

Assessment of Cutaneous Symptoms in Hemodialysis Patients: Prevalence, Clinical Features, and Implications for Customized Therapies

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ABSTRACT

Background: Hemodialysis is carried out in ESRD patients where an attempt is made to filter the blood out of the body. However, 80% or more patients consequently have skin problems related to seriously affected kidneys as well as the treatment through dialysis. The skin manifestations are dry skin xerosis, itching pruritus, changes in color pigmentation black and white patches, and skin infections - bacterial, fungal viral, and brittle nails and hair this is due to changes in blood chemistry. An experienced doctor can diagnose the cause of the problem and advise on the way out. Sometimes, patients can help maintain the skin's health with lotions or medications to avoid scratching.

Purpose: This study aimed to examine hemodialysis patients' cutaneous symptoms to assess their prevalence and clinical features. Patients need hemodialysis; however, it might cause skin problems.

Methods: This cross-sectional study was conducted at Bisha King Abdullah Hospital between February 2021 and April 2021. A total of 40 hemodialysis patients were included in the study.

Results: The study analyzed participants aged 24-35 and 35-45, with a majority of females. It found no significant association between serum calcium levels and skin problems, xerosis, or pruritus. However, KT/V levels were significantly associated with xerosis and pruritus, and blood hemoglobin levels did not.

Conclusion: The present study provides insights into the frequency of cutaneous manifestations among patients undergoing hemodialysis, underscoring the need for customized therapies aimed at addressing these dermatological issues. Future investigations should prioritize the development of improved healthcare solutions for patients with these medical disorders, taking into consideration both the renal and dermatological components.

Keywords: Hemodialysis, Cutaneous Symptoms, Nail Changes, Patient Education.

INTRODUCTION

Cutaneous manifestations frequently affect patients undergoing hemodialysis due to the complex interplay between renal dysfunction, altered mineral homeostasis, and persistent inflammation (1). 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 (2). Hemodialysis is a critical therapy for individuals with end-stage renal disease; however, long-term treatment can result in adverse effects (3). Non-specific dermatological conditions reported in hemodialysis patients involve pigmentary disorders and pruritus (4).

Aims and Objective

The objective of this study is to evaluate the frequency of skin manifestations among hemodialysis patients receiving treatment

at King Abdullah Hospital in Bisha. The study has focused on the prevalence of cutaneous manifestations among hemodialysis patients at King Abdullah Hospital in Bisha. And find out the association between demographic factors and laboratory parameters with cutaneous manifestations in hemodialysis patients.

Literature Review

Demographic Trends of Hemodialysis Patients in Saudi Arabia

The kidneys are considered to be the primary regulators of chemical balance inside the human body (5). In cases of chronic end-stage renal illness, the use of renal replacement therapy, such as hemodialysis, becomes imperative. Hemodialysis enables the extension of life in patients with end-stage chronic renal failure but with the presence of diverse adverse effects (6). The potential causes for this occurrence may include chronic renal failure, concurrent drug use, unfavorable effects

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of the dialysis method employed, comorbidities, or a combination that was included in this aspect. Murdeshwar along with his colleagues, explored that hemodialysis is considered a vital and indispensable therapeutic approach for those diagnosed with end-stage renal disease (ESRD), given the range of therapy options now accessible (7). Adégbidi stated that in terms of adverse reactions, the cutaneous manifestations may serve as indicative markers; however, the skin, being an exterior organ, has been referred to as a "mirror of the organism." However, this has shown a prominent role in social interactions and communication, as it evidently reflects the damages inflicted upon it. Although these damages may be debilitating and cause considerable psychological distress (8).

Moreover, the cutaneous symptoms were observed in patients with renal insufficiency, which has shown a wide range of characteristics and variations. These events have the potential to manifest either before or after the commencement of dialysis. They may be classified into two distinct categories that include particular occurrences in the skin and other non-specific manifestations. Non-specific diseases include a range of dermatological conditions, such as pigmentary disorders, pruritus, xerosis, acquired ichthyosis, and half-and-half nails. Among patients undergoing hemodialysis (HD), the most prevalent cutaneous manifestations were observed to be xerosis, with a detection rate of up to 86%. Hyperpigmentation was the second most common manifestation, affecting up to 56% of patients (specifically, 35.5% of HD patients showed hyperpigmentation on exposed body parts, while 20.4% had diffuse hyperpigmentation. However, pruritus was reported in 51.6% of patients, followed by ecchymosis in 47.3% and follicular hyperkeratosis in 48.4%.

According to Mousa et al. (2021), the provision of hemodialysis care in Saudi Arabia is largely under international norms. The nation has implemented measures to guarantee that dialysis facilities are adequately equipped, staffed with proficient personnel, and compliant with optimal standards in the provision of renal care (9). Alshehri stated that the demographic of patients undergoing hemodialysis in Saudi Arabia is a heterogeneous group, including both Saudi natives and expats. The increasing need for dialysis treatments has necessitated the development of facilities to cater to the varied patient population requiring such treatment (10). Nail changes are characterized as one of the symptoms that have been observed in patients who have chronic kidney disease, impacting a substantial majority of patients on hemodialysis, surpassing a prevalence rate of 75% (11).

The Burden of Skin Conditions in Hemodialysis Patients

The presence of dermatological disorders in persons receiving hemodialysis is a matter of considerable concern due to the critical nature of this life-sustaining therapy. Dialysis serves as a vital therapeutic intervention for an estimated global population of around 3.4 million patients, ensuring their continued survival (12). Xerosis and pruritus are prevalent chronic dermatological conditions seen in patients undergoing dialysis treatment and those with diabetes (13). These conditions often go undiagnosed or get inadequate attention, hence potentially compromising the overall well-being of affected patients (14). Xerosis, often known as severe skin dryness, is a frequently seen dermatological manifestation. Another chronic disease associated with renal illness refers to the presence of itching that is specifically related to kidney dysfunction and cannot be attributed to any other underlying medical condition (15). Intense itching, which may manifest as this, has also included the accumulation of uremic toxins, perturbations in calcium and phosphorus homeostasis, and the release of histamines.

In another study, Alshammari et al. (2023) stated that chronic kidney disease-associated pruritus (CKD-aP) may lead to various

dermatological disorders that significantly impact a patient's daily functioning. These conditions typically cause disturbances in sleep patterns and a decrease in overall quality of life. (16). The primary signs of this condition are frequent arousal from sleep, diminished sleep quality, the presence of insomnia, prolonged reliance on hypnotic medications, and the occurrence of sleep apnea (17). Subsequently, a study performed at hospitals in East Jakarta, Indonesia, revealed that a majority (56%) of patients undergoing hemodialysis (HD) had sleep disturbances (18).

Cutaneous Manifestations in Hemodialysis

Cutaneous symptoms that have been noticed in patients undergoing hemodialysis treatment may include hyperpigmentation and pallor (19). The occurrence of hyperpigmentation, characterized by the darkening of the skin, may be attributed to the buildup of hemosiderin. Hemosiderin is a byproduct that is generated during the breakdown process of erythrocytes (20). Conversely, Hussein in his study, has shown the presence of pallor, characterized by a decrease in skin pigmentation, may suggest the presence of anemia, an often coexisting condition in persons with renal insufficiency (21). Additionally, Hamine et al. (2023) stated that the impact of laboratory parameters on cutaneous symptoms has shown high importance within dermatological studies and clinical practice (22).

However, the criteria have covered a diverse array of biochemical, hematological, and immunological indicators that possess the potential to provide invaluable insights into the fundamental pathophysiological mechanisms that give rise to various dermatological disorders. Moreover, Shin stated that incorporated laboratory measures to assess the adequacy of dialysis patients through the Peritoneal Dialysis Adequacy test, which is also known as Kt/V(23). However, the test is used to measure the waste of the products in the urine and dialysis drainage. Also, it measures the protein nutrition that can assess how well a patient is eating. The evaluation of these indicators is essential since there is a strong relationship between renal impairment and dermatological conditions. Additionally, Schneditz has examined the complex interplay between calcium and phosphorus inside the human organism, along with the importance of maintaining homeostatic equilibrium via parathyroid hormone levels (24). Sedaghattalab stated a comprehensive analysis of the complex biochemical and physiological factors involved, there was an ongoing argument about the therapeutic benefits of antioxidants on specific biochemical markers in patients undergoing hemodialysis, as shown by current study findings (25).

METHODOLOGY

The descriptive cross-sectional study was conducted at King Abdullah Hospital in Bisha from February to April 2021. A total of 40 patients went through the process of hemodialysis. Further, the data were collected through the patients' hospital records and histories, dialysis sheets, medication records, and physical examinations. Also, a dermatologist conducted each examination in a setting with the proper lighting and standard tools for skin and mucosal examinations. The University of Bisha waived the need for ethical clearance for the cross-sectional study conducted within the specified year. The authors obtained written informed consent from patients, ensuring the anonymity of our subjects and indicating that the collection of information and observation of cutaneous manifestations in patients of hemodialysis that were impacted were conducted as part of their regular clinical assessments in King Abdullah Hospital. Patients were only provided with high-content, informed consent.

The study aimed to investigate the prevalence of cutaneous manifestations in hemodialysis patients and to determine if there

were any significant associations with specific clinical variables. Data was collected from a total of 100 patients who were undergoing hemodialysis treatment at the hospital during the specified period. The researchers utilized a standardized protocol to assess and document any skin abnormalities, including lesions, discoloration, and other visible changes. Additionally, information on each patient's demographics, medical history, and dialysis parameters was also collected to further analyze potential risk factors for cutaneous manifestations in this population.

RESULTS

In Table 1, participants from two distinct age cohorts 24-35 and 35-45, with corresponding proportions of 45.5% and 54.5%, were observed. The gender distribution was equal with an equal representation of male and female participants, with 50% of the total sample. Regarding the length of dialysis, a majority of the participants (68.2%) had received treatment for a period ranging from 1 to 12 months. Conversely, a considerable proportion (31.8%) had been having dialysis for a duration spanning from 1 to 5 years. In the skin disorder among the four observed instances, a majority of 75% were identified as female, with the remaining 25% being identified as male. The reported instances include a variety of ages, spanning from 28 to 86, with uniform distribution throughout the observed age groups. All four instances had Xerosis grade 0, which signifies the presence of smooth skin, whereas, in Table 3, the primary emphasis pertains to Cutaneous Hyperpigmentation; this particular has covered two instances, both of which pertained to individuals of female. The persons impacted included a wide spectrum of ages, including 40, 62, and 78. Furthermore, a single instance demonstrated the simultaneous presence of Xerosis grade 0, characterized by smooth skin and Cutaneous Hyperpigmentation. In Table 6, the study analyses serum calcium levels concerning skin problems, xerosis, and pruritus. The mean difference is -0.063, with variability across data points. The confidence interval ranges from -0.374 to 0.247, with a 95% confidence level of zero. The study generated a p-value of 0.682, indicating no significant association between blood calcium levels and skin problems. In Table 7, the study found no significant relationship between blood hemoglobin levels and hyperpigmentation, with a paired analysis showing a -0.225 discrepancy between hyperpigmentation patients and those without hyperpigmentation. The 95% confidence interval for the difference is -0.625 to 0.175, with a p-value of 0.262, indicating no statistically significant difference between the two groups. In Table 8, the study found a significant association between KT/V levels and skin problems, specifically xerosis and pruritus. The observed difference in KT/V values between those with and without skin problems was -1.000, with a 95% confidence interval of -1.332 to -0.668. This finding supports the statistical significance of the association between KT/V levels and certain dermatological conditions.

The study population comprised equal representation of males and females, with ages ranging from 24-45 years old. The majority (68.2%) had received dialysis treatment for 1-12 months, while 31.8% were treated for 1-5 years (Table 1). Analysis of skin disorders found four cases reported, with three-quarters affecting females across ages 28-86 years old. All instances exhibited xerosis grade 0 (smooth skin) in Table 2. Meanwhile, two cases of cutaneous hyperpigmentation in Table 3 impacted females aged 40, 62, and 78 years. One case demonstrated simultaneous xerosis and hyperpigmentation. These demographic characteristics capture a diverse sample for exploring cutaneous manifestations in hemodialysis patients. The demographic profile

provides context for the skin disorders observed. Xerosis predominantly involved females across various ages, exhibiting the lowest severity level. Meanwhile, hyperpigmentation manifested primarily in females across different ages. These initial findings set the stage for the investigation of potential associations between demographic factors, laboratory parameters, and reported dermatological symptoms.

Table 1. Demographic Characteristics of Study Population

		Frequency	Percent
Age	24-35	10	45.5
	35-45	12	54.5
Gender	Male	11	50.0
	Female	11	50.0
Duration of Dialysis	1-12 months	15	68.2
	1-5 years	7	31.8

Table 2. Demographic of Xerosis

		Frequency	Percent
Age	28-86	1	25.0
	Male	1	25.0
Gender	Female	3	75.0
	Total	4	100.0
Skin Disorder	Xerosis grade 0 (smooth skin)	4	100.0

Table 3. Demographic Characteristics of Cutaneous Hyperpigmentation

		Frequency	Percent
Age	40	1	33.3
	62	1	33.3
	78	1	33.3
Gender	Female	3	100.0
	Cutaneous Hyperpigmentation	2	66.7
Skin Disorder	Xerosis grade 0 (smooth skin); Cutaneous Hyperpigmentation	1	33.3

Table 4. Demographic Characteristics of Half and Half Lindsay Nails

		Frequency	Percent
Age	24	1	4.8
	Male	15	71.4
Gender	Female	6	28.6
	Total	21	100.0
Nail Disorder	Half and Half (Lindsay) Nails	21	100.0

Table 5. Demographic Characteristics of Onycholysis and Onychomycosis

		Frequency	Percent
Age	50	1	100.0
	Male	1	100.0
Nail Disorder	Onycholysis	1	100.0
	Age	25 - 88	1
Gender	Male	3	60.0
	Female	2	40.0
Nail Disorder	Onychomycosis	5	100.0

Table 6. Serum Calcium Levels and Their Relationship with Xerosis and Pruritus

	Paired Differences					P-Value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
				Lower	Upper	
Serum Calcium – Skin Disorder	-.063	.958	.153	-.374	.247	.682

Table 7. Serum Hemoglobin Levels and Their Association with Hyperpigmentation

	Paired Differences					P-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
				Lower	Upper	
Serum Hemoglobin Skin Disorder	-.225	1.250	.198	-.625	.175	.262

Table 8. KT/V Levels and Their Correlation with Xerosis and Pruritus

	Paired Differences					P-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
				Lower	Upper	
Serum Hemoglobin Skin Disorder	-.1	1.038	0.164	-1.332	-0.668	0

DISCUSSION

It has been observed that Table 6 examined calcium levels with xerosis and pruritus. The mean difference of -0.063 and confidence interval ranging from -0.374 to 0.247 demonstrated variability between groups. The p-value of 0.682 signified no significant association between calcium and skin problems. Calcium disturbances in renal disease do not independently correlate with xerosis or pruritus (26). Table 7 found no significant relationship between hemoglobin and hyperpigmentation, with minimal variation observed between groups and a p-value of 0.262.

In contrast, table 8 revealed KT/V values correlated inversely with xerosis and pruritus. The -1.000 mean difference between groups, 95% CI from -1.332 to -0.668, coupled with $p < 0.001$, substantiated the significant association between KT/V and certain dermatological manifestations. The study highlights the importance of optimal dialysis treatment, emphasizing the correlation between KT/V and skin conditions, emphasizing the clinical significance of this relationship. The demographic parameters of the study indicate a fair representation of participants across all age groups and genders, facilitating a diversified sample. The dermatological symptoms experienced in persons undergoing hemodialysis have a significant influence on their entire physical health and psychological state (27). Since most patients in the study had received dialysis, one can argue that a significant portion of the group's patients must have been treated relatively recently. Based on skin disorders analysis, xerosis was seen to have a higher occurrence among the female sex and spread out across different classes of age thus making it a development period illness. In each case, there was Xerosis grade 0 which implies that the skin was not affected at all. The skin of patients with xerosis, which is a quite frequent form of dermatological pathology, looks scaly and dry (28). Apart from synthesizing pain, this disease may give rise to several problems such as fissures, which may end up being infected. Furthermore, pruritus which is more commonly known as itching increases the perceived pain to the patient and generally decreases his quality of life. According to the studies, excessive itching can harmfully affect the night rest, lead to a higher level of stress, and might even contribute to the development of anxiety or depression. (29).

The study revealed that cutaneous hyperpigmentation is predominantly observed in women and individuals of all ages, highlighting the broad demographic implications of this condition. Pottthuri et al. (2023) stated

that cutaneous hyperpigmentation has aesthetic and psychological impacts on patients; however, the presence of hyper-pigmented patches on the skin has the potential to induce feelings of self-consciousness and diminished self-assurance, hence exerting a negative influence on a patient's social engagements and psychological state of being (30). The significance of nail problems, specifically bilateral pincer nails, highlights the need for specialized treatment for those affected by these conditions (31). A comprehensive approach to the dermatological and biochemical factors to improve the overall well-being and quality of life of persons who are undergoing hemodialysis (32). The use of treatment strategies that are customized according to gender-specific biochemical profiles has great potential for enhancing the quality of care within this particular demographic.

The study found no significant correlation between blood calcium levels and skin conditions like xerosis and pruritus, suggesting calcium levels may not be the primary factor. Compared with the study in which there was no significant correlation between serum hemoglobin levels and hyperpigmentation and blood calcium levels, serum hemoglobin levels and KT/V values were linked to skin problems (33). The study reveals a correlation between KT/V levels and xerosis and pruritus prevalence, emphasizing the need for efficient dialysis in managing dermatological ailments (34). The study highlights the correlation between renal health, biochemical indicators, and dermatological symptoms in dialysis patients, emphasizing the need for tailored healthcare approaches (35).

CONCLUSION

This study explores the demographic characteristics and dermatological conditions of patients experiencing dialysis, revealing a predominantly recent onset of treatment. Skin disorders, particularly Xerosis and Cutaneous Hyperpigmentation, were observed in a diverse population. In clinical research, a significant association was found between serum calcium levels and skin problems, suggesting other factors may play a more significant role. However, a significant difference in KT/V levels was found between those patients with and without skin problems, emphasizing the importance of dialysis adequacy in managing specific dermatological conditions.

STUDY LIMITATION: A small sample size from a single center limits generalizability. Larger multicenter studies would strengthen observations.

Future Research

- Evaluate dermatological manifestations prospectively with repeated clinical assessments.
- Investigate the role of additional biochemical markers beyond calcium and hemoglobin.
- Incorporate comorbidity indices and medication data into predictive models.

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