**Introduction**

Restrictions in mobility (walking, transfers, bed mobility) and difficulty with carrying out everyday functional activities is common in individuals suffering from multiple sclerosis (MS). Weinshenker and colleagues [1] have shown within 10 years after the onset of MS one-third of patients reach a score of 6 on the Expanded Disability Status Scale (requiring the use of a unilateral walking aid), and that by 30 years the proportion increases to 83%. Within 5 years the Expanded Disability Status Score is 6 in 50% of those with the progressive form of MS [1]. Importantly, impairment of mobility frequently restricts the person’s ability to participate in family, social, vocational and leisure activities. Many factors may contribute to the development of mobility problems [2]. These include:

- Physical: for example, motor and sensory impairments and fatigue
- Psychological: for example, cognitive impairment, mood, motivation, “adjustment”
- Environmental: for example, home set-up, climate, outdoor terrain, physical barriers such as stairs, availability of equipment
- Socio-cultural: for example, policies which address the physical and attitudinal barriers confronted by disabled persons in various environments; accessible transportation, accessible accommodation
- Economic factors

In attempting to reduce mobility difficulties, medical interventions often focus on alleviating the patient’s neurological signs and symptoms. This approach may be effective in the early stages of the disease when impairments and disabilities tend to be minimal. As time progresses, however, the impairments and disabilities experienced usually become more numerous, inter-related and hence more complex. At this stage attempting to treat one symptom without taking account of the others is unlikely to be successful. Effective management requires assessment and intervention from a variety of different perspectives by using a coordinated, goal-oriented, multi-disciplinary management approach. Crucially, it requires management to be considered from a long-term perspective rather than as a fragmented series of isolated “quick-fixes”.

**Key words** Multiple sclerosis · Rehabilitation · Mobility · Activities of daily living

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**Abstract**

Persons with multiple sclerosis (MS) commonly experience restrictions in mobility and everyday functional activities. A wide range of factors including physical, psychological, environmental and economic issues may contribute to these difficulties. This is particularly the case as the disease evolves, and the impairments and disabilities become more numerous, inter-related and hence more complex. Effective management of these complex problems requires assessment and intervention from a variety of different perspectives by using a coordinated, goal-oriented, multi-disciplinary management approach. Crucially, it requires management to be considered from a long-term perspective rather than as a fragmented series of isolated “quick-fixes”.

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orthotist, and social worker. Similarly, different settings may be required to best meet the individual’s needs. For example, intervention may be most effectively provided within an acute hospital setting or an inpatient rehabilitation unit; as an outpatient; or within the community, either in the person’s own home or within an institutional setting. It is not uncommon for intervention to be transferred from one setting to another.

Broadly speaking, problems with mobility, balance and function can be addressed by intervening at the level of the impairment, the restricted activity (disability), or at broader environmental factors (handicap). Numerous strategies are available at each level of input. Occasionally treatment at only a single level is adequate to solve the problem(s); more commonly, however, intervention is required across all levels. The present contribution is structured around these three main levels of intervention. Examples of specific interventions are provided, and supported by evidence where available.

Key principles of comprehensive management

Fundamental to this comprehensive management approach are a number of key principles:

- Comprehensive and accurate assessment to determine factors that are contributing to the problem.
- Multi-disciplinary and multi-agency teamwork to ensure coordinated input which has a common aim.
- Programmes tailored to meet the individual’s needs.
- Establishment of mutually agreed patient-centred goals, in which professionals work in partnership with the patient. This is particularly relevant in MS, where many of the interventions impact directly on the life-style of both the person with MS and the family. As a consequence many decisions are not based simply on health care issues but are entangled with decisions concerning life-style.
- Regular review. The progressive nature of MS requires that persons with this condition are monitored throughout the life-long duration of the disease so that management may be altered to meet the changing needs of the person in a timely fashion.

A number of clinical trials have demonstrated the effectiveness of this comprehensive management approach. For example, studies evaluating the multidisciplinary “package of care” within an inpatient setting [3, 4] and outpatient setting [5] have shown significant improvements in functional activities and quality of life. Other studies demonstrate the effectiveness of physiotherapy in improving mobility and function [6–8].

Interventions aimed at the level of impairments

In MS a wide range of impairments may exist which can act either alone or in combination to impact directly on a person’s balance, function and mobility. Such impairments include fatigue, weakness, hypertonicity, low exercise tolerance, impaired balance, ataxia and tremor.

Hypertonicity

Interventions for hypertonicity (commonly referred to as spasticity) can be categorised under two main headings:

- Therapy: for example, physiotherapy, nursing, occupational therapy
- Drug intervention: for example, oral medications, intramuscular botulinum toxin, intrathecal baclofen

The first stage in the management of hypertonicity is the exclusion, or reduction, of noxious factors that might aggravate it [9]. These include: urinary tract infection, bowel impaction, skin irritation/ulceration, ingrown toenails, tight-fitting orthoses and deep vein thrombosis. Attention to these factors is the responsibility of all members of the multi-disciplinary team.

There are a number of rehabilitation strategies available to help in the management of hypertonicity. These include: patient and carer education to enable self-management, physiotherapy techniques to improve posture and movement, stretches, weight-bearing, positioning and splinting. To ensure that these strategies are effective they need to be incorporated into a 24-h a day management programme. Commitment from the patient, carer and all members of the multi-disciplinary team is therefore essential.

Oral medication with agents such as baclofen, dantrolene or tinazidine is a common intervention. Widespread evidence is available to support their effectiveness in reducing hypertonicity and painful spasms [10]. The patient’s underlying neurological and medical condition should always be considered when planning this treatment. For example, patients who have fatigue or cognitive impairment may not tolerate drugs that are sedating. These drugs may also have a negative impact on muscle strength and function [9]. This occurs because spasticity is merely one feature of the upper motor neurone syndrome; it is generally accompanied by other positive features, such as spasms, clonus and negative features such as weakness. Interventions aimed at reducing spasticity may therefore have a worsening effect on function by aggravating some of these other features. This is particularly the case for weakness, which is thought by many to be the most disabling component of the upper motor neurone syndrome. For example, many patients with severe flexor or extensor spasms have marked underlying weakness of the trunk and pelvis;