

## NEUROREHABILITATION STRATEGIES IN MULTIPLE SCLEROSIS

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### ABSTRACT

Multiple sclerosis (MS) is a chronic progressive disease which is one of the leading causes of handicap in young subjects. Despite the availability of advanced disease-modifying and symptomatic therapies, there is still a need for complex rehabilitation interventions in order to compensate functional deficits, to minimize limitations in activity, to increase independence and quality of life of MS patients. Individualized programs elaborated by a multidisciplinary team of experts are the key to success of rehabilitation. Treatment should be adapted depending on: the individual patient's needs, demands of their surrounding environment, type and degree of disability, and treatment goals.

The main objective of rehabilitation is, therefore, to ease the burden of symptoms by improving self-performance and independence. The methods used are: function conservation , optimization of restant capacities, compensation of functional deficits and prevention of complications.

Benefits of rehabilitation interventions are generally higher in earlier phases of MS. Inpatient and outpatient multidisciplinary rehabilitation has been shown to be beneficial in improving disability. Outcome measures applied for patients with MS include: the EDSS score, the Barthel index and the FIM (Functional Independence Measure). The coexistence of physical and cognitive impairments, together with the imprevisibile evolution of the disease makes MS rehabilitation very challenging.

Rehabilitation is a valuable tool in the overall management of MS patients, the improvements obtained after treatment sessions often outlast the treatment period by several months. Neurorehabilitation methods are important tools in developing complex management strategies for patients with multiple sclerosis.

Key words: multiple sclerosis, neurorehabilitation, functional deficits, disability

Multiple sclerosis (MS) is a chronic progressive disease which is one of the leading causes of handicap in young subjects. The large range of symptoms associated with MS lead to continuing decline in neurologic status and quality of life.

Rationale for a rehabilitation treatment in MS: Despite the availability of advanced disease-modifying and symptomatic therapies that may decrease activity and progression of disease, there is still a need for comprehensive rehabilitation interventions in order to reduce sequels and symptoms of the disease, and to achieve maximal independence and the best quality of life.

Objectives for rehabilitation in MS patients: Neurorehabilitation can be highly effective in multiple sclerosis with the goals of increasing independence and quality-of-life and improving functional capacities. Although rehabilitation has no direct influence on disease progression, recent studies indicate that this form of intervention improves personal activities and participation in social activities, thereby improving quality of life. Rehabilitation is an effective element in the overall management of MS patients, and can minimize limitation in activity and restriction in participation. The improvements often outlast the treatment period by several months (1).

Individualized programs elaborated by a multidisciplinary team of experts are the key to success of rehabilitation.

Compensation of functional deficits, adaptation and reconditioning, together with management of symptoms, impairment, emotional coping and self-estimation, are all important long-term objectives. Treatment should be adapted depending on: the individual patient's needs, demands of their surrounding environment, type and degree of disability, and treatment goals (2)..

The main objective of rehabilitation is, therefore, to ease the burden of symptoms

by improving self-performance and independence. The methods used are: function conservation (prehension, walking, etc by endurance training and resistance training), optimization of restant capacities, compensation of functional deficits, prevention of complications (urinary, articular,etc). Endurance training and resistance training improve muscle strength without having negative effect on fatigue (3).

Other important issues responsible for beneficial effects of rehabilitation in MS include education, instruction, and information of patients and caregivers.

Cognitive deficits are a common manifestation of multiple sclerosis (MS) and have a significant effect on the patient's quality of life. There is no evidence to support the effectiveness of memory rehabilitation on memory function or functional abilities in patients with MS. However, further trials are needed. Present trials have shown low-level evidence for positive effects of neuropsychological rehabilitation in MS.

When to start rehabilitation treatment in MS patients? There are no temporal or spatial limitations in performing rehabilitation in patients with MS. Number and frequency of sessions is not established by guidelines or sanitary authorities. Rehabilitation interventions should be considered early for maintaining functional capacity and reducing risk for losing important abilities or independence. Due to gradual failure of adaptive compensatory mechanisms along the course of disease, benefits of rehabilitation interventions are generally higher in earlier phases of MS.

Actual recommendations states that rehabilitation should begin as soon as an impairment is noticed by patient (for example gait difficulties, hand clumsiness, attention or memory deficits, urinary troubles, visual deficits, speaking difficulties, or excessive tiredness). (4)

Patients with relapsing-remitting multiple sclerosis (RR-MS) often make incomplete recovery after an exacerbation,

despite relapse treatment. Studies have shown that RR patients showed considerable improvement after rehabilitation. Inpatient rehabilitation is considered by Liu C et al. (4) to be useful in patients with incomplete recovery after a relapse. Another study (5) suggests a benefit of multidisciplinary rehabilitation for individuals with RR MS to improve their disability after a relapse.

Between relapses, rehabilitation treatment is mandatory for maintaining the acquisitions and preventing the complications. In each stage of the disease, rehabilitation has a benefic effect, which depends on achieving established objectives, adapted to patient's needs and to disability's degree.

Duration and frequency of rehabilitation sessions are not established by Cochrane meta-analysis. (6), (7) Strategies which perform regular and low-intensity sessions, during long periods of time have better effects on quality of life parameters (8). Classical recommendation is to perform repetitive and periodical sessions, in order to consolidate patient's acquisitions (9).

Who is in charge for rehabilitation treatment?: Inpatient rehabilitation needs a multidisciplinary team: kinesiologist, ergotherapist, speech therapist, psychologist, physicians, social assistants, specialized nurses.

Settings for rehabilitation programs in MS: Rehabilitation treatment in MS could be organized in different settings: full-time hospitalization, partial-time hospitalization in "day-centers", ambulatory in private practice or home-based. Inpatient and outpatient multidisciplinary rehabilitation has been shown to be beneficial in improving disability. Good evidence exists for different specific interventions improving physical and cognitive performance.

A Cochrane review (8) compares effectiveness of rehabilitation approaches in different settings. Despite no changes in the level of impairment, inpatient

multidisciplinary rehabilitation can produce short term benefits in the levels of activity and participation for patients with MS. For outpatient and home-based rehabilitation programs there was limited evidence of improvements in symptoms and disability with "high-intensity" programs; interestingly, "low-intensity" programs conducted over longer periods of time have obtained strong evidence for gains in quality of life.

In another study (10) inpatient rehabilitation improves functional independence, but has only limited success improving the degree of impairment, and with short-time benefits. For outpatients and home-based settings, therapy can be performed either daily, over a period of 6 to 15 weeks, either weekly, lasting for several months.

In the early phases of the disease, outpatient rehabilitation is recommended, in order to assure the continuity with familial, social and professional environment.

Inpatient hospitalization in Rehabilitation Centers has the advantage of involving a multidisciplinary team, containing kinesiologist, ergotherapist, speech specialist, psychologist, social assistant, nutritionist. The duration of the training program is between 3 to 4 weeks. Indications for inpatient rehabilitation are: recent increase in disability (walking distance less than 100 m, frequent falls, balance problems at work) and recent decrease in functioning. In each case, realistic and precise objectives should be discussed and assumed by the patient and family. (4)

In advanced phases, a combined approach, including inpatient and home-based sessions are proposed. The priority is to maintain the patient at home as long as possible, in safety conditions.

Measuring rehabilitation effects in MS: Outcome measures applied for patients with MS include: the EDSS score, the Barthel index and the FIM (Functional Independence Measure).

Comprehensive assessment of health domains in MS patients using standardized

framework and common language for describing the impact of disease at different levels, for example the International Classification of Functioning, Disability and Health (ICF) core sets may increase the knowledge of needs of these patients for more efficient and adapted rehabilitation interventions meeting these individual requirements, and promote perception and acceptance of rehabilitation as a valuable treatment option in MS. The ICF provides a framework of disability and functioning with different perspectives of health from a biological, individual and social perspective. (11)

Limits of rehabilitation in MS: The coexistence of physical and cognitive impairments, together with the imprevisible evolution of the disease and the consequent disability degree, involving emotional, social and professional issues, makes MS rehabilitation very challenging.

Severely disabled people (4) derive equal or more benefit from rehabilitation than those who are less disabled, but cognitive problems and ataxia tend to be refractory. Physical exercise can improve function for patients with mild MS, and helps to maintain function for those with moderate to severe disability.

Cerebellar syndrome is less influenced by usual rehabilitation methods - (heavy deambulatory, weighted bracelets, wheelchair...) and is a continuous challenge for rehabilitation specialists.

Cognitive impairments, especially memory troubles, influence learning abilities in patients with MS. Attention and concentration deficits, parts of dis-executive syndrome, are responsible for lack of progress in attending rehabilitation objectives. Depressive states are an important factor, which, if not treated, could delay the recovery process.

Evaluation of candidates for rehabilitation programs: The preliminary consultation with a physician with expertise in rehabilitation is mandatory for admission

of a patient with MS in a rehabilitation program. The consultation will include not only the clinical exam, but also a knowledge of patient's limitations in day-to-day life, and a precise analysis of patient's disabilities. After this expertise, the patient and the rehabilitation specialist will establish clear objectives to accomplish during the rehabilitation session, whatever be the hospitalization modalities (full-time, partial time or home-based).

Before admission to a rehabilitation service, it is necessary to examine the patient and set clear and realistic objectives of the rehabilitation program together with the patient. The discrepancy between the patient's expectations/objectives and the therapeutic program proposed by the doctor can lead to the demotivation of the patient and his/her leaving the rehabilitation program, with the false conviction that "rehabilitation is of no help".

The objectives assumed by the patient rely on clinical examination and on the accurate analysis of the degree of disability; these should be precise, clear, explained to the patient and the patient's family, and accepted by the patient. The objectives will be aimed, depending on the case, at improving residual functional capacity, reducing the degree of disability and increasing the quality of life.

There are no specific methods used for the rehabilitation of patients with MS; currently, multidisciplinary techniques, common to neurological disorders and adapted to the characteristics of the disease, particularly fatigue, and to its evolutive nature are used. (4).

General principles in MS neurorehabilitation :

Each stage of the rehabilitation treatment starts with the clinical analysis of the deficiencies and the degree of disability of the patient with multiple sclerosis. This allows to define the objectives of the rehabilitation treatment and to prescribe the rehabilitation methods. These objectives are personalized and may include various priorities, depending

on the patient's functional status: reduction of deficiencies, improvement of function control, maintenance of a function or optimization of residual functional capacity, prevention of complications and increase of autonomy.

#### 1. Evaluation and treatment of neuro-orthopedic dysfunctions

Capsuloligamentous and musculotendinous retraction may occur during the evolution of MS. This is due to prolonged spasticity and immobilization in patients with motor deficits. If persistent, it can cause the irreversible fixation of joints in non-functional positions. Clinical examination consists of a joint evaluation, which can be performed clinically or using the goniometer (with passive joint mobilization starting from reference anatomical positions). The objectives of treatment are passive mobilization exercises for all joints and learning of self-mobilization techniques (if the joints are unaffected), in an attempt to obtain a degree of functional mobility, if stiffness has already developed. The methods used are mainly masso-kinesitherapy techniques.

#### 2. Evaluation and treatment of motor deficits

Motor deficits such as paraparesis, tetraparesis or less frequently, hemiparesis are found in almost all patients with MS, being induced by pyramidal tract lesions. Clinical examination consists of the evaluation of fine motility, segmental muscle strength using the BMRC scale, and spasticity using the Ashworth scale. These evaluations are performed at 2 speeds: slow – analyzing muscle suppleness, and rapid – triggering spasticity. The objectives of the rehabilitation treatment refer to the inhibition of spastic hypertonia that limits voluntary movements and the facilitation of voluntary control present in certain muscle groups. (4) Kinesitherapeutic methods include passive muscle stretching exercises and alternate inhibition postures, guided active mobilization exercises in order to

obtain a range of motion beyond the threshold of spasticity, neuromotor reeducation (Bobath or Kabat technique), sensory-motor reeducation, reeducation in functional position, exercises for increasing effort tolerance. Exercise training is effective for improving both aerobic capacity and muscular strength. (12). Exercise may improve mobility, fatigue and health-related quality of life. These exercises should be supported by drug treatment for spasticity (myorelaxants or intramuscular botulinum toxin injections), or by surgery.

#### 3. Evaluation and treatment of sensitivity deficits

Sensitivity disorders are a frequent symptom in patients with multiple sclerosis. Their evaluation consists of a thorough examination of all sensitivity modes and their topography. It is important to assess the presence of sensory ataxia or neuropathic pain. The objectives of rehabilitation are making the patient aware of the loss of a sensitive modality and developing compensatory modalities, enhancing residual sensitivity, increasing sensitive vigilance. Therapeutic methods use masso-kinesitherapy, ergotherapy and psychomotor activities. The recovery of thermo-algesic sensitivity deficits is based on relearning the recognition of stimuli of various types and intensities and on protective measures against burns, trauma, etc. The recovery of fine sensitivity deficits uses the recognition with eyes closed of the positions of small body segments, bipedal and unipedal balance exercises, on an inclined or unstable plane, using compensatory visual information.

#### 4. Evaluation and treatment of sensory deficits

Vision disorders are the consequence of retrobulbar optic neuritis and ocular motricity disorders. Clinical examination includes the clinical and instrumental testing of visual acuity, the visual field and the eye fundus. Treatment methods use reeducation through orthoptic methods.

#### 5. Evaluation and treatment of neurovegetative dysfunctions

Neurovegetative disorders include bladder sphincter disorders, anorectal disorders and sexual disorders. Their evaluation includes: a micturition calendar, determination of post-micturition residue, urodynamic testing, bladder and renal ultrasound. The rehabilitation treatment of bladder sphincter disorders is aimed at acquiring adequate, regular, complete, effortless micturitions and at improving bladder continence by pharmacological, functional or surgical methods. The rehabilitation of anorectal disorders is based on hygienic-dietary methods (a fiber rich diet, lots of fluids, physical activity), physical methods (postures, colic massage) and pharmacological methods.

#### 6. Evaluation and treatment of cognitive disorders

Although little recognized at first sight, cognitive disorders are quite frequent, affecting memory, attention and intellectual efficiency. A general evaluation can be performed using MMSE, and a more detailed examination, using neuropsychological test batteries (e.g. PASAT 3, included in MSFC). Cognitive rehabilitation treatment in MS includes the ergotherapeutic and neuropsychological reeducation of cognitive deficits: exercises for memory maintenance, for stimulating attention and activity planning, for applying different memory compensation strategies (diaries, sonorous alarms, mental associations, mnemotechnic procedures, etc.). An important role is played by the rehabilitation of emotional lability and mood disorders. Individual or group psychotherapeutic techniques, cognitive-behavioral techniques, coping strategies and relaxation techniques are used.

#### 7. Evaluation and treatment of verbal communication disorders

Verbal communication disorders are dysarthric or dysphonic. Evaluation involves phonological analysis and word articulation.

For reeducation, orthophonic methods are used (articulation exercises, verbal control exercises, breathing and voice coordination exercises, behavioral techniques).

#### 8. Evaluation and treatment of deglutition disorders

Deglutition disorders may occur in one third of patients with MS, particularly in advanced forms. Their examination requires an examination of the position of the head during feeding, a sound pronunciation analysis, an ENT examination, and special paraclinical examinations. The rehabilitation of deglutition disorders includes gustatory stimulation, soft palate reflex stimulation, exercises for lingual and facial muscles, vocalization exercises. Compensation strategies (slight anteflexion of the neck, adaptation of food texture, a calm setting) are also important.

#### 9. Evaluation and treatment of balance and coordination disorders

Balance and coordination are evaluated during the neurological examination of sensitivity, the cerebellum and the vestibular system, to which numerous balance tests (Tinetti, Berg Balance Scale, Timed Up and Go tests) are added. The treatment of sensory ataxia is based on the stimulation of epicritic sensory perception and on visual compensation exercises. The reeducation of cerebellar ataxia includes the stimulation of static balance and exercises for the control of trunk and limb movements. The reeducation of vestibular ataxia is based on the compensation of vestibular deficits through proprioceptive and visual information.

#### 10. Evaluation and treatment of walking disorders

The functional evaluation of walking includes: analysis of the walking speed (Timed 25-Foot Walk), analysis of the walking time (endurance) using the 6-minute walk or the 2-minute walk test, analysis of the ambulatory index. The need for other aids (stick, walking frame, wheelchair) is also assessed. The aim of reeducation treatment is to maintain safe walking for as long as possible. The

reeducation methods used depend on the clinical evaluation of the type of deficit that has caused the walking disorder. Walking without assistance is possible if balance is good enough in each of the intermediate positions. Adapted balance exercises in a vertical position, with eyes closed if possible, will be practiced, for the improvement of trunk and lower limb control. The presence of cerebellar syndrome associated with spasticity reduces walking performance, requiring the use of technical aids (crutch, 2 crutches, tripod stick, walking frame, orthoses or orthopedic shoes).

#### 11. Evaluation and treatment of fatigue

Fatigue is a frequent and early symptom in MS; its cause is multifactorial. The evaluation of fatigue is done using specific scales (Modified Fatigue Impact Scale). The presence of asthenia should not be an obstacle to rehabilitation treatment: aerobic exercises will be performed with an increasing intensity and with rest periods. Behavioral education is also important for the application of optimal energy use strategies.

Neurorehabilitation is the only approach available which can improve the limitations in activity and restrictions in social participation of people with multiple sclerosis. For MS patients, comprehensive multidisciplinary rehabilitation became an important tool for decreasing the impact of the disabling neurological condition of the individual and for achieving a better quality of life. Even though rehabilitation has no direct influence on disease progression, studies have been shown that this type of treatment improves personal activities and participation in social activities, thereby improving quality of life. (1,13,14) Improvement of patient's condition commonly persists for several months beyond the treatment period, mostly as a result of reconditioning and adaptation.

Rehabilitation is one of the treatment options of MS patients and should be viewed as an ongoing process to maintain and restore maximum function and quality of life.

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