

Comparison Of The Prevalence And Severity Of Cutaneous Manifestations In Dialysis And Non-Dialysis Patients With Chronic Kidney Disease

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KEYWORDS

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ABSTRACT:

Background: Chronic kidney disease (CKD) is a global public health problem associated with numerous systemic complications, including cutaneous manifestations. Skin changes often reflect underlying renal pathology and may affect quality of life. The prevalence and severity of these dermatological abnormalities may differ between dialysis and non-dialysis CKD patients. **Objective:** To compare the prevalence and severity of cutaneous manifestations in CKD patients receiving maintenance haemodialysis (MHD) versus without dialysis. **Materials and Methods:** This cross-sectional study was conducted in the Department of Dermatology & Venereology and Department of Nephrology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh and International Medical College, Tongi, Gazipur, Bangladesh from January 2022 to June 2022. Eighty adult CKD patients (stages III–V) were recruited, divided equally into two groups: 40 on MHD and 40 without dialysis. Exclusion criteria included acute kidney injury, previous kidney transplantation, and pre-existing dermatological conditions. Demographic, clinical, and laboratory data were recorded. Cutaneous manifestations were assessed based on clinical findings and, when necessary, confirmed through laboratory investigations. Statistical analysis was performed using Chi-square and unpaired Student's t tests, with $p < 0.05$ considered significant. **Results:** Among 80 patients, males predominated (66.3%) with a mean age of 44.6 years. Cutaneous abnormalities were significantly more common in dialysis patients, including xerosis, pruritus, purpura/ecchymosis, infections, ulcerative stomatitis, and half-and-half nails (all $p < 0.05$). In pre-dialysis CKD, skin changes increased with stage, with pallor, xerosis, pruritus, half-and-half nails, pigmentation, and infections most frequent in Stage V. Overall, abnormalities were markedly more prevalent in advanced CKD and dialysis patients. **Conclusion:** Cutaneous manifestations are highly prevalent among CKD patients and are more severe in those undergoing dialysis. Early recognition of these dermatological changes may aid in timely diagnosis, management, and improved quality of life for CKD patients.

INTRODUCTION

The skin and the kidney are two major organ systems that are interconnected both physiologically and pathologically. The skin often reflects underlying systemic diseases, including renal disorders, and thus serves as an important diagnostic tool for clinicians.¹ Early recognition of subtle cutaneous markers can aid in timely detection of renal disease, helping to avoid delays in treatment. Cutaneous changes may be evident from the early stages of renal impairment through to end-stage renal disease (ESRD), in patients undergoing hemodialysis, and even after kidney transplantation.²

Chronic kidney disease (CKD) is defined as kidney damage or reduced kidney function lasting for at least three months, irrespective of cause.^{3,4} Globally, CKD affects approximately 8–16% of the population, with higher prevalence in low- and middle-income countries compared with high-income nations, and is a major contributor to morbidity and mortality.^{3,5} It has emerged as a significant public health issue worldwide.⁶ In Bangladesh, an estimated 18–20% of patients are affected by CKD, and progression to ESRD requires renal replacement therapy such as dialysis or transplantation for survival.^{7,8}

Dermatological manifestations are among the most common extra-renal complications of CKD, with 50–100% of patients developing at least one cutaneous abnormality during the course of the disease.^{9,10} These manifestations may precede renal failure, arise during the uremic stage, or develop as consequences of dialysis and immunosuppressive therapy after transplantation.^{2,6} Common presentations include xerosis, pruritus, pigmentary changes, and ecchymosis, which can significantly impair quality of life.^{11,12}

Among these, pruritus is one of the most prevalent and distressing symptoms, affecting 22–84% of patients on maintenance hemodialysis.¹³ The severity is often greater in patients who are not on regular dialysis.¹⁴ The pathogenesis of CKD-associated pruritus is multifactorial, involving xerosis, uremic toxin retention, calcium-phosphate imbalance, mast cell proliferation with histamine release, hormonal dysregulation, and vitamin D deficiency.^{15,16}

Given the rising global burden of CKD and its high prevalence in Bangladesh, along with the considerable impact of cutaneous manifestations on patients' quality of life, comparing the prevalence and severity of these skin changes in dialysis and non-dialysis CKD patients is of great clinical significance. A better understanding of these differences may help guide management strategies and improve patient outcomes.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Dermatology & Venereology and Department of Nephrology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh and International Medical College, Tongi, Gazipur, Bangladesh from January 2022 to June 2022. Hospital-admitted adult patients (age >18 years) with CKD stages III–V, with or without maintenance haemodialysis (MHD), who provided informed written consent after explanation of the study purpose, were consecutively recruited. Patients with acute kidney injury (AKI), history of kidney transplantation, or pre-existing dermatological conditions were excluded. A total of 80 CKD patients were included, equally divided into two groups: 40 receiving MHD and 40 not on dialysis. All participants underwent detailed general and systemic examinations. Demographic, clinical, and laboratory data were collected, including complete blood count (CBC), serum creatinine, 24-hour urinary total protein (UTP), and fasting lipid profile (serum total cholesterol, triglycerides, LDL-C, and HDL-C). The estimated glomerular filtration rate (eGFR) was calculated using the Cockcroft–Gault formula, and CKD staging was assigned according to the KDIGO 2012 Clinical Practice Guideline. Fungal scraping and potassium hydroxide mounts were performed where clinically indicated. Cutaneous manifestations were primarily assessed on the basis of clinical findings with confirmation obtained through laboratory investigations when deemed necessary. Participants were further categorized based on the presence or absence of cutaneous abnormalities. Outcome variables compared between groups included age, gender, haemoglobin level, serum creatinine, 24-hour urinary protein, and lipid profile. Data were recorded in a pre-tested structured data sheet.

Common Cutaneous Changes Associated with CKD

- **Pruritus:** Itchy sensation of the skin, often worsened by dryness.
- **Xerosis:** Abnormal dryness of the skin and mucous membranes.
- **Pallor:** Pale skin due to reduced haemoglobin.
- **Hyperpigmentation:** Darkening of skin or nails from increased melanin.
- **Purpura/Ecchymosis:** Red or purple spots caused by subcutaneous bleeding.
- **Ulcerative Stomatitis:** Erosions or ulcerations in oral mucosa or gingiva.
- **Bacterial Infection:** Skin and soft tissue infections such as cellulitis, impetigo, or folliculitis.

- **Fungal Infection:** Includes dermatophyte and yeast infections (e.g., athlete's foot, ringworm, candidiasis).
- **Half-and-Half Nails:** Proximal nail appears white, distal portion reddish-brown with a sharp demarcation line.

Definition and Staging of CKD: CKD was defined as abnormalities of kidney structure or function persisting for more than 3 months, according to KDIGO 2012 Guidelines. Stages were classified as follows:

- Stage I: **eGFR ≥ 90 mL/min/1.73 m²**
- Stage II: **eGFR 60–89 mL/min/1.73 m²**
- Stage IIIa: **eGFR 45–59 mL/min/1.73 m²**
- Stage IIIb: **eGFR 30–44 mL/min/1.73 m²**
- Stage IV: **eGFR 15–29 mL/min/1.73 m²**
- Stage V: **eGFR <15 mL/min/1.73 m² (kidney failure)**

Statistical Analysis

Data were entered and analyzed using SPSS version 25. Categorical variables were presented as frequencies and percentages, and continuous variables as mean $\pm$ standard deviation (SD). Comparisons between groups were performed using the Chi-square test (with Fisher's exact correction when appropriate) for categorical variables and unpaired Student's t test for continuous variables. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Gender and age of the study patients (n=80)

Parameters	Group A (n=40)	Group B (n=40)	Total (n=80)	*p Value
Gender				
Male n (%)	27 (67.5%)	26 (65.0%)	53	0.802
Female n (%)	13 (32.5%)	14 (35.0%)	27	
Age (yrs)				
Mean $\pm$ SD	46.1 $\pm$ 14.3	42.3 $\pm$ 11.0	44.6 $\pm$ 12.3	0.220
Range	18.0–70.0	20.0–57.0	18.0–70.0	

In this study (n = 80), males were predominant in both groups (67.5% in Group A vs. 65.0% in Group B; p = 0.802). The mean age was 46.1 $\pm$ 14.3 years in Group A and 42.3 $\pm$ 11.0 years in Group B (overall 44.6 $\pm$ 12.3 years), with no significant difference between groups (p = 0.220).

Table 2: Comparison of cutaneous abnormalities in CKD patients on dialysis (MHD) and without dialysis (Stage III–V)

Parameters (Skin Manifestations)	Dialysis (n=40) n (%)	Without-Dialysis (n=40) n (%)	Total	p value
Pallor	34 (85)	32 (80.0)	66	0.55
Xerosis	23 (57.5)	14 (35.0)	37	0.04
Pruritus	32 (80.0)	19 (47.50)	51	0.002
Pigmentation	23 (57.5)	19 (47.5)	42	0.37
Purpura/Ecchymosis	14 (35)	3 (7.5)	17	0.002
Bacterial infection	10 (25.0)	3 (7.5)	13	0.03
Fungal infection	9 (22.5)	2 (5.0)	11	0.02
Ulcerative stomatitis	8 (20.0)	2 (5.0)	10	0.04
Half-and-half nails	22 (55)	8 (20.0)	30	0.001

Cutaneous abnormalities were more frequent in dialysis patients compared to those without dialysis. Significant differences were observed for xerosis (57.5% vs. 35.0%, p = 0.04), pruritus (80.0% vs. 47.5%, p = 0.002), purpura/ecchymosis (35.0% vs. 7.5%, p = 0.002), bacterial (25.0% vs. 7.5%, p = 0.03) and fungal infections (22.5% vs. 5.0%, p = 0.02), ulcerative stomatitis (20.0% vs. 5.0%, p = 0.04), and half-and-half nails (55.0% vs. 20.0%, p = 0.001). Pallor and pigmentation were common in both groups without significant difference.

Figure shows among the study population (n = 80), 23 patients (28.7%) were in Stage III, 19 patients (23.8%) in Stage IV, and 38 patients (47.5%) in Stage V. Thus, nearly half of the patients were in Stage V, indicating that advanced CKD was most common in the study group.

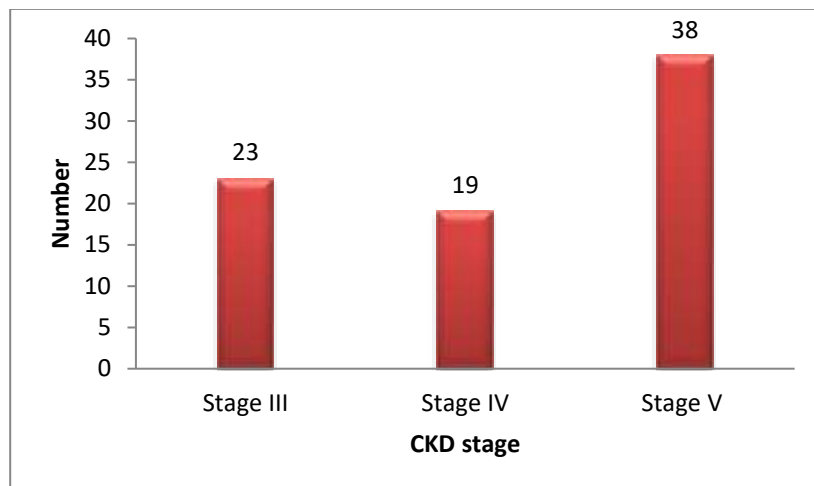


Figure I: Distribution of cutaneous abnormalities in different stages of CKD patients (pre-dialysis; CKD stage-III, IV & V)

Table 3: Distribution of cutaneous abnormalities in different stages of CKD patients (pre-dialysis; CKD stage-III, IV & V, n = 80)

Parameters (Skin Manifestations)	Stage III n=23	Stage IV n=19	Stage V n=38	Total
Pallor	15 (65.22)	17 (89.47)	34 (89.47)	66
Xerosis	8 (34.78)	6 (31.58)	23 (60.53)	37
Pruritus	15 (65.21)	9 (47.36)	27 (71.05)	51
Pigmentation	16 (59.57)	5 (26.32)	21 (55.26)	42
Purpura/Ecchymosis	1 (4.35)	2 (10.53)	14 (36.84)	17
Bacterial infection	2 (8.70)	3 (15.79)	5 (13.16)	13
Fungal infection	2 (8.69)	1 (5.26)	8 (21.05)	11
Ulcerative stomatitis	2 (4.35)	1 (5.26)	7 (18.42)	10
Half-and-half nails	5 (21.74)	3 (15.79)	22 (57.89)	30

Among pre-dialysis CKD patients (n = 80), the frequency of skin manifestations increased with advancing stage. Pallor was the most common finding, observed in 65.2% of Stage III, 89.5% of Stage IV, and 89.5% of Stage V patients. Xerosis (60.5%), pruritus (71.1%), and half-and-half nails (57.9%) were predominantly seen in Stage V. Pigmentation were relatively more frequent in Stage III (59.6%) and Stage V (55.3%) than in Stage IV (26.3%). Purpura/ecchymosis showed a progressive rise, being highest in Stage V (36.8%). Infective complications were also more common in Stage V, with bacterial infection in 13.2%, fungal infection in 21.1%, and ulcerative stomatitis in 18.4% of patients. Overall, most cutaneous abnormalities were markedly more prevalent in Stage V compared to earlier stages.

DISCUSSION

In this study of 80 patients, males predominated in both groups (67.5% in Group A vs. 65.0% in Group B; $p = 0.802$), with a mean age of 44.6 ± 12.3 years, showing no significant difference between groups ($p = 0.220$). These findings are comparable with Rahman et al. who reported a mean age of 44.6 ± 12.3 years and male predominance of 66%.¹² Similarly, Bahashwan et al. observed a slightly younger cohort with age groups 24–35 and 35–45 years comprising 45.5% and 54.5% of their population, respectively, and an equal gender distribution.¹⁷ In our study, females represented the majority (75%) among patients with skin disorders, indicating a potential sex-related predisposition to certain cutaneous manifestations.

Cutaneous abnormalities were more frequent in dialysis patients compared to those managed conservatively. Xerosis, pruritus, purpura/ecchymosis, bacterial and fungal infections, ulcerative stomatitis, and half-and-half nails were significantly more prevalent in patients undergoing dialysis. Specifically, xerosis was noted in 57.5% of dialysis patients versus 35.0% in non-dialysis patients ($p = 0.04$), pruritus in 80.0% versus 47.5% ($p = 0.002$), and purpura/ecchymosis in 35.0% versus 7.5% ($p = 0.002$). These findings align with Rahman et al., who observed higher incidence of pigmentation, purpura, ulcerative stomatitis, and bacterial infections among dialysis patients.¹² Similarly, Asokan et al.¹ reported xerosis as significantly more common in dialysis patients (70.5% vs. 31.3%), with notable differences in pigmentation and hair changes.¹ Khatri et al. also reported higher prevalence of xerosis (73.8% vs. 51.7%) and pallor (72.1% vs. 21.5%) in dialysis patients.¹⁸

Pallor was the most common cutaneous manifestation in our cohort, observed in 72% of patients, consistent with previous reports where prevalence ranged from 45% to over 90%.^{19,20} Pallor is predominantly attributed to anemia, which may be exacerbated in dialysis patients due to recurrent blood loss.^{12,20} Xerosis, observed in 68.6% of patients, was the second most frequent abnormality and consistent with the reported range of 46–90% in prior studies.^{21–23} Pathophysiologically, xerosis results from reduced eccrine sweat gland function and epithelial dehydration, with tropical climates and chronic sun exposure as contributing factors.^{24,25}

Pruritus was present in 63.8% of patients, showing higher prevalence in the dialysis group, similar to Rahman et al.¹² who reported 65.3%, and Udayakumar et al. and Leena et al., who reported rates around 53%.^{21,22} The etiology is multifactorial, involving accumulation of uremic toxins, systemic inflammation, and secondary hyperparathyroidism.¹¹ Pigmentation changes were seen in approximately one-third of patients, more frequent among dialysis patients, consistent with Rahman et al. and Khatri et al.^{12,4} Hyperpigmentation is thought to result from increased melanin deposition due to impaired clearance of β -melanocyte-stimulating hormone.²⁶

Purpura and ecchymosis occurred in 35% of dialysis patients, consistent with Rahman et al., likely due to platelet dysfunction and anticoagulation during hemodialysis.^{12,19} Nail abnormalities, particularly half-and-half nails, were common in dialysis patients (55%), confirming earlier observations by Jeswani et al.⁶ and Amatya et al.²³ Mucosal changes, including ulcerative stomatitis, were also more prevalent in dialysis patients, as previously reported.

The frequency of cutaneous manifestations increased with advancing CKD stage. In this study, Stage V patients exhibited the highest prevalence of pallor (89.5%), xerosis (57.9%), pruritus (71.1%), half-and-half nails (57.9%), pigmentation (55.3%), and purpura/ecchymosis (36.8%). Infective complications such as bacterial infection (13.2%), fungal infection (21.1%), and ulcerative stomatitis (18.4%) were also more frequent in Stage V. These findings align with Rahman et al., highlighting that dermatological manifestations correlate strongly with CKD severity.¹²

Overall, this study reinforces the evidence that cutaneous abnormalities are highly prevalent among CKD patients, particularly in those undergoing dialysis or in advanced stages of the disease. The pattern and prevalence of skin disorders observed here are consistent with prior studies.^{21–25}, emphasizing the need for regular dermatological evaluation and management as part of comprehensive CKD care.

CONCLUSION

Cutaneous abnormalities are highly prevalent among CKD patients, with higher severity observed in those receiving dialysis. Recognizing these manifestations can facilitate early diagnosis, better clinical monitoring, and improved quality of life. Regular dermatological assessment should be integrated into CKD management protocols.

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