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From Luster to loss: The impact of Chronic Kidney Disease on hair health

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Abstract:

Background: Chronic Kidney Disease (CKD) is a progressive disorder associated with multiple systemic complications, including dermatologic changes. However, hair alterations in CKD patients remain poorly characterized. This study aimed to evaluate the spectrum of hair changes in CKD patients and correlate them with disease severity, dialysis status, and biochemical parameters.

Methods: A cross-sectional study was conducted over 24 months at Sri Siddhartha Medical College, Tumkur, involving 102 CKD patients aged ≥18 years. Participants underwent detailed clinical and dermatological evaluations, with hair assessed for changes in texture, density, and color. Relevant biochemical and hematological parameters were recorded. Statistical analysis was performed using SPSS v22, with $p < 0.05$ considered significant.

Results: The most common hair changes observed were diffuse hair thinning (66.7%), brittle and dry hair (53.9%), premature graying (39.2%), and telogen effluvium (34.3%). These changes were significantly associated with advanced CKD stages and dialysis status. Diffuse thinning and brittle hair were notably higher among dialysis patients ($p = 0.004$ and $p = 0.003$, respectively). Hair abnormalities also correlated with elevated serum creatinine and urea levels ($p = 0.003$).

Conclusion: Hair changes are prevalent in CKD patients, especially in advanced stages and those on dialysis, and correlate with biochemical markers of renal dysfunction.

Introduction

Chronic Kidney Disease (CKD) is a progressive condition characterized by a gradual loss of kidney function over time, leading to multisystemic complications.[1] While cardiovascular, metabolic, and dermatologic manifestations of CKD are well-documented, hair changes in these patients remain an underexplored area. Hair abnormalities, including alterations in texture, color, density, and growth patterns, can significantly impact the quality of life and serve as potential indicators of disease severity or treatment-related effects.[2–4]

The pathophysiology of hair changes in CKD is multifactorial, involving uremic toxins, nutritional deficiencies, metabolic imbalances, and medication side effects.[5] Commonly reported hair changes include diffuse hair thinning, brittle and dry hair, premature graying, and altered hair cycle dynamics, such as telogen effluvium. Additionally, dialysis and kidney transplantation may influence hair regrowth patterns, further complicating clinical evaluation.[6]

This study aims to systematically evaluate and document the spectrum of hair changes in CKD patients, correlating them with disease severity, dialysis status, and biochemical parameters. A better understanding of these manifestations can aid in early diagnosis, improved patient counseling, and targeted therapeutic interventions.

Methodology

This cross-sectional study was done in the outpatient departments of Dermatology, Venereology and Leprosy, General Medicine, and Nephrology, including patients undergoing hemodialysis at Sri Siddhartha Medical College, Tumkur. Ethical clearance was obtained from the Institutional Ethics Committee (Reg. No.: SSMC/MED/IEC-030/March-2023) before initiating the study. The study was conducted over a period of 24 months, with a minimum required sample size of 102, determined using a reference study by Adejumo et al.[7] The study included patients aged 18 years and above diagnosed with Chronic Kidney Disease (CKD), irrespective of gender, type, or severity, including those on conservative management and dialysis. CKD patients with hypertension and diabetes mellitus were also included, as these are the most common etiologies of CKD. Patients with a history of renal transplantation, chronic liver disease, pre-existing dermatological conditions, or those unwilling to provide informed consent were excluded.

Purposive sampling was done for patient selection. After obtaining written informed consent, each participant underwent a thorough history-taking process, including demographic details, onset and duration of CKD, severity, comorbidities, treatment history, personal habits (such as smoking and alcohol consumption), and dermatological complaints. A complete dermatological examination was performed under good lighting to assess hair for specific and nonspecific cutaneous manifestations associated with CKD. Hair changes were examined based on texture, color, density, and growth abnormalities. Clinical photographs were taken with a Samsung Galaxy S22 smartphone after obtaining consent.

All patients underwent routine hematological and biochemical investigations, including complete blood count, liver function tests, renal function tests (urea, creatinine, uric acid, serum electrolytes), urine routine and microscopy, erythrocyte sedimentation rate (ESR), and random blood sugar levels. Specific dermatological investigations such as potassium hydroxide (KOH) mount for fungal infections, pus culture and sensitivity for suspected bacterial infections or histopathological evaluation were performed when clinically indicated. Bedside hair tests including hair pull test, trichoscopy and micrographic examination of the hair was done. All investigations were provided free of cost to the patients.

For illiterate patients, a witness signature and thumb impression were obtained for informed consent. The collected data were recorded in a structured proforma and analyzed using SPSS version 22. Descriptive statistics, including mean and standard deviation for numerical variables and frequencies and percentages for categorical variables, were calculated. Statistical significance was assessed using Student's t-test for continuous variables and the chi-square test for categorical data. A p-value of <0.05 was considered statistically significant.

Results

Table 1: Demographic and Clinical Characteristics of CKD Patients

Characteristic	Frequency (n=102)	Percentage (%)
Age Group (years)		
18-30	15	14.7%
31-45	30	29.4%
46-60	35	34.3%
>60	22	21.6%
Gender		
Male	62	60.8%
Female	40	39.2%

CKD Stage		
Stage 3	25	24.5%
Stage 4	35	34.3%
Stage 5	42	41.2%
Dialysis Status		
On Dialysis	58	56.9%
Not on Dialysis	44	43.1%

The study population was predominantly male, with most patients aged between 31-60 years. CKD stage 5 was the most common stage, and a significant proportion (56.9%) of patients were on dialysis.

Table 2: Distribution of Hair Changes in CKD Patients

Hair Changes Observed	Frequency (n=102)	Percentage (%)
Diffuse Hair Thinning	68	66.7%
Brittle and Dry Hair	55	53.9%
Premature Graying	40	39.2%
Telogen Effluvium	35	34.3%
Loss of Eyebrows/Eyelashes	15	14.7%

The most common hair change observed in CKD patients was diffuse hair thinning (66.7%), followed by brittle and dry hair (53.9%). Premature graying and telogen effluvium were also frequently noted.

Table 3: Association of Hair Changes with CKD Stages

Hair Changes Observed	CKD Stage 3 (n=25)	CKD Stage 4 (n=35)	CKD Stage 5 (n=42)	p-value
Diffuse Hair Thinning	10 (40.0%)	25 (71.4%)	33 (78.6%)	0.002
Brittle and Dry Hair	8 (32.0%)	20 (57.1%)	27 (64.3%)	0.01
Premature Graying	6 (24.0%)	14 (40.0%)	20 (47.6%)	0.08
Telogen Effluvium	4 (16.0%)	12 (34.3%)	19 (45.2%)	0.005

Hair changes were more prevalent in advanced CKD stages, with a significant association ($p < 0.05$) observed for diffuse hair thinning, brittle hair, and telogen effluvium, showing worsening hair conditions with disease progression.

Table 4: Comparison of Hair Changes Between Dialysis and Non-Dialysis Patients

Hair Changes Observed	Dialysis Patients (n=58)	Non-Dialysis Patients (n=44)	p-value
Diffuse Hair Thinning	45 (77.6%)	23 (52.3%)	0.004
Brittle and Dry Hair	40 (69.0%)	15 (34.1%)	0.003
Premature Graying	28 (48.3%)	12 (27.3%)	0.06
Telogen Effluvium	22 (37.9%)	13 (29.5%)	0.25

Dialysis patients had significantly higher rates of diffuse hair thinning (77.6%) and brittle hair (69%) compared to non-dialysis patients. However, premature graying and telogen effluvium did not show a statistically significant difference.

Table 5: Correlation of Hair Changes with Biochemical Parameters

Hair Changes	Mean Serum Creatinine (mg/dL) ± SD	Mean Urea (mg/dL) ± SD	p-value
Present (n=80)	6.8 ± 1.2	78.2 ± 14.5	0.003
Absent (n=22)	5.1 ± 1.0	65.7 ± 12.8	0.07

Hair changes were more frequently seen in patients with higher serum creatinine and urea levels, with statistically significant differences ($p < 0.05$), showing a correlation between renal dysfunction and hair abnormalities.

Discussion

Hair changes are common dermatological manifestations in patients with chronic kidney disease (CKD), and their prevalence, type, and severity vary depending on disease stage, dialysis status, and biochemical parameters. Our study findings provide valuable insights into these changes, which are compared extensively with existing literature below.

Our study cohort (n=102) had a higher proportion of Stage 5 CKD patients (41.2%) compared to Singh et al.'s cohort (40% Stage 5D) [8] . Both studies reported a male predominance (~60–61%) and similar age distributions (31–60 years in our study vs. 36–62 years in Singh et al.) [8]. However, our cohort included a larger proportion of non-dialysis patients (43.1% vs. 60% in Singh et al.'s Stage 5D group) [8], which may reflect differences in regional healthcare access or dialysis initiation criteria.

Our study population predominantly consisted of males (60.8%) aged between 31–60 years (63.7%), with CKD Stage 5 being the most prevalent stage (41.2%). These findings align with Mourad et al.'s [9] study on hemodialysis patients, which reported a similar male predominance (60.2%) and mean age of 50.23 years [9]. The higher proportion of advanced CKD stages in our cohort reflects the progressive nature of renal disease and its associated complications.

Figure 1: 56-yr-old female patient of chronic kidney disease on conservative management with dry, brittle hair

Figure 2: 32-year-old male patient of chronic kidney disease on dialysis with telogen effluvium

Figure 3: 46-year-old male patient of chronic kidney disease on dialysis with telogen effluvium

Our study cohort (n=102) had a higher proportion of Stage 5 CKD patients (41.2%) compared to Singh et al.'s cohort (40% Stage 5D) [8] . Both studies reported a male predominance (~60–61%) and similar age distributions (31–60 years in our study vs. 36–62 years in Singh et al.) [8]. However, our cohort included a larger proportion of non-dialysis patients (43.1% vs. 60% in Singh et al.'s Stage 5D group) [8], which may reflect differences in regional healthcare access or dialysis initiation criteria.

Diffuse hair thinning was the most common hair change observed in our study (66.7%), followed by brittle and dry hair (53.9%), premature graying (39.2%), and telogen effluvium (34.3%). Mourad et al.[9] similarly reported brittle and lusterless hair as predominant findings in 68.8% and 67.7% of hemodialysis patients [9] . However, Sultan et al. found hair changes in only 47% of their dialysis patients, showing variability across populations. [10] Udayakumar et al. attributed hair abnormalities to anemia, decreased sebum secretion, and secondary hyperparathyroidism, [11] factors that may have contributed to the high prevalence observed in our study.

Our study identified diffuse hair thinning (66.7%) and brittle/dry hair (53.9%) as the most common manifestations, contrasting sharply with Singh et al.'s report of sparse scalp hair (19%) and lusterless hair (10%) [8] . This discrepancy may arise from methodological differences. Singh et al. focused on sparse and lusterless hair, while our study categorized changes into specific clinical subtypes (e.g., telogen effluvium).

Our study included a higher percentage of Stage 5 CKD patients (41.2% vs. 20% in Singh et al.'s Stage 5 non-dialysis group) [8] , which correlates with more pronounced hair abnormalities. 56.9% of our patients were on dialysis, whereas Singh et al.'s Stage 5 group comprised 40% of their cohort [8] . Dialysis accelerates metabolic disturbances linked to hair changes, as noted in Khanna et al.'s study[12].

Figure 4: 35-year-old female patient of chronic kidney disease on dialysis with diffuse hair thinning

Comparatively, Udayakumar et al. reported brittle/lusterless hair in 16% of hemodialysis patients. [11] , aligning more closely with Singh et al.'s[8] findings but still lower than our results. This shows regional or diagnostic variability in reporting hair abnormalities.

Premature graying was noted in 39.2% of our patients but did not show significant associations with CKD stage or dialysis status ($p > 0.05$). This contrasts with Mourad et al., where graying was shown as a CKD-related manifestation[9]. Telogen effluvium was moderately prevalent in our cohort (34.3%), consistent with reports linking systemic stress from chronic illness to hair shedding.

Hair changes were significantly more prevalent in advanced CKD stages, particularly Stage 5, as demonstrated by diffuse thinning (78.6%, $p = 0.002$), brittle hair (64.3%, $p = 0.01$), and telogen effluvium (45.2%, $p = 0.005$). Mourad et al.'s study corroborated this trend, attributing worsening dermatological manifestations to metabolic derangements such as hyperparathyroidism and anemia [9] . Elevated serum creatinine and urea levels in our study further supported the role of renal dysfunction in exacerbating hair abnormalities.

The findings of the present study are similar to Khajuria et al., who also reported diffuse alopecia (26%) as the most commonly observed hair change, followed by fine brittle hairs (21%). Notably, their study found that out of the 26 patients with alopecia, 15 were undergoing hemodialysis, showing a strong association between dialysis and hair loss. [13]

Singh et al. similarly observed higher hair changes in Stage 5 (11%) compared to earlier stages (3–9%)[8], though their overall prevalence was lower. This progression aligns with Khanna et al.'s finding that xerosis and pruritus worsen with disease severity[12], likely due to cumulative uremic toxin exposure and metabolic imbalances (e.g., anemia, hyperparathyroidism). [11]

Our data show significantly higher rates of diffuse thinning (77.6% vs. 52.3%, $p=0.004$) and brittle hair (69% vs. 34.1%, $p=0.003$) in dialysis versus non-dialysis patients. Singh et al. reported similar trends, with 11% of Stage 5 patients exhibiting hair changes versus 3–9% in earlier stages[8]. However, Khanna et al. noted no significant difference in most cutaneous manifestations between dialysed and undialysed ESRD patients [12] , showing that dialysis per se may not directly cause hair changes but exacerbates pre-existing metabolic disturbances. Mourad et al.'s findings similarly showed more pronounced cutaneous manifestations in hemodialysis groups [9] . Dialysis-related factors such as oxidative stress, nutritional deficiencies, and altered hormonal dynamics likely contribute to these differences.

Interestingly, premature graying showed no statistically significant difference between dialysis and non-dialysis groups ($p = 0.06$), showing that this manifestation may be less influenced by treatment modality than other hair changes.

Our study showed a significant correlation between higher serum creatinine levels and the presence of hair changes ($p = 0.003$). Elevated urea levels also showed a trend toward association but did not reach statistical significance ($p = 0.07$). These findings align with Mourad et al., who elaborated on the role of metabolic imbalances in CKD-related dermatological issues [9] . Additionally, Udayakumar et al.'s explanation of anemia and secondary hyperparathyroidism as contributors to hair abnormalities further supports this correlation.[11]

Singh et al. and Udayakumar et al. attributed hair changes to reduced sebum secretion and micronutrient deficiencies [8,11] , while our study showed uremic toxin accumulation as the main contributor to hair changes (evidenced by elevated urea/creatinine)[12].

Khanna et al. [12] linked pruritus and xerosis to prolonged dialysis [12] , which may indirectly worsen hair health via chronic inflammation.

Our findings of premature graying (39.2%) and telogen effluvium (34.3%) were absent in Singh et al.'s [8] study but mirror Sultan et al.'s reports of hair shedding in 47% of Egyptian dialysis patients. [10]

Unique cases such as spontaneous resolution of alopecia after COVID-19 infection have been reported, showing potential immune modulation effects distinct from typical CKD-associated mechanisms[14]. While rare, such phenomena show the complexity of systemic interactions affecting hair health in renal disease.

The high prevalence of hair changes in CKD patients shows the importance of early recognition and management strategies to improve quality of life. Addressing nutritional deficiencies, optimizing

dialysis protocols, and mitigating oxidative stress may help reduce these manifestations.

Conclusion

This study shows a high prevalence of hair changes among chronic kidney disease (CKD) patients, particularly in those with advanced stages and those undergoing dialysis. Diffuse hair thinning emerged as the most common alteration, followed by brittle and dry hair, premature graying, and telogen effluvium. The severity and frequency of these changes were significantly associated with CKD stage progression and dialysis status. Additionally, elevated serum creatinine and urea levels were correlated with the presence of hair abnormalities, showing a strong link between worsening renal function and deteriorating hair health. These findings show the importance of recognizing dermatological manifestations as part of the systemic impact of CKD.

References

1. GézaPethő Á, Tapolyai M, Csongrádi É, Orosz P. Management of chronic kidney disease: The current novel and forgotten therapies. J Clin Transl Endocrinol 2024;36:100354. https://doi.org/10.1016/J.JCTE.2024.100354.
2. Vaidya SR, Aeddula NR. Chronic Kidney Disease. The Scientific Basis of Urology, Second Edition 2024:257–64. https://doi.org/10.51249/hs.v4i01.1865.
3. Goel V, Sil A, Das A. Cutaneous Manifestations of Chronic Kidney Disease, Dialysis and Post-Renal Transplant: A Review. Indian J Dermatol 2021;66:3. https://doi.org/10.4103/IJD.IJD_502_20.
4. Escamilla DA, Lakhani A, Antony S, Villegas KNS, Gupta M, Ramnath P, et al. Dermatological Manifestations in Patients With Chronic Kidney Disease: A Review. Cureus 2024;16:e52253. https://doi.org/10.7759/CUREUS.52253.
5. Zitzmann M. Testosterone deficiency and chronic kidney disease. J Clin Transl Endocrinol 2024;37:100365. https://doi.org/10.1016/J.JCTE.2024.100365.
6. Boswell L, Vega-Beyhart A, Blasco M, Quintana LF, Rodríguez G, Díaz-Catalán D, et al. Hair cortisol and changes in cortisol dynamics in chronic kidney disease. Front Endocrinol (Lausanne) 2024;15. https://doi.org/10.3389/FENDO.2024.1282564.
7. Adejumo O, Madubuko R, Olokor A, Aina O. Skin changes and dermatological life quality index in chronic kidney disease patients in a tertiary hospital in Southern Nigeria. Niger J Clin Pract 2019;22:245–50. https://doi.org/10.4103/NJCP.NJCP_270_18.
8. Singh GJ. Nail and hair changes in chronic kidney disease patients 2020.
9. Mourad B, Hegab D, Okasha K, Rizk S. Prospective study on prevalence of dermatological changes in patients under hemodialysis in hemodialysis units in Tanta University hospitals, Egypt. Clin CosmetInvestig Dermatol 2014;7:313–9. https://doi.org/10.2147/CCID.S70842.
10. Sultan MM, Mansour HH, Wahby IM, Houdery AS. Cutaneous Manifestations in Egyptian Patients with Chronic Renal Failure on Regular Hemodialysis 2009.
11. Udayakumar P, Balasubramanian S, Ramalingam KS, Lakshmi C, Srinivas CR, Mathew AC. Cutaneous manifestations in patients with chronic renal failure on hemodialysis. Indian J Dermatol VenereolLeprol 2006;72:119. https://doi.org/10.4103/0378-6323.25636.
12. Khanna D, Singal A, Kalra OP. Comparison of cutaneous manifestations in chronic kidney disease with or without dialysis. Postgrad Med J 2010;86:641–7. https://doi.org/10.1136/PGMJ.2009.095745.
13. Khajuria R, Singh K, Rahim G. ORIGINALARTICLE Dermatological Manifestations in Patients with Chronic Renal Failurea: A Clinicopathological Study n.d.;18.
14. Wu Q, Gao F, Zhang T, Zhang S, Bai Y, Zhu B, et al. A case of chronic kidney disease patient with rapid deterioration of renal function, hair loss, and spontaneous resolution of facial warts after COVID-19 infection. Aging Medicine 2024;7:131. https://doi.org/10.1002/AGM2.12281.