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European Journal of Physical and Rehabilitation Medicine 2017 February;53(1):105-13
DOI: 10.23736/S1973-9087.16.04158-7

ORIGINAL ARTICLE

The role of psychological well-being in multiple sclerosis rehabilitation

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ABSTRACT

BACKGROUND: In patients affected by multiple sclerosis (MS) the disabilities increase during the progression of the disease, with a negative impact on quality of life. Rehabilitation improves motor performances, but remains unclear the role of psychological variables on motor recovery.
AIM: The aim of this study was to investigate the role of the psychological well-being during a rehabilitation care in MS patients with moderate to severe disability.
DESIGN: Longitudinal study.
SETTING: Outpatients in a Neurorehabilitation Unit of Pisa and Ferrara University Hospital.
POPULATION: 93 subjects affected by MS with moderate to severe degree of impairment were recruited (43 male, 50 female; mean age 53±11.19 years). In relation to the Expanded Disability Status Scale (EDSS) score the sample was divided in two group: Group 1 with moderate impairment (EDSS 4-5.5) and Group 2 with severe impairment (EDSS 6-7).
METHODS: Psychological and functional status was assessed before and after a motor rehabilitative treatment, appropriate to their clinical needs. Parameters collected were: Short Form 36, Patient Health Questionnaire, Fatigue Severity Scale, 6-minute walking test and 10-meter walking test.
RESULTS: Mood disorders, low quality of life (QoL) and high perceived fatigue are characteristic symptoms in our sample. Results do not show a direct correlation with motor impairment. Mood improves in both groups, while walking endurance and speed ability recovers only in Group 1, on the contrary QoL improves only in Group 2. Regression analysis show that in Group 1 a better QoL predicts a higher motor recovery, whereas in Group 2 the improvement of walking endurance influences the subjective well-being at the discharge.
CONCLUSIONS: Subjective well-being is related with the perception of the new condition of life. In less impaired patients psychological status can influence the liability toward rehabilitation treatment, while in more impaired patients motor recovery affect well-being. Therefore, the psychological counselling should be provided during the rehabilitation treatment in order to achieve a successful patients' care.
CLINICAL REHABILITATION IMPACT: Our approach contributes to bring out the role of subjective factors on motor rehabilitation outcome and the functional recovery effect on the psychological well-being. The knowledge of subjective needs related to disability degree should be used to customize an appropriate care in MS patients.

(*Cite this article as:* Fanciullacci C, Straudi S, Basaglia N, Chisari C. The role of psychological well-being in multiple sclerosis rehabilitation. Eur J Phys Rehabil Med 2017;53:105-13. DOI: 10.23736/S1973-9087.16.04158-7)

Key words: Multiple sclerosis - Quality of life - Attitude - Fatigue - Neurological rehabilitation.

Multiple sclerosis (MS) is a chronic inflammatory disease considered to be of autoimmune origin and characterized by neurodegeneration of the central nervous system (CNS), affecting the white matter, cortex and deep gray matter.[1] MS primarily affects adults, with an age of onset typically between 20 and 40 years, and is more common in women than in men. The course of MS is difficult to predict, and the disease may, at times, either lie dormant or progress steadily.[2]

MS can cause a variety of symptoms, including changes in sensation, visual problems, muscle weakness, difficulties in coordination and speech, severe fatigue, cognitive impairment, problems with balance, overheating and pain.

In MS patients motor ability is also impaired by fatigue and bodily pain;[3, 4] fatigue leads to a decrease in physical activity, which leads to impaired fitness.[5] This scenario may be an important reason for encouraging physical activity programs in people with MS.

Despite the paramount of symptoms characterizing the disease, few studies investigated the psychosocial aspects of the disease and how these patients perceive their own quality of life (QoL).

Several studies have documented high rates of mood and anxiety disorder in MS,[6, 7] more prevalent than in patients with other chronic neurological diseases.[8, 9] A delay in MS diagnosis and greater disability at the time of the diagnosis has also been associated with low psychological well-being, reduced quality of life and increased risk of suicidal ideation.[10, 11] In this scenario we need to take in account the psychological well-being as an aspect concerning MS patients' management and the subjective and multidimensional concept of QoL.

However, total level of physical activity has been shown unrelated to psychological status, self-efficacy, perceived barriers, and social support from family members and friends in MS.[5] Therefore we cannot disregard a specific aspect of perceived well-being: the difficult of patients to engage their selves in self-management behaviors during activities of daily living.[12]

The aim of the present study is to investigate the relationship between physical and psychological aspects during a rehabilitation treatment. More specifically, the main interest is to seek the possible role of clinical and subjective factors on motor recovery and to observe if the functional improvement affects psychological status at the discharge.

Materials and methods

A total of 93 MS patients (43 male and 50 females, mean age 53±11.19 years, 15±7.73 years of disease duration) diagnosed according with McDonald *et al*. criteria (2001) [13] were enrolled for a longitudinal study at Pisa and Ferrara University Hospitals.[14-16] Specifically, only 81 of them undergone rehabilitation clinical trials according to their disability degree: 29 patients (Group 1: Expanded Disability Status Scale [EDSS] 4-5.5) received a task-oriented circuit training or usual care [15, 16] and 52 patients (Group 2: EDSS 6-7) received Robot-assisted gait training or conventional physiotherapy.[14] The task oriented circuit training was organized in several stations in which patients were asked to: overcome an obstacles course; achieve various targets placed at different heights sights on a mirror with the feet, walk along a 10 meter long line drawn on the ground, climb and descend stairs. Robotic training was performed using the Lokomat gait trainer (Hocoma, Volketswil, Switzerland): the patient wear a harness attached to a system to provide body weight support and he walk on a treadmill with the help of a robotic-driven gait orthosis. The training is characterized by a progressive adjustments in the assistance provided by the driven-gait orthosis: the amount of body weight support and the treadmill speed. Conventional therapy consisted in training sessions focused on locomotor function improvements. The subjects performed lower-limb and core stretching exercises to increase muscles flexibility; lower-limb muscles strengthening exercises tailored on their baseline characteristics and a train on walking abilities (like walking at different speeds, rapid changes directions) with or without assistive aids.[14] The drop out of 12 patients was caused by organization reason.

Each patient was evaluated before treatment (T0) and at the end (T1) (Figure 1). Inclusion criteria were: 1) age 18 or older; 2) diagnosis of primary or secondary progressive multiple sclerosis; 3) moderate to severe gait impairments referred to EDSS between 4.0 and 7.0; 4) lack of global aphasia or significant cognitive deficits (>24 score at the Mini Mental State Examination); 5) perfect awareness of motor and visual impairments evaluated using a methodology described by Bisiach *et al*.[17] Exclusion criteria were 1) neurologic conditions in addition to MS, and 2) severe medical conditions.

The research study has been reviewed by the Pisa University Hospital and Ferrara University Hospital (study n. 3297/2011, approved in CE session on 26-05-2011) Ethics Committee and all the participants were asked to carefully read and sign an informed consent.

Outcome measures

Short Form 36 (SF-36)

It is an assessment tool of health-related QoL, consisting of eight subscales: Physical functioning (PF),

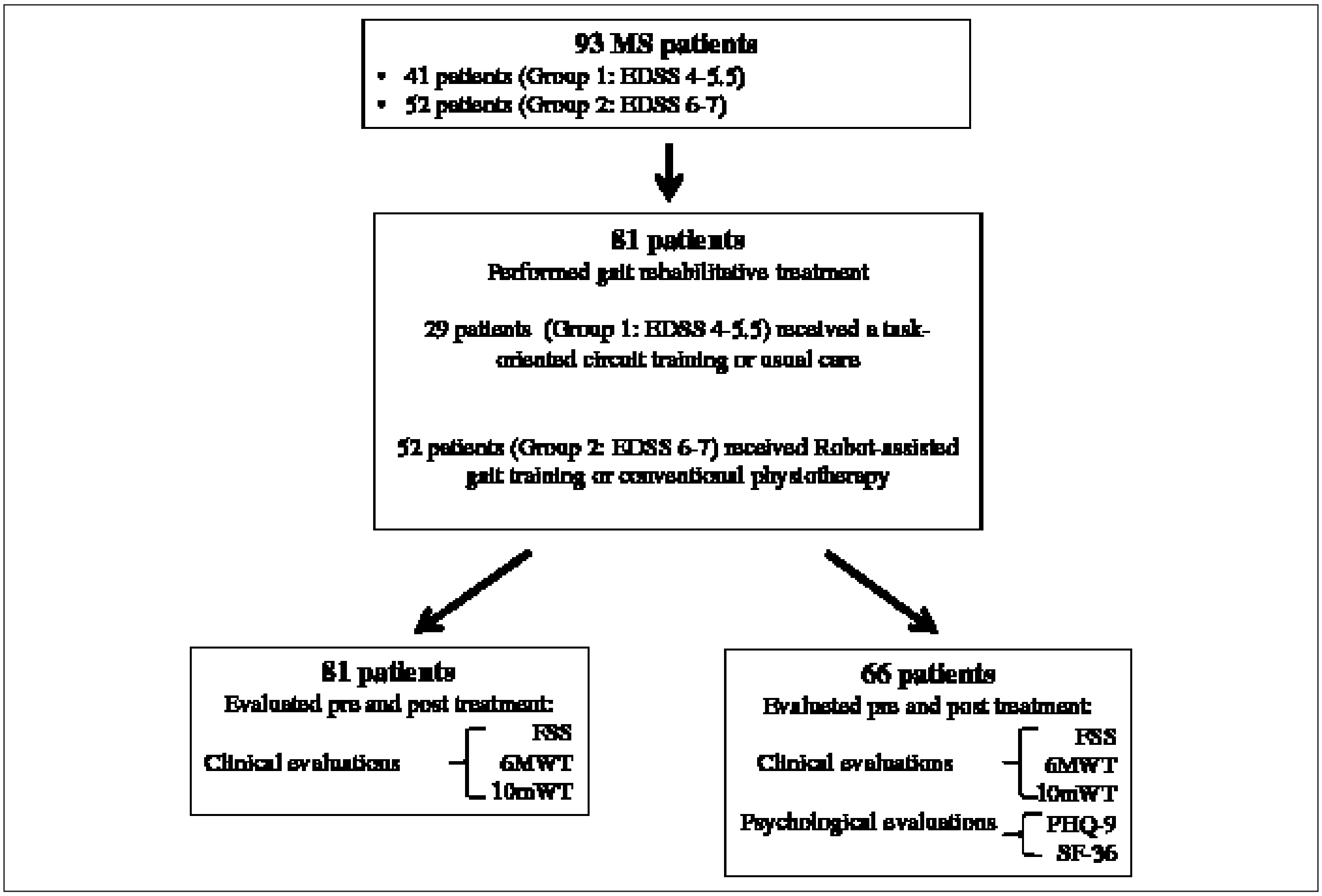

Figure 1.—Flow chart of patients' recruitment.
MS: multiple sclerosis; EDSS: Expanded Disability Status Scale; 6MWT: six-minute walking test; 10mWT: 10-meter walking test; FSS: Fatigue Severity Scale; PHQ-9: Patient Health Questionnaire; SF-36: Short Form 36.

Physical role functioning (PRF), Bodily pain (BP), General health perceptions (GHP), Vitality (VT), Social functioning (SF), Emotional role functioning (ERF) and Mental health (MH). Each subscale can be includes in a range from 0 to 100, suggesting respectively a bad to a good QoL. Moreover, SF-36 generates two synthetic indices: Physical Component Summary (PCS) and Mental Component Summary (MCS) Measures.[18] Their scores are normalized toward healthy population levels and a 50% score describes the cut-off.

Patient Health Questionnaire (PHQ-9)

It is a nine items mood scale, used to monitor the severity of depression and response to treatment;[19] 10 is the cut-off limit that underline the presence of clinical depression.

Fatigue Severity Scale (FSS)

FSS is a widely used scale to asses subjective fatigue, consisting in a short questionnaire that requires the subject to rate his/her own level of fatigue in the last week.[20] The score range is between 0-7 and if is >5 describes a fatigue symptom correlated to Multiple Sclerosis Syndrome.

Six-minute walking test (6MWT)

Walking endurance assessment, subjects were instructed to "walk as far as possible in six minutes". Subjects walked up and down a 25-meter walkway without encouragement.[21]

10-Meter walking test (10MWT)

Gait speed assessment. Participants must ambulate 10 meters while being timed. A "flying start" is used where the subject may accelerate 2 meters before entering the timed 10-meter distance and 2 meters to decelerate afterwards. Speed is only calculated for the 10-meter distance between the "end zones".[22]

Statistical analysis

Descriptive statistic (mean, median, standard deviation) was used to describe sample at T0 and T1. Functional improvement was calculated by means of the score difference between T1 and T0 in clinical scales (6MWT and 10MWT) — Δ6MWT and Δ10MWT, respectively.

The sample was divided in 2 subgroup in relation to EDSS score: Group 1, with an EDSS score of 4-5.5, and Group 2, with an EDSS score of 6-7. The Mann-Whitney Test was performed in order to compare two groups scores at T0. The Wilcoxon Signed Ranks Test was also performed in each subgroup.

All the correlations (Spearman's R) among the scales and subscales were performed at both T0 and T1 in each group. Moreover, psychological scales at T0 and T1 were correlated with Δ6MWT and Δ10MWT.

A multivariate linear regression analysis was applied only on significant bivariate correlation to identify significant psychological predictors on motor rehabilitation and significant functional predictor of psychological well-being. Results of linear regression analyses are reported as R^2 value and adjusted beta and P values. Significance of statistical tests was set at P<0.05. Bonferroni correction was applied. Statistical analysis was performed by the use of the SPSS v.20.0 software (IBM Corp., Armonk, NY, USA).

Results

We evaluated 93 patients at T0 and 81 of them performed a gait rehabilitative treatment and were evaluated before and after treatment. FSS, 6MWT and 10MWT were obtained in all patients whereas PHQ-9 and SF-36 were only received from 69 patients. Clinical and demographical characteristics are summarized in Figure 1.

Clinical depression is evident in 26/69 (38%) patients at T0; at T1 mood disorder was highlighted only in 17 patients (P<0.01). In detail at T0 the 53% of Group 1 and the 29% of Group 2 showed a mood deflection, at T1 the 47% and 17% in Group 1 and 2 respectively (P<0.01) showed depression.

As regard the SF-36, at T0 67/69 patients showed a lower PCS and 36/69 a lower MCS respect to healthy subjects. At T1 the PCS did not show a significant change (P=0.101) while MCS showed an improvement: it was lower in 24/69 patients (P<0.01).

In detail, at T0 the 88% of the Group 1 performed a low PCS whereas the all group (100%) showed a lower value at T1 (P=0.448); the 100% of Group 2 showed a low PCS at both times (P=0.130). Regarding MCS we observed a mild improvement: in 65% and 59% of Group 1 (P=0.306) and in 48% and 27% of Group 2 was low at T0 and T1 respectively (P<0.05).

72/93 and 59/81 patients showed a FSS >5 at T0 at T1 respectively (P=0.155). In detail 42/52 patients at T0 and 41/52 patients at T1 showed a high level of fatigue in Group 1 (P=0.207), while Group 2 showed fatigue in 22/29 patients at T0 and 19/29 at T1 (P=0.498).

Regarding clinical scales, 6MWT improved (181.48±118.35 m and 196.07±124.46 m at T0 and T1, respectively; P<0.01). Group 1 performs 296.84±82.82 m at T0 and 323.81±77.1 m at T1 (P<0.01). Group 2 performs 115.88±78.62 m at T0 and 123.43±79.38 m at T1 (P=0.05).

10MWT does not improve significantly (28.75±38.56 s at T0 and 31.20±50.15 s, P=0.473). In detail, Group 1 improves significantly (10.61±3.41 s and 9.58±2.6 s at T0 and T1, respectively; P<0.05), while no significant changes are shown in Group 2 (39.48±45.4 s and 44.01±59.84 s at T0 and T1, respectively; P=0.680).

Analysis of the whole group

Correlations at T0 between disease characteristics and functional status

Concerning correlation of the whole group at T0, patients' age correlates negatively 10MWT (R=0.220, P<0.05) and FSS (R=0.236, P<0.05). Disease onset years correlate positively with 6MWT (R=0.262, P<0.05) and negatively with 10MWT (R=-0.200, P<0.01).

EDSS correlates negatively with PF (R=-0.622,

P<0.01), PCS (R=-0.285, P<0.05), 6MWT (R=-0.864, P<0.01) and positively with 10MWT (R=0.788, P<0.01). PF and PCS correlates negatively with 10MWT (R=-0.622, P<0.01, and R=-0.285, P<0.05, respectively) and positively with 6MWT (R=0.638, P<0.01, and R=-0.328, P<0.01, respectively.

Psychological well-being, mood and fatigue interactions

Regarding psychological scales, PHQ correlates negatively with SF-36 subscales: PRF(R=-0.468, P<0.01), BP (R=-0.436, P<0.01), GHP (R=-0.398, P<0.01), VT (R=-0.657, P<0.01), SF (R=-0. 554, P<0.01), ERF (R=-0.572, P<0.01), MH (R=-0.755, P<0.01), and with MCS (R=-0.767, P<0.01), and is positively correlated with FSS (R=-0.375, P<0.01). FSS is negatively correlated with SF-36 subscales: PF (R=-0.299, P<0.05), PRF (R=-0.310, P<0.05), BP (R=-0.305, P<0.05), VT (R=-0.453, P<0.01), SF (R=-0.464, P<0.01), MH (R=-0.268, P<0.05) PCS (R=-0.271, P<0.05) and MCS (R=-0.308, P<0.05).

Correlation between functional improvement and psychological status

At T0 no significant correlation were showed between psychological scales and Δ6MWT and Δ10MWT, respectively. Δ6MWT is positively correlated with ERF (R=0.260, P<0.05) and negatively with FSS (R=-0.214, P<0.05) at T1. Moreover Δ10MWT is positively correlated with GHP (R=-0.318, P<0.01) and MH (R=-0.261, P<0.05).

Analysis of the two groups relatively to disability degree

In relation to the EDSS score the sample was divided in two group: moderate impairment (EDSS 4-5.5) and severe impairment (EDSS 6-7). Observing the statistical groups differences at T0, significant dissimilarities are shown in 6MWT and 10MWT (P<0.01) and in PF and PCS (P<0.05) but not in Δ6MWT (P=0.17) and Δ10MWT (P=0.25). No differences were founded in fatigue and PHQ-9 (Tables I, II).

Table II.—*Predictors of functional improvement (regression model 1): regression analysis.*

	Outcome variable	R^2	Predicting variable	Standardized	
				β	P value
Group 1	Δ6MWT	0.571	PF	0.627	0.038
			BP	-0.818	0.021
			ERF	-0.053	0.866
			MH	-0.240	0.418
Group 2	Δ6MWT	0.162	PF	0.951	0.346
			BP	-0.458	0.649
			ERF	-1.168	0.249
			MH	2.294	0.026

6MWT: six-minute walking test; 10MWT: ten-meter walking test; PF: Physical functioning (SF-36 subscale); BP: Bodily pain (SF-36 subscale); ERF: Emotional role functioning (SF-36 subscale); MH: Mental health (SF-36 subscale).

Correlation analysis in Group 1

At T0, disease duration does not correlate with any variable.

PHQ-9 correlates negatively with SF-36 subscales PRF (R=-0.776, P<0.01), BP (R=-0.553, P<0.05), GHP (R=-0.617, P<0.01), VT (R=-0.641, P<0.01), SF (R=-0.844, P<0.01), ERF (R=-0.841, P<0.01), MH (R=-0.840, P<0.01), and MCS (R=-0.792, P<0.01).

FSS is negatively correlated with SF-36 subscales: PRF (R=-0.738, P<0.01), VT (R=-0.542, P<0.05), and PCS (R=-0.566, P<0.05). PF correlates positively with 6MWT (R=0.525, P<0.05); PCS correlates positively with 6MWT (R=0.617, P<0.01).

Table I.—*Predictors of functional improvement (regression model 1): correlation analysis.*

		Δ6MWT	Δ10MWT	FSS	PHQ	PF	PRF	GHP	VT	SF	ERF	MH	PCS	MCS
Gr1	Δ6MWT	1.000	-0.425*	-0.115	0.435	-0.116	-0.220	-0.257	-0.173	-0.450	-0.488*	-0.522*	-0.318	-0.471
	Δ10MWT	-0.425*	1.000	-0.048	-0.083	0.161	0.081	-0.215	-0.083	0.132	0.280	0.205	0.090	0.187
Gr2	Δ6MWT	1.000	-0.362*	-0.050	-0.080	0.310*	0.074	0.055	-0.171	0.107	0.048	0.366†	0.169	0.138
	Δ10MWT	-0.362*	1.000	0.033	0.025	-0.259	0.063	-0.141	0.022	-0.058	0.060	-0.296*	-0.041	-0.091

MS: multiple sclerosis; EDSS: Expanded Disability Status Scale; 6MWT: six-minute walking test; 10MWT: ten-meter walking test; FSS: Fatigue Severity Scale; PHQ: Patient Health Questionnaire; PF: Physical functioning (SF-36 subscale); PRF: Physical role functioning (SF-36 subscale); BP: Bodily pain (SF-36 subscale); GHP: General health perceptions (SF-36 subscale); VT: Vitality (SF-36 subscale); SF: Social functioning (SF-36 subscale); ERF: Emotional role functioning (SF-36 subscale); MH: Mental health (SF-36 subscale); PCS: Physical component summary; MCS: Mental component summary.
*P<0.05; †P<0.01.

Table III.—*Predictors of psychological status (regression model 2): correlation analysis.*

		Δ6MWT	Δ10MWT	FSS	PHQ	PF	PRF	BP	GHP	VT	SF	ERF	MH	PCS	MCS
Gr1	Δ6MWT	1.000	-0.425*	-0.021	0.244	-0.161	-0.152	-0.796 †	-0.030	0.130	-0.029	-0.292	-0.075	-0.368	-0.096
	Δ10MWT	-0.425*	1.000	0.064	0.028	0.110	-0.173	0.195	-0.396	-0.017	-0.098	0.016	-0.138	0.048	-0.089
Gr2	Δ6MWT	1.000	-0.362*	-0.075	-0.067	0.291*	0.108	0.119	0.082	0.085	0.300*	0.493 †	0.296*	0.056	0.344*
	Δ10MWT	-0.362*	1.000	-0.211	0.072	-0.022	0.022	-0.124	0.096	0.030	0.044	-0.094	0.033	0.005	0.027

MS: multiple sclerosis; EDSS: Expanded Disability Status Scale; 6MWT: six-minute walking test; 10MWT: ten-meter walking test; FSS: Fatigue Severity Scale; PHQ: Patient Health Questionnaire; PF: Physical functioning (SF-36 subscale); PRF: Physical role functioning (SF-36 subscale); BP: Bodily pain (SF-36 subscale); GHP: General health perceptions (SF-36 subscale); VT: Vitality (SF-36 subscale); SF: Social functioning (SF-36 subscale); ERF: Emotional role functioning (SF-36 subscale); MH: Mental health (SF-36 subscale); PCS: Physical component summary; MCS: Mental component summary.
*P<0.05; †P<0.01.

Table IV.—*Predictors of psychological status (regression model 2): regression analysis.*

	Outcome variable	R^2	Predicting variable	Standardized	
				β	P value
Group 1	FSS	0.003	Δ6MWT	0.54	0.790
	ERF	0.151		-0.389	0.123
	PF	0.004		-0.059	0.821
	MH	0.026		-0.161	0.538
	BP	0.501		-0.708	0.001
	SF	0.007		-0.081	0.757
	MCS	0.032		-0.179	0.491
Group 2	FSS	0.002	Δ6MWT	-0.047	0.745
	ERF	0.239		0.489	0.000
	PF	0.070		0.264	0.061
	MH	1.99		0.446	0.001
	BP	0.001		0.031	0.827
	SF	0.047		0.218	0.125
	MCS	0.186		0.431	0.002

6MWT: six-minute walking test; 10MWT: ten-meter walking test; FSS: Fatigue Severity Scale; ERF: Emotional role functioning (SF-36 subscale); PF: Physical functioning (SF-36 subscale); MH: Mental health (SF-36 subscale); BP: Bodily pain (SF-36 subscale); SF: Social functioning (SF-36 subscale); MCS: Mental component summary.

EDSS correlates negatively with SF-36 subscales PF (R=-0.736, P<0.01), BP (R=-0.605, P<0.05), with PCS (R=-0.736, P<0.01) and 6MWT (R=-0.397, P<0.05), but it correlates positively with 10MWT (R=0.339, P<0.05)

At T0, BP (R=-0.578, P<0.05), ERF (R=-0.488, P<0.05) and MH (R=-0.522, P<0.05) of SF-36 are negatively correlated with Δ6MWT (Tables III, IV). Moreover, in Group 1 Δ6MWT correlates with BP at T1 (R=-0.796, P<0.01) (Tables III, IV).

Correlation analysis in Group 2

At T0, disease onset years correlates positively with EDSS (R=0.293, P<0.05). PHQ-9 correlates positively with FSS (R=0.400, P<0.01) and negatively with SF-36 subscales: PRF (R=-0.351, P<0.01), BP (R=-0.430, P<0.01), GHP (R=-0.315, P<0.05), VT (R=-0.643, P<0.01), SF (R=-0.451, P<0.01), ERF (R=-0.456, P<0.01), MH (R=-0.680, P<0.01) and with MCS (R=-0.718, P<0.01). PF correlates negatively 10MWT (R=-0.613, P<0.01) and positively with 6MWT (R=-0.564, P<0.01), PCS correlates negatively with 10MWT (R=-0.282, P<0.05).

FSS is negatively correlated with SF-36 subscales: VT (R=-0.417, P<0.01), SF (R=-0.443, P<0.01), MH (R=-0.350, P<0.05) and MCS (R=-0.376, P<0.01).

EDSS correlates negatively with PF (R=-0.483, P<0.01), 6MWT (R=-0.744, P<0.01) and positively with 10MWT (R=0.718, P<0.01). Regarding motor outcome, in Group 2 PF and MH at T0 are positively correlated with Δ6MWT (R=0.310, P<0.05, and R=-0.366, P<0.01, respectively) and MH correlates negatively with Δ10MWT (R=-0.296, P<0.05) (Table III).

However, Δ6MWT is positively correlated with SF-36 at T1: PF (R=0.291, P<0.05), SF (R=0.300, P<0.05), ERF (R=-0.493, P<0.01), MH (R=0.296, P<0.05) and MCS (R=0.344, P<0.05) (Table III).

Predictors of functional improvement

Two regression models were created from significant correlation. The first model is characterized by SF-36 subscales MH, PF and ERF at T0 as predictors and Δ6MWT as dependent variable. The model is significant only in Group 1 (R^2=0.57, P<0.05) and two path of coefficients were statistically significant: functional improvement is positively influenced by an highest perception of PF (β=0.627) and negatively influenced by BP score (β=-0.85), that means that the lower was the pain the worse was the recovery (Table IV).

The second model is a linear regression between Δ6MWT and single psychological variables at T1: FSS, ERF, PF, MH, BP, SF and MCS. Δ6MWT positively influences ERF (β=0.489), MH (β=0.446) and MCS (β=0.431) in Group 2 (Table IV).

Discussion

The first information emerging from our study is that 38% of our MS sample shows a clinical mood flexion, according with previous studies describing a clinically significant depression that can affect up to 50% of patients with multiple sclerosis over the course of their lifetime.[7] This result can be discussed in relation to the psychosocial influence on mood. Several studies reveal that subjective variables as inadequate coping strategies, helplessness, loss of recreational opportunities, poor quality relationships, high levels of stress and fatigue are all implicated in depression. In fact literature describe that depression is most closely associated with mental and emotional well- being rather than physical functioning or pain.[23]

In this regard, observing the details of our two subgroups, no significant differences emerged in terms of mood. We could justify our data according to previous studies showing a high impact of MS diagnoses *per se* on the subjective well-being. It is known that these patients become vulnerable in connection with the initial symptoms being less concerned about physical disability.[24-26] After the diagnosis patients report a world of conflicting emotional reactions as shock, anxiety, fear, sadness, sorrow, anger, uncertainty, shame, loss of identity, abandonment or confidence, which may play a role in the future development of psychological impairment.[27] The perception of well-being is expressed with greater clarity in the subjective realization of quality of life. In this regard, our patients showed a decreased QoL. In particular, the whole group exhibited an impaired physical perceived QoL whereas the 50% of patients showed a lower mental well-being. Our result gives us important indications for the long-lasting handling of these patients. In fact actually in literature emerges the importance of Quality of life considered as patient-centered care measure, in which the patient's perspective is taken as the principal reference point, revealing aspects of illness that are of major concern to the patient.[28] In this regard, the low score in quality of life scale of our sample showed an awareness of their clinical condition. In particular. the well-being related to physical domains of QoL scale is more compromised and correspond to a greater motor disability and to a longer disease duration.

Nevertheless we can observe a not linear relation between MS per se and psychological status in our sample, whereas is clear the impact of motor symptoms on psychological well-being.

Furthermore, the perceived QoL and mood status of our sample does not show to be influenced from the disease duration while the latter is significantly related to all functional scales. Despite some studies emphasized the value of well-being to predict changes in disability status over a substantial period of time in patients with MS,[29] in our results no clear relation between them was observed. This result can be due to the difficulty of collect this information caused by sample of patients often lacking of homogeneity.[30] Our sample is composed by patients with different disability degree, age and life story, therefore the most common element in the sample appears to be the awareness of the difficulties in everyday life.

One of the most representative symptoms in our sample is fatigue. It is well-known that fatigue is one of the most common disabling symptoms in patients with multiple sclerosis.[31] Still, our data do not show a significant correlation among fatigue, physical impairment and functional ability, while fatigue is highly correlated with all domains of QoL. These results are in line with the literature that demonstrated no significant correlation between FSS scores and physical activity[5, 15] and no difference between the degree of severity of fatigue and the classification of disability.[32] Nevertheless, individuals with MS feel abnormal fatigability regardless of the stage and duration of the disease. This discrepancy can be explained by the FSS properties: it is a self-reported questionnaire, which assesses the subjective perception of symptoms and their impact on daily functioning.[31]

As for our two subgroups, the data showed no significant differences about psychological status and fatigue perception; conversely, physical impairment was significantly greater in Group 2. These findings could be explained by the fact that MS — notoriously a progressive and severely disabling disease — may have a very strong impact on patients at the time of the diagnosis and it is not related to real disability.[33] In this regard, the preservation of social integration and functional autonomy becomes one of the most important aspects to consider.

In this scenario, the role of the rehabilitative treatment take place as a problem solving and education process in which it leads a person to reach the better standard of life: functional, social and emotional. Although the efficacy of the functional motor treatment in MS patients is well known, its impact on their psychological well-being remains unclear.

In our results, the impact of mood and QoL on treatment effect showed no significant relation, especially in more severely impaired patients. Only in Group 1 the subjective perception of physical ability seemed to be a predictor of motor recovery, suggesting that the perception of functional impairment can be influenced by the disability degree and could be a predicting component of the rehabilitation outcome.

Still, rehabilitation seems to have an effect only on the QoL of more severely impaired patients, particularly as for mental QoL, which is related to the emotional problems perceived in daily life, despite the two groups not showing significant differences in motor recovery.

These results confirm previous findings concerning the complex relationship between functional status and QoL.[34] The main aspect which influences this trend is probably the subjective perception of functional outcomes. QoL is strongly related to functional independence and one of the primary aims of rehabilitation is to increase patients' levels of activity and so increase their autonomy. Both of our groups improved in functional activity, but only the more severely impaired patients perceived it. This result may be related with the illness perception and the recovery expectations. Patients in Group 1 probably had higher expectations of recovery. Moreover, being affected by a long-term incurable illness may modify the patient's subjective priorities so that the social context becomes a key life aspect. Consequently, preserving social participation and support networks can increase subjective satisfaction. For this reason attending the hospital cause a constant comparison with subjective and others disability, highlighting the diseased condition and demoralizing patients. The synthesis of patients' experiences of developing MS includes feelings of vulnerability and the patient become less optimistic.[35]

The current study presents some limitations: 1) the sample was not homogeneous for disease duration and disability degree, and 2) treatments were heterogeneous.

These findings suggest that patients' psychological status explain a different role in the course of the rehabilitation related to disability degree: it predicts the rehabilitative outcome in less impaired patients while it is affected by the rehabilitation care in more impaired patients. Therefore, it should be taken into consideration in treatment decisions and in outcome assessment as it represents the subjective aspect of rehabilitation success. Moreover, a successful patients' care could be increased by means of a psychological counselling provided during rehabilitation treatment.

The role of illness perception suggests new strategies for psychological intervention in patients with MS, with a particular attention for social functioning, vitality, general health and mental health, more than for physical disability.

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Conflicts of interest.—The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Acknowledgements.—This research was partially funded by the Italian Multiple Sclerosis Society (grant 2010/R/6). The authors would like to thank Dr Martina Venturi, who contributed to clinical assessment, and the physiotherapists Irene Sabella, Chiara Simonella, Mirella Ferreri, Daniela Ripa, Livio Balugani and Carlotta Martinuzzi who assisted the patients during the treatment and helped with outcome measurements.

Article first published online: July 13, 2016. - Manuscript accepted: July 11, 2016. - Manuscript revised: May 5, 2016. - Manuscript received: December 1, 2015.