**Cutaneous Manifestations of End Stage Renal Disease (ESRD) on Hemodialysis in Libyan patients.**

**Abstract:**

Background: Chronic renal failure (CRF) is associated with various cutaneous manifestations, ranging from xerosis and hyperpigmentation to severe, life-threatening pruritus. Hemodialysis interventions have introduced different and newer dermatological presentations in CRF patients.

Aims of the Study: This study aimed to assess the frequency of skin manifestations in Libyan patients with chronic renal failure undergoing hemodialysis.

Materials and Methods: A total of 100 CRF patients on hemodialysis attending the hemodialysis unit at Ibn-Sina Teaching Hospital, Sirte, Libya, participated in this cross-sectional study. A comprehensive medical history was obtained, along with blood pressure measurement and a full clinical dermatological examination. Blood investigations included fasting blood sugar, HbA1c, hemoglobin, serum creatinine, and blood urea. Skin biopsies and additional investigations were performed when necessary.

Data analysis was conducted using IBM SPSS Statistics for Windows, Version 20.0. Quantitative data were analyzed using the Chi-squared test (χ²), with statistical significance set at a p-value of <0.050.

Results: Among the 100 patients included, 54% were male and 46% were female, with an age range of 20 to 87 years (mean: 54.3 years; SD=14.5). Hypertension was present in 74% of patients, diabetes mellitus in 23%, and 6% had no comorbidities.

Ninety-one percent of patients exhibited at least one cutaneous manifestation. The average CRF duration was 10.3 years. The most common dermatological findings were pruritus (67%), nail changes (45%), xerosis (36%), pallor (34%), pale nails (32%), hyperpigmentation (20%), and infections (14%). Rare manifestations included uremic nephropathy (5%), calcification (4%), bullous disease (2%), Kyrle disease (1%), and uremic frost (1%).

Pruritus was reported in 71% of hypertensive patients and 65% of diabetics, whereas pallor was noted in 39% of hypertensive patients and 22% of diabetics. Calcification, hyperpigmentation, and xerosis were more prevalent in females. The prevalence of hypertension and diabetes mellitus increased significantly with age (e.g., hypertension: 44% in the 20–39 age group vs. 86% in those ≥60 years, p=0.001). Pruritus, xerosis, pallor, and pale nails showed a significant age-related increase (p<0.05), and fungal infections were predominantly observed in patients ≥60 years.

Hemoglobin levels ranged from 6 to 12 g/dL (mean: 9 g/dL), urea from 40 to 288 mg/dL (mean: 140 mg/dL), and creatinine from 4.5 to 18 mg/dL (mean: 7 mg/dL).

Conclusion: The most frequent cutaneous manifestations observed in this study were pruritus, nail changes, xerosis, pallor, hyperpigmentation, and infections. Early identification of these dermatological signs can help alleviate patient discomfort and reduce morbidity.

**Keywords:** ESRF, CRF, Hemodialysis, Pruritus, Xerosis, Libya.

**Introduction**:

A broad range of skin diseases occurs in patients with ESRD, from the benign and asymptomatic to the physically disabling and life-threatening (1).

Many factors are involved in the pathogenesis of the cutaneous manifestations of ESRD, including electrolyte imbalance, buildup of uremic substances, and comorbid disease (2, 3). Many factors are involved in the pathogenesis of the cutaneous manifestations of ESRD, including electrolyte imbalance, buildup of uremic substances, and comorbid disease (2).

Skin color changes, such as pallor and hyperpigmentation, are seen in approximately 40% and 20% of patients, respectively (4, 5). Half-and-half nails (or Lindsay’s nails) are seen in approximately 20% of patients, and xerosis (dry and scaly skin) is seen in 50%–85% of patients with ESRD (4,5). Some of the skin changes, like pruritus, xerosis, hyperpigmentation, and acquired perforating dermatosis, are said to be present regardless of hemodialysis. “Nephrogenic fibrosing dermopathy” and “bullous dermatoses of hemodialysis” develop only consequent to the initiation of hemodialysis (6). Prolonged life expectancy as a result of prompt treatment with hemodialysis enables newer cutaneous manifestations to appear (7). The advent of hemodialysis as the treatment of chronic renal failure (CRF) has virtually made uremic frost and erythema papulatum uremicum, the most frequent skin findings encountered in the predialysis era, extinct (7). The frequently reported intraoral findings in CRF patients are xerostomia, macroglossia, and ulcerative stomatitis (7). Hair is sparse and lustreless. Half-and-half nails, absent lunulae, and onychomycosis are common (8).

A review of the 2019 report reveals that diabetes mellitus remains the most common cause of ESRD, responsible for approximately 42% of all patients on renal replacement therapy (9). Hypertension accounts for approximately 26% of cases, and glomerulonephritis and cystic kidney diseases account for about 16%, although glomerulonephritis is not as prevalent as it was in the past (1). The remaining causes of ESRD included vasculitis from an infectious or rheumatologic disease, interstitial nephritis, tumors, cholesterol emboli, and systemic amyloidosis (9).

Cutaneous manifestations frequently affect patients undergoing hemodialysis due to the complex interplay between renal dysfunction, altered mineral homeostasis, and persistent inflammation (1, 10, 11). Common skin presentations among this population include xerosis, pruritus, ecchymosis, and hyperpigmentation, which negatively impact quality of life. Pruritus associated with chronic kidney disease, or CKD-associated pruritus, affects 22-84% of hemodialysis patients (12, 13). Hemodialysis is a critical therapy for individuals with end-stage renal disease; however, long-term treatment can result in adverse effects (7, 14).

**Aims of the study**:

The aim of this study is to evaluate the frequency of skin manifestations among Libyan patients with chronic renal failure on hemodialysis.

**Materials and methods:**

A total of 100 patients with CRF on hemodialysis registered in the Hemodialysis unit at Ibn-Sina Teaching Hospital, Sirte, Libya, over a period of one year (June 2023 to June 2024) were included in this cross-sectional study. Verbal consent was taken from all patients.

A detailed history of patients’ age, sex, primary and secondary diagnoses, medications, and present cutaneous status was noted. History included the duration of CRF and hemodialysis. Blood pressure measurement and complete clinical dermatological examination were done. Data were collected and recorded in a proforma.

Blood investigations were done for all patients, including fasting blood sugar, HbA1c, hemoglobin, serum creatinine, and blood urea. Skin biopsy and other investigations were done wherever required.

Statistical analysis Data analysis was facilitated using IBM SPSS Statistics for Windows, Version 20.0.

Quantitative data interpretation employed the Chi-squared test (χ²). Statistical significance was set at a p-value of Statistical significance was set at a p-value of < 0.050.

**Results:**

Among 100 patients included in this cross-sectional study, 54 patients were males and 46 patients were females. The patient age ranged from 20 years to 87 years (mean age, 54.3; SD=14.5 years). Hypertension was reported in 74% of study patients and diabetes mellitus in 23%, and only 6% of patients had no comorbidities (Figure 1).

According to manifestation categories, pruritus was presented in 67% of patients, nail changes in 45%, xerosis in 36%, pallor in 34%, pale nails in 32%, hyperpigmentation in 20%, and infections in 14% of study patients (Table 1). Rare manifestations include uremic nephropathy (5%), calcification (4%), bullous disease (2%), Kyrle disease, and uremic frost, which were seen in one case each.

Pruritus was reported in 71% of hypertensive patients and in 65% of diabetics, whereas pallor was reported in 39% of hypertensive patients and in 22% of diabetics (Table 2). Calcification, hyperpigmentation, and xerosis were seen more in females, while uremic neuropathy was more in males (Figure 2).

Comorbidities: HTN and DM prevalence rises sharply with age (e.g., HTN: 44% in 20–39 vs. 86% in ≥60, p=0.001). Patients ≥60 years have the highest rates of HTN+DM (27%, p=0.003) (Table 3).

Skin Symptoms: Pruritis, Xerosis, Pallor, and Pale Nails increase significantly with age (p<0.05); Pallor rises from 17% (20–39) to 43% (≥60) (Table 4). Infections: Rare Manifestations: Uremic Frost, Kyrle Disease, and Calcification occur only in ≥60 years (3–8%) (Table 5). Hemoglobin level in our study patients ranged from 6 to 12 gm/dl (mean: 9 gm/dl ), urea ranged from 40 to 288 mg/dl (mean: 140 mg/dl), and creatinine ranged from 4.5 mg/dl to 18 mg/dl (mean: 7 mg/dl ).

**Figure 1: Comorbidity Distribution in study group**

### ****Table 1: Symptom Prevalence (N=100)****

|  |  |  |  |
| --- | --- | --- | --- |
| **Symptom** | **Prevalence** | **Symptom** | **Prevalence** |
| **Pruritus** | 67% (67/100) | **Pale Nails** | 32% (32/100) |
| **Xerosis** | 36% (36/100) | **Splinter Hemorrhages** | 6% (6/100) |
| **Pallor** | 34% (34/100) | **Fungal Infections** | 7% (7/100) |
| **Hyperpigmentation** | 20% (20/100) | **Bacterial Infections** | 4% (4/100) |
| **Uremic Frost** | 1% (1/100) | **Viral Infections** | 3% (3/100) |
| **Muehrcke’s Nails** | 5% (5/100) | **Kyrle Disease** | 1% (1/100) |
| **Half & Half Nails** | 8% (8/100) | **Bullous Disease** | 2% (2/100) |
| **Calcification** | 4% (4/100) | **Uremic Neuropathy** | 5% (5/100) |

### ****Table 2: Associations with Comorbidities****

|  |  |  |  |
| --- | --- | --- | --- |
| **Symptom** | **HTN (Yes vs. No)** | **DM (Yes vs. No)** | **HTN & DM (Yes vs. No)** |
| **Pruritus** | 71% vs. 57% (p=0.14) | 65% vs. 68% (p=0.82) | 75% vs. 66% (p=0.47) |
| **Pallor** | 39% vs. 15% (p=0.01\*) | 22% vs. 36% (p=0.17) | 31% vs. 35% (p=0.70) |
| **Fungal Infection** | 5% vs. 12% (p=0.24) | 17% vs. 4% (p=0.03\*) | 19% vs. 4% (p=0.02\*) |
| **Splinter Hemorrhage** | 6% vs. 6% (p=1.00) | 9% vs. 5% (p=0.45) | 12% vs. 3% (p=0.04\*) |

### ****Figure 2: Sex Differences (Male vs. Female)****

### ****Table 3: Demographic and Comorbidity Distribution by Age Group****

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** | **20–39 years (n=18)** | **40–59 years (n=45)** | **≥60 years (n=37)** | **p-value** |
| **Hypertension (HTN)** | 44% (8/18) | 76% (34/45) | 86% (32/37) | **p=0.001**\* |
| **Diabetes (DM)** | 6% (1/18) | 20% (9/45) | 35% (13/37) | **p=0.01**\* |
| **HTN & DM** | 0% (0/18) | 13% (6/45) | 27% (10/37) | **p=0.003**\* |
| **No Comorbidities** | 39% (7/18) | 9% (4/45) | 0% (0/37) | **p<0.001**\* |

### ****Table 4: Skin and Nail Manifestations by Age Group****

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Symptom** | **20–39 years** | **40–59 years** | **≥60 years** | **p-value** |
| **Pruritus** | 56% (10/18) | 67% (30/45) | 73% (27/37) | **p=0.03**\* |
| **Xerosis** | 22% (4/18) | 36% (16/45) | 43% (16/37) | **p=0.04**\* |
| **Pallor** | 17% (3/18) | 33% (15/45) | 43% (16/37) | **p=0.02**\* |
| **Hyperpigmentation** | 11% (2/18) | 18% (8/45) | 27% (10/37) | p=0.11 |
| **Muehrcke’s Nails** | 6% (1/18) | 4% (2/45) | 5% (2/37) | p=0.90 |
| **Half & Half Nails** | 6% (1/18) | 7% (3/45) | 11% (4/37) | p=0.62 |
| **Pale Nails** | 17% (3/18) | 31% (14/45) | 41% (15/37) | **p=0.04**\* |
| **Splinter Hemorrhage** | 0% (0/18) | 4% (2/45) | 11% (4/37) | p=0.10 |

### ****Table 5: Infections and Rare Manifestations by Age Group****

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Symptom** | **20–39 years** | **40–59 years** | **≥60 years** | **p-value** |
| **Fungal Infection** | 0% (0/18) | 4% (2/45) | 14% (5/37) | **p=0.03**\* |
| **Bacterial Infection** | 0% (0/18) | 2% (1/45) | 8% (3/37) | p=0.20 |
| **Viral Infection** | 0% (0/18) | 2% (1/45) | 5% (2/37) | p=0.40 |
| **Uremic Frost** | 0% (0/18) | 0% (0/45) | 3% (1/37) | p=0.50  |
| **Kyrle Disease** | 0% (0/18) | 0% (0/45) | 3% (1/37) | p=0.50 |
| **Calcification** | 0% (0/18) | 2% (1/45) | 8% (3/37) | p=0.20 |
| **Bullous Disease** | 0% (0/18) | 2% (1/45) | 3% (1/37) | p=0.80 |
| **Uremic Neuropathy** | 0% (0/18) | 4% (2/45) | 8% (3/37) | p=0.30 |

**Discussion**:

End-stage renal disease (ESRD) presents a myriad of systemic challenges and complications, among which cutaneous manifestations are frequent and, at times, distressing for patients (15).

Pruritus is defined as the unpleasant sensation of itching of the skin, either in a specific area or all over the body, producing the urge to scratch (16). Uremic pruritus is the most common skin symptom in patients with chronic kidney disease (CKD), particularly in advanced stages of the disease. Although it is known as uraemic pruritus, the fact that there is no known direct cause-effect relationship with uraemia (since it does not usually occur in patients who present with episodes of acute kidney injury) means it is more accurately referred to as CKD-associated pruritus (CKD-aP), a term that is increasingly employed when discussing this condition (17, 18). In a study conducted by Al-Thnaibat MH et al. from Jordan (2025) (19), the incidence of generalized pruritus was highlighted in 36.4% (N = 28, 95% CI: 25.70–48.12%) of the participants. In a study conducted by Pisoni RL et al., pruritus, or itching, has been acknowledged as a profound detriment to the quality of life of CKD and ESRD patients (20). Furthermore, as shown in a study by Deshmukh et al., pruritis ranked first with a prevalence of 65.71% in patients (21). Its pathophysiology is multifaceted, with mechanisms ranging from elevated parathyroid hormone levels to the mere presence of xerosis (22). In our study , 91% of patients were presented with at least one cutaneous manifestation, and according to manifestation categories, pruritus was presented in 67% of our study patients.

Also, Al-Thnaibat et al. (2025) in their study found that generalized xerosis was observed in 63.6% (N = 49, 95% CI: 51.88–74.30%) of the participants, supporting the findings presented by Udayakumar et al. (19, 23). while in this study xerosis showed a low prevalence as compared to other studies and was observed only in 36% of the cases.  This prevalent cutaneous manifestation among ESRD patients can be explained by the impaired functionality of both sweat and sebaceous glands, coupled with the perpetual dehydration induced by recurrent dialysis treatments (11).

Among 105 patients in a study conducted by Rashpa RS et al. (2018), it was found that xerosis was seen in 93 (76.2%), skin pallor in 61 (50%), pruritus in 57 (46.7%), pigmentation in 47 (38.5%), and purpura in 18 (14.8%) patients; these were the major dermatoses (24).

Tameezuddin A, et al. (2023) in his study found that Xerosis and pruritus were most commonly reported (83.7%), followed by nail changes (18.6%) and skin discoloration (7). The median duration of dialysis was 36 (1-180) months, and there was no significant increase in skin symptoms with the increase in the duration of dialysis (p=0.082) (7).

In our study, males were presented in 54% of patients, and nail changes were seen in 45%, xerosis in 36%, pallor in 34%, pale nails in 32%, hyperpigmentation in 20%, and infections in 14% of study patients.

Xerosis and pruritus were most commonly reported (83.7%), followed by nail changes (18.6%) and skin discoloration (16.3%) (7). The median duration of dialysis was 36 (1-180) months, and there was no significant increase in skin symptoms with the increase in the duration of dialysis (p=0.082) (7).

Deshmukh SP et al. (2013) (19) observed thatthe overall prevalence of the dyspigmentation described in CRF patients was 31.42% in our study. Udayakumar et al. (23) reported this prevalence as 43% in their study. Diffuse hyperpigmentation happens due to increased levels of β-melanocyte-stimulating hormone as a result of its inadequate excretion through the kidney and dialysis (21). The present study showed pigmentation was seen in 20% of the patients.

Also, Deshmukh SP (2013) reported that nail changes were seen in 21 (60%) of our patients. The more common findings were Beau's lines seen in six (28.57%) patients and subungual hyperkeratosis in five (23.8%) patients. Half-and-half nails and platynychia were seen in four (19.04%) patients each. Dyachenko et al. (8), in their exclusive study of nail changes in patients with CRF, found half-and-half nails (16.9%) as the most common finding, followed by absent lunulae (13%) and onychomycosis (10.4%). Major nail abnormalities were reported by Rashpa RS et al. (2018) as pallor (in 35.2%), absent lunula (in 23.8%), nail discoloration (in 18%), and "half-and-half nails" in 16.4% of patients, respectively (24).

In our study, nail changes were observed in 45% of cases, including pale nails, Muehrcke’s nails, and half-and-half nails. In the Deshmukh SP (2013) study, cutaneous infections were identified in 12 (34.2%) patients, with eight cases of dermatophytosis (seven with tinea cruris and one with tinea faciei). Additionally, two patients had scabies, while herpes zoster and pyoderma were each reported in one case (21). The prevalence of cutaneous infections in an Indian study (23) and an Egyptian study (25) was 55% and 40%, respectively. These infections were exclusively fungal and were predominantly observed in older adults (14% in individuals aged ≥60 vs. 0% in those aged 20–39, p=0.03).

Udayakumar et al. (23) and Sultan et al. (25) reported the prevalence of APD in their studies as 21% and 10%, respectively. One case of Kyrle disease and another case of uremic frost were reported in this study, and both patients were diabetics.

Various other dermatoses like calcinosis cutis, bullous dermatoses of hemodialysis, drug reactions, arteriovenous shunt dermatitis, and nephrogenic fibrosing dermopathy have been frequently reported in other studies (26, 27, 28). Absence of the above findings in the Deshmukh SP (2013) study could be due to its small sample size (21). In this study, rare manifestations included uremic nephropathy (5%) and calcification (4%).

Our study showed that skin symptoms, including pruritis, xerosis, and pallor, increase significantly with age (p<0.05); pallor rises from 17% (20–39) to 43% (≥60). Infections: Rare manifestations like uremic frost, Kyrle disease, and calcification occur only in ≥60 years (3–8%).

**Ethical approval:** Ethical approval: The authors declare that they have taken the local ethical committee approval.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent.

**Conflicts of interest:** There are no conflicts of interest.

**Use of artificial intelligence (AI):** The authors confirm that there was no use of artificial intelligence (AI)-assisted technology in the manuscript preparation.

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