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Original Article

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Relationship between Renal Osteodystrophy, Pain, Pruritus, and Comfort in Hemodialysis Patients

Seyit Ahmet Korkmaz, Eylem Topbaş

[1]Department of Internal Medicine Nursing, Amasya University Institute of Health Science, Amasya Gümüşhacıköy State Hospital, Amasya, Türkiye
[2]Department of Internal Medicine Nursing, Amasya University Faculty of Health Sciences, Amasya, Türkiye

ABSTRACT

Background: The study aimed to determine renal osteodystrophy, pain, pruritus, and comfort level in hemodialysis patients and examine the relationship between them and the affecting factors.
Methods: The study population consisted of 244 hemodialysis patients in the province of X and its districts, and the sample consisted of 163 patients who met the inclusion criteria. Data were collected using a Patient Identification Form, the 5-D Itch Scale, the Brief Pain Inventory, and the Hemodialysis Comfort Scale Version II.
Results: The mean age of the patients was 62.07 ± 13.51 years. According to parathormone levels, 26.4% had low bone turn over renal osteodystrophy, 30.7% had normal bone turnover, and 42.9% had high bone turn over renal osteodystrophy. The total score on the comfort scale was 99.96 ± 12.28. According to the Brief Pain Inventory, the mean pain level in the last 24 hours was 2.13 ± 2.10, and the 5-D Itch Scale score was 8.26 ± 374. There was a statistically significant negative correlation between the comfort scale score and the mean pain score ($r = -0.409$, $P < .001$) and the itch scale score ($r = -0.181$, $P = .021$). A positive significant correlation was determined between the itch scale score and the mean pain score ($r = 0.292$, $P < .001$). There was a positive relationship between the mean pain score and P level ($r = 0.167$, $P = .033$), a positive relationship between the itch scale score and blood urea nitrogen (BUN) ($r = 0.160$, $P = .041$), and a positive relationship with creatinine ($r = 0.157$, $P = .045$).
Conclusion: It was observed that elevated phosphorus increased pain and that elevated BUN and creatinine increased pruritus. It was determined that pain and pruritus negatively affected patient comfort and that pruritus increased the pain score.
Keywords: Pain, hemodialysis, pruritus, comfort, renal osteodystrophy, nursing

Corresponding author: Eylem Topbaş ✉ eylem.topbas@gmail.com or eylem.topbas@amasya.edu.tr
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INTRODUCTION

A decrease in kidney function leads to fluid accumulation in the body and the inability to excrete harmful products, and thus various health problems such as edema, hypertension, anemia, neuropathy, impairment in bone-mineral structure, pain, and pruritus.[1-3] One of these problems, renal osteodystrophy (ROD), is an important condition that defines chronic kidney disease (CKD)-related mineralization disorder in bones and changes in bone tissue structure.[3] High phosphorus (P) and low calcium (Ca) levels, active vitamin D deficiency, high parathormone (PTH) levels, and increased fibroblast growth factor-23 have an important role in the development of ROD.[4-6] These changes decrease bone density and bone quality and cause structural and functional disorders in the bones.[3] Renal osteodystrophy manifests with different clinical pictures, including high turnover (PTH > 300 pg/mL), low turnover (PTH < 150 pg/mL), and mixed type.[7-10] Increased bone destruction and Ca loss are observed in the high turnover type in which

PTH levels are constantly high. In contrast, bone metabolism activities slow down, and bone mineralization decreases in the low turnover type with low PTH levels. High and low turnover characteristics are observed in the mixed type.[10] In studies, the prevalence of ROD varies between 72.7% and 89%.[7-9]

Renal osteodystrophymanifests itself with symptoms such as bone-joint-muscle pain, weakening of the muscles, pruritus of the skin, fracture of the bones and susceptibility to fractures, vascular structure, and soft tissue calcifications.[4,5,10] Early diagnosis of the disease, treatment methods, and preventive measures are vital in the prevention of ROD-related problems. In several studies, it has been reported that 42.9% of patients experienced bone-joint pain,[2] and 54% experienced musculoskeletal pain.[11] Furthermore, the accumulation of uremic toxins causes patients to suffer from pruritus complaints, and the prevalence of pruritus caused by chronic kidney failure (CKF) ranges between 10% and 77%.[12] In a study in which uremic patients receiving and not receiving hemodialysis (HD) treatment were compared, pruritus was found in 50.8% of HD-receiving patients and 40.6% of non-HD-receiving patients. It was stated that pruritus negatively affected daily comfort in both patient groups.[13] Dikmen et al[14] emphasized that HD-related symptoms affected patient comfort by 21.5% and that symptoms had negative effects on patient comfort.

In the literature, there are several studies on HD patients' pain,[11] pruritus,[12,13] and comfort levels.[2,13-15] There are also studies on the prevalence of ROD;[7-9] however, there are no studies in which the effect of ROD on the pain, pruritus, and comfort levels of patients has been investigated. In this context, our study aimed to determine ROD, pain, pruritus, and comfort levels in HD patients and to determine their relationship and the factors affecting this relationship.

MATERIAL AND METHODS

Research Type

The study is a cross-sectional study.

Research Population and Sample

The population and sample of the study consisted of 244 HD patients who received treatment in 6 HD centers in the province of Amasya and its districts between February 2023 and March 2023. The aim was to reach to the entire population without using any sampling method. The study was completed with 163 patients who met the inclusion criteria. Inclusion criteria were aged 18 years or older, receiving HD treatment for at least 6 months, having no auditory or visual disabilities, and agreeing to participate in the study. Data were collected by the face-to-face interview method.

MAIN POINTS

- It is important to provide individualized nursing care for parathormone and renal osteodystrophy patient subgroups.
- High phosphorus levels increase pain.
- High blood urea nitrogen and creatinine levels increase pruritus.
- Pruritus increases the pain score.
- Pain and pruritus negatively affect patients' comfort.

Data Collection Tools

Patient Identification Form

This form was created by the researchers according to the literature,[2,9,10,12,13,15] and consists of 3 parts. The first part includes 9 questions regarding the sociodemographic characteristics of the patients. The second part includes 15 questions regarding descriptive characteristics of the disease. The third part consists of a table with monthly (*Ca, P, hemoglobin (Hb), Kt/V, sodium (Na), potassium (K), blood urea nitrogen (BUN), and creatinine*) and 3-month (*PTH, alkaline phosphatase (ALP)*) laboratory parameters and, if available, annual bone densitometry values. The third part is obtained retrospectively from patient files; the average of the last 3 months is written for monthly parameters, and the most recent examination result is written for parameters analyzed quarterly and annually.

Brief Pain Inventory

This inventory was developed by Cleeland and Ryan in 1994,[16] and its Turkish validity and reliability study was conducted by Dicle et al[17] in 2009. It has 2 parts: pain severity and the impact of pain on functioning. In assessing pain severity, the patient's pain at the time of data collection and the most severe, the mildest, and the average pain experienced in the last 24 hours are rated numerically on a scale from 0 (no pain) to 10 (unbearable pain). In assessing how pain affects functioning, the patient's general activity, mood, walking ability, deep breathing and coughing exercise, relations with other people, sleep, and enjoyment of life are rated numerically from 0 (does not interfere) to 10 (completely interferes). The Cronbach alpha coefficient of the brief pain inventory (BPI) was 0.79 for pain severity and 0.80 for the impact of pain on functioning.[17]

Hemodialysis Comfort Scale - Version II

Hemodialysis Comfort Scale - Version II was developed by Kosar Sahin and Cinar Pakyuz in 2022 to determine the comfort of HD patients.[18] It is a 5-point Likert-type scale consisting of 26 items and 6 subscales. The subscales of the scale are physical relief, physical ease, psychospiritual ease, psychospiritual transcendence, environmental transcendence, and sociocultural ease. The lowest score on the scale is 26, and the highest score is 130. Patient comfort increases as the scale score rises. The Cronbach alpha value of the scale was reported as 0.79 in the scale development study,[18] and 0.74 in our study.

5-D Itch Scale

The scale was developed by Elman et al,[19] and its Turkish validity and reliability study was conducted by Altınok Ersoy and Akyar in 2018.[20] The scale includes 5 dimensions assessing the

duration, degree, direction, and distribution of itching experienced in the last 2 weeks and the disability caused by itching. A minimum score of 5 points (no itching) and a maximum score of 25 points (itching at the highest degree) can be obtained from the scale. The Cronbach alpha value of the scale was 0.608.[20] The Cronbach alpha coefficient of the scale was found to be 0.83 in our study.

Ethical Consideration

The ethics committee granted approval through the Amasya University Non-Invasive Clinical Research Ethics Committee (application dated 01/25/2023, numbered E-30640013-050. 01.04-120291, decision number 2023/18). Additionally, written institutional permission was obtained from the chief physicians of the relevant hospitals (permissions numbered E-18650231 -929-209717597; E-62949364-903.07.02-210832654; E-44269710 -773.99-210718784; 03/08/2023; E-54300783-044-211175679; 03/08/2023). Written informed consent was obtained from the patients participating in the study. The ethical principles of the Declaration of Helsinki were adhered to at all stages of the study.

Data Analysis

The data were transferred to the SPSS v.20 (IBM SPSS Corp.; Armonk, NY, USA) package program. They were evaluated using mean, percentage, *t*-test, one-way analysis of variance (ANOVA), independent *t*-test, and Pearson correlation analysis. $P < .05$ was considered statistically significant.

RESULTS

Sociodemographic and Disease-Related Characteristics of Hemodialysis Patients

The mean age of the patients was 62.07 ± 13.51 years. Of the patients, 57.1% were female; 51.5% were primary school graduates; 47.2% were retired; 73.6% did not exercise; 71.8% had chronic comorbidities; 54% had been on dialysis treatment for 1 to 5 years; 85.9% received dialysis 3 times a week; 74.8% had an AV fistula as vascular access; 52.8% experienced pruritus before HD treatment; 68.7% used vitamin D; 52.8% took Ca supplements; 82.2% used phosphate binding drugs; 71.8% did not use any antipruritic drugs (Table 1).

Distribution of Disease-Related Characteristics and Renal Osteodystrophy Rates of Patients

The mean PTH level of the patients was 357.20 ± 345.13 pg/mL; the mean BUN value was 113.19 ± 31.85 mg/dL; the mean Kt/v value was 1.72 ± 0.27; the mean creatinine value was 7.29 ± 2.38 mg/dL; the mean Hb value was 10.68 ± 1.36 g/dL; the mean Ca value was 8.80 ± 0.79 mg/dL; the mean *P* value was 4.75 ± 0.96 mg/dL. The mean Ca × P product was <55 mg^2/dL^2 in 95.7% of the patients. Regarding ROD rates according to PTH levels, 26.4% of the patients had low turnover ROD, 30.7% had normal bone turnover, and 42.9% had high turnover ROD (Table 2).

Table 1. Distribution of Demographic and Introductory Characteristics of the Patients (n = 163)

		X ± SD	
Age, years		62.07 ± 13.51	
Dialysate flow rate ml/min		414.05 ± 82.94	
		n	%
Sex	Female	93	57.1
	Male	70	42.9
Marital status	Married	125	76.7
	Single	38	23.3
Education status	Illiterate	28	17.2
	Primary school	84	51.5
	Middle school	17	10.4
	High school	24	14.7
	University and over	10	6.1
Employment status	Yes	9	5.5
	No (unemployed due to the disease)	23	14.1
	No (unemployed for reasons other than the disease)	54	33.1
	Retired	77	47.2
Income status	Income more than expenses	14	8.6
	Income equal to expenses	98	60.1
	Income less than expenses	51	31.3
Cohabitants	With family	151	92.6
	Alone	12	7.4
Presence of care support	Yes	145	89.0
	No	18	11.0
Exercise/physical activity/sports	Yes	43	26.4
	No	120	73.6
Presence of chronic comorbid disease	Yes	117	71.8
	No	46	28.2
Duration of HD treatment	Less than 1 year	4	2.5
	1-5 years	88	54.0
	6-10 years	37	22.7
	11 years and above	34	20.9
Weekly frequency of HD treatment	2 sessions	10	6.1
	3 sessions	140	85.9
	4 sessions and above	13	8.0
Duration of one HD session	Less than 4 hours	3	1.8
	4 hours and above	160	98.2

(*Continued*)

Table 1. Distribution of Demographic and Introductory Characteristics of the Patients (n = 163) (*Continued*)

		X ± SD	
		n	%
Vascular access	Catheter	41	25.2
	AV Fistula	122	74.8
Pruritus before HD treatment	Yes	86	52.8
	No	77	47.2
Pruritus during HD treatment	Yes	34	20.9
	No	129	79.1
Pruritus after HD treatment	Yes	68	41.7
	No	95	58.3
Use of vitamin D supplement	Yes	112	68.7
	No	51	31.3
Use of Ca supplement	Yes	86	52.8
	No	77	47.2
Use of phosphate-binding drugs	Yes	134	82.2
	No	29	17.8
Use of antipruritic drugs	Yes	46	28.2
	No	117	71.8

Ca, calcium; HD, hemodialysis; SD, standard deviation; X, mean.

Table 2. Distribution of Patients' Laboratory Findings (n = 163)

Laboratory Parameters		X ± SD	
Hb		10.68 ± 1.36 gr/dL	
Kt/v value		1.72 ± 0.27	
Na		136.92 ± 2.88 mEq/L	
K		4.87 ± 0.68 mEq/L	
BUN		113.19 ± 31.85 mg/dL	
Creatinine		7.29 ± 2.38 mg/dL	
ALP		125.08 ± 84.78 IU/L	
Ca		8.80 ± 0.79 mg/dL	
P		4.75 ± 0.96 mg/dL	
Ca × P		41.72 ± 8.85 mg^2/dL^2	
PTH		357.20 ± 345.13 pg/mL	
		n	**%**
Ca × P	Ca × P < 55 mg^2/dL^2	156	95.7
	Ca × P = >55 mg^2/dL^2	7	4.3
Clinical characteristics of ROD according to PTH level	<150 pg/mL (low turnover ROD)	43	26.4
	=150-300 pg/mL (normal)	50	30.7
	>300 pg/mL (high turnover ROD)	70	42.9

ALP, alkaline phosphatase; BUN, blood urea nitrogen; Ca, calcium; Ca × P, calcium-phosphorus product; Hb, hemoglobin; K, potassium; Na, sodium; P, phosphorus; PTH, parathormone; ROD, renal osteodystrophy; SD, standard deviation; X, mean.

Distribution of the Scores of HD Patients on the BPI, HDCS-II, and 5-D Itch Scale and the Relationship Between Them

The HDCS-II score was 99.96 ± 12.28. The subscale scores were 13.40 ± 3.71 for physical relief, 17.47 ± 2.52 for physical ease, 30.48 ± 6.01 for psychospiritual ease, 18.13 ± 3.88 for psychospiritual transcendence, 6.29 ± 1.89 for environmental transcendence, and 14.21 ± 1.50 for sociocultural ease. According to the BPI, the average pain level of the patients in the last 24 hours was 2.13 ± 2.10, and the mean itch scale score was 8.26 ± 3.74. The patients' comfort level was above average, and their pain experiences and itch levels in the last 24 hours were low.

There was a statistically significant negative correlation between the comfort scale score and the mean pain score ($r = -0.409$, $P < .001$), and the itch scale score ($r = -0.181$, $P = .021$). In addition, the itch scale score was significantly and positively correlated with the mean pain score ($r = 0.292$, $P < .001$) (Table 3).

Comparison of the Scores of HD Patients on the BPI, HDCS-II, and 5-D Itch Scale with Sociodemographic and Disease-Specific Characteristics

Accordingly, the sociocultural ease subscale score was higher in men than in women ($P = .031$); the psychospiritual transcendence subscale score was higher in primary school graduates or illiterates than in high school graduates ($P = .021$); the environmental transcendence subscale score was higher in those who were unemployed due to the disease than in those who were retired ($P = .048$).

The mean pain levels differed according to income status ($P = .010$). Accordingly, the mean pain level of those whose income was more than their expenses was higher than those whose income was equal to their expenses.

The scores on the comfort scale, the physical ease, psychospiritual ease, environmental transcendence subscales, the mean pain level, and the itch scale score differed according to the presence of other chronic diseases. Hence, individuals without other chronic diseases exhibited higher scores on the comfort scale and on the physical, psychospiritual, and environmental transcendence subscales compared to those with other chronic diseases. Conversely, the average pain level and itch scale score were higher among individuals with other chronic diseases than those without (Table 4).

Comparison of Laboratory Results with the Scores on the BPI, HDCS-II and Its Subscales, and 5-D Itch Scale

No statistically significant correlation was identified between the total comfort score and age, Ca, P, ALP, PTH, Kt/V, BUN, and

Table 3. Relationship between the Total and Subscale Scores on the BPI, 5-D Itch Scale, and HDCS-II

		Mean Pain Level	Itch Scale Score	Comfort Total Score	Physical Relief	Physical Ease	Psychospiritual Ease	Psychospiritual Transcendence	Environmental Transcendence	Sociocultural Ease
Mean pain level	*r*	1	.292*	−.409*	−.202*	−.291*	−.287*	−.180*	−.224*	−.212*
	P	–	**.000**	**.000**	**.010**	**.000**	**.000**	**.022**	**.004**	**.007**
Itch scale score	*r*	–	1	−.181*	−.177*	−.184*	−0.149	−0.084	−.184*	0.047
	P	–	–	**.021**	**.023**	**.019**	.057	.286	**.019**	.555
Comfort total score	*r*	–	–	1	.581*	.548*	.791*	.574*	.492*	.464*
	P	–	–	–	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
Physical relief	*r*	–	–	–	1	.234*	.246*	.256*	.160*	.287*
	P	–	–	–	–	**.003**	**.002**	**.001**	**.041**	**.000**
Physical ease	*r*	–	–	–	–	1	.273*	.279*	.202*	.167*
	P	–	–	–	–	–	**.000**	**.000**	**.010**	**.034**
Psychospiritual ease	*r*	–	–	–	–	–	1	.299*	.375*	.234*
	P	–	–	–	–	–	–	**.000**	**.000**	**.003**
Psychospiritual transcendence	*r*	–	–	–	–	–	–	1	0.142	0.148
	P	–	–	–	–	–	–	–	.071	.060
Environmental transcendence	*r*	–	–	–	–	–	–	–	1	.211*
	P	–	–	–	–	–	–	–	–	**.007**
Sociocultural ease	*r*	–	–	–	–	–	–	–	–	1
	P	–	–	–	–	–	–	–	–	–

BPI, Brief Pain Inventory; HDCS-II, Hemodialysis Comfort Scale - Version II; *r*, Pearson correlation coefficient.

creatinine values ($P > .05$). A positive relationship was revealed between the physical relief subscale score and age ($r = 0.252$, $P = .001$), and a negative relationship with *P* level ($r = −0.203$, $P = .009$); a negative relationship between the physical ease subscale score and P level ($r = −0.197$, $P = .012$); a positive relationship between psychospiritual transcendence and age ($r = 0.184$, $P = .019$) and a negative relationship with P level ($r = −0.167$, $P = .033$); a negative relationship between the environmental transcendence subscale score and age ($r = −0.237$, $P = .002$) and a positive relationship with PTH ($r = 0.189$, $P = .016$); and a positive relationship between the sociocultural ease subscale score and ALP ($r = 0.169$, $P = .034$). In addition, there was a positive relationship between the mean pain score and P level ($r = 0.167$, $P = .033$), a positive relationship between the itch scale score and BUN ($r = 0.160$, $P = .041$), and a positive relationship with creatinine ($r = 0.157$, $P = .045$) (Table 5).

Comparison of ROD Clinical Characteristics with the Scores on the BPI, HDCS-II and Its Subscales, and 5-D Itch Scale

Accordingly, the physical relief ($P = .041$) and physical ease ($P = .005$) subscale scores were higher in patients with PTH < 150 pg/mL than in patients with PTH 150-300 pg/mL; the psychospiritual transcendence score was higher in patients with PTH < 150 pg/mL than in patients with PTH 150-300 and PTH > 300 pg/mL ($P = .002$); the environmental transcendence score was higher in patients with PTH > 300 pg/mL than in patients with PTH 150-300 pg/mL ($P = .026$) (Table 6).

DISCUSSION

In our study aimed at assessing ROD, pain, pruritus, and comfort levels among HD patients, as well as exploring the relationships between these variables and the influencing factors, we observed an overall prevalence of 69.3% for low and high turnover ROD. This rate is below the prevalence reported in the literature (72.7-89%).[7-9] The high rates of use of phosphate-binding drugs and vitamin D and Ca supplements, the 4-hour duration of HD treatment in most patients, and the high number of patients receiving HD treatment for 1 to 5 years may have contributed to the lower ROD prevalence compared to that reported in the literature. According to the PTH values of our patients, it was determined that 26.4% had low turnover ROD (PTH < 150 pg/mL), and 42.9% had high turnover ROD (PTH > 300 pg/mL). In a study by Seyedzadeh et al[9] 31.3% of patients had low turnover ROD, and 41.4% had high turnover ROD. In the study of Nasim et al,[8] low turnover ROD was found in 13.6% of patients, and high turnover ROD was found in 73.9%. According to these results, it can be suggested that the incidence of high-turnover ROD is higher than that of low-turnover ROD.

In the study, it was noted that the pain levels in the last 24 hours were low. Ghonemy et al[11] examined the frequency of pain in 100 patients who received HD treatment for 6 months or longer and found that 52% of the patients experienced chronic pain and 52% of them had mild pain. In the study conducted by

Table 4. Comparison of Patients' Sociodemographic and Disease-specific Characteristics with the Total and Subscale Scores on the BPI, 5-D Itch Scale, and HDCS-II

	Comfort Total Score	Physical Relief	Physical Ease	Psychospiritual Ease	Psychospiritual Transcendence	Environmental Transcendence	Sociocultural Ease	Mean Pain Level	Itch Scale Score
	X ± SD	X ± SD	X ± SD	X ± SD	*X* ± SD	X ± SD	X ± SD	X ± SD	X ± SD
Sex									
Female	100.29 ± 13.38	13.57 ± 3.55	17.78 ± 2.25	31.01 ± 6.12	17.8 ± 4.33	6.39 ± 2.03	14 ± 1.69	2.01 ± 2.17	8.38 ± 3.93
Male	99.53 ± 10.72	13.17 ± 3.94	17.04 ± 2.8	29.79 ± 5.83	18.59 ± 3.16	6.16 ± 1.69	14.49 ± 1.15	2.29 ± 2	8.11 ± 3.5
t/p	0.403/.696	0.677/.499	1.874/.063	1.290/.199	−1.347/.180	0.767/.444	**−2.177/.031***	−0.827/.410	0.453/.651
Marital Status									
Married	99.86 ± 11.91	13.31 ± 3.68	17.51 ± 2.44	30.41 ± 6.09	18.44 ± 3.49	6.16 ± 1.89	14.15 ± 1.58	2.14 ± 2.06	8.41 ± 3.7
Single	100.32 ± 13.6	13.68 ± 3.86	17.32 ± 2.8	30.74 ± 5.83	17.13 ± 4.86	6.71 ± 1.87	14.39 ± 1.2	2.11 ± 2.24	7.78 ± 3.89
t/p	−0.201/.841	−0.540/.590	0.419/.676	−0.294/.769	1.543/.129	−1.579/.116	−0.872/.384	0.079/.937	0.911/.364
Education Status									
Illiterate	101.07 ± 6.98	13.79 ± 3.1	17.86 ± 1.99	29.68 ± 4.34	18.96 ± 2.05a	6.07 ± 1.54	14.36 ± 1.34	1.93 ± 1.74	7.12 ± 4.05
Primary school	99.68 ± 11.53	13.46 ± 3.67	17.12 ± 2.71	30.33 ± 5.96	18.35 ± 3.93a	6.27 ± 1.92	14.26 ± 1.34	2.3 ± 2.26	8.33 ± 3.58
Middle school	101.12 ± 10.52	12.71 ± 3.58	18.12 ± 2.06	30.88 ± 5.97	18.12 ± 2.57	7 ± 2.32	14.29 ± 1.21	1.71 ± 2.28	9.76 ± 3.68
High school	97.5 ± 17.76	12.67 ± 4.19	17.38 ± 2.98	31.33 ± 7.03	15.83 ± 5.72b	6.33 ± 1.95	13.96 ± 1.73	2.04 ± 1.76	8.43 ± 3.99
University and over	103.2 ± 17.46	14.7 ± 4.76	18.4 ± 1.17	31.3 ± 8.46	19.6 ± 1.26	5.7 ± 1.57	13.8 ± 2.82	2.2 ± 2.3	7.93 ± 3.34
F/p	0.515/.725	0.766/.549	1.206/.310	0.318/.866	**2.992/.021***	0.939/.443	0.455/.769	0.379/.823	1.394/.238
Employment Status									
Yes	96.11 ± 18.13	13 ± 3.43	17.56 ± 2.35	29.56 ± 8.63	17 ± 3.04	5.44 ± 1.33b	13.56 ± 2.92	2.56 ± 2.24	8.11 ± 1.58
No (unemployed due to the disease)	99.39 ± 12.94	12.17 ± 3.49	17.7 ± 2.51	30.61 ± 6.4	17.48 ± 4.17	7.22 ± 2.09a	14.09 ± 1.38	1.7 ± 1.92	7.8 ± 4.51
No (unemployed for reasons other than the disease)	98.2 ± 10.47	12.96 ± 3.97	16.83 ± 2.81	29.19 ± 5.72	18.43 ± 3.38	6.24 ± 1.69	14.41 ± 1.22	2.5 ± 2.3	8.23 ± 3.43
Retired	101.82 ± 12.43	14.12 ± 3.54	17.83 ± 2.28	31.47 ± 5.68	18.26 ± 4.21	6.14 ± 1.95b	14.18 ± 1.49	1.95 ± 1.98	8.44 ± 3.92
F/p	1.273/.286	2.118/.100	1.762/.157	1.620/.187	0.600/.616	**2.692/.048***	0.941/.422	1.207/.309	0.175/.913
Income Status									
Income more than expenses	102.29 ± 17.18	14.86 ± 4.28	17.57 ± 2.17	31.14 ± 8	18.43 ± 2.71	6.5 ± 2.07	14 ± 2.39	3.64 ± 2.47a	7.64 ± 3.03
Income equal to expenses	100.92 ± 11	13.51 ± 3.6	17.69 ± 2.33	30.91 ± 5.71	17.98 ± 3.94	6.23 ± 1.93	14.34 ± 1.37	1.86 ± 2.03b	8.07 ± 3.58

(*Continued*)

Table 4. Comparison of Patients' Sociodemographic and Disease-specific Characteristics with the Total and Subscale Scores on the BPI, 5-D Itch Scale, and HDCS-II (*Continued*)

	Comfort Total Score	Physical Relief	Physical Ease	Psychospiritual Ease	Psychospiritual Transcendence	Environmental Transcendence	Sociocultural Ease	Mean Pain Level	Itch Scale Score
	X ± SD	X ± SD	X ± SD	X ± SD	*X* ± SD	X ± SD	X ± SD	X ± SD	X ± SD
Income less than expenses	97.49 ± 12.95	12.78 ± 3.72	17 ± 2.93	29.49 ± 5.97	18.35 ± 4.08	6.33 ± 1.8	14.02 ± 1.45	2.24 ± 1.98	8.8 ± 4.2
F/p	1.592/.207	1.840/.162	1.287/.279	1.025/.361	0.197/.821	0.140/.869	0.896/.410	**4.734/.010***	0.846/.431
Presence of Chronic Comorbid Disease									
Yes	97.83 ± 11.34	13.10 ± 3.47	17.11 ± 2.56	29.32 ± 5.66	18.18 ± 4.04	6.08 ± 1.85	14.12 ± 1.64	2.38 ± 2.12	8.64 ± 3.87
No	105.39 ± 13.03	14.15 ± 4.22	18.37 ± 2.20	33.46 ± 5.90	18.02 ± 3.47	6.83 ± 1.90	14.43 ± 1.07	1.48 ± 1.91	7.30 ± 3.23
t/p	**−3.672/.000***	−1.632/.105	**−2.934/.004***	**−4.151/.000***	0.233/.816	**−2.306/.022***	−1.444/.151	**2.521/.013***	**2.066/.040***
Duration of HD Treatment									
1-5 years	98.95 ± 12.09	13.35 ± 3.87	17.24 ± 2.58	29.85 ± 5.94	18.25 ± 3.90	6.07 ± 1.86	14.35 ± 1.44	1.99 ± 2.05	8.69 ± 3.78
6-10 years	101.22 ± 12.39	13.32 ± 3.37	17.54 ± 2.35	31.92 ± 6.25	17.62 ± 4.11	6.54 ± 2.23	14.05 ± 1.49	2.46 ± 2.28	7.80 ± 3.90
11 years and above	101.35 ± 12.78	13.62 ± 3.74	18.00 ± 2.53	30.65 ± 5.85	18.38 ± 3.61	6.62 ± 1.52	14.00 ± 1.67	2.15 ± 2.06	7.60 ± 3.41
F/p	0.723/.487	0.074/.928	1.153/.318	1.593/.206	0.431/.651	1.494/.228	0.920/.401	0.661/.518	1.406/.248
Weekly Frequency of HD Treatment									
2 sessions	101.10 ± 6.26	13.20 ± 3.99	16.90 ± 2.60	30.90 ± 4.33	19.70 ± 3.13	5.80 ± 1.87	14.60 ± 0.70	2.20 ± 1.93	9.18 ± 4.33
3 sessions	100.36 ± 12.50	13.55 ± 3.68	17.45 ± 2.50	30.66 ± 6.26	18.18 ± 3.80	6.34 ± 1.88	14.20 ± 1.56	2.10 ± 2.14	8.16 ± 3.70
4 sessions and above	94.77 ± 12.83	11.92 ± 3.84	18.08 ± 2.75	28.23 ± 3.81	16.46 ± 4.82	6.08 ± 2.06	14.00 ± 1.29	2.38 ± 1.94	8.62 ± 3.88
F/p	1.284/.280	1.159/.317	0.633/.532	1.000/.370	2.060/.131	0.470/.626	0.465/.629	0.114/.892	0.402/.670

a, b: shows the mean differences between the groups (a: the highest mean). *$P < .05$. BPI, Brief Pain Inventory; HD, hemodialysis; HDCS-II, Hemodialysis Comfort Scale - Version II; F, one-way ANOVA; SD, standard deviation; t, independent samples *t*-test; X, mean.

Table 5. Comparison of Laboratory Parameters and Age with the Scores on the BPI, HDCS-II and its Subscales, and the 5-D Itch Scale

		Ca mg/dl	P mg/dl	Ca × P mg^2/dl^2	Hb gr/dl	Kt/v value mEq/L	Na mEq/L	K mg/dl	BUN mg/dl	Creatinine IU/l	PTH pg/ml	ALP	Age Year
Mean pain level	*r*	−0.037	.167*	0.153	0.020	0.106	0.094	.181*	−0.078	−0.046	0.057	0.109	0.073
	P	.642	**.033**	.051	.796	.177	.235	**.020**	.325	.556	.473	.170	.356
A. General activity	*r*	0.115	0.009	0.058	0.022	0.092	−0.045	0.091	−0.020	−0.078	0.016	.162*	−0.003
	P	.142	.913	.462	.780	.241	.572	.246	.800	.321	.837	**.042**	.968
B. Mood	*r*	0.086	0.035	0.065	−0.056	0.000	−0.054	.210*	−0.102	0.003	0.060	0.148	−0.145
	P	.275	.659	.411	.481	1.000	.498	**.007**	.194	.965	.452	.062	.064
C. Walking ability	*r*	0.031	−0.028	−0.012	−0.010	0.094	−0.077	0.049	−0.029	−0.122	−0.019	.172*	0.017
	P	.692	.727	.877	.895	.234	.326	.532	.714	.122	.812	**.030**	.829
D. Normal work	*r*	0.130	.181*	.231*	−0.097	.185*	0.137	0.143	0.007	−0.050	−0.103	−0.054	0.003
	P	.098	**.020**	**.003**	.219	**.018**	.082	.069	.925	.523	.193	.497	.974
E. Relations with other people	*r*	0.015	0.092	0.087	−0.023	0.030	0.102	.260*	−0.099	0.064	−0.099	0.065	−0.090
	P	.853	.240	.271	.770	.701	.193	**.001**	.211	.418	.209	.417	.251
F. Sleep	*r*	0.016	0.024	0.025	−0.028	0.060	0.020	.206*	0.006	−0.076	−0.112	−0.117	0.087
	P	.838	.760	.749	.726	.446	.804	**.008**	.942	.332	.157	.141	.271
G. Enjoyment of life	*r*	−0.031	0.064	0.042	−0.011	0.031	−0.110	.198*	−0.111	0.008	0.071	.229*	−0.080
	P	.695	.416	.593	.893	.695	.163	**.011**	.158	.916	.369	**.004**	.308
Itch scale score	*r*	−0.136	0.105	0.054	0.092	−0.094	0.146	.195*	.160*	.157*	−0.129	−0.033	0.083
	P	.083	.183	.493	.241	.234	.063	**.013**	**.041**	**.045**	.101	.678	.295
Comfort total score	*r*	0.095	−0.143	−0.093	0.105	−0.022	0.071	−.324*	0.101	0.004	−0.028	0.033	0.099
	P	.227	.068	.235	.184	.785	.367	**.000**	.201	.964	.724	.682	.210
Physical relief	*r*	0.114	−.203*	−0.134	0.057	0.012	0.074	−.247*	0.123	−0.071	−0.133	−0.039	.252*
	P	.148	**.009**	.087	.470	.882	.351	**.001**	.119	.367	.091	.626	**.001**
Physical ease	*r*	0.023	−.197*	−.170*	0.115	−0.115	−0.060	−.344*	0.047	−0.014	0.005	0.041	0.011
	P	.773	**.012**	**.030**	.145	.144	.447	**.000**	.548	.856	.946	.605	.884
Psychospiritual ease	*r*	0.009	−0.007	−0.009	0.052	−0.054	0.134	−.176*	0.050	0.115	0.046	0.032	−0.035
	P	.914	.928	.912	.506	.494	.088	**.025**	.525	.144	.559	.688	.658
Psychospiritual transcendence	*r*	0.102	−.167*	−0.122	0.111	0.127	0.008	−0.125	0.092	−0.019	−0.117	−0.039	.184*
	P	.195	**.033**	.122	.158	.105	.921	.112	.245	.806	.139	.626	**.019**
Environmental transcendence	*r*	0.081	−0.005	0.037	−0.080	−0.104	-0.133	−.198*	0.023	0.066	.189*	0.073	−.237*
	P	.305	.948	.638	.310	.185	.090	**.011**	.771	.404	**.016**	.358	**.002**
Sociocultural ease	*r*	0.121	0.017	0.074	0.044	0.053	−0.022	−.166*	0.079	−0.082	−0.020	.169*	0.101
	P	.122	.831	.347	.576	.504	.784	**.034**	.319	.298	.803	**.034**	.200

ALP, alkaline phosphatase; BPI, Brief Pain Inventory; BUN, blood urea nitrogen; Ca, calcium; Ca × P, calcium phosphorus product; HDCS-II, Hemodialysis Comfort Scale - Version II; Hb, hemoglobin; K, potassium; Na, sodium; P, phosphorus; PTH, parathormone; *r*, Pearson correlation coefficient. *$P < .05$.

Kusztal et al,[21] 57% of patients reported "moderate" pain with a mean VAS score of 5.01 + 1.3. Sadigova et al[22] concluded that HD patients had moderate pain. Accordingly, it is seen that the pain severity of HD patients is mild or moderate. The low pain severity in our study may have been because the Ca and *P* values of the patients were within the desired ranges.

The results of our study indicated that as the P levels of the patients increased, the mean pain scores also increased. In the study by Kusztal et al,[21] PTH levels and Ca ×× P product were higher in HD patients with pain compared to those without pain. In contrast to our study, Sadigova et al[22] reported no difference in P, C-reactive protein (CRP), ferritin, PTH, Hb, and Kt/V values

Table 6. Comparison of Clinical ROD Characteristics with the Scores on the BPI, HDCS-II and its Subscales, and 5-D Itch Scale

	Clinical ROD Characteristics According to PTH Level				
	<150 pg/mL (Low turnover ROD)	=150-300 pg/mL (Normal)	>300 pg/mL (High turnover ROD)		
	X ± SD	X ± SD	X ± SD	F	*P*
Comfort total score	103.84 ± 7.10a	97.08 ± 13.79b	99.53 ± 13.24	3.627	**.029***
Physical relief	14.60 ± 3.35a	12.73 ± 3.46b	13.19 ± 3.96	3.257	**.041***
Physical ease	18.33 ± 1.95a	16.63 ± 2.85b	17.57 ± 2.42	5.554	**.005***
Psychospiritual ease	30.65 ± 4.60	30.16 ± 6.57	30.44 ± 6.32	0.077	.926
Psychospiritual transcendence	19.74 ± 0.85a	16.98 ± 3.80b	17.86 ± 4.64b	6.549	**.002***
Environmental transcendence	6.09 ± 1.39	5.88 ± 1.92b	6.76 ± 2.00a	3.736	**.026***
Sociocultural ease	14.49 ± 1.16	14.20 ± 1.46	14.06 ± 1.70	1.101	.335
Mean pain level	1.67 ± 1.81	2.65 ± 2.23	2.06 ± 2.13	2.614	.076
A. General activity	2.88 ± 2.95	3.49 ± 2.97	3.07 ± 3.29	0.473	.624
B. Mood	1.12 ± 1.82b	2.49 ± 2.65a	1.83 ± 2.90	3.252	**.041***
C. Walking ability	2.88 ± 3.16	3.39 ± 3.32	2.93 ± 3.32	0.363	.696
D. Normal work	2.21 ± 2.65	3.02 ± 3.00	1.94 ± 2.71	2.22	.112
E. Relations with other people	0.84 ± 1.43b	2.10 ± 2.42a	0.93 ± 1.78b	6.811	**.001***
F. Sleep	1.95 ± 2.83	3.18 ± 3.11a	1.66 ± 2.40b	4.685	**.011***
G. Enjoyment of life	0.93 ± 1.65b	2.76 ± 2.98a	1.77 ± 2.70	5.847	**.004***
Itch scale score	8.58 ± 3.81	8.91 ± 3.44	7.58 ± 3.85	2.081	.128

a, b: shows the mean differences between the groups (a: the highest mean). **P* < .05. BPI, Brief Pain Inventory; F, one-way ANOVA; HDCS-II, Hemodialysis Comfort Scale - Version II; PTH, parathormone; ROD, renal osteodystrophy; SD, standard deviation; t, independent samples *t*-test; X, mean.

between patient groups with and without pain and stated that low albumin and high Ca values in patients with pain were significant compared to patients without pain. In another study, a significant relationship was demonstrated between low Ca and high PTH and chronic pain.[11] In our study and other studies in the literature, we observed that the relationships between pain and laboratory parameters were different. This is due to the differences in the study groups.

In our study, a negative relationship was found between the comfort scale score and the mean pain score, which was consistent with the literature. In the study conducted by Kusztal et al,[21] it was stated that even if the patient has mild pain, it negatively affects the quality of life. It is seen that the pain symptom influences HD patients' quality of life and comfort, and this symptom should not be ignored.

In our study, the patients' pruritus levels were low. The high rate of not using pruritus drugs in our patients (71.8%) may support this finding. In a study conducted by Altınok Ersoy et al,[12] patients' mean itch scale score was 13.97 ± 4.11, and it was concluded that they had moderate pruritus. In a study in which the effect of pruritus experienced by CRF patients on patient comfort and sleep quality was examined, the mean itch scale score of 91 patients was found to be 12.20 ± 3.29, and patients were found to have moderate pruritus.[23] A similar result was obtained in the study of Ozen et al;[24] the severity of pruritus of HD patients was measured using VAS, the mean pruritus severity of the patients was determined as 6.47 ± 1.56, and 50.4% of them were found to have moderate pruritus complaints. In another study, itching severity was found to be 12.70 ± 3.35.[25] In literature the prevalence of disturbed sleep quality and quantity due to pruritus was 9-76%.[26] According to this literature information, it is seen that HD patients have moderate pruritus complaints. The fact that the pruritus levels of the patients in our study were lower than the findings in the literature may be because the laboratory parameters were at the desired levels for HD patients, and the appropriate frequency and duration of HD sessions were ensured.

In our study, pruritus complaints of the patients increased as their creatinine or BUN levels increased. In the study by Zhao et al,[27] patients without uremic pruritus were compared with patients with uremic pruritus, and it was found that patients with uremic pruritus had higher BUN, PTH, Hb, and CRP levels. In the study conducted by Ozen et al,[24] a significant relationship was found between uremic pruritus and white blood cell count in HD patients; no significant relationship was found with BUN, P, PTH, Ca × P, Ca, and Kt/v values. In studies in the literature, the relationship between the complaint of pruritus experienced

by HD patients and laboratory parameters varies. We think that this was due to the differences in the study groups.

In this study, it was determined that the patients' comfort level was above the moderate level. Various studies have reported that the comfort of HD patients is at a moderate level.[2,15,23] In the study conducted by Dikmen et al,[14] the comfort level of the patients was found to be below the moderate level. The low pruritus level and pain averages in the last 24 hours and the ROD parameters within the desired ranges are effective in the comfort level above the moderate level in our patients. In addition, 92.6% of our patients were living with their families, and 89% of them had someone to support their care, which may have been effective in the comfort level above the moderate level. Dikmen[28] study reported that the comfort level of patients who had someone to support their care at home was higher. Living with a spouse or family may positively impact comfort as it provides both physical and emotional support and facilitates compliance with the disease process.

Our study found a statistically significant negative relationship between the comfort scale score and the itch scale score. A similar result was obtained in the study by Çalışkan et al.[13] Their study explored the impact of pruritus on patient comfort among uremic individuals, both with and without HD treatment. The findings indicated that pruritus had a negative effect on daily comfort levels in both groups.[13] One of our study's findings, the negative effect of pruritus on comfort, is similar to other studies in the literature.

This study found a significant difference in the sociocultural ease subscale score according to sex ($P = .031$). It was concluded that the sociocultural ease subscale score was higher in men than in women. Similarly, in a study in which the comfort level of HD patients was determined, it was found that the mean ease subscale score of male patients was higher than that of female patients.[15] There are also studies in which male patients had a higher comfort levels.[28,29] The high comfort levels of male participants may be attributed to the fact that men take on fewer roles in housework and responsibilities in traditional Turkish society and are more active than women in socializing and spending time for themselves.

In our study, the comfort scale physical ease, psychospiritual ease, and environmental transcendence subscale scores differed according to the presence of other chronic diseases. It was found that the comfort scale physical ease, psychospiritual ease, and environmental transcendence subscale scores were higher in those without other chronic diseases than in those with comorbid chronic diseases. Similar results have been reported in other studies in the literature.[15,28-30] Different chronic diseases can impair individuals' physical, mental, and social status, negatively affect their daily lives, and thus reduce their comfort levels.

Limitations

The limitations of our study include the fact that bone biopsy was not used in the diagnosis of ROD, that ROD groups were based entirely on serum PTH measurements, and that vitamin D levels were not measured.

This study reveals considerable rates of low-, normal-, and high-turnover ROD subgroups in HD patients according to their PTH levels. This classification is important for developing personalized intervention strategies focusing on unique patient needs. In addition, it was observed that an increase in P levels increased pain, and an increase in BUN and creatinine values increased pruritus. Our findings emphasized that pain and pruritus negatively affect patient comfort, and pruritus increases the severity of pain. It is recommended that nurses follow pain and pruritus by creating individual care strategies, evaluating the factors affecting them, and planning nursing interventions to manage them effectively.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of The ethics committee granted approval through the Amasya University Non-Invasive Clinical Research Ethics Committee date: 01/25/2023, number: E-306 40013-050.01.04-120291, approval no.: 2023/18).

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