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Quality of life and sleep disorders among patients treated with hemodialysis in relation to dialysis adequacy

Abstract

Introduction. Recent studies in this field are insufficient to determine the relationship between life quality and hemodialysis adequacy. The problem, which requires further analysis is the issue of verification of these relationships and the problem of the relationship between sleep disorders and hemodialysis indicators.

Aim. The aim of this study is to determine the relationship between quality of life and sleep disorders occurring among patients with end stage renal disease (ESRD) treated with hemodialysis and the dialysis adequacy parameters.

Material and methods. The survey was based on two standardized international scales: the Quality of Life Scale (SF-36) and the Pittsburg Sleep Quality Index (PSQI). The study was conducted among 150 patients (67 women and 83 men) treated with hemodialysis at the Fresenius center. All patients participating in the study were undergoing dialysis three times a week. The average value of Kt/V was 1.45 (SD=0.22) and URR ration 71.78 (SD=5.95).

Results. The urea level prior to hemodialysis moderately strongly correlates with life energy deficit (r=-0.34, p=-0.049) and that the values of urea reduction ratio URR weakly correlates with the patient's conviction on restricting life's activity (SF-36) (r=0.18, p=0.046). The level of urea prior to dialysis correlates positively with the time of falling asleep in PSQI scale (r=-0.39, p=0.023).

Conclusions. Patients with lower urea level before hemodialysis have a significantly higher vitality level. Higher fluctuations of urea concentrations before and after hemodialysis (higher urea reduction ratio URR) are associated with restrictions of physical activity in hemodialysis patients.

Keywords: quality of life, sleep disorders, end stage renal disease, hemodialysis.

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INTRODUCTION

The existential situation of patients treated with renal replacement therapy in the course of end stage renal disease (ESRD) is connected with certain limitations imposed by the disease and the therapeutic requirements. Hemodialysis as a method of renal replacement therapy requires systematic, most frequently a three time per week, few hour stay in a dialysis center. Effects of renal replacement therapy conducted by means of chronic hemodialysis are connected with being on a diet, including restriction on excessive fluid intake, systematic ingestion of doctor prescribed medication and self-control of one's own weight. End stage renal disease together with the requirements of applying effective treatment in the form of hemodialysis, reduces the patient's quality of life, especially in the area of physical activity [1]. The quality of life of patients maintained on chronic hemodialysis is the subject of many recent research studies [2-6] including reports drawing attention to sleep disorders concurrent with the decreased life quality [7-10]. The subject of several research projects included the search for a relationship between selected biomarkers (including indicators of dialysis adequacy) and the level of life quality of patients on hemodialysis. Recent studies in this field are insufficient to determine the relationship between life quality and hemodialysis adequacy [11-15]. The problem, which requires further analysis, is the issue of verification of these relationships and the problem of the relationship between sleep disorders and hemodialysis indicators.

AIM

The aim of this study was to determine the relationship between life quality and sleep disorders occurring among patients with end stage renal disease (ESRD) treated with hemodialysis and the dialysis adequacy parameters.

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MATERIAL AND METHODS

The research procedure involved conducting a survey based on two standardized international scales: the Quality of Life Scale (SF-36) [16] and the Pittsburg Sleep Quality Index (PSQI) [17] and was made on 150 people with chronic hemodialysis.

Quality of Life Scale (SF-36) is designed for the subjective assessment of health status. It consists of 36 questions and analyses the functional profile of health and well-being, as well as the psychometric assessment based on the physical and mental health status of the respondents. The quality of life based on the physical health is measured using the following indicators: physical functioning, pain perception, and overall health. The quality of life based on psychological health is measured using: vitality of social functioning, and the emotional and mental state. SF-36 proved to be useful in population studies, as well as in comparing the relative burden of a disease and diversified healthcare benefits resulting from various treatments. The SF-36 has been constructed so that it can meet the minimum psychometric standards necessary for the comparison of various groups of respondents.

Pittsburg Sleep Quality Index Scale (PSQI) constructed by C. Smyth is a questionnaire consisting of 18 items, which within the framework of 7 factors studies sleep quality: Subjective sleep quality (C1), Sleep latency (C2), Sleep duration (C3), Habitual sleep efficiency (ratio of actual number of hour of sleep to the time spent in bed) (C4), Sleep disturbances (C5), Use of sleeping medication (C6), Daytime dysfunction (C7). The PSQI scale is primarily based on quantitative questions to which answers include specific values (minutes, hours) or incidence of events that affect sleep (e.g. number of awakenings per night caused by breathing difficulties). The result of each PSQI scale factor varies from 0 (no difficulty) to 3 (extreme difficultly). The overall result of the PSQI scale ranges from 0 to 21 points. The higher the score, the worse the quality of sleep.

Within the research procedure, urea concentration has been established for each of the patients prior to hemodialysis (C0) and afterwards (C1). The values of urea concentration were measured in each patient on the day of the survey. The urea reduction rate (URR) and the dialysis dose (Kt/V) were established. Kt/V was determined using the Daugirdas formula (1993) [18]. The URR as a method evaluating the effectiveness of dialysis was established using the following formula: URR=(C0-C1)/ C0, using the urea concentrations before (C0) and after hemodialysis (C1). As part of the research procedure interdependent variables such as age, gender, education and place of residence of the patients participating in the study were also monitored.

The study was conducted among 150 patients (67 women and 83 men) treated with hemodialysis at the Fresenius center. Eighty-five of the respondents came from rural and 65 from urban regions. The respondents aged 30-87, average age being 64.04 years (SD=12,57). All patients participating in the study were undergoing dialysis three times a week. The average value of Kt/V was 1.45 (SD=0.22) and URR ration 71.78 (SD=5.95) (Table 1).

In order to analyze the obtained data the correlation model was applied. Using the Pearson's product moment correlation between the SF-36 and PSQI and controlled variables concerning the dose of dialysis: Kt/v, URR and urea concentration before (C0) and after hemodialysis (C1) were calculated. The differences between groups based on gender and place of residence were calculated based on Student's t test. The level of significance was determined at $p<0.05$. To analyze the obtained data, the authors used the Statistica 10.0 PL program.

TABLE 1. Characteristics of the study group in terms of age structure and dialysis parameters.

	N	Average	Minimum	Maximum	SD
Patients' age [in years]	150	64,04	30	87	12,57
URR [%]	150	71,78	53	84	5,95
Kt/V	150	1,45	0,96	2,08	0,22
Urea before HD [mg%]	150	133,78	47,20	203,00	39,68
Urea after HD [mg%]	150	38,32	12,10	82,30	14,60

RESULTS

When analyzing the correlations obtained between indicators of dialysis adequacy (Kt/V, URR) and the urea concentration and the life quality of patients undergoing hemodialysis in the SF-36 scale, two statistically significant correlations were observed ($p<0.05$). It was found that the

TABLE 2. Correlation between the indicators of hemodialysis dose and the SF-36 scale (N=150).

SF-36 factors	Kt/V		URR ratio		Urea before HD		Urea after HD	
	R	P	r	p	r	p	r	p
Influence of health problems on social functioning	0,10	0,444	0,04	0,733	0,03	0,88	0,08	0,694
Limitations of physical functioning	0,14	0,111	0,18*	0,046	-0,06	0,735	-0,21	0,226
Role limitations due to physical health	-0,04	0,679	-0,10	0,296	0,10	0,574	0,07	0,696
Role limitations due to emotional problems	0,05	0,574	0,02	0,867	0,07	0,681	-0,04	0,811
Pain	0,05	0,586	0,03	0,775	0,10	0,575	0,00	0,98
Fatigue	-0,05	0,549	-0,07	0,423	0,34*	0,049	0,31	0,073
Deficiency of emotional well being	0,15	0,092	0,11	0,21	0,16	0,357	0,06	0,757
Perception of ones' own general health	0,12	0,172	0,16	0,084	-0,05	0,769	-0,11	0,543

* Correlation significant at $p<0.05$

urea level prior to hemodialysis moderately strongly correlated with life energy deficit (r=-0.34, p=-0.049) and that the values of urea reduction ratio URR weakly correlated with the patient's conviction on restricting life's activity (r=0.18, p=0.046) (Table 2).

When analyzing the correlations between hemodialysis parameters (Kt/V, URR) and urea concentration and the quality of sleep of patients treated with hemodialysis measured using the seven factors of the PSQI scale, only one statistically significant correlation was identified. It was observed that the level of urea prior to dialysis correlated positively with the time of falling asleep (r=-0.39, p=0.023). This correlation suggests, that higher urea values measured before HD is conductive to problems with falling asleep (Table 3).

When analyzing, in accordance with the research procedure, the correlation between SF-36 and PSQI and sociodemographic data it was stated that the respondents declaring a higher education level in the 3 point scale (primary, secondary and higher education) declared lower levels of physical activity limitation and fulfilling social roles and also to a smaller extent they felt limited in their life activities and pain experience (Table 4).

When analyzing the obtained correlations between the subjective evaluation of sleep (PSQI) and age and education of patients, three statistically significant relationships were observed. Among patients treated with chronic hemodialysis along with advancing age, the incidence of sleep disorders increased. On the other hand, two statistically significant correlations were recorded in relation to the education level of the respondents.

When analyzing the significance of differences based on gender, it was found that men maintained on chronic hemodialysis experienced greater limitations in performing social roles due to emotional problems than women (Table 5). While analyzing the significance of differences by gender of the respondents, no statistically significant differences between women and men with respect to the subjective assessment of sleep quality and sleep disorders according to the PSQI scale were observed.

DISCUSSION

Medical literature demonstrates the usefulness of URR in evaluating the effectiveness of dialysis, using this indicator in predicting the prognosis for patients on hemodialysis.

TABLE 3. Correlation between indicators of dialysis dose and factors of the PSQI scale (N=150).

PSQI scale factor	Kt/V		URR ratio		Urea before HD		Urea after HD	
	R	P	r	p	r	p	r	p
Subjective sleep quality (C1)	0,04	0,661	0,01	0,931	-0,03	0,861	-0,09	0,622
Sleep latency (C2)	0,09	0,315	0,05	0,595	0,39*	0,023	0,29	0,100
Sleep duration (C3)	0,00	1	-0,01	0,941	0,22	0,304	0,14	0,502
Habitual sleep efficency (C4)	-0,02	0,856	-0,04	0,661	0,15	0,487	0,07	0,740
Sleep disturbances (C5)	0,02	0,823	-0,06	0,504	0,02	0,898	-0,08	0,663
Use of sleeping medication (C6)	-0,09	0,327	-0,04	0,683	0,22	0,219	0,11	0,530
Daytime dysfunction (C7)	-0,01	0,929	-0,01	0,890	0,18	0,300	0,15	0,384
PSQI global score	0,02	0,811	0,01	0,942	0,27	0,117	0,12	0,505

* Correlation significant at p<0.05

TABLE 4. Relationship between the SF-36 scale factors and age and education (N=150).

SF-36 scale factors	Age		Education	
	R	P	r	P
Influence of health problems on social functioning	0,08	0,413	-0,02	0,808
Limitations of physical functioning	0,40***	0,001	-0,28***	0,001
Role limitations due to physical health	0,20*	0,021	-0,24***	0,004
Role limitations due to emotional problems	0,29***	0,001	-0,24***	0,004
Pain	0,12	0,175	-0,23**	0,009
Fatigue	0,13	0,138	-0,10	0,257
Deficiency of emotional well being	0,16	0,058	-0,07	0,383
Perception of one's own general health	-0,10	0,224	0,08	0,317

* Correlation significant at p<0.05
** Correlation significant at p<0,01
*** Correlation significant at p<0,005

TABLE 5. Significance of differences in the results of the SF-36 items depending on the gender of patients undergoing hemodialysis.

SF-36 scale factors	Women		Men		Test t	
	M	SD	M	SD	t	p
Influence of health problems on social functioning	3,28	1,14	3,47	1,13	-0,94	0,351
Limitations of physical functioning	43,42	13,11	41,88	13,61	0,69	0,491
Role limitations due to physical health	19,23	7,26	20,26	6,84	-0,87	0,385
Role limitations due to emotional problems	10,81	6,95	13,25	6,40	-2,18	0,031
Pain	7,49	2,05	7,40	2,92	0,21	0,831
Fatigue	15,46	4,09	15,38	3,78	0,13	0,895
Deficiency of emotional well being	16,51	5,01	16,16	4,03	0,46	0,646
Perception of one's own general health	17,46	3,93	16,90	4,33	0,81	0,420

The value of URR less than 60% is a factor of poor diagnosis and increased mortality [19]. For the optimal value of URR, the value of 65-70% has been assumed. In accordance with the current state of medical knowledge, for the patients undergoing hemodialysis 3 times per week, the minimum value of dialysis dose Kt/V should equal to 1.2, although it is recommended to reach the range of 1.3-1.4, which is a prerequisite for beneficial long-term results [19].

Up to date reports point to the existence of limited relationships between the indicators of hemodialysis adequacy and the factors of Quality of Life Scale SF-36 [1-15]. In a recent study conducted by Kalender and Tosun on 112 patients undergoing hemodialysis [15] statistically significant differences have been observed, although with a relatively weak force, between Kt/V and URR and role limitations due to emotional problems in the SF-36 scale. The same study also reports statistically significant positive correlation between the level of urea and vitality deficit. This latter relationship has been confirmed by our study. On the basis of the conducted research and on the analysis of previous reports, it should be noted that dialysis adequacy ratio is not a factor influencing to a large extent the quality of patients' life. Based on the conducted study a hypothesis can be made that a biomarker, which to a greater extent than the indicators of dialysis adequacy, correlates with the quality of patients' life is the urea level determined before hemodialysis. This hypothesis may be confirmed by achieving a statistically significant correlation between this biomarker and the time of falling asleep determined according to the PSQI scale.

The factor modifying the life quality of patients on hemodialysis proved to be age and education. The conducted study confirms the reports made in the field of health psychology that with age a negative perception of ones' own illness increases, in consequence leading to lowering of life quality level. It is worth to note that people with lower education perceive their life quality as worse in comparison to others. A difference between women and men, which has been found in the study, should also be underlined in terms of role limitations due to emotional problems. These observations should provide a rationale for taking action in the sphere of psychological support in groups of people under chronic hemodialysis.

CONCLUSIONS

1. Patients with lower urea level before hemodialysis have a significantly higher vitality level.
2. Higher fluctuations of urea concentrations before and after hemodialysis (higher urea reduction ratio URR) are associated with restrictions of physical activity in hemodialysis patients.
3. Education is a variable correlating to a more positive extent with life quality evaluation.
4. Higher age positively correlates with lower levels of life's quality among patients maintained on chronic hemodialysis.
5. Men on chronic hemodialysis experience greater limitations in performing social roles due to emotional problems than women.

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