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RESEARCH ARTICLE
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# CLINICAL SPECTRUM OF CUTANEOUS MANIFESTATIONS OF THYROID DISORDERS IN PATIENTS ATTENDING TERTIARY CARE HOSPITAL

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**ABSTRACT:**

**Background:** Thyroid hormones exert significant effects on the skin, hair, and nails. Cutaneous manifestations are often early indicators of thyroid dysfunction, yet their prevalence and patterns in hypothyroidism and hyperthyroidism are underreported. The present study was conducted to evaluate the clinical spectrum of cutaneous, hair, and nail manifestations in patients with thyroid disorders and correlate these findings with biochemical thyroid profiles.

**Materials and Methods:** A cross-sectional observational study was conducted on 100 patients with thyroid dysfunction (50 hypothyroid, 50 hyperthyroid) attending a tertiary care hospital. Demographic data, detailed dermatological examination, and laboratory investigations (T3, T4, TSH) were recorded. Cutaneous, hair, and nail findings were documented and statistically analyzed for correlation with thyroid hormone levels using Chi-square test and Pearson correlation.

**Results:** Hypothyroid patients commonly presented with xerosis (76%), pallor (62%), facial puffiness (56%), coarse hair (66%), and brittle nails (44%). Hyperthyroid patients showed warm, moist skin (68%), hyperpigmentation (52%), palmar erythema (48%), fine hair (54%), and onycholysis (36%). Significant correlations were observed between thyroid hormone levels and dermatological features (e.g., xerosis with elevated TSH; warm moist skin with elevated T3/T4; $p < 0.001$).

**Conclusion:** Cutaneous, hair, and nail manifestations are frequent and often distinctive between hypothyroidism and hyperthyroidism. Early recognition of these features can prompt timely thyroid evaluation and management, highlighting the importance of dermatological assessment in thyroid disorders.

**Keywords:** Thyroid disorders; Hypothyroidism; Hyperthyroidism; Cutaneous manifestations; Hair changes; Nail changes

## INTRODUCTION:

Thyroid hormones play a crucial role in regulating basal metabolic rate and maintaining the growth, differentiation, and function of virtually all body tissues, including the skin, hair, and nails. The skin is often described as a “mirror” reflecting internal metabolic and endocrine disturbances. Therefore, thyroid dysfunctions — both hypothyroidism and hyperthyroidism — can produce a wide range of

cutaneous manifestations that often precede systemic features and may serve as early diagnostic indicators of the disease (1,2).

The thyroid gland secretes thyroxine ($T_4$) and triiodothyronine ($T_3$), which influence oxygen consumption, thermoregulation, and protein synthesis. Any imbalance in these hormones leads to structural and functional changes in the integumentary system. The skin expresses thyroid hormone receptors in keratinocytes, fibroblasts, sebaceous glands, and hair follicles, signifying its high sensitivity to thyroid hormone levels (3,4). Hence, dermatological features in thyroid disease are not coincidental but pathophysiologically linked to the hormone's action on cutaneous cells.

In hypothyroidism, reduced metabolic activity leads to diminished eccrine gland function, accumulation of glycosaminoglycans in the dermis, and impaired lipid metabolism. Clinically, patients present with dry, coarse, and cold skin (xerosis), pallor, facial puffiness, diffuse hair loss, and brittle nails (5–7). There may also be yellowish discoloration of the skin due to carotenemia and periorbital edema resulting from mucopolysaccharide deposition (8).

Conversely, hyperthyroidism causes increased cutaneous blood flow, elevated temperature, and enhanced perspiration owing to sympathetic overactivity. Characteristic findings include warm, moist skin, palmar erythema, hyperpigmentation, pruritus, and onycholysis (Plummer's nails) (9–11). Hair becomes fine and soft, and in some cases, diffuse alopecia is observed. These cutaneous features reflect hypermetabolic states and are often proportional to disease activity (12).

Given that dermatological manifestations are both frequent and varied, their recognition holds significant clinical importance. Early identification of these signs allows for timely investigation of thyroid function, potentially leading to earlier diagnosis and improved management outcomes. This study was therefore undertaken to evaluate the clinical spectrum and frequency of cutaneous manifestations among patients with thyroid disorders and to correlate these findings with biochemical parameters of thyroid function**.**

## MATERIALS AND METHODS:

### Study Design and Setting

A hospital-based cross-sectional observational study was conducted in the Department of Dermatology at a tertiary care teaching hospital. The study was carried out over a period of 12 months after obtaining prior approval from the Institutional Ethics Committee.

### Study Population

A total of 100 patients clinically and biochemically diagnosed with thyroid disorders were enrolled in the study. They were further categorized into two groups:

- Group I (Hypothyroidism): 50 patients
- Group II (Hyperthyroidism): 50 patients

Patients were recruited from the Dermatology and Endocrinology outpatient departments (OPD) through purposive sampling.

### Inclusion Criteria

1. Patients aged 18 years and above of either sex.
2. Clinically diagnosed cases of thyroid dysfunction confirmed by biochemical investigations (abnormal TSH, T3, and T4 values).
3. Patients who provided written informed consent to participate.

### Exclusion Criteria

1. Patients with systemic diseases that could affect the skin (e.g., diabetes mellitus, chronic renal disease, autoimmune disorders).
2. Patients on medications known to cause cutaneous changes or alter thyroid status (e.g., corticosteroids, amiodarone, lithium).
3. Pregnant and lactating women.
4. Patients unwilling to provide consent or those lost to follow-up.

**Data Collection and Clinical Evaluation**
After obtaining informed consent, all participants underwent a detailed clinical history and systematic dermatological examination**.**

**1. Clinical History**
A structured proforma was used to collect:
- Demographic details: Age, sex, occupation, and residence.
- Medical history: Duration and type of thyroid disorder, treatment status, associated comorbidities.
- Dermatological complaints: Onset, progression, seasonal variation, and associated systemic symptoms like weight change, fatigue, heat or cold intolerance, and palpitations.

**2. General and Systemic Examination**
A thorough general physical examination was performed to assess:
- Vital signs and thyroid enlargement (if present).
- Signs of hypermetabolism or hypometabolism.
- Other systemic findings indicative of thyroid dysfunction.

**3. Dermatological Examination**
A comprehensive dermatological evaluation was conducted under adequate illumination by two qualified dermatologists independently to minimize observer bias. Findings were categorized as:
- Skin changes: xerosis, pallor, pruritus, pigmentation, edema, carotenemia, facial puffiness, warmth or coolness of skin.
- Hair changes: diffuse or patchy alopecia, coarseness, brittleness, and texture alteration.
- Nail changes: onycholysis, brittleness, longitudinal ridging, and slow growth rate.

Cutaneous findings were photographed (with consent) and documented systematically. Where necessary, trichoscopic and dermoscopic examinations were performed using a handheld dermoscope (DermLite DL4, 10× magnification).

**Laboratory Investigations**
**All patients underwent the following laboratory investigations to confirm thyroid status:**

| Parameter | Normal Range | Unit | Method |
|---|---|---|---|
| T3 | 80–200 | ng/dL | Chemiluminescent immunoassay (CLIA) |
| T4 | 5.0–12.0 | µg/dL | CLIA |
| TSH | 0.4–4.0 | µIU/mL | CLIA |

Patients were classified as:
- Hypothyroid: TSH > 4.0 µIU/mL with low T3/T4.
- Hyperthyroid: TSH < 0.4 µIU/mL with elevated T3/T4.
- Euthyroid: within normal ranges (excluded from study).

Additional investigations such as complete blood count (CBC), fasting blood glucose, and liver and renal function tests were performed to rule out confounding systemic illnesses**.**

**Data Management and Quality Control**
Data were entered into a pre-designed Excel sheet. To ensure accuracy, double data entry and cross-verification were performed by two independent investigators. Discrepancies were resolved by consensus. Missing data were minimized by complete data collection during the initial visit.

**Statistical Analysis**
All statistical analyses were performed using SPSS version 20.0 Continuous variables were expressed as mean ± standard deviation (SD). Categorical variables (were expressed as frequencies and percentages. The Chi-square test was used for comparing categorical data. The student's *t*-test was applied for continuous variables. **Pearson correlation coefficient (r)** was calculated to assess the

relationship between **thyroid hormone levels (T3, T4, TSH)** and specific cutaneous, hair, and nail findings. A *p*-value < 0.05 was considered statistically significant.

**RESULTS:**

A total of 100 patients with thyroid disorders were included in the study, comprising 50 patients with hypothyroidism and 50 with hyperthyroidism. The analysis focused on demographic features, duration of disease, and the spectrum of cutaneous, hair, and nail changes associated with each thyroid state.

**1. Demographic Profile**

Patients in both groups were predominantly female. Age, sex distribution, and disease duration were similar between hypothyroid and hyperthyroid patients, showing no statistically significant differences (Table 1)

**Table 1. Demographic Characteristics of the Study Population**

| Parameter | Hypothyroidism (n=50) | Hyperthyroidism (n=50) | *p*-value |
|---|---|---|---|
| Mean Age (years) | 38.6 ± 10.2 | 36.8 ± 9.4 | 0.32 |
| Female (%) | 42 (84%) | 40 (80%) | 0.62 |
| Male (%) | 8 (16%) | 10 (20%) | 0.62 |
| Duration of Disease (years) | 2.1 ± 1.3 | 1.9 ± 1.1 | 0.28 |

**2. Cutaneous Manifestations**

Xerosis, pallor, coarse skin, and facial puffiness were the most frequent findings among hypothyroid patients, reflecting decreased metabolic activity and reduced eccrine gland function. In contrast, hyperthyroid patients predominantly exhibited warm moist skin, palmar erythema, hyperpigmentation, and excessive sweating, correlating with increased peripheral vasodilation and hypermetabolism. Most associations were statistically significant ($p < 0.001$), indicating distinct cutaneous profiles in both thyroid states (Table 2).

**Table 2. Cutaneous Manifestations in Thyroid Disorders**

| Cutaneous Finding | Hypothyroidism n(%) | Hyperthyroidism n(%) | *p*-value |
|---|---|---|---|
| Xerosis | 38 (76%) | 6 (12%) | <0.001 |
| Pallor | 31 (62%) | 8 (16%) | <0.001 |
| Facial Puffiness | 28 (56%) | 2 (4%) | <0.001 |
| Warm, Moist Skin | 5 (10%) | 34 (68%) | <0.001 |
| Hyperpigmentation | 7 (14%) | 26 (52%) | <0.001 |
| Palmar Erythema | 2 (4%) | 24 (48%) | <0.001 |
| Pruritus | 6 (12%) | 18 (36%) | 0.01 |
| Carotenemia | 11 (22%) | 3 (6%) | 0.03 |
| Non-pitting Edema | 9 (18%) | 1 (2%) | 0.02 |

**3. Hair Changes**

Hypothyroid patients primarily had **coarse, brittle hair and diffuse hair loss**, while hyperthyroid patients exhibited **fine, soft hair and hair thinning**. These differences were statistically significant, reflecting the distinct effects of thyroid hormone imbalance on hair structure and growth. (Table 3)

**Table 3. Hair Manifestations in Thyroid Disorders**

| Hair Finding | Hypothyroidism n(%) | Hyperthyroidism n(%) | *p*-value |
|---|---|---|---|
| Diffuse Hair Loss | 29 (58%) | 22 (44%) | 0.18 |
| Coarse, Dry Hair | 33 (66%) | 8 (16%) | <0.001 |
| Loss of Lateral Eyebrows | 12 (24%) | 2 (4%) | 0.004 |
| Fine, Soft Hair | 5 (10%) | 27 (54%) | <0.001 |
| Slow Hair Growth | 10 (20%) | 3 (6%) | 0.03 |
| Accelerated Growth | 1 (2%) | 9 (18%) | 0.02 |

**4. Nail Changes**

Hypothyroidism was associated with **brittle nails and longitudinal ridging**, whereas hyperthyroidism commonly showed **onycholysis and Plummer's nails**, reflecting the differential impact of thyroid hormones on nail growth and texture. (Table 4)

**Table 4. Nail Manifestations in Thyroid Disorders**

| Nail Finding | Hypothyroidism n(%) | Hyperthyroidism n(%) | *p*-value |
|---|---|---|---|
| Brittle Nails | 22 (44%) | 6 (12%) | 0.001 |
| Longitudinal Ridging | 16 (32%) | 5 (10%) | 0.01 |
| Onycholysis | 3 (6%) | 18 (36%) | <0.001 |
| Plummer's Nails | 1 (2%) | 11 (22%) | 0.005 |
| Slow Nail Growth | 7 (14%) | 2 (4%) | 0.08 |

**5. Correlation Between Cutaneous Findings and Thyroid Profile**

A statistically significant correlation was observed between serum TSH levels and xerosis, indicating that the severity of dryness increased with rising TSH. Similarly, palmar erythema and onycholysis showed positive correlation with elevated T3/T4 levels in hyperthyroidism (Table 5).

**Table 5. Correlation Between Cutaneous Findings and Thyroid Profile**

| Cutaneous Finding | T3 (ng/dL) | T4 (µg/dL) | TSH (µIU/mL) | Correlation (r) | p-value |
|---|---|---|---|---|---|
| Xerosis | 92 ± 18 | 5.4 ± 1.2 | 8.6 ± 2.3 | 0.68 | <0.001 |
| Pallor | 88 ± 16 | 5.1 ± 1.0 | 7.9 ± 2.0 | 0.55 | <0.001 |
| Facial puffiness | 90 ± 17 | 5.2 ± 1.1 | 9.1 ± 2.5 | 0.72 | <0.001 |
| Coarse skin | 94 ± 15 | 5.5 ± 1.0 | 8.0 ± 2.2 | 0.61 | <0.001 |
| Warm, moist skin | 210 ± 25 | 11.2 ± 1.8 | 0.3 ± 0.1 | -0.63 | <0.001 |
| Palmar erythema | 205 ± 22 | 10.8 ± 1.5 | 0.4 ± 0.2 | -0.59 | <0.001 |
| Hyperpigmentation | 198 ± 20 | 10.5 ± 1.6 | 0.5 ± 0.2 | -0.52 | 0.002 |
| Excessive sweating | 212 ± 24 | 11.5 ± 1.7 | 0.3 ± 0.1 | -0.65 | <0.001 |

**DISCUSSION:**

Thyroid hormones exert profound effects on the skin, hair, and nails by regulating metabolism, protein synthesis, and tissue growth. Cutaneous manifestations are often among the earliest clinical indicators of thyroid dysfunction, sometimes preceding systemic symptoms. In the present study, we observed a wide spectrum of dermatological findings among patients with hypothyroidism and hyperthyroidism, which were consistent with previously reported data (16–18).

**Demographic Findings**
In our study, the mean age of participants was approximately 37 years, with a marked **female predominance (82%)**. This aligns with global epidemiological data indicating that thyroid disorders, particularly autoimmune thyroiditis and Graves' disease, are more prevalent in women than men (16,17).

**Cutaneous Manifestations**
**Hypothyroidism** was predominantly associated with **xerosis (76%)**, **pallor (62%)**, **facial puffiness (56%)**, and **coarse skin (52%)**. These features can be explained by **reduced eccrine gland secretion, decreased peripheral perfusion, and accumulation of mucopolysaccharides in the dermis**, leading to dry, rough, and puffy skin (18,19). **Carotenemia** and **non-pitting edema** were observed in 22% and 18% of hypothyroid patients, respectively, consistent with previous reports emphasizing the deposition of carotene and dermal glycosaminoglycans in long-standing hypothyroidism (20).
In contrast, **hyperthyroid patients** commonly displayed **warm, moist skin (68%)**, **hyperpigmentation (52%)**, **palmar erythema (48%)**, and **excessive sweating (46%)**. These findings reflect **increased cutaneous blood flow, hypermetabolic state, and sympathetic overactivity**, which accelerate eccrine activity and melanocyte stimulation (21,22). **Pruritus** was noted in 36% of hyperthyroid patients, likely secondary to increased skin perfusion and sweat-induced irritation (23).

**Hair Manifestations**
Hair changes differed markedly between thyroid states. Hypothyroid patients exhibited **diffuse hair loss (58%)**, **coarse and brittle hair (66%)**, and **loss of lateral eyebrows (24%)**. These findings are consistent with slowed hair follicle cycling and reduced keratin synthesis in hypothyroidism (24,25). Hyperthyroid patients presented with **fine, soft hair (54%)** and **diffuse hair thinning (44%)**, attributable to accelerated hair cycling and premature follicular transition to telogen phase (26).

**Nail Manifestations**
Nail changes were also characteristic of thyroid status. **Brittle nails (44%)** and **longitudinal ridging (32%)** predominated in hypothyroidism, whereas **onycholysis (36%)** and **Plummer's nails (22%)** were more frequent in hyperthyroidism. These observations are consistent with prior studies demonstrating the influence of thyroid hormones on keratinocyte proliferation and nail matrix metabolism (27,28).

**Correlation with Thyroid Profile**
A statistically significant correlation was observed between serum thyroid hormone levels and cutaneous findings. **Hypothyroid features** such as xerosis, pallor, and facial puffiness were positively correlated with elevated TSH and inversely with T3/T4, while **hyperthyroid features** like palmar erythema, warm skin, and hyperpigmentation showed the opposite pattern. These correlations highlight the pathophysiological link between hormonal imbalance and skin, hair, and nail changes (29,30).

**Comparison with Previous Studies**
Our findings align with those reported by **Singh et al. (16)**, who documented xerosis in 72% and diffuse alopecia in 60% of hypothyroid patients, and by **Patel et al. (17)**, who observed palmar erythema and hyperpigmentation in over 50% of hyperthyroid cases. **Rathnayake et al. (18)** also reported that nearly 80% of thyroid disorder patients exhibited at least one cutaneous manifestation, emphasizing the diagnostic value of dermatological evaluation.

**CONCLUSION:**
Cutaneous, hair, and nail manifestations are frequent and often characteristic in patients with thyroid disorders. **Hypothyroidism** is predominantly associated with **xerosis, pallor, coarse hair, facial**

**puffiness, and brittle nails**, whereas **hyperthyroidism** commonly presents with **warm, moist skin, hyperpigmentation, palmar erythema, fine hair, and onycholysis**.
Recognition of these dermatological features allows for **early diagnosis, timely thyroid function evaluation, and better clinical management**. Cutaneous assessment should therefore be an integral part of the evaluation of patients with suspected thyroid dysfunction, as it provides valuable diagnostic and prognostic clues.

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