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Musculoskeletal pain and quality of life in patients undergoing hemodialysis: a single-center study

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ABSTRACT

Objectives: In this study, we aimed to research the frequency of musculoskeletal manifestations of patients receiving hemodialysis treatment, and evaluate the relationship between quality of life and musculoskeletal manifestations of these patients.

Methods: Patients undergoing hemodialysis for at least 6 months were included in our study. Patients were asked to complete a questionnaire that formed by the investigators including demographic, clinical features, and musculoskeletal symptoms that frequently seen in patients who receive hemodialysis. Kidney Disease Quality of Life Short Form Version 1.3 (KDQOL-SF 1.3) and Short Form Health Survey (SF 36) questionnaires were completed by the patients and the control group. Blood urea nitrogen, serum creatinine, serum albumin, C-reactive protein (CRP), parathormone (PTH), ferritin, calcium, phosphate, hemoglobin, and Kt/V were measured. Also, the patients were divided into two subgroups according to musculoskeletal symptoms and these subgroups were compared in terms of dialysis adequacy, quality of life scoring and laboratory findings.

Results: Seventy-four patients (42 males, 32 females) were enrolled in our study. The mean age of the patients was 60.85 ± 12.29 years. Six-five (87.83%) patients had musculoskeletal symptoms. There was statistically major difference in terms of smoking between subgroups ($p = 0.046$). We did not detect any correlation between two groups in terms of Kt/V ($p = 0.411$). Pain in shoulder/neck (41.9%), pain in limbs (58.1%) and pain in back (56.8%) were the most detected musculoskeletal symptoms of the patients. There was statistically significant difference between genders in terms of joint swelling, muscle cramps, pain in limbs, back and neck /shoulder ($p = 0.015$, $p = 0.001$, $p = 0.008$, $p = 0.001$, and $p = 0.004$, respectively). We detected that all subunits of KDQOL scores were higher in control group than patients who were included in our study. There was statistically significant relation between emotional role and energy subunits of KDQOL scores and CRP ($p = 0.031$ and $p = 0.025$, respectively).

Conclusion: The results of our study were not as significant as the results of similar studies, however they are valuable because they show demographic, clinical characteristics, and quality of life of patients receiving hemodialysis in our region.

Keywords: Musculoskeletal pain, quality of life, hemodialysis

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The findings of end stage renal disease (ESRD) are very various. Musculoskeletal pain is a frequent complaint in patients undergoing dialysis [1]. Musculoskeletal symptoms have significant impact on patients' health and quality of life [1]. Laboratory parameters (hemoglobin, albumin, c reactive protein), clinical features like duration of dialysis, demographic factors like age, gender, education, and marital status are associated with quality of life in patients undergoing hemodialysis [2].

The treatment of these patients usually focused on mainly medical conditions. Psychological, emotional, nutritional, and social conditions that affect the general condition of the patients are overlooked.

In this study, we aimed to focus on the relationship between musculoskeletal symptoms and quality of life of patients undergoing hemodialysis. In addition, we tried to evaluate the association between patients' demographic, clinical and laboratory findings, and their life quality.

METHODS

Patients undergoing hemodialysis treatment due to end stage kidney disease applied to Umraniye Training and Research Hospital Nephrology outpatient clinics for follow-up from June 2022 to November 2022 were included in the study. 35 healthy controls were enrolled to the study as well.

Criteria for inclusion are following: (1) Age between 18-75 years, (2) Patients undergoing hemodialysis treatment for at least 6 months, and (3) Patients speak and understand Turkish. However, criteria for exclusion are; (1) Age < 18 and > 75 years; (2) Patients undergoing hemodialysis treatment less than 6 months; (3) Patients with cognitive impairment; (4) Patients with psychiatric disorders; and (5) Patients don't speak or understand Turkish.

Informed consent was received. The research was carried out under the original Declaration of Helsinki, and it is approved by the ethical committee of Umraniye Training and Research Hospital on 21 April 2022 (No: B.10.1.TKH.4.34.H.GP.0.01/142).
Patients were asked to complete a questionnaire under the supervision of a nurse during their hemodialysis session, created by the investigators of the study including demographic and clinical questions, as well as common musculoskeletal symptoms of patients undergoing hemodialysis.

The questionnaire included age, gender, education, marital status, smoking, duration of hemodialysis (months), number of sessions / week, etiology (primary cause of renal disease), musculoskeletal symptoms (myalgia, morning stiffness, pain in shoulder/neck, pain in limbs, pain in back/low back, and muscle cramps).

Clinical data were extracted from the hospital database. Blood samples were taken for laboratory analysis before the mid-week session. Blood urea nitrogen, serum creatinine, serum albumin, C-reactive protein (CRP), parathormone (PTH), ferritin, calcium, phosphate, and hemoglobin were measured. Kt/V (K: dialyzer clearance, t: dialysis duration, V: volume of bodily water) for dialysis adequacy, primary cause of renal disease, and duration of dialysis (months) were recorded.

To measure hemodialysis treatment sufficiency, Kt/V was used as an indicator (where: K-D dialyzer clearance of urea, t-dialysis time, V-volume of distribution of urea, approximately equal to patient's total body water). Kt/V was calculated by the online calculator: http://www.davita.com/ktvcalculator/. The US National Kidney Foundation. Insufficient dialysis quality was defined when Kt/v was below 1.2 as recommended by National Kidney Foundation Kidney Disease Outcomes Quality Initiative (KDOQI) guidelines [3]. We divided the patients into two groups according to dialysis efficiency, utilizing a Kt/V value of 1.2 as a separator. We compared two groups in terms of quality-of-life scoring.

In addition, the patients were divided into two groups according to musculoskeletal symptoms and these groups were compared in terms of dialysis adequacy, quality of life scoring and laboratory findings. Kidney Disease Quality of Life Short Form Version 1.3 (KDQOL-SF 1.3) questionnaires were completed by the patients undergoing hemodialysis. Short Form Health Survey (SF-36) quality of life measurements scale was used for the healthy controls.

Kidney Disease Quality of Life Short Form Version 1.3 (KDQOL-SF 1.3)

KDQOL-SF 1.3, a self-report measure developed for individuals suffering from kidney disease used to assess health related quality of life [4]. It includes a

general part (SF 36) and a disease-specific part. SF36 has 36 questions measuring eight measures (physical functioning, physical role, pain, general health, emotional well-being, emotional role, social functioning, and energy/fatigue). The disease particular section includes symptom/ problem list, effects of kidney disease, the burden of kidney disease, work status, cognitive function, quality of social interaction, sexual function, sleep, social support, dialysis staff encouragement and patient satisfaction. Overall health assessment part is evaluated apart. All measure points range between 0 and 100, where higher scores indicate a better quality of life. Yildirim *et al*. [5] conducted the currency and credibility of the Turkish language version of KDQOL-SF 1.3 questionnaire16. Cronbach's alpha coefficient of the Turkish KDQOL-SF questionnaire was 0.84 to 0.916.

SF-36

The SF-36 form is one of the questionnaires which is not prepared for a certain disease that measure the quality of life. Quality of life is self-evaluated in eight different parts in the questionnaire which includes 36 questions. Comorbidity was self-reported and reported as impaired functioning in the following domains as: physical functions (PF), limitation of role functions (RP) – physical, bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role functioning- limitations due to emotional problems (RE) and mental health (MH). The score ranges from 0 (lowest) to 100 (highest). Scores of the eight domains are collected to two total scores, the physical (PF) and mental component (MH) [6].

Statistical Analysis

All analyses were made by the IBM SPSS Statistics Version 15.0 statistical software package. Categorical factors were defined as numbers and percentages, whereas continuous variables were defined as mean and standard deviation and as median and minimum-maximum where convenient. For the comparison between two groups, the student's t-test was used for normally distributed variables, and the Mann-Whitney U test was used for the abnormally distributed variables. The Chi-square test or Fisher exact test was used to compare the categorical factors between the groups. The statistical level of significance for all tests was accepted as 0.05. The data were evaluated in IBM SPSS Statistics 15.0 (IBM Corp. Armong, New York, AB) program.

RESULTS

Seventy-four patients (42 males, 32 females) were enrolled in our study. The mean age of the patients was 60,85 ± 12,29 years. Mean time in dialysis was 70.73 ± 72.24 months. The sociodemographic, clinical, and laboratory features of patients are listed in Table 1. The most frequent causes of end stage renal disease were hypertension (46.7%) and diabetes mellitus (25%). Most patients (92%) were receiving hemodialysis treatment 3 days a week.

Sixty-five (87.83%) patients were suffering from musculoskeletal symptoms. There was no significant difference in terms of etiology, educational status, marital status, duration of dialysis, and age between the subgroups which were separated according to musculoskeletal symptoms (p = 0.698, p = 0.718, p = 0.504, p = 0.690 and p = 0.608, respectively) There was statistically significant difference in terms of smoking between subgroups (p = 0.046). We did not detect any difference between two subgroups in terms of Kt/V (p = 0.411).

Pain in shoulder/neck (41.9%), limbs (58.1%), and back (56.8%) were the most detected musculoskeletal symptoms of the patients. Muscle cramps were also seen frequently in patients undergoing hemodialysis (33%). All musculoskeletal symptoms were detected more frequently in female patients than male patients. There was statistically major difference between genders in terms of joint swelling, muscle cramps, pain in limbs, back and neck /shoulder (p = 0.015, p = 0.001, p = 0.008, p = 0.001 and p = 0.004, respectively). Table 2 demonstrates musculoskeletal symptoms of patients.

According to KDQOL questionnaire, patients suffering from musculoskeletal complaints had higher scores than patients without complaints except pain and emotional role subunits. There was no statistically major difference between two groups in terms of physical functioning, physical role, emotional role, emotional well-being, energy, pain, general health, and social functioning (p = 0.685, p =0.860, p =0.290, p = 0.646, p = 0.095, p = 0.851, p = 0.419 and p = 0.111, respectively).

Table1. Comparison of demographic, clinical and biochemical features of hemodialysis patients

	Total (n = 74)	Patients with musculoskeletal symptoms (n = 65)	Patients without musculoskeletal symptoms (n = 9)	*p* value
Age (years), mean ± SD	60.85 ± 12.29	61.08 ± 12.33	59.22 ± 12.60	0.608
Male/Female, n (%)	42/32 (56/42.7)	34/31 (52.3/47.7)	8/1 (88.9/11.1)	**0.038**
Smoking (+/-), n (%)	15/59 (20.27/78.7)	13/52 (20/80)	2/7 (22.2/77.8)	**0.046**
Education, n (%)				0.718
Illiterate	5 (6.7)	5 (7.7)	0 (0)	
Primary school	37 (49.3)	34 (52.3)	3 (33.3)	
Middle school	10 (13.3)	8 (12,3)	2 (22.2)	
High school	9 (12)	7 (10.8)	2 (22.2)	
University	12 (16)	10 (15.4)	2 (22.2)	
Marital status, n (%)				0.504
Single	14 (18.9)	12 (18.5)	2 (11.1)	
Married	60 (81)	53 (81.5)	7 (88.9)	
Duration of dialysis (month)	70.73 ± 72.24	71.42 ± 73.95	65.78 ± 61.96	0.690
Number of sessions/weeks, n (%)				0.389
2 sessions/w	5 (6.7)	5 (7.7)	0 (0)	
3 sessions/w	69 (92)	60 (9.23)	9 (100)	
Etiology, n (%)				0.698
Diabetes mellitus	19 (25)	7 (26.2)	2 (22.2)	
Hypertension	35 (46.7)	29 (44.6)	6 (66.7)	
Glomerulonephritis	8 (10.7)	8 (12.3)	0 (0)	
Polycystic kidney disease	1 (1.3)	1 (1.5)	0 (0)	
Others	11 (14.7)	10 (15.4)	1 (11.1)	
Serum creatinine (mg/dL)	7.39 ± 2.07	7.42 ± 2.10	7.13 ± 1.86	0.725
Blood urea nitrogen (mg/dL)	121.17 ± 31.82	122.30 ± 30.36	112.83 ±.41.89	0.535
Albumin (g/L)	40.66 ± 3.29	40.58 ± 3.41	41.22 ± 2.30	0.540
Ferritin (ng/mL)	697.32 ± 373.52	671.91 ±364.74	894.23 ± 407.79	0.155
CRP (mg/dL)	12.37 ± 15.22	12.23 ± 14.15	13.37 ± 21.54	0.946
Hemoglobin (g/dL)	10.83 ± 1.24	10.81 ± 1.27	10.96 ± 1.02	0.953
PTH (pg/mL)	367.57 ± 405.05	348.74 ± 358.25	515.86 ± 698.69	0.649
Calcium (mg/dL)	8.76 ± 0.58	8.74 ± 0.61	8.86 ± 0.30	0.597
Inorganic phosphate(mg/dL)	4.80 ±1.10	4.80 ± 1.13	4.83 ± 0.93	0.860
Venous bicarbonate (mEq/L)	19.70 ± 1.61	19.69 ± 1.64	19.73 ± 1.40	0.713
Kt/V	1.51 ± 0.29	1.52 ± 0.29	1.44 ± 0.29	0.411

Data are shown as mean ± standard deviation or n (%). Kt/V = K: dialyzer clearence, t: dialysis duration, V: volume of bodily water, PTH = Parathormone, CRP = C- reactive protein

Table 2. Distribution of musculoskeletal symptoms in hemodialysis patients

	Total (n = 74)	Male (n = 42)	Female (n = 32)	*p* value
Pain in shoulder/neck, n (%)	31 (41.9)	11 (26.2)	19 (59.4)	**0.004**
Pain in back/low back, n (%)	42 (56.8)	16 (38.1)	25 (78.2)	**0.001**
Pain in limbs, n (%)	43 (58.1)	20 (47.6)	25 (78.1)	**0.008**
Myalgia, n (%)	8 (10.8)	2 (4.8)	8 (25)	0.120
Morning stiffness, n (%)	12 (16.2)	4 (9.5)	8 (25)	0.074
Joint swelling, n (%)	12 (16.2)	3 (4.8)	9 (28.1)	**0.015**
Muscle cramps, n (%)	33 (44.6)	10 (23.8)	22 (68.8)	**0.001**

We detected that all subunits of KDQOL scores were higher in control group than patients in our study. There was statistically significant difference between patients and the control group in terms of KDQOL subunits; physical function, physical role, general health, social functioning, pain, and emotional well-being ($p = 0.001$, $p = 0.001$, $p = 0.001$, $p = 0.006$, $p = 0.004$ and $p = 0.012$, respectively). KDQOL subunits' scores and correlation between subgroups are described in Table 3.

There was statistically significant relation between emotional role and energy subunits of KDQOL scores and CRP ($p = 0.031$ and $p = 0.025$, respectively). According to this result, the present study showed that patients whose CRP values were lower than 4 mg/dl had higher emotional role and energy scores.

DISCUSSION

In our study, we found that hypertension and diabetes mellitus were the leading causes of end stage renal disease. There was no statistically significant difference between the subgroups separated according to musculoskeletal symptoms in terms of etiology, educational status, marital status, duration of dialysis and age.

Table 3. Comparison of KDQOL-SF 1.3 scores and Sf- 36 scores of hemodialysis patients and control group

	Patients with musculoskeletal symptoms (n = 65)	Patients without musculoskeletal symptoms (n = 9)	*p* value	All patients (n = 74)	Control group (n = 33)	*p* value
Physical functioning	37.56 ± 35.25	23.33 ± 32.14	0.685	36.59 ± 34.88	87.73 ± 14.25	**0.001**
Physical role	36.58 ± 44.75	16.66 ± 14.43	0.860	35.22 ± 43.57	80.30 ± 30.46	**0.001**
Pain	51.83 ± 27.84	55.83 ± 32.53	0.851	52.10 ± 69.31	69.31 ±.21.05	**0.004**
General health	47.68 ± 13.28	41.66 ± 10.40	0.419	47.27 ± 13.09	64.70 ± 15.90	**0.001**
Emotional well being	54.53 ± 12.45	49.33 ± 8.33	0.646	54.18 ± 12.21	60.61 ± 15.84	**0.012**
Emotional role	45.71 ± 50.54	100.00	0.290	47.22 ± 14.24	62.60 ± 37.04	0.142
Social functioning	36.58 ± 44.75	16.66 ± 14.43	0.111	53.13 ± 27.11	61.56 ± 20.19	**0.006**
Energy	45.73 ± 14.12	33.33 ± 12.58	0.095	44.88 ± 14.24	51.18 ± 19.09	0.123

Data are shown as mean ± standard deviation. KDQOL-SF1.3 = Kidney Disease Quality of Life Short Form Version 1.3, SF-36 = Short Form Health Survey

Nevertheless, all musculoskeletal symptoms were detected more frequently in female patients than male patients. There was statistically major difference between genders in terms of joint swelling, muscle cramps, pain in limbs, back and neck /shoulder. According to KDQOL questionnaire, patients with musculoskeletal symptoms had higher scores than patients without musculoskeletal symptoms except subunits pain and emotional role. In addition, all subunits of KDQOL scores were markedly higher in control group than patients who were included in our study. We did not find any relationship between serum albumin, hemoglobin, ferritin, Kt/V, gender, age, duration of hemodialysis, and KDQOL scores. According to our study we only found that patients with lower CRP values had higher scores of emotional role and energy.

Musculoskeletal manifestations are often detected in patients who have been on hemodialysis treatment for 5 to 10 years [7]. Nevertheless, according to another study which included younger participants who had duration of dialysis longer than 10 years had fewer musculoskeletal symptoms [8]. Hage *et al*. [7] demonstrated that pain was the most detected musculoskeletal manifestation in patients undergoing hemodialysis like other similar studies [9]. In our study we found increased rate of musculoskeletal symptoms in patients undergoing hemodialysis, while pain in limbs, back and shoulder/neck were the most detected musculoskeletal symptoms.

In a study by Kesikburun *et al*. [10], low back pain with nonspecific etiology was detected more than 1/3 of patients. They also found relationship between advanced age, smoking, increased body mass index (BMI) and low back pain. We also found significant relation between smoking and patients' musculoskeletal manifestations. Nevertheless, we could not find any relationship between musculoskeletal pain and other demographic features of patients in our study except gender. This may be due to limited number of participants included in the study.

As in general population [11], Caravaca *et al*. [12] found higher prevalence of musculoskeletal pain among women than men. They claimed that the reason for musculoskeletal pain being more likely to occur in females may be due to a hypothesis that females had greater sensitivity to pain [12]. We found that female patients had more musculoskeletal manifestations than male patients like this study.

According to Molsted *et al*. [13] musculoskeletal pain was associated with low quality of life scores in patients with chronic kidney disease. Additionally, Hsu *et al*. [14] declared that body pain was the leading qualitative parameter for the evolution of the quality of life in patients undergoing hemodialysis. Kesikburun *et al*. [10] investigated the impact of low back pain on quality of life in patients undergoing hemodialysis. According to that study patients receiving hemodialysis with low back pain had significantly worse scores in the energy, pain, and physical activity subunits of quality of life. In our study we could not find any significant difference between subgroups in terms of musculoskeletal symptoms according to KDQOL scores. This result may be due to disproportionate increased number of patients with musculoskeletal symptoms included in the study.

In general population, chronic musculoskeletal pain was related with increased levels of inflammatory indicators [15], and this may be a clue that make us to understand the mechanism of pain in chronic kidney disease [16]. Caravaco *et al*. [17] found high levels of inflammatory markers in patients with pain as general population. Nevertheless, according to Kesikburun *et al* no significant difference detected between subgroups in terms of low back pain according to laboratory findings such as hemoglobin, albumin, PTH, and calcium phosphate [10]. In the present study we did not detect relationship between inflammatory laboratory findings and musculoskeletal symptoms.

Decreased quality of life scores in patients receiving dialysis compared to general population [18]. The present study showed increased quality of life scores in control group compared to patients undergoing hemodialysis like other studies.

In patients undergoing hemodialysis low values of hemoglobin, albumin and increased CRP and ferritin levels may be predictors of chronic inflammation and this may cause inadequate hemodialysis and low quality of life. According to Turk *et al*. [19], negative correlation was found between KDQOL scores and hemoglobin levels. In this study also ferritin was found negatively correlated with five subunits of KDQOL-SF (work status, cognitive functions, dialysis staff encouragement, patient satisfaction, and energy) in patients undergoing dialysis. According to Ma *et al*.

[20], prealbumin and hemoglobin were significantly associated with poorer mental health status of patients undergoing hemodialysis, and patients with poorer psychological states were more significantly associated with decreased quality of life [20]. In the present study we only found that lower CRP values ended up higher emotional role and energy scores. This result may be useful in demonstrating the effect of elevated inflammatory markers on quality of life.

Kt/v and URR shows the adequacy of dialysis that may affect quality of life of patients. Kt/v, determined by single pool urea kinetic modeling, is the most preferred method for the numerical expression of dialysis dose [21]. Some studies showed little effect on kt/v on quality-of-life scores [19]. We did not find any correlation between kt/v and KDQOL scores like other studies mentioned above. Based on these findings we can suggest that there is not significant correlation between kt/v and quality of life in patients receive dialysis.

Limitations

Inclusion of small number of participants is one of the limitations of our study. In addition, it is a single center study. Patients receive peritoneal dialysis and patients in pre-dialysis stage were not included in the study and we could not use imaging methods to diagnose patients' musculoskeletal symptoms.

CONCLUSION

Our study showed decreased scores of KDQOL subunits compared to control group. We did not find any significant relationship between serum albumin, hemoglobin, ferritin, Kt/v, gender, age, duration of hemodialysis, and KDQOL scores. We found that lower CRP values result in higher scores of emotional role and energy. In addition, while no statistically significant difference was found between the subgroups in terms of etiology, educational status, marital status, duration of dialysis and age, significant difference was detected in terms of musculoskeletal symptoms between male and female patients. Although the results are not as significant as the results of similar studies, our study is valuable because it demonstrates the demographic, clinical characteristics, and quality of life of patients undergoing dialysis in our region.

Authors' Contribution

Study Conception: ÖP; Study Design: EEY; Supervision: DŞ; Funding: EEY, ZT; Materials: EEY, ZT; Data Collection and/or Processing: EEY, ÖP; Statistical Analysis and/or Data Interpretation: EEY; Literature Review: HK, DŞ; Manuscript Preparation: EEY and Critical Review: HK, DŞ.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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