

Clinical Profile of Cutaneous Manifestations in Patients with Chronic Kidney Disease

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Abstract

Background: Chronic renal failure (CRF) often leads to a range of skin-related manifestations, influenced by both the underlying disease and its treatment. The cutaneous manifestations are widespread in chronic kidney disease (CKD). The manifestations vary depending on the stage of CKD. They include widespread xerosis and pruritus to less frequent conditions like hyperpigmentation in exposed areas, acquired perforating dermatosis, and nail abnormalities. The current study aimed to study in detail the various cutaneous manifestations of CKD patients reporting to our hospital.

Methods: This cross-sectional study was conducted in the Department of General Medicine in collaboration with the Department of Nephrology and Dermatology, Institute of Medical Sciences. Patients diagnosed with chronic kidney disease (CKD) are defined according to the KDOQI (Kidney Disease Outcomes Quality Initiative) guidelines. The classification of patients with CKD was based on the presence of kidney damage and the glomerular filtration rate (GFR), following the KDOQI CKD classification standards. Staging was performed according to the estimated GFR (eGFR) using the MDRD (Modification of Diet in Renal Disease) formula. CKD stage V patients were further categorized as stable CKD or hemodialysis-dependent CKD (D-CKD).

Results: A total of 50 patients were included in the study. The stages range from 2 to 5, representing the increasing severity of CKD. A significant majority (50%) of the patients had CKD stage 5, indicating advanced kidney disease. 10% of the patients were newly diagnosed with CKD, and a small proportion (6%) had been diagnosed within the past year. A significantly higher proportion of patients in later CKD stages (3, 4, and 5) experienced pruritus (itching), xerosis (dry skin), and pallor compared to those in earlier stages (2 and 3). These manifestations were less common and did not show significant differences between CKD stages. Most of the patients in this study had pruritus in stage 5 and it was also reported more commonly in patients above the age of 50 years.

Conclusion: The results of this study showed that cutaneous manifestations were common and significant problems in patients with CKD, particularly those in the advanced stages. There is a strong association between the severity of chronic kidney disease (CKD) and the prevalence and severity of cutaneous manifestations. Pruritus, xerosis, and pallor were commonly observed in stages 4 and 5. It also appears that a longer duration of CKD is associated with higher skin complications.

Keywords: Chronic Kidney Disease (CKD), Cutaneous manifestations, Pruritus, Pallor.

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Introduction

Chronic kidney disease (CKD) is a complex, progressive condition that affects multiple organ systems, including the skin. It often leads to various cutaneous manifestations that significantly impact a patient's quality of life [1]. The skin is the largest organ in the body and plays a vital role in

protecting the body, regulating temperature, and maintaining fluid balance. Due to its structural and functional distinctiveness, it is susceptible to various manifestations when kidney function declines [2-5]. Currently, CKD is increasingly recognized as a major global health concern, with an approximate estimated prevalence affecting

between 8% and 16% of the world's population [6]. It is defined by either kidney damage or a reduction in the glomerular filtration rate (GFR) to less than 60 ml/min/1.73 m² for at least three months, regardless of the underlying cause. As kidney function progressively decreases, a range of systemic manifestations arises. The skin-related issues are some of the most visible and distressing for patients. The burden of CKD is especially high in developing countries, where limited access to healthcare can lead to higher morbidity and mortality rates.

It has been found that cutaneous manifestations are highly prevalent in CKD patients, with approximately 88% experiencing at least one dermatological issue during the course of their disease [7]. These manifestations can emerge at any stage of CKD and typically worsen as the disease progresses. The skin conditions associated with CKD range from common symptoms like generalized xerosis (dry skin) and pruritus (itching) to more uncommon disorders such as hyperpigmentation of exposed areas, acquired perforating dermatosis, and various nail abnormalities [8]. Xerosis and pruritus are particularly common and distressing for patients, often leading to discomfort, sleep disturbances, and a diminished quality of life. The pruritus associated with CKD, known as uremic pruritus, can be so severe that it significantly impairs daily functioning and mental well-being. Furthermore, studies have shown that between 50% and 100% of CKD patients will experience at least one cutaneous change during their disease progression [8, 9]. These dermatological complications can include pigmentary changes, which manifest as darkened or lightened patches of skin, often in exposed areas. Hyperpigmentation is thought to be related to the accumulation of waste products in the skin as the kidneys lose their ability to filter effectively. Additionally, CKD can lead to nail abnormalities such as Muehrcke's lines or half-and-half nails, conditions that indicate poor kidney function.

The cutaneous manifestations appear to be produced by various factors that are associated with CKD and its therapy. Cutis syndrome is caused by uremia, which is an accumulation of metabolic waste products in blood because of the failure of kidneys. Moreover, the treatment for CKD, dialysis, may cause skin problems, such as calciphylaxis which is equivalent to skin death or worsened skin itching [8]. These dermatologic complications are not only creating pain and physical discomfort to a CKD patient but also psychological discomfort to that patient, which will reduce the quality of life of the patient once more. Hence it is necessary to diagnose cutaneous manifestations and to treat them to enhance the quality of life. A nephrologist may be consulted to

provide the patient with proper management of CKD together with skin manifestations. However, the fact remains that cutaneous manifestations are highly common among CKD patients, and since this area lacks adequate research with special reference to our area. Knowledge of these manifestations will help in developing further strategies to combat these manifestations for better patient care. With this background, the current study was designed to evaluate the prevalence and pattern of cutaneous manifestations in CKD patients at a tertiary care center. The findings will contribute to the growing body of knowledge on dermatologic issues in CKD, emphasizing the importance of early diagnosis and intervention in improving the overall quality of life for these patients.

Material and Methods

This cross-sectional study was conducted in the Department of General Medicine in collaboration with the Department of Nephrology and Dermatology, Institute of Medical Sciences. Institutional Ethical approval was obtained for the study after duly following the protocol for human research based on the Helsinki Declaration. Written consent was obtained from all participants after explaining the nature of the study and its outcomes in vernacular language.

Inclusion Criteria

1. Age >18 years and above
2. Males and Females
3. eGFR < 60 ml/min/1.73 m²
4. CKD stage V (on dialysis) undergoing maintenance hemodialysis (MHD) for at least one month

Exclusion Criteria

1. Known dermatological disorders (e.g., collagen diseases, primary cutaneous diseases)
2. Known malignancies
3. Patients with drug-induced rashes
4. Known HIV, Hepatitis B, and C infections
5. Pregnant or lactating women
6. Patients with acute kidney injury
7. Renal transplant recipients
8. Patients on peritoneal dialysis

Chronic kidney disease (CKD) is defined according to the KDOQI (Kidney Disease Outcomes Quality Initiative) guidelines [10]. Patients were recruited from the nephrology clinic, General Medicine outpatient clinic, and wards, including both outpatients and inpatients, who provided written

informed consent. The classification of patients with CKD was based on the presence of kidney damage and the glomerular filtration rate (GFR), following the KDOQI CKD classification standards. Staging was performed according to the estimated GFR (eGFR) using the MDRD (Modification of Diet in Renal Disease) formula. CKD stage V patients were further categorized as stable CKD or hemodialysis-dependent CKD (D-CKD). All patients underwent investigations, including a complete blood count, kidney and liver function tests, tests for HIV, Hepatitis B and C, routine urine and microscopic analysis, electrocardiography (ECG), and abdominal and KUB ultrasound. eGFR was calculated using the MDRD formula. Dermatological assessments were performed by specialists, and specific investigations, such as skin biopsies, bacterial culture and sensitivity, Gram staining, potassium hydroxide mounts, and fungal cultures, were conducted where necessary.

Statistical analysis: All available data were refined and uploaded to MS Excel spreadsheets. The data

were analyzed using SPSS version 22 in Windows format. Continuous variables are represented as means, standard deviations, and percentages. Categorical variables were calculated using the chi-square test at a significance level of (0.05). The p values (<0.05) were considered significant.

Results

Table 1 shows the age distribution of 50 patients with chronic kidney disease (CKD) who exhibited cutaneous manifestations. The majority of patients (48%) were aged between 31 and 50, indicating that middle-aged adults are most commonly affected by CKD-associated skin conditions. Both younger (18-30) and older (>60) age groups had lower proportions of patients with cutaneous manifestations, suggesting that the prevalence of these conditions may be lower in these age ranges. The data suggests that middle adulthood is a period of increased risk for developing CKD-associated skin complications. The mean age of the cohort was 39.5 ± 5.5 years. Out of the 50 cases, 30(60%) were males and 20(40%) were females the male to female ratio was 3:2.

Table 1: Age group distribution of cases included in the study

Age in Years	Frequency	Percentage
18 - 20	5	10.0
21 - 30	6	12.0
31 - 40	13	26.0
41 - 50	11	22.0
51 - 60	10	20.0
> 60	5	10.0
Total	50	100.0

Table 2 shows the distribution of chronic kidney disease (CKD) stages among the 50 patients included in the study. The stages range from 2 to 5, representing the increasing severity of CKD. A significant majority (50%) of the patients had CKD stage 5, indicating advanced kidney disease. The remaining patients were distributed across CKD stages 2, 3, and 4, with lower frequencies in these earlier stages as depicted in the Table below.

Table 2: CKD Stage Distribution of Study Participants

CKD stage	Frequency	Percentage
2	1	2.0
3	10	20.0
4	19	38.0
5	20	40.0
Total	50	100.0

Table 3 depicts the distribution of CKD duration among the study participants. A significant majority (44%) of the patients had a history of CKD for more than 5 years, indicating that the study population consisted primarily of individuals with long-term kidney disease. Only 10% of the patients were newly diagnosed with CKD, and a small proportion (6%) had been diagnosed within the past year.

Table 3: Duration of CKD recorded in the cases of the study

Duration	Frequency	Percent
Newly diagnosed	5	10.0
<1 yr	3	6.0
1-5 yrs	20	40.0
>5 yr	22	44.0
Total	50	100.0

In this study, the recording of etiological factors for CKD revealed that 56% of cases had chronic diabetes mellitus. Similarly, Hypertension was found to be present in 48% of cases. 24% of cases had both hypertension and diabetes mellitus.

Table 4: Cutaneous manifestation based on the CKD stages in the cases of the study

Cutaneous manifestations	CKD stages				P value
	Stage 2	Stage 3	Stage 4	Stage 5	
Pruritus	0	2	3	11	0.002*
Xerosis	0	1	3	14	0.001*
Pallor	1	1	2	13	0.032*
Hyperpigmentation	0	0	2	5	0.120
Purpura, petechiae and ecchymosis	0	1	1	9	0.625
Nail changes	0	2	4	14	0.067
Hair changes	1	3	6	13	0.089

*Significant

The study of cutaneous manifestations at various stages has been described in Table 4. A significantly higher proportion of patients in later CKD stages (3, 4, and 5) experienced pruritus (itching), xerosis (dry skin), and pallor compared to those in earlier stages (2 and 3). These manifestations were less common and did not show significant differences between CKD stages. Most of the patients in this study had pruritus in stage 5 and it was also reported more commonly in patients above the age of 50 years. The existence of xerosis was identified in a primary skin lesion in 36% of patients. It was further classified as per Morton Classification into Grade 1 and Grade 2. Out of which 20% were grade I xerosis and 16% were grade 2 xerosis the differences between the existence of xerosis at various stages were found to be significant.

Pallor was the most common skin manifestation found in the CKD patients in our study. It was found in 34% of the patients it was found in

maximum cases of stage 5 disease. The existence was found to be increasing based on the severity of CKD the differences were found to be statistically significant. Hyperpigmentation was seen in 14% of cases out of which 10% were cases of stage 5. Purpura, petechiae, and ecchymosis were the other skin lesions found in CKD patients. They were seen in 22% of cases. The maximum was in stage 5, in eleven (18%) patients. Nail changes were found in 30(60%) patients of CKD. The most common nail change is half and half nails (Lindsay nails). It was found in 6 patients of CKD (12%). The other nail changes were a white nail, onychomycosis, and brown nail bed arc, Koilonychias in 4%, 4%, 4%, and 2%. Other changes seen were Beau's lines, onycholysis, and pitting nails. The nail changes were seen maximum in the age group of 50-65 (8%). Hair changes were seen in 23 patients (46%), with the findings including sparse hair in 8 patients (19%) and lusterless hair in 5 patients (10%). The hair changes were seen maximum in stage 5 cases.

Table 5: Presence of infections in the cases of CKD included in the study

Infections	Frequency	Percentage
No infections	40	80
Bacterial	4	8
Viral	1	2
Fungal	4	8
Others	1	2

Table 5 shows the frequency of different types of infections in the cases of CKD included in the study. A significant proportion of patients (20%) experienced infections, with bacterial and fungal infections being the most common types. Bacterial and fungal infections accounted for 8% of cases each, indicating a higher prevalence compared to viral and other infections. Patients with CKD are known to have a higher risk of infections due to impaired immune function and other factors. Bacterial and fungal infections are common in

CKD patients, likely due to their susceptibility to opportunistic pathogens.

Oral mucosal findings were seen in 9 patients (18%), with the most common finding being macroglossia and stomatitis each in four patients (8%), coated tongue and candidiasis were seen in 2 patients (4%) and one (1%) patient respectively. 2 patients (4%) had more than one oral mucosal finding. Other skin lesions that were seen in our study in the CKD patients included – perforating disorders-one case (1%), Uremic frost in one (1%)

patient, bullous dermopathy in one (1%) patient, malar rash in one (1%) patient.

Discussion

Chronic kidney disease (CKD) is a major global public health concern. Cutaneous manifestations are observed in nearly all stages of CKD, becoming more severe as the disease progresses, with the potential for the development of new skin conditions. Patients undergoing hemodialysis often show improvement and emergence of certain cutaneous manifestations. In the present study, the prevalence of skin manifestations in patients with CKD was 90%. Similar studies have found that the prevalence of cutaneous lesions in CKD ranges from 79% to 96%. [11-13]. The prevalence of pruritus in this study (36%) is comparable to that reported by Falodun et al. [14] (26.7%). In contrast, other similar studies found higher rates of pruritus in 46.7% and 53% of patients, respectively. In the present study, pruritus was more common in the pre-dialysis group (Stage 5) than in the group (Stages 3 and 4), a trend also observed in the study by Thomas et al. [15] suggesting that dialysis may not alleviate pruritus. Additionally, 38% of the patients in this study had xerosis, which differs from the findings of recent studies. In the present study, fewer cases of xerosis were observed in patients with diabetes mellitus. Xerosis was found in 28% of Stage 5 CKD patients, comparable to the findings of Thomas et al. [15] (48.38%) and Falodun et al. [14] (69.7%). The prevalence of xerosis increases as CKD progresses. Pigmentation was observed in 14% of the patients. Other similar studies have found a range from 32.3% to 43% [15-17]. Other studies have reported a pigmentation rate of 9.2% in their study [14]. This could be due to the difficulty in appreciating hyperpigmentation in dark-colored individuals unless it is extensive. In the present study, pallor of the skin was evident in only 34% of patients when compared with other similar studies, and the pallor distribution was as low as 2.5%–45.45% [14, 17, 18]. Pallor was most common in CKD Stage 5 and least common in Stages 2 and 3. In this study, purpura was observed in 22% of the patients, a higher rate than that reported in other studies. Nail changes were present in 40% of the patients, with the most frequent being half and half nails (12%), which aligns with the findings of Singh et al. [16] (13.3%). Koilonychia was seen in 2% of patients, a higher rate compared to the 5% reported in other studies [15]. This may be attributed to the associated anemia in the current study. The second most common nail finding was white nails, observed in 5% of patients. Hair changes were commonly observed in 26% of cases, and most of the cases had lusterless hairs and sparse hairs. Other studies have found a higher frequency of hair changes than in this study [17, 18]. Infection was present in 20% of the patients

(Bacterial-8%, fungal 8%, viral 2%, and others 1%). Other similar studies have reported infection rates of 16.6 and 26.2% in their study. The decreased incidence in the present study may be due to early referral, diagnosis, and treatment. In our study, oral mucosal findings were observed in 19 patients (18%); however, the total number of findings was much higher, because some patients had more than one finding. This proportion of mucosal findings is much lower than that reported in previous studies. The common finding in this study was macroglossia and stomatitis each in four patients (8%), and coated tongue and candidiasis in 2 patients (4%) and one (1%), respectively. Two patients (4%) had more than one oral mucosal finding each. Oral mucosal findings were seen in 9 patients (18%), with the most common findings being macroglossia and stomatitis each in four patients (8%), coated tongue and candidiasis in 2 patients (4%) and one (1%), respectively. Two patients (4%) had more than one oral mucosal finding each. Other skin lesions that were observed in our study in the CKD patients included perforating disorders in one case (1%), uremic frost in one (1%) patient, bullous dermopathy in one (1%) patient, and malar rash in one (1%) patient.

Conclusion

The results of this study showed that cutaneous manifestations were common and significant problems in patients with CKD, particularly those in the advanced stages. There is a strong association between the severity of chronic kidney disease (CKD) and the prevalence and severity of cutaneous manifestations. Pruritus, xerosis, and pallor were commonly observed in stages 4 and 5. It also appears that a longer duration of CKD is associated with higher skin complications. Overall, these findings suggest that early identification and management of skin issues are crucial for improving the quality of life of patients with CKD. Further research is needed to explore the underlying mechanisms and to develop effective interventions to address these challenges.

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