

Cutaneous Manifestations in Patients on Dialysis at Nephrology and Dermatology Units of Chandka Medical College Hospital, Larkana

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Author's Contribution

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Introduction

Chronic kidney disease (CKD) has emerged as the major health burden throughout the world, with end-stage renal disease (ESRD), involves a steady decline in kidney function and, currently ranked 16th among global causes of death.¹ Determined by global population growth and aging, CKD has become the most important concern, with its prevalence and incidence increasing by 40% over the last thirty years.² Patients with ESRD increasingly dependent on hemodialysis as a life-sustaining therapy, while dialysis effectively manages uremic toxin accumulation, fluid overload, and electrolyte imbalance, it does not fully correct the complex metabolic derangements related to renal impairment.³ Consequently, patients on maintenance dialysis remain vulnerable to a wide spectrum of extra-renal complications, among these, the dermatological manifestations remains one of the most prevalent yet under recognized situations of the disease burden.

The skin, being a highly vascularized and metabolically active organ, is specifically sensitive to disturbances in the metabolism of calcium-phosphate, regulation of

ABSTRACT

Objective: To determine the prevalence and spectrum of cutaneous manifestations in patients on dialysis at Dermatology and Nephrology units of Chandka Medical College Larkana.

Methodology: This cross-sectional study was carried out at dermatology and Nephrology departments, Chandka Medical College, Larkana from 30-January-2025 to 30 June 2025, on patients undergoing hemodialysis for at least 6 months, aged 18–70 years and both genders. Skin conditions such as xerosis, uremic pruritus, hyperpigmentation, hypopigmentation, uremic frost, and calciphylaxis were assessed, along with nail changes and hair-related findings were noted. Patients were monitored for any changes in cutaneous manifestations during subsequent dialysis sessions or follow-up visits. Data were entered and analyzed using SPSS version 26.

Results: Overall average age of patients was 45.20 ± 15.51 years. Females were 51.2% and 48.8% were males. Pruritus was the most common condition around 52.4%, followed by xerosis 50.8% and 48.4% calciphylaxis, hyperpigmentation (31.7%), subsequently hypopigmentation 23.2% and uremic frost was noted 22.8%. Additionally, the onychomycosis being the most prevalent nail finding (53.3%), following by half-and-half nails around 54.9%, 51.2% Beau's lines, and 41.5% koilonychias, while hair thinning, alopecia and hair dryness were found in 53.3%, 52.0% and 45.1% of the cases respectively. Overall cutaneous manifestations were insignificant according to age, gender, diabetes mellitus and frequency of dialysis ($p>0.05$).

Conclusion: The cutaneous manifestations were observed highly frequent among patients on dialysis, with the majority suffering from multiple skin, nail, and hair defects.

Key words: CKD, Cutaneous manifestations, dialysis, Xerosis, pruritus, Nail changes, alopecia

parathyroid hormone, immune dysfunction, anemia and the state of chronic inflammatory characteristic of uremia. However the pathogenesis underlying cutaneous involvement in CKD is multifactorial and remains incompletely recognized. Chronic inflammation, imbalances in calcium-phosphate and parathyroid hormone levels, and damage to small vessels together produce a spectrum of disorders ranging from pruritus to severe conditions like calciphylaxis. According to the international data around all hemodialysis patients develop some form of cutaneous abnormality during the treatment. According to a foundational study on patients with chronic renal failure on hemodialysis, all examined cases had at least one skin lesion attributable to their condition, with xerosis being the most frequent finding around 79%, followed by pallor, cutaneous pigmentation and pruritus.⁴ Another recent cross-sectional study from Iran demonstrated that the most prevalent skin findings was xerosis (84.7%), pallor (82.7%), pruritus (67.3%), and (40%) hyperpigmentation, with skin infections noticed in

around 36% of the cases with fungal infection being most common.⁵

The skin disease burden in the individuals on dialysis is constantly higher across the regions. According to a Brazilian study around 82% patients of CKD undergoing hemodialysis experience at least one cutaneous or mucosal changes, that may negatively impact quality of life, with the alterations of nail, xerosis, and mucous membrane alteration being specifically common.⁶ However at local level, Pakistani studies have confirmed these international findings while highlighting unique patterns of the region. The majority (58.9%) of dialysis patients presented with skin manifestations, and almost all hemodialysis patients had at least one dermatological manifestation.⁷

Overall dermatological abnormalities are frequently encountered among patients with ESRD; though, the occurrence of specific skin conditions varies considerably,^{5,8,9} and the variation may due to differences in ethnic background, socioeconomic factors, nutritional status, patient-related characteristics and environmental conditions.⁵ Although not usually life-threatening, these dermatological conditions can cause significant physical discomfort and negatively impact quality of life. In Pakistan, there is limited data on the pattern and prevalence of skin manifestations in dialysis patients. Hence this study was aimed to explore these findings in a local population to support early identification and management of dermatological complications in renal care.

Methodology

This cross-sectional study was conducted at dermatology and Nephrology departments, Chandka Medical College, Larkana. Study was done during six months (30-January-2025 to 30 June 2025) after approval of the synopsis from CPSP and ethical approval from Ethical review Committee (ERC) of Institute ref CMC/RER/058. The sample size of 246 patients was calculated using the OpenEpi sample size calculator for a cross-sectional study. Based on a previous study reporting a prevalence of 80% for dermatological manifestations in dialysis patients,¹⁰ with a 95% confidence level and 5% margin of error, the required sample size is 246 patients. Non-probability consecutive sampling technique was used. All the patients aged 18–70 years; both genders undergoing hemodialysis for at least 6 months were included. On the other hand patients with pre-existing dermatological conditions unrelated to dialysis (e.g., psoriasis, eczema), invidious with systemic diseases affecting the skin, such as systemic lupus erythematosus or HIV, pregnant or lactating females, and patients receiving immunosuppressive therapy were excluded.

Eligible patients undergoing dialysis at the Nephrology departments of Chandka Medical College, Larkana, were invited to participate and informed consent was obtained from each case after explaining the purpose of study. Baseline demographic and clinical data, including age, gender, residence (urban or rural), socioeconomic status, family monthly income, duration and frequency of dialysis, comorbidities and any current or past dermatological treatments, were recorded. Laboratory results, such as serum calcium, phosphorus, parathyroid hormone (PTH), hemoglobin, and urea levels, were noted from medical records or routine investigations. A comprehensive dermatological examination was performed by a trained dermatologist to document cutaneous, nail, and hair findings. Skin conditions such as xerosis, uremic pruritus, hyperpigmentation, hypopigmentation, uremic frost, and calciphylaxis were assessed, along with nail changes like half-and-half nails, Beau's lines, onychomycosis, and koilonychia. Hair-related findings such as dryness, thinning, or alopecia were also noted. Significant dermatological findings were photographed with patient consent for documentation and analysis.

Patients were monitored for any changes in cutaneous manifestations during subsequent dialysis sessions or follow-up visits. The appearance of new conditions, changes in severity, or improvement of existing manifestations were documented. To ensure the reliability and accuracy of the data, the dermatologist conducting the examination remained blinded to laboratory findings to minimize bias, and all data were cross-verified by an independent observer. All the collected data were securely stored in a centralized database, with unique identification numbers assigned to each participant to maintain confidentiality. Data were entered and analyzed using SPSS version 26.

Frequencies and percentages were calculated for qualitative variables. Mean and standard deviation will be used for quantitative variables. Chi-square or Fisher's exact test was applied to assess associations. A p-value of <0.05 was considered statistically significant.

Results

Present study enrolled the 246 patients with an average of 45.20 ± 15.51 years and average duration of dialysis of 31.38 ± 16.48 months. Gender distribution was approximately equal, with females including 51.2% and 48.8% males. Out of all 51.6% cases from rural and 48.4% were from urban areas. According to the frequency of dialysis, around half of the participants (50.4%) were on thrice weekly sessions and the remaining (49.6%) on twice weekly. According to the comorbidities, 48.4% patients were

diabetics, 47.6% were hypertensive, and cardiovascular disease was in 49.6% of the patients. Table I

Variables		N	%
Gender	Female	126	51.2%
	Male	120	48.8%
Residence	Rural	127	51.6
	Urban	119	48.4
Dialysis Frequency	Thrice weekly	124	50.4
	Twice weekly	122	49.6
Comorbidities	Diabetes	119	48.4
	Hypertension	117	47.6
	Cardiovascular disease	122	49.6

In the skin findings, pruritus was the most common, on 52.4% of the cases, following by xerosis around 50.8% and 48.4% calciphylaxis. In the pigmentary changes, hyperpigmentation being the most frequent type (31.7%), subsequently hypopigmentation 23.2%, uremic frost 22.8%, and 22.4% cases had no pigmentary changes. According nail abnormalities, the onychomycosis was the most prevalent (53.3%), following by half-and-half nails around 54.9%, 51.2% Beau's lines, and 41.5% koilonychia. According to the hair changes, hair thinning and alopecia were found in 53.3% and 52.0% of the cases respectively, while hair dryness was seen in 45.1% of the patients. Table II

Based on the post stratification analysis, almost all manifestations, including xerosis, hyperpigmentation, calciphylaxis, half-and-half nails, Beau's lines, onychomycosis, koilonychia, hair thinning, alopecia, and hair dryness, showed statistically insignificant differences according to age, gender, diabetes and frequency of dialysis ($p>0.05$), while only pruritus showed significant association with age of the patients ($p=.014$), as presented in table III and IV.

Cutaneous manifestations		N	%
Xerosis	Absent	121	49.2
	Present	125	50.8
Pruritus	Absent	117	47.6
	Present	129	52.4
Pigmentary changes	Hyperpigmentation	78	31.7
	Hypopigmentation	57	23.2
	None	55	22.4
	Uremic Frost	56	22.8
Calciphylaxis	Absent	127	51.6
	Present	119	48.4
Nail changes	Half and Half nail sign or Lindsay nails	135	54.9
	Beau's lines	126	51.2
	Onychomycosis	131	53.3
	Koilonychia	102	41.5
	Hair thinning	131	53.3
Hair related changes	Alopecia	128	52.0
	Hair dryness	111	45.1

Cutaneous manifestations	Female (n=126)	Male (n=120)	p-value	≤40 years	41-60 years	>60 years	p-value
Xerosis	62 (49.2%)	63 (52.5%)	0.606	50 (20.3%)	52 (21.1%)	23 (9.3%)	0.869
Pruritus	62 (49.2%)	67 (55.8%)	0.298	43 (17.5%)	63 (25.6%)	23 (9.3%)	0.014*
(Hyperpigmentation)	43 (34.1%)	35 (29.2%)	0.441	32 (13.0%)	32 (13.0%)	14 (5.7%)	0.220
Calciphylaxis	67 (53.2%)	52 (43.3%)	0.123	47 (19.1%)	44 (17.9%)	28 (11.4%)	0.279
Half-and-Half Nails	62 (49.2%)	73 (60.8%)	0.067	60 (24.4%)	48 (19.5%)	27 (11.0%)	0.225
Beau's Lines	60 (47.6%)	66 (55.0%)	0.247	51 (20.7%)	52 (21.1%)	23 (9.3%)	0.869
Onychomycosis	69 (54.8%)	62 (51.7%)	0.627	58 (23.6%)	49 (19.9%)	24 (9.8%)	0.387
Koilonychia	45 (35.7%)	57 (47.5%)	0.061	48 (19.5%)	37 (15.0%)	17 (6.9%)	0.181
Hair Thinning	64 (50.8%)	67 (55.8%)	0.428	48 (19.5%)	56 (22.8%)	27 (11.0%)	0.469
Alopecia	66 (52.4%)	62 (51.7%)	0.911	59 (24.0%)	46 (18.7%)	23 (9.3%)	0.148
Hair Dryness	54 (42.9%)	57 (47.5%)	0.464	44 (17.9%)	43 (17.5%)	24 (9.8%)	0.743

Cutaneous manifestations	Thrice Weekly (n=124)	Twice Weekly (n=122)	p-value	Non-Diabetic (n=127)	Diabetic (n=119)	p-value
Xerosis	62 (50.0%)	63 (51.6%)	0.797	71 (55.9%)	54 (45.4%)	0.099
Pruritus	70 (56.5%)	59 (48.4%)	0.204	68 (53.5%)	61 (51.3%)	0.720
(Hyperpigmentation)	39 (31.5%)	39 (32.0%)	0.972	43 (33.9%)	35 (29.4%)	0.693
Calciphylaxis	61 (49.2%)	58 (47.5%)	0.795	56 (44.1%)	63 (52.9%)	0.165
Half-and-Half Nails	67 (54.0%)	68 (55.7%)	0.788	64 (50.4%)	71 (59.7%)	0.144
Beau's Lines	64 (51.6%)	62 (50.8%)	0.901	67 (52.8%)	59 (49.6%)	0.618
Onychomycosis	63 (50.8%)	68 (55.7%)	0.438	64 (50.4%)	67 (56.3%)	0.353
Koilonychia	54 (43.5%)	48 (39.3%)	0.503	59 (46.5%)	43 (36.1%)	0.101
Hair Thinning	69 (55.6%)	62 (50.8%)	0.448	66 (52.0%)	65 (54.6%)	0.677
Alopecia	62 (50.0%)	66 (54.1%)	0.520	70 (55.1%)	58 (48.7%)	0.317
Hair Dryness	52 (41.9%)	59 (48.4%)	0.311	58 (45.7%)	53 (44.5%)	0.859



Fig: 1. Calciphylaxis



Fig: 2. Xerosis



Fig: 3. Half and half nails



Fig: 4. Alopecia

Discussion

The hemodialysis, while serving as a life-sustaining renal replacement therapy, does not fully manages the complex metabolic and biochemical imbalances of end-stage kidney disease, thereby allowing the gradual accumulation of uremic toxins, mediators of the inflammation, and imbalances in the mineral that collectively drive a wide spectrum of cutaneous manifestations. However present study evaluated the cutaneous, nail, and hair manifestations in 246 patients on maintenance hemodialysis, where pruritus and xerosis were the most common findings in 52.4% and 50.8% of the cases respectively following by 48.4% calciphylaxis; the findings were supported by the Iranian study conducted by Kebria AS et al¹¹ where most frequent skin findings were xerosis 84.7%, pallor 82.7% and pruritus 67.3% among patients on dialysis. According to another study the pruritus is the most frequently observed dermatological manifestation among cases with renal failure, followed by xerosis, Lindsay's nails, APD, metastatic calcinosis cutis (MCC), pseudoporphyria, NSF and PCT.¹² In the agreement with the present study, et al¹³ reported that the predominant findings of cutaneous manifestations were xerosis (60.4%), pallor (59.7%), and pruritus (40.3%).

Moreover in a review study by Robles-Mendez JC et al¹⁴ stated that the cutaneous manifestations are frequently high in chronic kidney disease include renal pruritus (50–90%), acquired perforating dermatosis (4.5–10%), calciphylaxis (1–4%), porphyria cutanea tarda and pseudoporphyria (each 1–18%), and nephrogenic systemic fibrosis, which is rare, while in non-specific disorders encompass xerosis (50–80%), pigmentary changes (20–50%), skin infections (40%), mucosal alterations (50–90%), nail disorders (30–60%) and hair

disorders around (30–50%).¹⁴ In line with our observations, a Korean study observed xerosis as the second most frequent manifestation at 67.7%, attributing its prevalence to dysfunction of sweat and sebaceous glands compounded by recurrent fluid shifts during the sessions of dialysis.¹⁵ The variation in the prevalence of pruritus and xerosis across the studies may due to the heterogeneity in the study design, diagnostic criteria, demographics of the patients, modality and adequacy of dialysis, socioeconomic factors of populations,

geographical and climatic changes, and fluctuating prevalence of comorbidities like as diabetes mellitus across the populations of studies.

In this study the hyperpigmentation being the most frequent type (31.7%), subsequently hypopigmentation 23.2%, uremic frost 22.8%, and 22.4% cases had no pigmentary changes. Our results are in conformity with the Iranian study conducted by Kebria AS et al¹¹ hyperpigmentation is reported in 40% of hemodialysis patients, whereas an Indian study from a maintenance hemodialysis cohort demonstrated the diffuse blackish hyperpigmentation among 40% of the cases, predominantly in sun-exposed areas.¹⁶

Generalized skin darkening in CKD is resulting from multiple mechanisms, like raised levels of melanocyte-stimulating hormone can enhance production of melanin, while accumulation of carotenoids and various uremic pigments may alter the coloration of skin, whereas in some cases, deposition of iron or hemosiderin due to repetitive blood transfusions, hemolysis, or minor cutaneous bleeding further contributes to pigmentation variations. Moreover, the chronic inflammatory state and oxidative stress related with uremia may stimulate melanocyte activity and intensify the discoloration in skin.^{17,18}

In this series according nail abnormalities, the onychomycosis was the most prevalent (53.3%), following by half-and-half nails around 54.9%, 51.2% Beau's lines, and 41.5% koilonychias, whereas hair changes include hair thinning and alopecia in 53.3% and 52.0% of the cases respectively and hair dryness were in 45.1% of the patients. In agreement with the present study, Galal SA et al¹⁹ reported that the nail changes were highly prevalent, in the 91% of

patients, with the most frequent dermoscopic findings being lateral nail fold scales (91%), dry cuticle (84%), onychoschizia (72%), and longitudinal striations (69%), and no significant association was observed between nail changes and sex, hemodialysis duration, or albumin level. As the onychomycosis found in 53.3% of our patients, is consistent with the Indian hemodialysis cohort that reported onychomycosis as the most common nail change among those with nail involvement (n=27/140), further noting fungal, bacterial, and viral skin infections in 53% of patients overall.¹⁶ Study conducted by Mourad B et al²⁰ reported that the Lusterless and brittle hair were the most frequently observed hair abnormalities, occurring in 68.8% and 67.7% of patients, respectively, whereas diffuse hair loss was reported in only 6.5% of the study cases.

Consistently with our findings a previous study conducted by Udayakumar P et al²¹ observed hair abnormalities as reduced body hair in 30% of cases, decreased scalp hair density among 11% of the cases, and brittle, dull hair in 16% of individuals. On the other hand Ghorui R et al also was observed nail changes in 56.31% of patients, with half-and-half nails being the most prevalent finding (22.3%), followed by absent lunula (15.3%), koilonychia (14.5%), subungual hyperkeratosis (7.7%), and onycholysis, onychomycosis, and Beau's lines each present in 5.8% of patients.²² Overall cutaneous manifestations in hemodialysis patients noted to be a broad and complex research domain, and the this study possess several important limitations like limited sample size, the severity of both chronic kidney disease and cutaneous manifestations

were not systematically evaluated. Moreover, patient management history, personal hair and nail care practices, dietary and nutritional status, and patient awareness regarding skin health were not analyzed, all of which are critical factors in fully identification the nature and extent of these manifestations in dialysis patients. Hence it is recommended that comprehensives separate studies should be done specifically on cutaneous, nail, and hair changes, incorporating evaluation of disease severity, nutritional status, history of the medication, and self-care practices, in order to clearly observe the clinical spectrum and underlying determinants of these manifestations and ultimately facilitate the development of substantial and evidence-based management strategies for patients on dialysis.

Conclusion

The cutaneous manifestations were observed highly frequent among patients with chronic dialysis, with the majority suffering from multiple skin, nail, and hair defects including pruritus, xerosis, pigmentary variations, and nail dystrophies. Additionally, a higher burden of comorbidities including diabetes, hypertension, and cardiovascular disease further complexes these issues. Such manifestations signifying the important clinical indicators of systemic uremic toxicity rather than simple cosmetic concerns, highlighting the requirement for routine dermatological evaluation as an integral component of comprehensive dialysis care to enhance the quality of life of patients.

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