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# Factors Associated with Uremic Pruritus Among Patients Undergoing Chronic Hemodialysis: Single-Center Study

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## Abstract

### Background

Uremic pruritus is a common and distressing complication in patients undergoing chronic hemodialysis, significantly affecting their quality of life. This study aims to identify factors associated with uremic pruritus and evaluate its clinical and biochemical correlates in a single-center population.

### Methods

This observational study included 150 chronic hemodialysis patients. Data on demographic, clinical, and biochemical parameters were collected and analyzed. Pruritus severity was graded as mild, moderate, or severe based on patient-reported outcomes, and its impact on quality of life was assessed using the Dermatology Life Quality Index (DLQI). Treatment modalities and their effectiveness were also evaluated.

### Results

Among the participants, 60% (n=90) reported uremic pruritus. Patients with pruritus had significantly longer dialysis durations ($p=0.003$) and higher levels of serum phosphorus, calcium-phosphorus product, and parathyroid hormone ($p<0.001$). Severe pruritus was associated with marked quality-of-life impairment, with 75% of these patients reporting a "severe effect" on DLQI. UV therapy and gabapentin showed the highest treatment efficacy, improving symptoms in 80% and 60% of patients, respectively. Lower dialysis adequacy (Kt/V) and hypoalbuminemia were also significant contributors to pruritus severity.

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**Conclusion**

Uremic pruritus is prevalent among chronic hemodialysis patients and is associated with longer dialysis duration, biochemical abnormalities, and reduced quality of life. Effective management requires addressing underlying metabolic derangements and exploring targeted therapies such as UV therapy and gabapentin.

**Keywords**

*Uremic pruritus, chronic hemodialysis, quality of life, dialysis adequacy, parathyroid hormone, UV therapy, gabapentin.*

**Introduction:**

Uremic pruritus (UP), also referred to as chronic kidney disease-associated pruritus (CKD-aP), is a distressing and often debilitating condition experienced by a significant proportion of patients undergoing hemodialysis. It is characterized by persistent itching that can severely impact the quality of life (QoL), leading to sleep disturbances, psychological distress, and overall poor health outcomes. Unlike other forms of pruritus, UP is not directly related to dermatological or allergic causes but is instead linked to systemic factors such as metabolic abnormalities, inflammation, and neurogenic pathways[1,2].

Urine pruritus, a condition affecting 20% to 50% of chronic hemodialysis patients globally, is more prevalent in patients with poorly controlled mineral metabolism, higher inflammatory markers, and inadequate dialysis clearance. Recent studies suggest that up to 60% of patients may experience pruritus at some point during treatment, with the condition being more severe in these patients[3].

Several studies have explored the factors contributing to uremic pruritus. Research has consistently shown a strong association between UP and elevated levels of serum phosphorus, calcium-phosphorus product, and parathyroid hormone[4] . Additionally, markers of systemic inflammation, such as C-reactive protein (CRP), and alterations in skin innervation and neuropeptides have been implicated[5]. Despite advancements in dialysis technology, the management of UP remains challenging, with treatments ranging from antihistamines to more specialized interventions like gabapentin and UV therapy[6,7].

Despite the significant impact of uremic pruritus on patient outcomes and quality of life, the underlying causes remain incompletely understood, particularly in specific populations. Variability in prevalence and severity across different regions and dialysis centers

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underscores the need for localized studies[8]. This single-center observational study aims to identify the factors associated with uremic pruritus among chronic hemodialysis patients, providing insights into its pathophysiology and potential targets for intervention. Understanding these factors is crucial for improving patient care and tailoring effective treatment strategies for this burdensome condition.

## Aims and objectives

### Aim

To identify the factors associated with uremic pruritus in patients undergoing chronic hemodialysis and to evaluate its impact on quality of life and treatment outcomes in a single-center setting.

### Objectives

1. To assess the prevalence of uremic pruritus among patients undergoing chronic hemodialysis.
2. To analyze the association between demographic, clinical, and biochemical parameters with the occurrence and severity of uremic pruritus.
3. To evaluate the effectiveness of various treatment modalities in managing uremic pruritus and their impact on patient quality of life.

## Materials and methods

### Study Design

This study was a single-center, observational, cross-sectional study conducted over a period of 6 months (from Aug 2023 to feb 2024) in a tertiary care hospital.

### Study Population

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The study included adult patients undergoing maintenance hemodialysis (MHD) at the center. A total of 150 patients were recruited for the study.

**Inclusion Criteria**

1. Patients aged 18 years and older.
2. Patients undergoing regular hemodialysis for at least 6 months.
3. Patients who consented to participate in the study.

**Exclusion Criteria**

1. Patients with skin conditions unrelated to uremia (e.g., eczema, psoriasis).
2. Patients with active infections or malignancies.
3. Patients with incomplete medical records.
4. Patients receiving peritoneal dialysis or renal transplants.

**Sample Size Calculation**

The sample size was calculated based on the prevalence of uremic pruritus in previous studies, using a confidence interval of 95% and a margin of error of 5%. A final sample size of 150 patients was determined.

**Data Collection**

1. **Demographic Data**: Age, gender, weight, height, and comorbidities (e.g., diabetes, hypertension).
2. **Dialysis Data**: Duration of dialysis, frequency, adequacy of dialysis (Kt/V), ultrafiltration volume, and dialysate composition.
3. **Biochemical Parameters**: Blood samples were collected to measure serum levels of phosphorus, calcium, parathyroid hormone (PTH), albumin, and hemoglobin.
4. **Pruritus Assessment**: Pruritus severity was evaluated using a Visual Analog Scale (VAS, 0-10), where 0 indicates no pruritus and 10 indicates the worst pruritus imaginable. The Dermatology Life Quality Index (DLQI) was used to assess the impact of pruritus on quality of life.
5. **Treatment Data**: Current management strategies for pruritus (e.g., topical emollients, antihistamines, UV therapy, gabapentin) were recorded.

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**Procedure**

The study involved identifying eligible patients during routine dialysis sessions, obtaining written informed consent, collecting demographic and dialysis parameters data from patient records and interviews, collecting blood samples before dialysis sessions, and assessing the severity and quality of life of pruritus using structured questionnaires administered by trained personnel.

**Ethical Considerations**

The study was approved by the Institutional Ethics Committee, participants provided written informed consent, and patient data confidentiality was strictly maintained throughout the study.

**Statistical Analysis**

The study used SPSS software to analyze data, comparing continuous variables using the independent t-test and categorical variables using the chi-square test. Multivariate logistic regression was used to identify independent factors associated with uremic pruritus, with a p-value of <0.05 being considered statistically significant.

**Results**

**Table 1: Demographic and Clinical Characteristics of the Study Population**

| Characteristic | Uremic Pruritus (n=90) | No Pruritus (n=60) | p-value |
|---|---|---|---|
| Age (mean ± SD, years) | 57.4 ± 12.1 | 55.2 ± 11.8 | 0.210 |
| Gender (Male, %) | 58 (64.4%) | 38 (63.3%) | 0.880 |
| Dialysis duration (years) | 3.1 ± 1.5 | 2.2 ± 1.3 | 0.003** |
| Diabetes mellitus (%) | 50 (55.6%) | 25 (41.7%) | 0.090 |
| Hypertension (%) | 72 (80.0%) | 42 (70.0%) | 0.180 |

This table compares the basic characteristics of patients with and without uremic pruritus. Patients with uremic pruritus tended to have longer dialysis duration

**Table 2: Association of Pruritus Severity with Dialysis Parameters**

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| Parameter | Mild Pruritus (n=40) | Moderate Pruritus (n=30) | Severe Pruritus (n=20) | p-value |
|---|---|---|---|---|
| Dialysis adequacy (Kt/V) | 1.2 ± 0.3 | 1.1 ± 0.3 | 1.0 ± 0.2 | 0.015* |
| Ultrafiltration volume (liters) | 2.0 ± 0.5 | 2.3 ± 0.6 | 2.6 ± 0.7 | 0.010* |
| Dialysate calcium concentration | 2.5 ± 0.1 | 2.6 ± 0.2 | 2.7 ± 0.2 | 0.045* |
| Frequency of dialysis (sessions/wk) | 3.2 ± 0.4 | 3.1 ± 0.4 | 3.0 ± 0.5 | 0.340 |

This table shows how dialysis-related factors, such as dialysis adequacy (Kt/V), ultrafiltration volume, and dialysate calcium levels, are associated with the severity of pruritus.

**Table 3: Biochemical Parameters and Their Association with Uremic Pruritus**

| Parameter | Uremic Pruritus (n=90) | No Pruritus (n=60) | p-value |
|---|---|---|---|
| Serum phosphorus (mg/dL) | 6.9 ± 1.3 | 5.5 ± 1.0 | <0.001** |
| Calcium-phosphorus product ($mg^2/dL^2$) | 62.4 ± 12.1 | 50.5 ± 10.3 | <0.001** |
| Parathyroid hormone (pg/mL) | 450 ± 120 | 310 ± 100 | <0.001** |
| Serum albumin (g/dL) | 3.4 ± 0.6 | 3.8 ± 0.4 | 0.004** |
| Hemoglobin (g/dL) | 9.5 ± 1.2 | 10.3 ± 1.1 | 0.002** |

This table highlights differences in blood test results between patients with and without uremic pruritus. Elevated levels of serum phosphorus, calcium-phosphorus product, and parathyroid hormone were more common in patients with pruritus, while serum albumin and hemoglobin levels were lower.

**Table 4: Distribution of Pruritus Severity Based on QoL Impairment (DLQI Scores)**

| QoL Category | Mild Pruritus (n=40) | Moderate Pruritus (n=30) | Severe Pruritus (n=20) | p-value |
|---|---|---|---|---|
| No effect (0-1) | 5 (12.5%) | 0 (0%) | 0 (0%) | <0.001** |

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| QoL Category | Mild Pruritus (n=40) | Moderate Pruritus (n=30) | Severe Pruritus (n=20) | p-value |
|---|---|---|---|---|
| Mild effect (2-5) | 25 (62.5%) | 5 (16.7%) | 0 (0%) | |
| Moderate effect (6-10) | 10 (25.0%) | 20 (66.7%) | 5 (25.0%) | |
| Severe effect (>10) | 0 (0%) | 5 (16.7%) | 15 (75.0%) | |

This table categorizes patients based on the Dermatology Life Quality Index (DLQI) scores, which measure the impact of pruritus on quality of life. Severe pruritus was associated with significant impairment in daily life, with most of these patients reporting a "severe effect."

**Table 5: Treatment Modalities and Their Effectiveness in Uremic Pruritus**

| Treatment Modality | Patients Receiving (n=90) | Improvement (%) | p-value |
|---|---|---|---|
| Topical emollients | 60 (66.7%) | 35 (58.3%) | 0.020* |
| Antihistamines | 40 (44.4%) | 15 (37.5%) | 0.150 |
| Gabapentin | 20 (22.2%) | 12 (60.0%) | 0.008** |
| UV therapy | 10 (11.1%) | 8 (80.0%) | 0.002** |
| Dialysate magnesium reduction | 15 (16.7%) | 9 (60.0%) | 0.010* |

This table lists various treatments used to manage uremic pruritus and their effectiveness. UV therapy and gabapentin showed the highest rates of improvement, while topical emollients were moderately effective.

**Discussion**

In our study, we observed a high prevalence of uremic pruritus (60%) among patients undergoing chronic hemodialysis, consistent with previous reports indicating a prevalence ranging from 40% to 70% in similar populations[3,9]. This finding underscores the importance of addressing uremic pruritus as a significant complication of end-stage renal disease (ESRD).

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Patients with uremic pruritus in our study exhibited longer dialysis durations compared to those without pruritus (p=0.003). This aligns with the findings of Narita et al.[10], who reported that prolonged dialysis increases the risk of chronic inflammation, which is strongly associated with pruritus. In our cohort, a significant association was also noted between dialysis inadequacy (Kt/V <1.2) and pruritus severity, corroborating the results of Ko et al[11]., who demonstrated that insufficient dialysis leads to the accumulation of uremic toxins implicated in pruritus.

Biochemical parameters such as elevated serum phosphorus, calcium-phosphorus product, and parathyroid hormone levels were significantly higher in patients with pruritus (p<0.001). Similar findings were reported by Askar et al.[12], who suggested that hyperphosphatemia and secondary hyperparathyroidism contribute to skin calcifications and nerve irritation, exacerbating pruritus. Lower serum albumin levels in pruritic patients (p=0.004) further suggest a role for malnutrition-inflammation syndrome, consistent with the observations of Ko et al[13].

The impact of pruritus on quality of life (QoL) in our study was profound, particularly among patients with severe pruritus, as evidenced by high Dermatology Life Quality Index (DLQI) scores. This is in agreement with Ibrahim et al.[14], who highlighted the psychosocial and functional burdens of pruritus, emphasizing its association with sleep disturbances, depression, and anxiety.

Management of uremic pruritus remains a challenge. In our study, gabapentin and UV therapy demonstrated the highest effectiveness, improving symptoms in 60-80% of patients. Previous studies have similarly shown the efficacy of gabapentin in alleviating pruritus, likely due to its action on neuropathic pathways[15]. The benefits of UV therapy, observed in our study, are supported Gilchrest et al.[16], who reported significant symptom relief through phototherapy, potentially due to its anti-inflammatory effects.

Interestingly, topical emollients, although widely used, provided only moderate relief (58.3%). This observation aligns with Makhlough et al., who noted that while emollients improve skin hydration, they may not address the underlying systemic causes of uremic pruritus[17].

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Our findings highlight the multifactorial nature of uremic pruritus and the need for individualized treatment strategies. Future studies could explore the role of newer interventions such as kappa-opioid receptor agonists, which have shown promise in recent trials.

## Conclusion

Uremic pruritus is a common and significant complication among patients undergoing chronic hemodialysis, with a prevalence of 60% in this study. The severity of pruritus was associated with higher levels of serum phosphorus, calcium-phosphorus product, and parathyroid hormone, as well as longer dialysis duration. Quality of life was significantly impaired in patients with severe pruritus. Among the treatment modalities, UV therapy and gabapentin were the most effective in alleviating symptoms. These findings emphasize the need for early identification and comprehensive management of uremic pruritus to improve the quality of life in hemodialysis patients.

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