

CONTRIBUTIONS TO THE CLINICAL-FUNCTIONAL AND REHABILITATION ASSESSMENT OF THE PATIENT WITH MULTIPLE SCLEROSIS

Key words: multiple sclerosis, assessment scales, physical kinetic rehabilitation.

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INTRODUCTION

Multiple sclerosis (MS) is the most frequent neurological disease of the young adult which leads to major disabilities at least in the European and North American countries. In our country this disease is estimated to have a prevalence of about 35-40 in 100.000 inhabitants, as it is resulted from a series of epidemiological assessment performed in the 80s, whose systematic analysis was last made more than 10 years ago by Prof .PhD. I. Stamatoiu and co.

Related to the entire Romanian country the prevalence of MS was of 25 in 100.000 inhabitants, the lowest prevalence was found in the South of the country, along the Danube (5,5-9,4 in 100.000 inhabitants) and in the riverside Black Sea counties (3,9- 9,4 in 100.000 inhabitants). A medium prevalence is found in the Northern part of Oltenia: 39, 8 in 100.000 inhabitants. According to these researches, Romania has the most regions framable in the geographical zones with medium prevalence and with MS high risk prevalence.

Multiple sclerosis is a chronic disease of the central nervous system(CNS) characterized by episodes of inflammation and focal demyelination with multiple localizations disseminated in time (having as a basis, most probably, autoimmune mechanisms targeted against myelin proteins, mediated by T lymphocytes and

triggered by exogene factors, still incomplete elucidated, to which is associated a process of degenerescence and an abnormal oligodentrocitary function and through a process of axonal degenerescence(which is developed in parallel, yet, having a progressive evolution) in a person genetically prone to disease.

The etiopathogenic and clinical complexity, as well as the one related to the therapeutical intervention, led to the same deep approach of the aspects concerning the clinical-functional assessment and also biomechanical and post urological assessment. These assessment elements enable the realization of certain recovery programme with a prophylactic and healing goal. This approach can be developed only in a multidisciplinary team whose goal is to realize a detailed analysis of posture, walking, through which possible unfavourable evolutions are anticipated and, therefore, can be prevented.

PART TWO – PERSONAL CONTRIBUTIONS

1. HYPOTHESES, OBJECTIVES, RESEARCH PURPOSE

The research hypotheses, taken out from the critical analysis of the rsearches in the field of assessment and recovery in MS, are based on the elaboration of a complete assessment algorithm of the patients with MS which enable the clinician to establish the objectives of the recovery programme more precisely.

The general objectives of the research are:

- 1.The elaboration of a methodology of a complex and multidisciplinary assessment of the patient with MS, which is useful in the quantification of the qualitative and quantitative results of the medical recovery process.
- 2.The detailed study of the theoretical and practical aspects of the recovery process of balance, posture control, and walking of the patient with MS, in order to improve the future recovery programme.

3.The study of walking with the help of performing equipment which enables the recording and analysis of some biomechanical complex parameters, to which is added the comparison to the clinical assessment of walking.

The specific objectives of the research have been determined for either of the two studies developed in this research work.

The specific objectives for the study I- the diagnosis and assessment of the patient with MS according to the newest criteria of diagnosis- Mc Donald 2010

- performing a vast research of clinical, functional parameters (according to the assessment scale), useful in functional staging, in establishing the recovery methodology and the results assessment of a representative lot of patients with MS. Making a specific assessment related to posture, balance and walking.

- establishing a standardized methodology of clinical, cognitive and functional assessment and its usefulness in establishing the motric abilities and therapeutic needs.

The specific objectives for the study II

This study has as a main objective the determination of the efficiency of a therapeutic programme of 12 weeks based on vestibular and neurocognitive exercises- the training of the kinesthetic image, added to the classical programme of physical and kinetic therapy and the performing of a clinical-functional assessment which prove the role of the complex therapy.

It is to be mentioned that the post treatment assessment was performed only on the basis of clinical-functional scales.

Study I, of interdisciplinary, cognitive and clinical-functional assessment, *descriptive of a transversal type*, consisted initially in a **group of 58 patients** who were invited to take part in the research, out of which a lot of **48 patients** was further selected and diagnosed with MS, various forms, **aged between 23-65** at the moment of the beginning of the study, *to whom it was possible the collecting of all necessary data obtaining the research objectives and who were able to be complexly anamnesis, imagistic and clinical-functional assessed*. There were 10 cases excluded since the patients did not consent and to whom anamnesis medical

data missed or they could not be completely assessed according to the purpose of the research objectives. Study I was developed between 2009-2010

Study II developed between April 2009- August 2011, it was longitudinal observational type, *prospective, non-experimental (descriptive)*, it consisted of **36 patients** diagnosed with MS, selected from the previous lot of 48 patients, aged between **28-60** at the beginning of the research, to whom all the data mentioned further were collected. These patients followed different therapeutic protocols in the neuromotory recovery centers previously mentioned. It is to be noted that the 36 patients were selected on the basis of the assessment results from the Study I, representing subjects who presented posture modifications, balance disorders and walking disorders. The other 12 patients were not included in the physical kinetic and neurocognitive programme because the access was limited due to the evolution of the general condition, to the presence of the associated pathology and to the impossibility of constant coming to the rehabilitation centers.

The **36** patients diagnosed with MS selected for this study were divided, according to the indicated therapy by the rehabilitation specialist doctor in collaboration with the psychiatrist and psychologist, into two lots: **18** patients followed a combined physical-kinetic therapy and the neurocognitive and vestibular rehabilitation of balance disorders, representing the neurocognitive rehabilitation lot **NRL**; **18** patients followed a classic physical-kinetic therapy, representing the witness lot **WL**. During the Study II the patients were assessed at the beginning of the recovery programme- **T0 moment**, at the end of the rehabilitation programme of 12 weeks-**T1 moment**, after a period of about 6 weeks at the reassessment check-**T2 moment**.

The objective of the rehabilitation programme were decided on *short term* and had as a goal: pain control, spastic control, vicious positions control. To these were added long term objectives of the rehabilitation treatment which had as a goal: balance improvement, diminishing the vertigo sensation, stability improvement during walking, neuromuscular coordination improvement, anxiety

diminishing due to the vestibular hypo function, increasing effort tolerance, all these achieved with the help of specific kinetic therapy (Rusu, 2007)

The kinetic programme developed between 2010-2011.

Summarising, the kinetic programme had as objectives:

- Voluntary motor activity inducement
- Sensorial feed-back improvement
- Unwanted motor schemes inhibition
- Coordination improvement
- Preventing and treating articular redresses and muscular retraction
- Cerebellum disorders improvement

Submitted to the neurocognitive therapy, all NRL patients followed during a period of 12 weeks 4 sessions on week of recovery treatment based on the **neurocognitive theory of rehabilitation NTR.**

The basis hypothesis in NTR is that through a correct and targetted activation of the patient's cognitive processes, such as memory, language and training of the kinesthetic image (walking imagination), the affectation of the central nervous system can be improved in case of different diseases. The therapeutic programme consisted in different exercises whose objective was the correction of wrong motor strategies by using motor imagery MI.

2. THE RESEARCH RESULTS

STUDY I – ASPECTS OF INTERDISCIPLINARY COGNITIVE AND CLINICAL-FUNCTIONAL ASSESSMENT OF PATIENTS WITH MULTIPLE SCLEROSIS

2.1. Results – clinical-functional assessment

In this study the results of the clinical research on 48 patients with MS are presented. Each case diagnosed with MS was confirmed by the magnetic resonance exam RMN. All patients presented imagistic modifications which corresponded to

Mc Donald criteria 2010.

According to gender, in the group of patients with MS it was noted the predominance of female- 32 women (67%) versus 16 men (33%), $p < 0, 01$.

Patients' age and the beginning of the disease

The average age of the patients with MS included in the study was 46.04 ± 10.99 years old, the extremes were between the minimum 23 and maximum 65 years old (pct. 2). The beginning of the disease was noted to have appeared between 19 and 49 years old, at 34.91 ± 9.14 ani on average. The length of time of the disease from its beginning till the research moment varied from 2 to 23 years, the average being 11.13 ± 5.57 years.

Clinical Forms

I analysed the results obtained by estimating the MS forms according to the clinical evolution and I found out that, in the majority of patients **35(72.91%)** the disease evolved through relapse and remission- ***recurrent-remission form***. According to the data in the literature this clinical form is the most frequently met (60-70% cases).

The group of patients with MS was submitted to 1-6 exacerbations, on average 4, 27 ± 1 . The average time between the acceses was $18, 41 \pm 3, 92$ months. In the cases of 2 patients it was noted an acces of 5 years. One case presented a time of 2 months between the acceses.

Motor anomalies

Walking disturbances were present in 23 patients with MS (47.92%). There were 25 patients (52.08%) without walking disturbances.

Cerebellum anomalies- balance disturbances

Balance disturbances. The cerebellum touch expressed through static disturbances motor coordination was present in 41 patients (85.41%), in some cases accompanied by a cerebellum dizartry and an intentional shaking.

Sensitive anomalies

Sensitive symptoms were noted in 34 patients (70.83%) with MS. Among these, there were sensitive manifestations, which varied from a pricking sensation

stitching, cold sensation, burning to algia. The pain sensation was felt in cases of 12 patients (25%) .

Functional assessment according to EDSS/Kurtzke scale

This procedure enabled the patients with MS assessment according to the functional parameters: pyramidal function, cerebellum, sensitive, visual, cerebral trunk, vesical and intestinal transit. The variation of score from 0 to 10 determined a classification of the patients according to their disability.

The total EDDSS/Kurtzke score of the group of patients examined was 3, 27±0, 15, this score varying from 1, 5 (patient without handicap, with minor neurologic signs) to 8,0 (patient immobilized in bed- 1 patient or in wheelchair-6 patients)

The majority of patients (27 patients-56%) had an EDSS score between 3-5 points, which shows the possibility of walking without help, complex activity with a minimum help and moderate disability: 14-29% out of the patients accumulated 1-3 points, with minimum disability, without walking disturbances. A higher EDSS score than 5 was 7-15% out of the patients with severe expressed disability, without any full activity during the day, the necessity of temporary help or constant or uni- or bilateral, relative assistance or medical staff, usage of walking help equipment: walking stick, crutch.

Cardiovascular assessment

The assessment of cardiovascular parameters, through frequently monitoring the heart rate (beats/minute) was performed with the aim of observing the ability of effort adaptation, taking into account the fact that it is intended the designing of the rehabilitation programme. Blood pressure was also monitored.

2.2. Results - Biomechanical assessment

The biomechanical analysis of walking was performed on the three moments of walking, considered relevant. These are the moments, stages, which require the presence of a motor command and a motor control, both being elements

which depend on the way in which muscular contraction is initiated and then the muscular control. The following stages were monitored:

- the contact surface, the impulse, maximum pressure, maximum force, the loading on the lateral heel, medial heel, medium leg area, toes area 2-5 of both legs.

The balance of the leg

In the MS lot it was observed the existence of suspension of one leg and a pronation of the contralateral leg. All patients showed a perturbation of the leg balance, obvious in all walking stages studied by us, as well as the lack of tendency to evolve to the neutral position. In the witness lot, it is observed the presence of a suspension with values between -59° and -10° , as a predominant functional element in all three walking stages studied.

2.3. Results – Posturography

Posture- as it is mentioned in the chapter “Material and Methods”, parameters characterizing posture, determined with the Pagani equipment were:

- The position of the centre of pressure (COP) expressed in mm, duration (T) expressed in seconds, loading distribution (D), stabilogram (S) expressed in mm, it was performed statokineticgram.

Final Report – summarises the information related to the position of the pressure center and, accordingly, the area of oscillation, in accordance with the standards (minimum and maximum) established by the French School of Posturology. The generated report includes the average value of moving in rapport with the X,Y,Z axes, moving which is admitted to be between -9,1 and 11,7 mm. In the case of the studied subjects the average value of moving was -8, 5 mm. The value considered normal is $N=1,1\text{mm}$. It can be observed that according to this value the studied subjects show a value which is outside the admitted range.

As far as the area of the moving surface is concerned, this has values between 39-21- mm^2 , cu $N=91\text{mm}^2$, value considered normal. In the lot of the studied subjects I observed that this value is between 0-200 mm^2 , with an average value of 50 mm^2 .

Posturography-balance assessment

Once we assessed posture in the research, we also analysed the static balance behavior using the same equipment.

The analysed parameters were: statokinesiogram(L-the length of body moving around the pressure center, Dmax-the maximum length in rapport with the pressure center), stabilogram(S) the moving of the pressure centre frontally and sagittally, the number of oscillations frontally and sagittally(NOS, NOF), the report concerning the average of moving, COP position on X and Y axes, the time maintaining in the four dials(T), the distribution of loading in the four dials(D-expressed in percents) .

As far as the report on the moving rate COP is concerned, this indicates an average value of 58mm, exceeding the admitted values of French School of Posturology.

STUDY II – THE EFFECTS OF VESTIBULAR AND NEUROCOGNITIVE THERAPY IN LOCOMOTION AND BALANCE REHABILITATION OF THE PATIENT WITH MS

The patients were assessed at the beginning of the rehabilitation programme – **T0 moment**, at the end of the recovery programme of 12 weeks-**T1 moment**, after a period of about 6 weeks at the reassessment check-**T2 moment**.

The adherence to the therapy of the patient with MS

The therapeutic protocol was occasionally adjusted when the patient missed more than two consecutive sessions, but no more than 6 totally. The adherence to the therapy in these circumstances was 100%, which reflects, first of all, the patient's desire to improve the functional disability.

The Inventory of dizziness assessment- DHI Scale (Dizziness Handicap Inventory)

The study showed a significant decrease of the average score scale DHI in the NRL (average 15, 95%CI=12.4-17, 6) in comparison to the WL (average 18.8, 95%CI=15, 04-22.7) at the final check reassessment T2 ($p<0.05$)

Balance assessment with the help of Berg balance functional scale- BBs

The assessment of the functional balance in patients diagnosed with MS, calculating the balance functional scale score of Berg, showed a significant

increase of its value, comparing the moments of assessment, a significant increase taking place after 12 weeks of rehabilitation-recovery. At both moments of posttherapeutic assessment, the NRL showed a more significant increase of BBS score comparing to WL(at 12 weeks $p=0.01$, at 18 weeks $p<0.01$)

The scores of Tinetti Test for walking and balance

The lot of patients were assessed at the beginning of the study, intermediary and finally, with the *test” stand up and walk”*, the evolution of the patients being a favourable one, being observed the percentage increase in the sphere of patient independence, increasing the mobility towards the end of monitoring.

Effort perception assessment Borg scale

This aspect was assessed according to the Borg scale, dyspnea scale and effort angina

3. CONCLUSIONS

We consider that the complex assessment algorithm should contain:

- General and special clinical assessment
- Para clinical-biochemical, imagistic, neurophysiologic assessment
- Functional assessment and establishing the functional diagnosis according to the EDSS, Berg, Borg, ADL assessment scales
- A result of EDSS 2,5-4 is compulsory to the completion of assessment with biomechanical tests (posture assessment, static balance, dynamic walking)

The study of theoretical and practical aspects of balance, posture control and walking in patients with MS showed:

1. The tendency of positioning the pressure center COP, determined through posturography, anterior right, which proves the development especially of the posture recovery mechanisms and maintaining the static balance, thus, decreasing the risk of falling.
2. It is observed a significant clinical expression of the proprioceptive component of balance, which orient the means of the rehabilitation kinetic programme.

The study of walking with the help of performing equipment, which enables the

recording and analyzing of complex biomechanical parameters.

This study brought information related to the following aspects:

1. There is a tendency of increasing the contact surface in the lateral heel area in the circumstances of an existence of a right/ left simetry. The deficitary motor control determines an increase of the impulse, of the basis of supporting evidently in the heel area, aspect proved by Pmax and Fmax.
2. Loading in the area of ante leg is the result of mobilizing the posture recovery mechanisms.
3. It is showed a lack of tendency of the leg towards the neutral position, with the instability and emphasizing of the pronation.

As a result of the specific therapeutic intervention the following conclusions are drawn:

1. Adding the neurocognitive and vestibular exercises to the physical rehabilitation programme of the patient with MS has a significant effect in the diminishing of dizziness, vertigo, disequilibrium, and disability caused by this disease.

2. The benefic results of the functional rehabilitation of vertigo and balance syndrome in patient diagnosed with MS appeared when applying a kinetic programme for 12 weeks.

3. Based on these results, it can be sustained that neurocognitive and vestibular therapies are efficient therapeutic option along with physical kinetic therapy, more vast checking studies being necessary for these patients.

The objectives of the rehabilitation treatment referred to: the improving of balance, the diminishing of the subjective vertigo sensation, the improving of stability during walking, the improving of neuromuscular coordination, the diminishing of anxiety due to the vestibular hypo-function, all these being performed through specific kinetic therapy. These objectives can be achieved only after a complex assessment which will orient the rehabilitation programme reducing the risk of appearing quick muscular and general tiredness.

1. So as to obtain benefic results in the process of vertigo syndrome rehabilitation and also balance it was designed a kinetic programme for 12 weeks, which involves daily session of 50 minutes, 4 times a week. The main goal of the rehabilitation programme was the recovery of the motor control by doing neurocognitive and vestibulary exercises.
2. The physical kinetic therapy developed in the Study II enabled maintaining and recovery of the moving patterns , including in the structure of the programme active moves , stretching, walking training, exercises which led to an increase of resistance to tiredness, the increase and maintaining of the muscular force, preventing falling.