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Assessment of Fatigue Severity, Mood, and Quality of Life in Post-polio Syndrome: A Controlled Study

Post-polio Sendromunda Yorgunluk Şiddeti, Duygudurum ve Yaşam Kalitesinin Değerlendirilmesi: Kontrollü Çalışma

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ABSTRACT Objective: This study aims to assess fatigue, quality of life, anxiety, and depression in post-polio syndrome (PPS) patients compared to healthy controls. **Material and Methods:** This cross-sectional study included 20 PPS patients and 20 healthy controls. Fatigue severity was measured utilizing the Fatigue Severity Scale (FSS), while quality of life was evaluated through the Short Form-36 (SF-36). Additionally, depression and anxiety levels were assessed using the Hospital Anxiety and Depression Scale (HADS). Pain intensity over the past month was evaluated using the Visual Analog Scale. **Results:** PPS patients exhibited higher rates of fatigue (70%) compared to the healthy control group (45%). FSS scores were significantly elevated in the PPS group compared to controls (p:0.031). HADS depression scores were also higher in the PPS group than in controls (p:0.003). While the HADS anxiety scores were elevated in the PPS group compared to controls, the disparity did not reach statistical significance (p>0.05). SF-36 assessments indicated significantly worse scores in all quality of life subparameters for the PPS group (p<0.05). A positive correlation was observed between FSS scores and age (rho: 0.618, p: 0.004) and the duration of polio (rho:0.606, p: 0.005). Additionally, a negative correlation was observed between FSS scores and the SF-36 social functioning subparameter (rho:-0.475, p: 0.034). **Conclusion:** This study shows significantly higher fatigue and depression rates in PPS patients compared to controls, along with lower quality of life. In PPS patients, fatigue was positively correlated with age and polio duration, and negatively with social functioning subparameter.

Keywords: Polio; fatigue; depression; anxiety; quality of life

ÖZET Amaç: Bu çalışma, post-polio sendromu (PPS) hastalarında yorgunluk, yaşam kalitesi, anksiyete ve depresyon düzeyinin değerlendirilmesi ve bulguların sağlıklı gönüllülerle karşılaştırılmasını amaçlamaktadır. **Gereç ve Yöntemler:** Bu kesitsel kontrollü klinik çalışmaya, 20 PPS'li hasta ve 20 sağlıklı gönüllü dâhil edildi. Yorgunluk şiddeti, Yorgunluk Şiddet Ölçeği [Fatigue Severity Scale (FSS)], yaşam kalitesi Kısa Form-36 [Short Form-36 (SF-36)] ile anksiyete ve depresyon düzeyleri ise Hastane Anksiyete ve Depresyon Ölçeği [Hospital Anxiety and Depression Scale (HADS)] kullanılarak değerlendirildi. Son 1 aydaki ağrı şiddeti Görsel Analog Ölçeği kullanılarak ölçüldü. **Bulgular:** PPS hastalarında, sağlıklı kontrol grubuna (%45) kıyasla daha yüksek oranda yorgunluk (%70) saptandı. PPS grubunda FSS skorları kontrollere göre anlamlı derecede yüksekti (p: 0,031). HADS depresyon skorları da PPS grubunda kontrollere göre daha yüksek bulundu (p: 0,003). HADS anksiyete skorları, PPS grubunda kontrollere göre daha yüksek olmasına rağmen aradaki fark istatistiksel olarak anlamlı değildi (p>0,05). SF-36 değerlendirmeleri, PPS grubu için tüm yaşam kalitesi alt parametrelerinde anlamlı derecede daha düşük skorlar olduğunu gösterdi (p<0,05). FSS skorları ile yaş (rho: 0,618; p: 0,004) ve polio süresi (rho: 0,606; p: 0,005) arasında pozitif, SF-36 sosyal fonksiyon alt parametresi (rho: -0,475, p: 0,034) arasında negatif korelasyon gözlendi. **Sonuç:** Bu çalışma, kontrollere kıyasla PPS hastalarında anlamlı derecede yüksek yorgunluk ve depresyon oranlarının olduğunu ve yaşam kalitesinin PPS grubunda daha düşük olduğunu ortaya koymaktadır. PPS'li bireylerde yorgunluk düzeyi, yaş ve polio süresi ile pozitif, sosyal fonksiyon alt parametresi ile negatif korele bulunmuştur.

Anahtar Kelimeler: Polio; yorgunluk; depresyon; anksiyete; yaşam kalitesi

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Poliomyelitis is a highly contagious viral infection primarily caused by the poliovirus. Although the majority of patients experience an asymptomatic course, there are three symptomatic clinical presentations known as abortive poliomyelitis, non-paralytic poliomyelitis, and paralytic poliomyelitis.[1] Paralytic poliomyelitis is the most severe form characterized by flaccid paralysis in various muscle groups and loss of deep tendon reflexes, occurring in less than 1% of patients.[2]

Post-polio syndrome (PPS) was described by Halstead and Rossi in 1985 as a disorder arising 15 years or more following a polio infection. It is marked by intense muscle and joint pain, muscle weakness, and fatigue.[3] Additionally, psychosocial issues such as sleep problems, depression, and negative thoughts related to the existing condition are often associated with PPS.[4] Studies evaluating cases presenting to hospitals have reported PPS prevalence between 69-92%.[5]

The pathogenesis of PPS is not fully understood, but the most widely accepted theory involves the degeneration of nerves distal to a limited number of expanded motor units in individuals who have had polio, leading to muscle weakness.[6]

Fatigue is one of the most commonly observed symptoms of PPS. Studies in the literature have reported fatigue prevalence in PPS to range between 34-93%.[7,8] Fatigue observed in PPS is characterized by rapid tiredness related to activity and muscle weakness. One of its most prominent features is the need for a prolonged recovery period after exercise. Progressive fatigue is reported in 60-90% of patients.[3,9] It usually starts abruptly shortly after physical activity and is associated with psychological, cardiorespiratory, or muscular factors. This sudden onset fatigue has been termed the "polio wall" and may be associated with a general feeling of fatigue unrelated to a specific activity.[10] In individuals with PPS, there can be a correlation between the severity of fatigue and depression and anxiety.[11]

Fatigue and the resulting lack of physical activity not only impact the quality of life for individuals with PPS but also lead to additional problems such as increased body mass index, cardiovascular issues, and dyslipidemia.[4] The objective of this study is to assess and compare the level of fatigue among individuals with PPS and healthy controls, and to examine the correlation between fatigue and quality of life, as well as emotional well-being.

MATERIAL AND METHODS

STUDY DESIGN

The clinical cross-sectional study included 20 patients being monitored with a diagnosis of PPS and 20 healthy volunteers from the outpatient clinics of University of Health Sciences, İstanbul Physical Medicine and Rehabilitation Training and Research Hospital, and Beylikdüzü State Hospital. The diagnosis of PPS had been made based on the March of Dimes diagnostic criteria.[12] The study excluded individuals who were using medications intended to boost physical performance or alleviate fatigue, as well as those with fibromyalgia, chronic fatigue syndrome, chronic decompensated cardiac, renal or hepatic insufficiency, rheumatological disorders, documented psychiatric conditions, or known presence of other neurological disorders. The research was conducted from January 21, 2024, to February 21, 2024. The relevant ethics committee approval has been obtained prior to the commencement of the study from Istanbul Physical Medicine and Rehabilitation Training and Research Hospital Ethics Committee. (date: 21 November 2023; no: 2023-05). The study was conducted in accordance with the Declaration of Helsinki.

The study collected sociodemographic information from patients, including age, gender, height, weight, body mass index, education level, and occupation. Additionally, data regarding the age of onset of polio, duration since polio contraction, and any concurrent medical conditions were also documented. The use of assistive devices, the presence of limb shortening, and the history of orthopedic surgery were also noted. The presence of any musculoskeletal pain in any part of the body in the last month was asked. Furthermore, pain intensity was evaluated utilizing the Visual Analog Scale (VAS), while the Fatigue Severity Scale (FSS) was utilized to assess the severity of fatigue.[13] For the assess-

ment of emotional well-being, the Hospital Anxiety and Depression Scale (HADS) was utilized.[14] Quality of life was evaluated using the Short Form-36 (SF-36).[15]

FSS

In our study, the Turkish version of the FSS, whose validity and reliability have been established for assessing the level of chronic fatigue in both the PPS and healthy groups, was preferred.[16] This scale consists of nine items evaluating both the severity of fatigue and its influence on individuals. Each item is rated on a scale from zero to seven, where these values respectively represent "completely disagree" and "completely agree". The total score is calculated through the arithmetic mean of the scores given to the items. The minimum possible score is zero, and the maximum score is seven. A higher total score indicates a higher level of fatigue. According to the determined cut-off value for FSS, scores of 4 and above indicate the presence of fatigue.[13]

SF-36

The Turkish validity and reliability study of this scale, used for assessing quality of life, was conducted by Koçyiğit et al. in 1999.[17] The scale comprises 36 items that inquire about parameters such as physical function, social situation, limitations in activities, pain, and emotional well-being.

HADS

The HADS Turkish validity and reliability study was conducted by Aydemir et al. in 1997.[18] This scale is a 14-item assessment method that queries symptoms associated with anxiety and depression, with seven items for each. Patients are asked to give a score between zero to three for each question. The maximum score that can be obtained is 21 for both anxiety and depression. The defined cut-off value for the depression subscale is seven, and for the anxiety subscale, it is ten. Scores of eight and above indicate the presence of significant depression, while scores of 11 and above indicate the presence of significant anxiety.[18]

VAS

To assess the level of pain experienced by the patient anywhere in the body in the last month, the VAS was utilized.[19] According to the VAS scale, zero represents no pain, and 100 represents the most severe level of pain on a linear scale.

STATISTICAL ANALYSIS

In our investigation, we examined the normal distribution of data through the Shapiro-Wilk test. Quantitative data were presented with mean and standard deviation or minimum, maximum, and median values, while qualitative data were expressed with percentage and frequency values. In the research involving two independent groups, the association among independent quantitative variables was assessed using the independent two-sample t-test when the data exhibited a normal distribution. Alternatively, the Mann-Whitney U test was employed when the data did not adhere to a normal distribution pattern. The relationship between independent categorical variables was assessed using the chi-square test. The correlation between the data was demonstrated by Spearman correlation analysis based on the distribution. A p-value less than 0.05 was considered statistically significant.

RESULTS

Descriptive statistics for the data are provided in detail in Table 1. There was no statistically significant variance between the two groups in terms of gender, age, height, weight, educational attainment, or employment status ($p>0.05$).

Fatigue, anxiety, depression, and quality of life scores for the polio and control groups are presented in Table 2. The FSS scores were significantly higher in the PPS group compared to the control group ($p=0.031$). In this study, 14 individuals (70%) in the PPS group and nine individuals (45%) in the healthy control group had FSS scores ≥4. Anxiety scores assessed with HADS did not show a significant difference between the two groups ($p=0.150$). However, depression scores were significantly higher in the PPS group ($p=0.003$). Anxiety sub-scores of 11 and above were found in seven patients (35%) in the PPS group and three patients (15%) in the healthy group. Depression sub-scores of 8 and above were observed in seven patients (35%) with PPS and three patients (15%) in the control group. The PPS group exhibited significantly lower scores across all categories assessed by

TABLE 1: Descriptive statistics.

		PPS				Control group				
		X̄±SD/n(%)		Median	Minimum-maximum	X̄±SD/ n(%)		Median	Minimum-maximum	p value
Gender	Female	13	65%			13	65%			1.000[X2]
	Male	7	35%			7	35%			
Age		42.6±10.9		44	(19-60)	37.8±11.8		35	(20-60)	0.186[t]
Height (cm)		160.5±10.4		165	(139-178)	166.8±10.3		167	(150-184)	0.095[m]
Weight (kg)		64.4±9.9		65	(44-90)	68.3±13.5		68	(45-90)	0.298[t]
Education	None	3	15%			0	0%			0.495[X2]
	Primary school	5	25%			5	25%			
	Middle school	2	10%			3	15%			
	High school	6	30%			7	35%			
	University	4	20%			5	25%			
Employment status	Unemployed	8	40%			6	30%			0.507[X2]
	Employed	12	60%			14	70%			
Pain	No	6	30%			14	70%			0.011[X2]
	Yes	14	70%			6	30%			
Polio duration (year)		40.8±12.24								
Assistive device usage	No	4	20%							
	Yes	16	80%							
Lower limb shortening	No	6	30%							
	Yes	14	70%							
Orthopedic surgery	No	12	60%							
	Yes	8	40%							

[t]Independent sample t-test; [m]Mann-Whitney U test; [X2]Chi-square test; SD: Standard deviation; PPS: Post-polio syndrome.

the SF-36, including physical functioning, role limitations due to physical and emotional health issues, vitality, mental health, social functioning, bodily pain, and general health (Table 2). The area of quality of life most notably impacted was role limitations due to physical health issues. The impact on mental health was relatively less pronounced. Regarding pain, when the patient and healthy groups were queried, 14 individuals (70%) in the PPS group reported pain in various parts of the body, while in the healthy control group, six participants (30%) reported experiencing pain ($p<0.05$) (Table 1). Median values for pain intensity measured with VAS were 75 (10-100) in the PPS group and 30 (0-90) in the control group (Table 2).

Among PPS patients, a statistically significant positive correlation was observed between FSS scores and age (rho: 0.618, p: 0.004), as well as between FSS scores and the duration of polio (rho: 0.606, p: 0.005). However, no significant relationships were found between FSS scores and levels of depression or anxiety disorder. There was a significant negative correlation between FSS scores and social function, one of the SF-36 parameters (rho: -0.475, p: 0.034) (Table 3).

DISCUSSION

In this study, the fatigue rate measured by FSS in individuals with PPS was 70%, while in the control group, this rate was determined as 45%. The fatigue level in the PPS group was markedly higher compared to that of the control group ($p<0.05$). Previous studies have also reported higher levels of fatigue in individuals with PPS compared to controls.[4,20-22] A study conducted by Schanke et al. in Norway, involving 276 individuals who had experienced polio and were surveyed through letters, reported a fatigue rate of 67.9%.[21] Furthermore, in another study conducted in a subsequent period, similar results were obtained, and it was suggested that physical fatigue posed a greater problem than mental fatigue.[23] On et al. found that the severity of fatigue in patients diagnosed with PPS was significantly higher than in individuals who

TABLE 2: Differences in fatigue, emotional status, and quality of life in PPS and the healthy controls.

	PPS		Control		
	Median	Minimum-maximum	Median	Minimum-maximum	P[m]
FSS	5.2	(2.22-6.11)	3.4	(1.11-5.88)	**0.031**
Anxiety	7	(0-18)	5	(2-16)	0.150
Depression	7	(2-11)	3	(1-9)	**0.003**
VAS	75	(10-100)	30	(0-90)	**0.001**
SF-36 PF	37.5	(0-90)	90	(75-100)	**0.000**
RP	0	(0-100)	100	(25-100)	**0.000**
RE	33.3	(0-100)	83,3	(33.3-100)	**0.003**
VT	50	(25-88)	80	(35-88)	**0.001**
MH	62	(36-88)	76	(48-88)	**0.016**
SF	50	(0-100)	81.3	(37.5-100)	**0.006**
BP	36.5	(0-100)	90	(45-100)	**0.000**
GH	53.5	(10-97)	80	(35-97)	**0.000**

PPS: Post-polio syndrome; FSS: Fatigue Severity Scale; VAS: Visual Analogue Scale; SF-36: Short Form-36; PF: Physical functioning; RP: Role physical; RE: Role emotional; VT: Vitality; MH: Mental health; SF: Social functioning; BP: Bodily pain; GH: General health; [m]Mann-Whitney U test.

TABLE 3: Correlation between FSS scores and other parameters.

	FSS	
	rho	p value
SF-36 GH	-0.168	0.479
BP	-0.048	0.84
SF	**-0.475**	**0.034**
MH	-0.114	0.631
VT	-0.230	0.330
RE	0.207	0.381
RP	-0.141	0.554
PF	-0.179	0.451
VAS	-0.097	0.684
Depression	0.415	0.069
Anxiety	0.306	0.189
Polio duration (year)	**0.606**	**0.005**
Age	**0.618**	**0.004**

FSS: Fatigue Severity Scale; SF-36: Short Form-36; GH: General health; BP: Bodily pain; SF: Social functioning; MH: Mental health; VT: Vitality; RE: Role emotional; RP: Role physical; PF: Physical functioning; VAS: Visual Analogue Scale; Spearman correlation.

had experienced polio but did not have PPS and healthy controls.[24] In a study by Bruno et al. involving 373 post-polio patients, they reported a fatigue rate of 91%, while in the control group, this rate was 15%.[22]

In this study, it was observed that nearly half of the control group also experienced fatigue. In a previous study, the fatigue rate in the general population was reported to be 10-20%.[25] This result suggests that fatigue can affect broader populations in today's context.

In this study, individuals with PPS exhibited lower scores in various domains of quality of life, including physical function, limitations due to emotional and physical reasons, energy and vitality, mental health, social function, general health perception, and perceived pain, compared to healthy controls. In a study by On et al., it was reported that fatigue in individuals with PPS significantly affected their quality of life, causing substantial problems in physical and psychosocial domains, while not significantly impacting the mental domain.[24] In their examination of quality of life using SF-36 in PPS, Gusi et al. observed decreased scores in physical function, pain level, general health perception, and vitality compared to the healthy group.[4] However, they indicated that scores in physical and emotional role limitations, social function, and mental health were comparable to the control group. In our study, all these parameters exhibited lower scores than those of the control groups, highlighting the most pronounced impact on quality of life in the domain of role limitations due to physical issues, with relatively lesser impact on mental health. Additionally, a significant negative correlation was found between fatigue and social function. No significant relationship was observed between fatigue and other quality of life parameters.

In a study conducted by Nollet et al. comparing 76 patients with PPS to 27 patients who had polio but did not develop PPS, it was reported that the PPS group had significantly worse outcomes in terms of physical mobility, energy, and perceived pain.[26] Additionally, the study suggested that disability in PPS patients was more pronounced in physical and social domains. In the same study, fatigue was reported as the primary problem in 78% of PPS patients. Other problems mentioned by patients included difficulty in outdoor walking (45%), difficulty in climbing stairs (41%), and pain (39%).

In a study conducted by Grimby et al. examining 59 patients with post-polio sequelae, they found that disability was more pronounced in mobility-related activities.[10] In patients with PPS, disability was reported to be particularly prominent in instrumental activities such as cooking, shopping, and cleaning. The same study suggested that the impact on the quality of life was less in mental, social, and emotional domains, but problems were still experienced in these areas. Westbrook and McDowell reported that the most commonly observed lifestyle change in PPS patients was a decrease in walking, with a rate of 33%.[27] Other affected activities included restrictions in social life, increased need for rest, decreased physical activities, and difficulty in performing household chores. Additionally, approximately half of the patients were reported to need changes in their work life. In their study, Einarsson and Grimby examined 41 patients who met PPS criteria and reported that the most challenging activity for patients was taking a bath.[28] Moreover, difficulties were suggested in daily life activities such as walking a few blocks, lifting heavy objects, and using public transportation.

Our study reported that 70% of individuals with PPS experienced pain, whereas the pain rate in the control group was 30%. In a study by Hammarlund et al. which involved 14 patients who had previously had polio, all patients except one reported experiencing pain during rest and movement.[29] The same study indicated that all patients experienced weakness, general fatigue, and muscle fatigue. In a study conducted by Bruno et al., it was reported that the incidence of muscle pain in individuals who had previously had polio was 72%, while in the control group, the same rate was 15%.[22]

In this study, depression scores measured by HADS in individuals with PPS were significantly higher compared to that of the healthy group's. However, there was no significant difference in terms of anxiety level between the groups ($p>0.05$). Depression was present in 35% of the PPS group, and anxiety was present in 35%. In the healthy group, both depression and anxiety rates were 15%. It is considered that depression is more common in individuals with PPS.[30] In the study by Schanke et al., a positive correlation between fatigue and both anxiety and depression levels was shown ($r=0.50$, $p<0.001$ and $r=0.36$, $p<0.05$, respectively).[11] In the study by Tate et al., it was suggested that individuals with polio survivors who have symptoms associated with depression experience more pain and physical symptoms.[31] In another study, the depression rate was found to be 57% and the anxiety rate was 69% in the group of patients who had polio. In the control group, these rates were reported to be 41-36%, respectively, and the difference was statistically significant.[22]

In this study, significant positive correlations were found between fatigue and age, disease duration, and the level of impairment in social function in individuals with PPS ($p<0.05$). On the other hand, no significant relationships were found between fatigue and depression level, anxiety disorder, and other parameters of quality of life ($p>0.05$). In previous studies, it has been suggested that there is no significant relationship between age and fatigue level in individuals who have had polio.[11,22] These results indicate that the fatigue observed in PPS patients is independent of mood.

Our study has both strengths and limitations. Among its strengths, all scales used in the study have undergone Turkish validation and reliability studies. The results of the PPS group have been objectively compared with those of a control group. Additionally, face-to-face interviews with both patient and control groups have ensured a more accurate assessment. However, a limitation of our study is the relatively small sample size. Conducting research with a larger number of participants would provide more enlightening results.

CONCLUSION

In conclusion, this study identified higher rates of fatigue, depression, and lower quality of life in individuals with PPS compared to the healthy control group. Factors associated with fatigue included age, the time elapsed since polio, and impaired social functioning. The most significant deteriorations in the quality of life in PPS were observed in the physical and functional domains, with less impact on mental health.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

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