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Xerosis cutis in patient with chronic renal failure

Xerosis kutis pada pasien dengan gagal ginjal kronik

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Abstract

Background: Chronic kidney disease (CKD) is a multifaceted condition that affects multiple organs including the skin. Xerosis is the most prevalent skin manifestation in CKD.
Objectives: This study aimed to present clinical findings that can assist healthcare professionals in diagnosing and managing common skin conditions, particularly xerosis, which frequently occurs in patients with Chronic Kidney Disease (CKD).
Methods: This study used a descriptive method with a case study approach. The case description is A 31-year-old-man consulted our department with dry, scaly, and itchy skin throughout his body for 5 months. Initially, the patient felt itchy throughout the body, and the skin felt dry and spread throughout the body. He was also diagnosed with chronic kidney disease with an eGFR value of 5.81 mL/min/1.73 m2. Dermatological examination showed xerosis with fine scales, hyperpigmented macules, multiple, well-defined, lenticular-plaque size in the fascial, anterior and posterior thoracic,wasominal, bilateral brachial, bilateral antebrachial,and bilateral anterior and posterior femoral, bisizesral anterior and posterior cruris regions.
Results: Laboratory results revealed a urea level of 199 mg/dL and a creatinine level of 8.0 mg/dL. The patient was diagnosed with xerosis cutis and underwent multidisciplinary assessment involving dermatology and internal medicine.
Conclusion: The diagnosis in this patient was made clinically based on history, physical examination, and laboratory tests. Early diagnosis of xerosis can improve quality of life and reduce skin manifestations.

Keywords:
Chronic Kidney Disease, CKD, Dermatitis, eGFR, Xerosis

Abstrak

Latar Belakang: Penyakit ginjal kronik (PGK) merupakan kondisi medis yang bersifat multifaset, memengaruhi berbagai organ tubuh, termasuk kulit. Xerosis atau kulit kering adalah salah satu manifestasi kulit yang paling sering ditemukan pada pasien dengan PGK.
Tujuan: Untuk mengetahui menyajikan temuan klinis yang dapat membantu tenaga kesehatan dalam mendiagnosis dan menangani kondisi kulit yang sering muncul pada pasien PGK, khususnya xerosis.
Metode: Penelitian ini menggunakan metode deskriptif dengan pendekatan studi kasus. Deskripsi kasusnya adalah Seorang pria berusia 31 tahun datang ke departemen kami dengan keluhan kulit kering, bersisik, dan gatal di sekujur tubuhnya selama 5 bulan. Awalnya, pasien merasa gatal di seluruh tubuh dan kulit terasa kering dan menyebar hampir ke seluruh tubuh pasien. Pasien juga didiagnosis menderita penyakit ginjal kronik dengan nilai eGFR 5,81 mL/menit/1,73 m2. Pemeriksaan dermatologis menunjukkan xerosis dengan sisik halus, makula hiperpigmentasi, banyak, berbatas tegas, ukuran plak lentikular pada daerah fasia, toraks anterior dan posterior, wasominal, brakialis bilateral, antebrakialis bilateral, serta femoralis anterior dan posterior bilateral, cruris anterior dan posterior bisizesral.
Hasil: Hasil laboratorium menunjukkan kadar urea sebesar 199 mg/dL dan kreatinin sebesar 8,0 mg/dL. Berdasarkan anamnesis, pemeriksaan fisik, dan hasil laboratorium, pasien didiagnosis dengan xerosis kutis dan menjalani penilaian multidisiplin yang melibatkan dermatologi dan penyakit dalam.
Kesimpulan: Xerosis kutis adalah manifestasi kulit yang sering ditemukan pada pasien dengan penyakit ginjal kronik. Deteksi dini dan tata laksana yang tepat berperan penting dalam meningkatkan kualitas hidup serta mengurangi gejala terkait kondisi kulit tersebut.

Kata Kunci:
Dermatitis, eGFR, Penyakit Ginjal Kronik, Xerosis

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Introduction

Chronic kidney disease (CKD) is a major global health concern and is among the top 20 causes of death worldwide. The prevalence of CKD is expected to increase owing to increasing rates of its risk factors, such as hypertension, diabetes mellitus, and obesity, contributing to a significant increase in CKD cases (Dwiyana et al., 2023; Ke et al., 2022). According to the Centers for Disease Control and Prevention's CKD Surveillance System, approximately one in seven adults in the United States are diagnosed with CKD stages 1-4. From 2017 to March 2020, the crude prevalence of CKD rose to 14,8% (Melyda, 2017). This increase is anticipated to be particularly significant in Asia, where approximately 434.3 million adults in eastern, southern, and southeastern Asia are affected by CKD. In Indonesia, data from the 2023 Indonesian Health Survey indicate a 1,2% increase in the prevalence of CKD among hemodialysis patients per thousand individuals aged 25 and older, compared to the figures from 2018. Among the 34 provinces studied, North Sumatera had the fourth-highest CKD prevalence.

Chronic Kidney Disease (CKD) is a condition in which kidney function gradually deteriorates and persists for more than three months, impairing the ability of the kidneys to maintain metabolism and fluid and electrolyte balance due to progressive damage to the kidney's structure with the accumulation of metabolites (Khare & Gulanikar, 2020; Robby et al., 2020; Verma et al., 2023). CKD is divided into five stages according to glomerular filtration rate (GFR). The fifth stage, which is defined by a GFR of less than 15 mL/min/1,73m^2, is commonly known as end-stage renal disease (ESRD). It is associated with numerous severe and life-threatening complications, including bone and mineral disorders, electrolyte imbalances, cardiovascular issues, and skin manifestations (Goel et al., 2021; Rehman et al., 2020).

The most common manifestation is xerosis, affecting 50-85% of patients. This condition more common in male patients than female patients, with a male-to-female ratio of 1,3:1. Despite dialysis, up to 90% of patients with CKD continue to experience xerosis, and the precise mechanism underlying this condition remains unknown. Uremic xerosis is characterized by widespread rough and scaly skin that particularly affects the legs, hands, back, and chest. Skin changes in patients with CKD lead to a weakened skin barrier, which is further aggravated by heightened sensitivity to external irritants, such as sunlight, pollutants, and low humidity, increasing the risk of uremic pruritus. Although not life-threatening, it significantly affects a patient's quality of life and life expectancy.(Khare & Gulanikar, 2020; Malkud S & Dyavannanavar V, 2024). This case report presents xerosis cutis in a patient with CKD and chronic kidney disease patient with CKD with an assessment of skin hydration levels.

Method

This case report describes the clinical manifestations, diagnostic process, and management of xerosis cutis in a patient with chronic kidney disease (CKD). The case was documented descriptively and narratively, emphasizing the clinical course, diagnostic workup, and follow-up outcome.

Case Subject

The subject was a 31-year-old male with end-stage CKD who presented with dry, scaly, and itchy skin that had affected the entire body for the past five months.

The case was selected purposively based on the following criteria: (1) adult patient with a confirmed diagnosis of CKD established by an internist; (2) presence of skin manifestations consistent with xerosis cutis; and (3) patient’s willingness to undergo dermatologic assessment and follow-up evaluations.

Data Collection

Data were collected using the following steps.

1. History taking. A comprehensive history was obtained, including the duration and distribution of skin lesions, pruritus characteristics, skin dryness, and prior treatment. A medical history of systemic diseases, such as hypertension and diabetes mellitus, was also reviewed as a potential risk factor for CKD.
2. General physical examination. General examination included the assessment of vital signs (blood pressure, pulse rate, respiratory rate, and body temperature), nutritional status, and systemic findings related to CKD.
3. Dermatological examination. Dermatological evaluation was performed through inspection

and palpation to determine lesion morphology, distribution, and extent of involvement. The findings were described using standard dermatological terminology regarding color, size, border, and configuration. Clinical photographs were taken to document skin manifestations.

4. Laboratory investigation. Laboratory tests included serum urea, creatinine, estimated glomerular filtration rate (eGFR), and routine hematological profiles. Laboratory data supported the staging of CKD and the overall clinical assessment.
5. Skin Hydration Measurements. Skin hydration was objectively assessed using the Corneometer CM 825® at baseline and repeated at the 4-week and 8-week follow-ups across multiple affected body sites.

Interventions and Management

The patient underwent multidisciplinary management involving dermatology and internal medicine. The interventions included the following.

1. Topical therapy. Application of ceramide-containing moisturizer twice daily in affected areas.
2. Systemic therapy. Administration of low-dose gabapentin to alleviate pruritus.
3. Skin care education. Appropriate skincare, including regular moisturizer use, avoidance of harsh soaps, bathing with lukewarm water, and adherence to prescribed treatments.

Outcome Evaluation

Clinical outcomes were evaluated descriptively based on changes in the skin condition, pruritus severity, quality of life, and laboratory findings. The following instruments were used:

1. The Numeric Rating Scale (NRS) was used to assess pruritus intensity.
2. The Dermatology Life Quality Index (DLQI) was used to evaluate the impact of xerosis on quality of life.
3. A Corneometer CM 825® was used to objectively monitor the changes in skin hydration. Assessments were performed at baseline, week four, and week eight.

Data Analysis

Data were analyzed descriptively and presented in a chronological narrative supported by tables and clinical documentation. No inferential statistical analysis was performed as this was a single case report.

Ethical Considerations

The patient was informed of the purpose of this case report and its potential contribution to scientific knowledge. Written informed consent was obtained prior to clinical documentation, diagnostic procedures, and publication. Patient identity was anonymized and confidentiality was maintained in accordance with medical research ethics.

Result

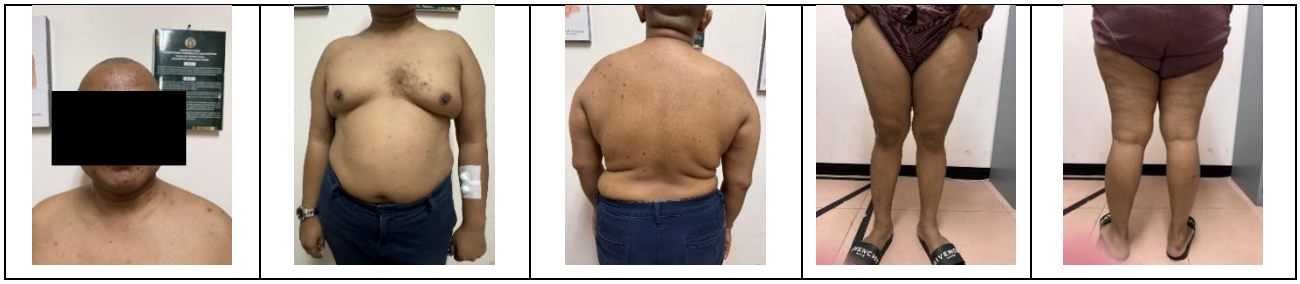
A 31-year-old man presented to the Dermatology and Venereology Polyclinic of CPL USU Medan Hospital with a chief complaint of dry, scaly, and itchy skin all over the body for 5 months. Initially, four months prior, the patient felt itchy all over the body, and the skin felt dry and taut, especially after bathing. The patient complained of dry skin and itching of the face, which spread throughout the patient's body. The patient had been treated at the hospital 3 months prior and was prescribed moisturizer and cetirizine; however, the complaints did not improve.

Previously, the patient visited the internal medicine department every week and was diagnosed with chronic kidney failure (CKD). The patient was recommended for haemodialysis considering the eGFR value of 5.81 mL/min/1.73 m^2 (including stage 5 or chronic renal failure), followed by routine hemodialysis 2 times a week. There had no known history of allergy to any medication.

On general examination, the patient was found to be composed of mentis and appeared moderately ill. vital signs were as follows: blood pressure, 130/90 mmHg; pulse, 78 beats/min; respiration, 20 breaths/min; and temperature 36.2^{0}C. The severity of pruritus, assessed using the Numerical Rating Scale (NRS), was 7 and the Dermatology Life Quality Index (DLQI) score was 22. The physical examination findings were within normal limits. Dermatologic examination revealed xerosis with fine scales, hyperpigmented macules, multiple, well-defined, lenticular-plaque size in the fascial, anterior and posterior thoracic, abdominal, bilateral brachial, bilateral antebrachial, bilateral anterior and posterior femoral, bilateral anterior and posterior cruris regions (Figure 1-A to 1-E). Laboratory results showed haemoglobin 9.5 g/dL, haematocrit 28%, leukocytes 7,003/uL, platelets

219,000/uL, urea 199 mg/dL, creatinine 8.0 mg/dL, blood glucose (GDS) 233 mg/dL, sodium 118 mEq/L, potassium 5.0 mEq/L, and chloride 107

The patient was recommended to undergo a supporting examination by measuring skin hydration on the face, arms, and legs using a Tewameter device (Corneometer CM 825®). The results of the tewameter examination showed a measuring value of 40 AU (face), 40 AU (forearm), and 10 AU (foot), which were classified as dry skin (Figure 2-A to 2-C). Based on the results of the history, physical examination, and supporting examination, the patient was diagnosed with xerosis cutis secondary to chronic kidney disease.



(a) (b) (c) (d) (e)

Figure 1. (A-E). First-visit photographs of the patients. There was xerosis with fine scales, hyperpigmented macules, multiple, well-demarcated, lenticular-plaque size on the fascial, anterior and posterior thoracic, abdominal, bilateral brachial, bilateral, and antebrachial, bilateral were found, with the anterior and posterior femoral and bilateral anterior cruris regions.

Table 1. Calculation of skin hydration degree in patients using Corneometer CM 825

Week of treatment								
First visit			First control (4 weeks after the first visit)			2nd control (8 weeks after the first visit)		
Facialis	Antebrachii	Kruris	Facialis	Antebrachii	Kruris	Facialis	Antebrachii	Kruris
40 AU	40 AU	10 AU	74 AU	70 AU	42 AU	72 AU	70 AU	50 AU
Dry skin			Normal skin			Normal skin		

The patient was treated with a moisturizer containing ceramide (Cerave®) twice daily on the face and whole body and gabapentin 300 mg once a day. Patients were instructed to avoid scratching and bathing for a maximum of 10 minutes with room temperature water or body temperature. Shower with moisturizing soap or use baby soap (avoid using irritant soap). The patient was recommended to be re-controlled for 4 weeks.

The patient was administered a moisturizer containing ceramide (Cerave®) 2 times a day on the face and whole body, and systemic antipruritus gabapentin 300 mg once a day when it felt itchy. Patients were instructed to avoid scratching and limit bathing to a maximum of 10 min with room temperature water or body temperature. Shower with moisturizing soap or use baby soap (avoid irritating soap). It was recommended that the patient be re-controlled for 4 weeks.

At the 2nd control, 8 weeks after the first visit, the skin was dry, and occasional itching was noted. No new lesions were noted. Upon examination of dermatologic status, hyperpigmented macules and multiple, well-demarcated, lenticular-plaque sizes were found on the fascial, anterior and posterior thoracic, abdominal, bilateral brachial, bilateral antebrachial, bilateral anterior and posterior femoral, and bilateral anterior and posterior cruris regions (Figure 3). The tewameter examination results obtained measured values of 72 AU (face), 70 AU (forearm), and 50 AU (leg), which were classified as normal skin (Table 1). The severity of pruritus (NRS) was 2 and the Dermatology Life Quality Index (DLQI) score was 7 (Table 2).

Laboratory results: haemoglobin 9.2 g/dL, haematocrit 26%, leukocytes 5,789 /uL, platelets 220,000 /uL, ureum 35.2 mg/dL, creatinine 5.54 mg/dL, blood sugar (GDS) 210 mg/dL, sodium 125 mEq/L, potassium 4.10 mEq/L, and chloride 181 mEq/L. Therapy was continued, and the patient was given a moisturizer containing ceramide (Cerave®) 2

times a day on the face and whole body and systemic antipruritus gabapentin 300 mg once a day when it felt itchy. Patients were instructed to avoid scratching, and bathing was not too long for a maximum of 10 min with room temperature water or body temperature. Shower with moisturizing soap or use baby soap (avoid irritating soap). The prognosis of this patient was *quo ad vitam bonam, quo ad functionam bonam, and quo ad sanationam bonam.*

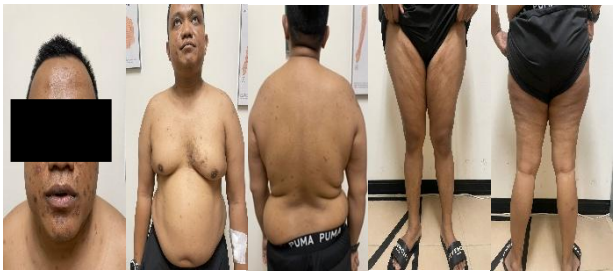


Figure 3. Histopathological examination revealed pleomorphic cells and eosinophilic cytoplasm with keratinized masses (red arrow).

Table 2. NRS and DLQI scores

Week of treatment	NRS	DLQI
First visit	7	22
First control (4 weeks after first visit)	3	11
Second control (8 weeks after first visit)	2	7

Discussion

Skin manifestations of renal failure are common. Some studies have shown that chronic patients frequently complain of xerosis, pruritus, pale skin, pigmentary changes, half and half nails, alopecia, uremic frost, and porphyria cutanea tarda. In renal failure, there is no increase in transepidermal water loss (TEWL) (Escamilla et al., 2024). Histologically, there is a decrease in the amount of sweat and sebaceous gland atrophy (Dalimunthe et al., 2024). In this patient, the manifestations of skin complaints were xerosis, pruritus, and pale skin, in accordance with the skin complaints of patients with renal failure. In addition, laboratory tests of ureum 199 mg/dL (normal 15-39 mg/dL) and creatinine 8.0 mg/dL (normal 0.6-1.0 mg/dL) also supported the diagnosis.

Xerosis cutis and skin dryness are among the most common conditions observed in patients with chronic renal failure. A predilection has been observed for extensor surfaces of the forearms, legs, and thighs (Rehman et al., 2020). Xerosis cutis occurs in approximately 85% of patients with CKD and generally worsens before the start of hemodialysis therapy (Shirazian et al., 2017). Xerosis is thought to be caused by decreased moisture content in the stratum corneum, impaired sebum production due to sebaceous gland atrophy, and decreased moisture content in the dermis layer caused by fluid transfer during the dialysis process. Pruritus is a common symptom in patients with chronic kidney disease (CKD) undergoing hemodialysis, with a prevalence of 50-90% (Rehman et al., 2020). Pruritus generally occurs 3-6 months after hemodialysis initiation. However, some patients experience pruritus before the initiation of hemodialysis therapy (Ibrahim et al., 2016). The onset, duration, and intensity of pruritus may change throughout the hemodialysis period; however, symptoms generally worsen at night and often occur in the dorsal extremities, chest, and head region. Approximately 20-50% of patients experience generalized pruritus (Przepiórka-Kosińska et al., 2017).

Pruritus and xerosis cutis can cause discomfort, which affects a patient's quality of life. Pruritus and xerosis cutis in patients undergoing hemodialysis are often underestimated and not thoroughly treated. Data on the effects of pruritus and xerosis on the quality of life of patients with CKD in Indonesia are scarce (Rehman et al., 2020).

Dermatologic examination reveals xerosis with fine scales, hyperpigmented macules, multiple, well-defined, lenticular-plaque size in the fascial, anterior and posterior thoracic, abdominal, bilateral brachial, bilateral antebrachial, bilateral anterior and posterior femoral, bilateral anterior and posterior cruris regions. Xerosis is caused by atrophy and decreased function of sebaceous and sweat glands, reduced skin fat content, and water content in the skin, which reduces moisture in the epidermis (Khare & Gulanikar, 2020). A decrease in the pH of the stratum corneum has also been reported as a cause of xerosis, because it activates proteases that result in skin exfoliation (Wojtowicz-Prus et al., 2014). Renal pruritus can be found in 50-90% of patients with chronic renal failure undergoing hemodialysis therapy. Pruritus can lead

to anxiety, depression, and sleep disturbances (Shaikh et al., 2019). The causes of renal pruritus are multiple factors. Risk factors for renal pruritus include male sex; increased levels of urea, calcium, phosphorus, β2-microglobulin, magnesium, aluminum, vitamin A, ferritin, histamine, and mast cells; and decreased levels of transferrin, albumin, erythropoietin, and iron (Aramwit et al., 2015; Shaikh et al., 2019). Xerosis plays an important role in the onset of renal pruritus (Phan et al., 2012). Renal pruritus involves cytokines, such as TNF, INF-γ, IL2, and C-reactive protein (CRP). Pruritus is transmitted through C nerve fibers (Rashpa et al., 2018).

Patients with CKD have at least one skin disorder, with a prevalence of 50-100%. The most common skin disorder is renal pruritus in 58-90% of patients undergoing hemodialysis. In addition, cuticular xerosis can also be found with a prevalence of 60-90% which is also one of the predisposing factors for renal pruritus. Skin color changes, such as hypo-epigmentation, yellowish skin, and pale skin, are estimated to occur in 25-70% (Shirazian et al., 2017).

The patient was treated with a ceramide-containing moisturizer (Cerave®) 2 applications/day on the face and whole body and systemic antipruritic gabapentin 300 mg once daily. A step-by-step approach is recommended for the treatment of chronic pruritus (Basic measures, such as the use of moisturizers to prevent xerosis or the avoidance of allergens and potentially irritating substances, should be taken regardless of the cause of pruritus. Ointments containing antipruritus compounds, such as urea, menthol, ceramide and polidocanol should be recommended to patients (Verma et al., 2023).

Ceramide is an essential physiological lipid required to build and maintain epidermal barriers. Skin care products, such as ceramide-containing moisturizers, are beneficial for xerosis associated with various skin conditions. The main function of ceramide is to maintain the integrity of the skin barrier which helps prevent water loss (Verma et al., 2023). Ceramide increases skin hydration and improves skin barrier function, making it suitable for use on dry skin. A moisturizing composition that is a combination of physiological lipids in the stratum corneum consisting of ceramide, free fatty acids, and cholesterol (3:1:1) can help replace lipid deficiency in some skin diseases with barrier damage (Augustin et al., 2018; Phan et al., 2012).

If the cause of pruritus can be determined, the doctor should prepare targeted therapies, such as immunosuppressive drugs (e.g., cyclosporine) for atopic dermatitis, gabapentin for neuropathic pruritus, and antidepressants (e.g., paroxetine) for paraneoplastic pruritus. Combination treatments with H1-antihistamines and sedatives (hydroxyzine and doxepine), mu-opioid antagonists, kappa-antagonists (Naltrexone and Butorphanol), gabapentin, pregabalin, and mirtazapine are recommended for patients with renal pruritus (Osakwe & Hashmi, 2024). The patient was recommended to undergo a supporting examination by measuring skin hydration with a Tewameter tool (Corneometer CM 825®) on the face, forearm, and foot. The results of the tewameter examination obtained a measuring value of 40 AU (face), 40 AU (forearm), and 10 AU (foot), which were classified as dry skin. Skin hydration was measured before and after treatment using a Corneometer CM 825®.

The Corneometer CM 825® is the most sensitive instrument for measuring moisture content in dry skin. The measurement was based on the capacitance of the dielectric medium in the stratum corneum, which is the uppermost skin layer. The Corneometer CM 825® measures the change in dielectric constant due to hydration of the skin surface, which changes the capacitance of the precision capacitor; that is, as hydration increases, its dielectric properties change. Water has a higher dielectric constant than most other substances; therefore, it is a powerful material for increasing the capacity of a capacitor, which suggests that skin capacitance is directly proportional to the skin moisture content. The higher the hydration level in the stratum corneum, the higher the capacitance (Corsini & Galbiati, 2019; Westermann et al., 2020).

During the first observation, the measured values were 40 AU (face), 40 AU (forearm), and 10 AU (foot). In the second observation period (week 2), the measured values were 74 AU (face), 70 AU (forearm), and 42 AU (foot). In the third observation (week 4), the measured values were 72 AU (face), 70 AU (forearm), and 50 AU (foot). This shows that the administration of moisturizing therapy containing ceramide (Cerave®) 2 times a

day on the face and whole body, along with systemic antipruritus gabapentin 300 mg once a day, yields good results.

Skin hydration measurements using a corneometer were expressed in arbitrary units (AU). The corneometer measurement scale ranges from 0 to 130 AU, and the lower the score, the drier the skin (the lower the skin hydration). As the skin became more hydrated, the score increased. There is no agreed range of values used to determine the level of skin hydration; however, studies have standardized the range of skin hydration values as follows (Spada et al., 2018): very dry skin, <30 AU, Dry skin: 30-40 AU and Normal skin, >40 AU.

The severity of pruritus (NRS) was 7 and the quality of life, as measured by the Dermatology Life Quality Index (DLQI), was 22. According to literature, the degree of pruritus was assessed using the NRS scale. This instrument is one of the most widely used scales to evaluate the degree of pruritus. The NRS score ranges from 0 to 10, where 0 indicates no itching, and 10 represents the most severe possible itching (Yosipovitch et al., 2019). The Dermatology Life Quality Index (DLQI) is commonly used and simple to administer, consisting of ten questions divided into six categories: symptoms and feelings, daily activities, leisure, work and school, personal relationships, and treatment. Scores range from 0 to 30, with higher scores indicating worse dermatological quality of life (Esteve-Simó et al., 2023).

Conclusion

Xerosis cutis is a common dermatological manifestation in patients with chronic renal failure. Early recognition and management of this condition are essential to improve a patient's quality of life. Healthcare providers should be vigilant in monitoring and addressing skin changes in patients with chronic kidney disease, as they can serve as indicators of underlying renal dysfunction and improve overall patient care.

Conflict of Interest Declaration

There are no potential conflicts of interest from the authors or the institution regarding the research, authorship, and/or publication of this article.

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