy, with reductions in epidermal thickness and inflammatory cell infiltration. These improvements were maintained at 6 months but showed partial regression at 1-year follow-up. Long-term phototherapy was associated with sustained histopathological benefits, although some patients experienced a recurrence of psoriatic lesions. Phototherapy is effective in inducing histopathological improvements in psoriasis, with benefits persisting up to 6 months post-treatment. Long-term follow-up indicates partial regression of benefits, highlighting the need for maintenance therapy. This study underscores the importance of ongoing management in achieving sustained control of psoriasis.

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Key Words
Psoriasis, phototherapy, skin histopathology, NB-UVB, PUVA, long-term effects

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INTRODUCTION

Psoriasis is a chronic, immune-mediated skin disorder characterized by hyperproliferation of keratinocytes, leading to the formation of erythematous plaques covered with silvery scales. The pathogenesis of psoriasis involves a complex interplay between genetic predisposition, environmental triggers and immune system dysregulation[1]. Phototherapy, utilizing ultraviolet (UV) radiation, has been a cornerstone in the management of moderate to severe psoriasis due to its anti-proliferative, anti-inflammatory and immunosuppressive effects[2,3].

Narrowband ultraviolet B (NB-UVB) and psoralen plus ultraviolet A (PUVA) are the most commonly used phototherapy modalities. NB-UVB therapy involves exposure to a specific wavelength of UVB light, which has been shown to effectively reduce psoriatic plaques with minimal side effects. PUVA therapy combines UVA exposure with the photosensitizing agent psoralen, enhancing the efficacy of the treatment[4].

While the short-term efficacy of phototherapy in reducing clinical symptoms and improving histopathological features of psoriasis is well-documented, there is limited data on the long-term effects of these treatments on skin histopathology. Understanding the long-term impact of phototherapy is crucial for optimizing treatment regimens and ensuring sustained disease control[5,6].

This observational cohort study aims to evaluate the long-term effects of phototherapy on skin histopathology in patients with psoriasis. By assessing histopathological changes over time, this study seeks to provide insights into the durability of phototherapy benefits and inform clinical practice regarding maintenance therapy strategies.

MATERIALS AND METHODS

This observational cohort study was designed to evaluate the long-term effects of phototherapy on skin histopathology in patients with psoriasis. The study was conducted at a teritiary care hospital, ensuring a consistent and controlled treatment environment. The study adhered to ethical guidelines and received approval from the Institutional Review Board of the clinic.

Study Design and Setting: The study utilized an observational cohort design to collect data over a period of 1 year. The setting included a tertiary care hospital with expertise in the management of psoriasis and the application of phototherapy.

Participants: The study targeted patients diagnosed with moderate to severe psoriasis who were eligible for phototherapy. Inclusion criteria were:

- Diagnosis of psoriasis confirmed by clinical and histopathological examination.
- Indication for phototherapy (NB-UVB or PUVA) as determined by the treating dermatologist.
- Age 18 years or older.
- Willingness to participate in the study and provide informed consent.

Exclusion Criteria Were:

- Patients with other dermatologic conditions that could confound the results.
- Patients who had received systemic treatments for psoriasis within the past 3 months.
- Incomplete data on key variables.

Sample Size: A sample size of 150 patients was determined to be adequate based on power calculations to detect significant histopathological changes over time. This calculation was based on an assumed effect size, a confidence level of 95% and a power of 80%.

Data Collection: Data were collected using standardized protocols and included the following:

- **Skin Biopsies:** Skin biopsies were taken from psoriatic lesions before the initiation of phototherapy, immediately after completing the phototherapy regimen, and at follow-up intervals of 6 months and 1 year. The biopsies were processed and analyzed by experienced dermatopathologists.
- **Histopathological Evaluation:** The biopsies were evaluated for key histopathological features, including epidermal thickness, inflammatory cell infiltration, keratinocyte proliferation, and presence of Munro microabscesses. Standard histopathological techniques, including hematoxylin and eosin (H and E) staining, were used for these evaluations.

Statistical Analysis: Data were analyzed using statistical software. Descriptive statistics were used to summarize demographic characteristics, histopathological features and changes over time. Paired t-tests and repeated measures ANOVA were conducted to compare histopathological features at different time points. Multivariate linear regression models were used to adjust for potential confounders and to examine the independent effects of phototherapy on histopathological outcomes.

Ethical Considerations: Ethical approval for the study was obtained from the Institutional Review Board of

Table 1: Histopathological Features Assessed

Feature	Description
Epidermal Thickness	Measured in micrometers (μm)
Inflammatory Cell Infiltration	Qualitative and quantitative assessment
Keratinocyte Proliferation	Presence of mitotic figures
Munro Microabscesses	Presence and number of microabscesses

Table 2: Demographic Characteristics

Characteristic	Frequency (%)
Age (years)	
-18-30	30 (20%)
-31-45	40 (27%)
-46-60	50 (33%)
->60	30 (20%)
Gender	
-Male	90 (60%)
-Female	60 (40%)
Duration of Psoriasis	
-<5 years	50 (33%)
-5-10 years	60 (40%)
->10 years	40 (27%)

Table 3: Histopathological Features Before and After Phototherapy

Feature	Pre-Treatment (Mean ± SD)	Post-Treatment (Mean ± SD)	6 Months (Mean ± SD)	1 Year (Mean ± SD)
Epidermal Thickness (μm)	350 ± 50	200 ± 40	220 ± 45	250 ± 50
Inflammatory Cell Infiltration	3.5 ± 0.5	1.5 ± 0.4	1.8 ± 0.5	2.5 ± 0.6
Keratinocyte Proliferation	4.0 ± 0.6	1.8 ± 0.5	2.0 ± 0.5	2.8 ± 0.6
Munro Microabscesses	2.5 ± 0.4	0.8 ± 0.3	1.0 ± 0.4	1.5 ± 0.5

Table 4: Changes in Histopathological Features Over Time

Feature	Mean Change Post-Treatment	Mean Change at 6 Months	Mean Change at 1 Year
Epidermal Thickness (μm)	-150	-130	-100
Inflammatory Cell Infiltration	-2.0	-1.7	-1.0
Keratinocyte Proliferation	-2.2	-2.0	-1.2
Munro Microabscesses	-1.7	-1.5	-1.0

Table 5: Histopathological Features of Patients with Relapse at 1 Year

Feature	Patients with Relapse (n=30)	Patients without Relapse (n=120)
Epidermal Thickness (μm)	300 ± 40	220 ± 30
Inflammatory Cell Infiltration	3.0 ± 0.5	2.0 ± 0.4
Keratinocyte Proliferation	3.5 ± 0.5	2.5 ± 0.4
Munro Microabscesses	2.0 ± 0.4	1.0 ± 0.3

the clinic. Informed consent was obtained from all participants. Participants were assured of the confidentiality and anonymity of their responses. Data were securely stored and only accessible to the research team.

RESULTS AND DISCUSSIONS

The results section includes detailed findings from the study, organized into multiple tables to comprehensively present the data.

This table presents the demographic characteristics of the study participants, including age, gender and duration of psoriasis.

This table shows the mean values of histopathological features before treatment, immediately after phototherapy and at 6-month and 1-year follow-up intervals.

This table presents the mean changes in histopathological features from pre-treatment to post-treatment and at follow-up.

This table compares the histopathological features of patients who experienced a relapse of psoriatic lesions at the 1-year follow-up with those who did not.

The findings of this observational cohort study provide significant insights into the long-term effects of phototherapy on skin histopathology in patients with psoriasis. Phototherapy, including NB-UVB and PUVA, was found to induce substantial histopathological improvements, which persisted up-6 months post-treatment. However, partial regression of these benefits was observed at the 1-year follow-up, highlighting the need for maintenance therapy to sustain long-term control of the disease[6].

Immediate Effects of Phototherapy: Immediately after the completion of phototherapy, there was a significant reduction in epidermal thickness, inflammatory cell infiltration, keratinocyte proliferation, and the presence of Munro microabscesses. These histopathological changes reflect the anti-proliferative and anti-inflammatory effects of phototherapy, which are essential for reducing the clinical symptoms of psoriasis[7].

Sustained Benefits and Partial Regression: At the 6-month follow-up, the majority of patients maintained the histopathological improvements achieved post-treatment. This indicates that

phototherapy has a lasting impact on skin pathology, supporting its use as a first-line treatment for moderate to severe psoriasis. However, at the 1-year follow-up, some degree of partial regression was observed, with increases in epidermal thickness and inflammatory cell infiltration, although not to pre-treatment levels. This suggests that while phototherapy is effective, its benefits may diminish over time without ongoing management[8].

Relapse and Maintenance Therapy: Approximately 20% of patients experienced a relapse of psoriatic lesions by the 1-year follow-up[9]. These patients had higher mean values of epidermal thickness, inflammatory cell infiltration and keratinocyte proliferation compared to those who did not relapse. This finding underscores the importance of maintenance therapy in preventing disease recurrence. Maintenance therapy strategies may include periodic phototherapy sessions, topical treatments, or systemic medications to sustain the benefits achieved with initial phototherapy[10].

Clinical Implications: The study highlights the effectiveness of phototherapy in managing psoriasis and its positive impact on skin histopathology. However, it also emphasizes the need for personalized treatment plans that include maintenance therapy to prevent relapse and sustain long-term disease control. Dermatologists should consider integrating regular follow-up and maintenance treatments into the care plans for patients who respond well to initial phototherapy[11].

Strengths and Limitations: One of the key strengths of this study is its longitudinal design, which allowed for the assessment of histopathological changes over an extended period. Additionally, the use of standardized protocols for data collection and histopathological evaluation enhances the reliability of the findings.

However, the study also has limitations. The single-centre design may limit the generalizability of the results to broader patient populations. Future studies should include multicentre designs to validate these findings across different settings. Additionally, while the study provides valuable insights into the long-term effects of phototherapy, it does not account for potential confounding factors such as variations in treatment adherence, lifestyle factors and concurrent use of other treatments.

CONCLUSION

This observational cohort study demonstrates that phototherapy is effective in inducing significant histopathological improvements in psoriasis, with benefits persisting up-6 months post-treatment. However, partial regression of these benefits at the 1-year follow-up highlights the need for maintenance therapy to achieve sustained disease control. The findings underscore the importance of personalized treatment plans and regular follow-up to prevent relapse and optimize long-term outcomes for patients with psoriasis.

Future research should focus on developing and evaluating maintenance therapy strategies to extend the benefits of phototherapy and improve the quality of life for patients with psoriasis. By integrating these findings into clinical practice, healthcare providers can enhance the management of psoriasis and achieve better long-term control of the disease.

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