



Multidisciplinary treatment of Parkinson's disease: current state and future directions

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Practice Points

- The multidisciplinary treatment is a promising yet poorly studied therapeutic approach in Parkinson's disease.
- Implementation of this approach in clinical practice and in future research needs to take into account the following considerations: target need, assessment tools and outcome measures, therapeutic interventions, interdisciplinary implementation, setting (inpatient vs outpatient) and follow-up.
- There is good evidence in literature to support the use of physical, occupational and speech therapy and nursing services in Parkinson's disease.

SUMMARY The multidisciplinary treatment of Parkinson's disease has been used in the clinical setting for a number of years in order to address Parkinson's disease-related symptoms that do not usually respond to the established pharmacological treatments, but also to mitigate impairment, decrease disability and enhance quality of life. Yet, there are very few studies on the effectiveness of such treatment. This article discusses the existing evidence and proposes approaches for the clinical application and future research of the multidisciplinary treatment of Parkinson's disease. Considerations in designing a clinical program or a clinical trial should include a target need; selection of the appropriate assessment tools and outcome measures; selection of appropriate interventions; interdisciplinary implementation; inpatient versus outpatient setting; and follow-up planning.

Parkinson's disease (PD) is a chronic, progressive degenerative disease of the nervous system. The disease affects approximately seven out of every 1000 persons above the age of 40 years and three out of every 100 persons older than 80 years and its incidence increases dramatically with age [1,2]. Although the pathological hallmark of the disease is the loss of the

dopaminergic neurons in the pars compacta of the substantia nigra, the neurodegenerative process encompasses most areas of the central and parts of the peripheral nervous system [3]. The advent of L-dopa treatment and the subsequent development of additional dopaminergic therapies have improved survival among PD patients [4], yet this improved survival belies the

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fact that many PD patients will develop serious complications from their disease, which often lead to institutionalization [5]. Indeed, several years after disease onset, the clinical picture of PD is dominated by symptoms not responsive to treatment with L-dopa [6]. This may in fact be the untoward byproduct of the L-dopa-mediated prolonged survival among PD patients [4]: the disease process is given the opportunity to progress further, increasingly involving structures of the brain with diverse functions [3] that bear little relationship with dopaminergic neurotransmission. Such symptoms of advanced PD may include non-L-dopa-responsive motor symptoms (e.g., postural instability, falls, dysphagia and dysarthria), cognitive dysfunction and dementia, psychiatric syndromes (e.g., psychotic phenomena, depression, anxiety, emotional lability and apathy) and symptoms of autonomic dysfunction (e.g., hemodynamic instability, gastrointestinal motility disturbances, disordered sphincter control and sexual dysfunction). As awareness of the non-L-dopa-responsive symptoms increased, it became evident that a number of these problems are present even from the earliest stages of the disease [7]. Functional neurosurgery and pharmaceutical interventions have alleviated to a degree motor complications and some of the non-L-dopa-responsive symptoms, yet it has become clear that additional treatment measures were needed: over the last decade clinical research has increasingly focused on the use and optimization of therapy protocols to improve function, decrease disability and ameliorate quality of life in PD. Such protocols typically involve concerted rehabilitative therapeutic courses of physical, occupational and speech therapies, with nurse specialist, social services, and, at times, mental health professional support, either in an ambulatory [8,9] or in an inpatient setting [10].

Considering the variety of symptoms that such treatments address, as well as the multiplicity of disciplines involved and the available methodologies, it is imperative that both clinical practice and further research in this area follow a predetermined rationale, so that clinical results can be appropriately appreciated and evidence of high quality can be obtained with the least possible ambiguity. In this review we discuss the existing evidence not so much for its intrinsic value as such – a goal already served by multiple previous recent reviews – but rather

as a starting point to develop a strategy for the future, in terms of both clinical practice and study design.

Existing evidence

Unfortunately, very little quality evidence exists to support or discourage the use of a multidisciplinary rehabilitative approach on the treatment of PD. The causes of such deficiency lie within the nature of the intervention itself. A rigorous evaluation of multidisciplinary treatments is subject to the following limitations according to the UK National Clinical Guidelines for diagnosis and management of PD [11]:

- Variations in location of therapy (home, outpatient clinic and in hospital)
- Lack of reporting the intensity of therapy given
- Variations in therapy regimen between trials
- Unclear qualifications and experience of person delivering the intervention
- Short trial duration and lack of long-term follow-up
- Small sample sizes without power calculations provided
- Lack of reporting methods of randomization or allocation concealment
- Lack of reporting drop-outs from trials
- Lack of intention-to-treat analysis

To this list, one would have to add the methodological limitations of proving the effectiveness of multidisciplinary treatments; such studies may never reach what is currently the gold standard for clinical trials, namely the double-blind, placebo-controlled design, as subjects may not be blinded to the treatment and placebo (or sham) treatments may be easily recognized as such by the study participants.

Although some of these shortcomings have been overcome in more recent trials, there remains a lack of standardization of the therapeutic approach that not only limits one's ability to derive generalizable conclusions, but also at times results in seemingly contradictory findings.

An earlier systematic review of the extant literature on the effectiveness of rehabilitative therapies in PD [12] discovered 44 studies including physical therapy (13), occupational therapy (4), speech therapy (10), counseling (3), educational intervention (1) and multidisciplinary (1), all but one demonstrating improvement

in at least one outcome measure. The authors concluded that such interventions appear beneficial, adding, however, the caveats of publication bias and unknown clinical significance of the reported statistical findings.

A more recent systematic review [13] focused on the evidence for a multidisciplinary outpatient rehabilitative program for PD and discovered only four studies, ranging from poor to good quality, suggesting no long-term benefit to following a multidisciplinary rehabilitative effort. Considering, however, the quality of the extant evidence, as well as the lack of reliable evidence on the short-term effectiveness of such intervention, the authors concluded that further studies were necessary. Notwithstanding such limitations, we will endeavor to discuss the existing evidence with regard to specific interventions, in the context of the multidisciplinary model.

Elements of the multidisciplinary model

In order to better assess the effectiveness of the multidisciplinary approach, a degree of standardization will be necessary. One problem with the heretofore studies has been the indiscriminate inclusion of PD patients undergoing multidisciplinary rehabilitation, without regard to the particular indications, expectations or goals of the intervention. Another problem has been the appropriateness of the outcome measures for the particular intervention. Based on the theory supporting the multidisciplinary approach, a schema for standardization, allowing for better assessment of outcomes, will have to take into account the following considerations:

- Target need
- Assessment tools and outcome measures
- Interventions
- Interdisciplinary implementation
- Setting (inpatient vs outpatient)
- Follow-up

These elements can also be implemented as criteria in the evaluation of interventional studies assessing the effectiveness of the multidisciplinary model in PD. In the following sections, we review these considerations.

▪ Target need

A multidisciplinary intervention needs to fulfill a perceived need. Following WHO's

International Classification of Functioning, Disability and Health (ICF) model, a target need may be an impairment, activity limitation or loss of participation level [14]. Some examples are cognitive impairment, balance impairment and fall prevention, driving abilities, activities of daily living, nutrition and weight loss issues and assessment for deep brain stimulation. Identifying a targeted need not only helps to select the appropriate assessment tools and outcome measures but also allows for better planning of the appropriate interventions – the 'disciplines' in 'multidisciplinary' – and, moreover, allows for better grouping and classification of different multidisciplinary protocols, which can then be individually studied as to their respective effectiveness. Upon reviewing the existing studies of multidisciplinary interventions in PD again [8,13,15], it becomes clear that patient selection did not include a requirement for a perceived need and a target of the multidisciplinary intervention was not defined, other than in the form of an outcome measure, usually a health-related quality-of-life measure. The lack of such a declared target in any of the published studies renders interpretation of their results difficult and may underpin some of the apparent contradictions and inconsistencies [13].

▪ Assessment tools & outcome measures

Two types of assessment tools need to be entertained; first, instruments appropriate for the specific target will need to be selected, aimed at assessing the patient at the front end. The degree of the specific need (be that the degree of specific impairment or disability that needs to be addressed or the evaluation of circumstance such as social support system) will need to be quantified in order to help design the intervention and monitor its progress. A second type of instrument needed would include tools to assess the success of the program. As a convention, for the purposes of this paper, we will use the term 'assessment instrument' for the former type and 'outcome measure' for the latter. Although, theoretically, the same instrument can be used for both purposes, in practice, the two types of instrument will serve somewhat different purposes and, therefore, will need to have somewhat different characteristics. For example, an assessment instrument will need to have sufficient responsiveness to change, so

that progress can be monitored and the intervention accordingly adjusted. It will have to have sufficient specificity to the need targeted and to PD-specific impairments. It will have to have excellent test–re-test reliability. Since the purpose of such assessment instruments is ultimately to assist in the clinical practice, it may not be very important that the instrument is specific to the particular intervention to the exclusion of other therapeutic manipulations (e.g., medication changes) that may occur in parallel. On the other hand, such a characteristic, however difficult to achieve, would be desirable for an outcome measure, so that the effectiveness of the specific intervention can be assessed as much as possible in isolation from the effects of other factors. At the same time, outcome measures need not be specific to the targeted need alone, but may explore the effects of the intervention on other aspects of the disease. By way of example, the success of an intervention designed to improve safety with regard to falling may be assessed with outcome measures of quality of life, caregiver strain, depression and anxiety. Specific assessment instruments and outcome measures will be discussed with respect to the interventions later in this paper; however, there are numerous literature sources addressing the appropriateness of such tools [16–19,101]. Similar to developing a rational approach in future applications of multidisciplinary treatment, development of future assessment tools and outcome measures should proceed in a structured and rational manner. In that respect, the principles embodied within the ICF model may serve as a blueprint [14].

■ Interventions

There is no standardization of the disciplines that are necessary components of a multidisciplinary intervention. It seems logical that the selection of disciplines will need to be customized to the targeted need, allowing for flexibility of interdisciplinary referrals. Traditionally, multidisciplinary rehabilitation programs in PD have included nurse specialists, physical and occupational therapists, and speech and language pathologist assessments and interventions [8–10]. Disciplines that may also contribute to the multidisciplinary intervention include dietary specialists, exercise physiologists, mental health professionals, social workers and even spiritual counselors and financial advisers.

Accordingly, medical specialties involved may include physiatrists, neurologists, neurosurgeons and psychiatrists. As per good clinical practice, each discipline will use its own assessment instruments and will set its own particular short- and long-term goals and develop a strategy. Interdisciplinary integration is one of the cornerstones of the multidisciplinary model and is discussed later in this paper; however, it merits special mention here, as goals have to be cross-referenced and compatible between disciplines. Cross-discipline awareness is a necessary element for the success of this schema and the ability of the allied health professionals to appreciate and identify the need for a different discipline to be involved will add cohesiveness and consistency to the intervention. Therefore, familiarity of the professionals involved with the various aspects of PD is important and cross-education through team reviews of individual cases is an indispensable step in the whole process. Here, we will review briefly the evidence for the core disciplines of nursing, physical and occupational therapy and speech and language pathology and also briefly touch on the remaining disciplines, for which there may not be much information in the available literature.

Nursing

The role of nurses in the management of PD has been extensively studied in the UK, with a particular focus on the cost–effectiveness of community-based nurse specialist services for PD patients [20–22]. The utility of a PD nurse specialist in the setting of a multidisciplinary model has not been specifically studied. Nevertheless, a PD specialist nurse may fulfill a wide spectrum of patient needs within the multidisciplinary model including patient and family education on diagnosis [23], symptom management [24], proper use of medication [22,25,26], clinical assessments [27], palliative care [28] and coordination of perioperative care, neurotransmitter programming for deep brain stimulation patients [29] and assessment and management of nonmotor symptoms such as issues of sleep [30], continence and constipation. A nurse specialist may also function as the nexus of coordination for the multidisciplinary team, as well as the liaison between the various allied health professionals, the physician and the patients and their care partners.

Physical therapy

The benefits of physical therapy interventions in PD have been well documented in the existing literature [31–33]. Because of the wide variety of modalities that have been studied and the small size of the studies, the available evidence is consistent, yet neither strong, nor very informative despite its apparent consistency. For example, the ‘BIG’ physical therapy protocol has been found to significantly improve part III (motor score) of the Unified Parkinson’s Disease Rating Scale (UPDRS) [34], while parallel groups receiving a Nordic walking program, or training in a home exercise program did not experience any improvements [35]. On the other hand, separate studies of Nordic walking have shown improved gait velocity in PD patients [36] and of treadmill walking have shown improvements in objective measures of balance [37,38], while studies of home-based exercise programs have shown a reduction in frequency of near-falls [39] and PD-related fall risk [40]. It is evident, therefore, that the assessed effectiveness of the multiple available interventions may vary greatly depending on the outcome measures used. Such measures, therefore, need to be tailored to the targeted need of the specific intervention. According to the UK National Clinical Guideline for diagnosis and management of PD, potential targets for physical therapy may include any of the following [11]:

- Gait re-education, improvement of balance and flexibility
- Enhancement of aerobic capacity
- Improvement of movement initiation
- Improvement of functional independence, including mobility and activities of daily living
- Provision of advice regarding safety in the home environment

Naturally, appropriate outcome measures should be employed in assessing both the patient’s level of function and the effectiveness of physical therapy interventions. Such measures have been validated in PD and include the Timed Up-and-Go (TUG) [41,42] and Five Times Sit-to-Stand Test (FTSST) [43] as overall mobility measures and the Berg Balance Scale (BBS) [44] and Tinetti score [45] as measures of balance and falls risk. Instrumented versions of some of these tests [46] seem promising, yet

further studies are still necessary to establish a ‘gold standard’. Posturography has been used in PD; however, its utility is being debated [47].

Occupational therapy

The purpose of occupational therapy in the treatment of PD is the facilitation of activities of daily living. As mobility appears to be a principal requirement for many such activities, the close collaboration of the occupational therapist with the physical therapist within the multidisciplinary team can be viewed as having a synergistic effect; a similar interaction may be beneficial with the speech pathologist, since communication and swallowing are functions that may be affected by PD and are at the root of many of the everyday life activities. It is therefore not surprising that much of the occupational therapy in PD literature has examined this discipline as part of a multidisciplinary approach [48] and its effects are difficult to distinguish from the effects of the complementary interventions. Nevertheless, despite the relative lack of strong evidence, the use of occupational therapy is supported, based on a few small studies and the body of clinical experience [11,49].

Among the guiding principles of occupational therapy are early intervention in order to maintain and prevent the loss of abilities, and patient-centered goal development and therapy. The role of the occupational therapist within the multidisciplinary team may vary, but the goal remains the facilitation of activities of daily living. Thus, occupational therapy interventions may be as varied as training to improve dexterity, assessment for, education about and implementation of adaptive equipment, cognitive assessment and training with regard to activities of daily living. The occupational therapist may be further involved in evaluation and assistance with professional and leisure activities and environmental adaptations to the work and home environment, and always aiming to facilitate the activities of everyday life.

Given the variety of targets for occupational therapy interventions, appropriate assessment tools need to be selected. As much of what the occupational therapist does overlaps to a degree with other disciplines, assessment tools may be shared accordingly. Instruments specifically assessing the activities of daily living in patients with PD are available, including the activities of daily living section (part II) of the UPDRS

[34] and the experiences of daily living subscale of the Movement Disorders Society (MDS) UPDRS [50]. Other scales of activities of daily living, both PD-specific [51,52] and generic [53], may be implemented; however, depending on the goals of the particular intervention, attention will have to be paid to the appropriateness and sensitivity to change of the particular instruments. Assessing instrumental activities of daily living [54–56] may provide a more objective measure of everyday life abilities; however, some of the objective instruments may be hampered by clinimetric shortcomings, such as poor test–retest reliability.

Speech & language pathology

The role of the speech therapist in PD is also considerably varied. PD affects not only articulation, but also voice volume, inflection and prosody. On a cognitive level, the loss of mental flexibility, associated with frontal lobe dysfunction in PD, can affect name and word memory and interfere with the train of thought and the natural flow of conversational speech. This produces a clinical picture of language disturbance, further compounding the communication problems facing PD patients. In certain clinical settings, the role of the speech therapist encompasses education and counseling of patients and families on cognitive issues in PD and even involvement in cognitive rehabilitation therapeutic protocols. Last but not least, it is within the realm of speech therapy that assessment and treatment of dysphagia lies. As important as these areas of dysfunction may be, and despite numerous published studies with positive results, a critical review of the literature discloses no level 1 evidence to strongly support the utility of speech therapy in PD – a finding common for most nonpharmacological treatments [57].

By far the therapeutic protocol that has attracted most attention and has gained momentum in improving speech in PD is the Lee Silverman Voice Treatment, a method that has consistently produced improvements in communication and health-related quality of life among PD patients [58,59]. Interestingly, the Lee Silverman Voice Treatment has also been found to improve swallowing function in PD [60]. Other strategies of speech therapy have not been studied to the same extent and some studies have shown little, if any, benefit from alternative speech therapy approaches [61,62].

Speech therapy assessment tools may be subjective (i.e., standardized questionnaires pertaining to communication and swallowing functions) [63–65] or objective (e.g., computerized voice and speech analysis and video swallow study). Both types of instrument are useful, as a lack of subjective improvement may suggest that the treatment was unsuccessful in improving the patient's quality of life despite improvements seen in objective scales [65].

Other interventions

Besides the traditional therapeutic approaches of physical, occupational and speech therapy, there is a mounting corpus of medical literature on the utility of additional complementary interventions in the context of the multidisciplinary treatment of PD. Such interventions include, but are not limited to:

- Behavioral therapy [66]
- Cognitive rehabilitation [67,68]
- Music therapy [69]
- Structured exercise and dance [70–72]
- Social services
- Spiritual services
- Patient and care partner education
- Palliative and end-of-life care

Although there is some evidence supporting such interventions, the existing studies are generally underpowered. More, better-powered and -designed studies are going to be necessary for these promising complementary therapies to become part of the mainstream treatment of PD.

Interdisciplinary implementation

A basic premise of the multidisciplinary model is the interdisciplinary implementation. The rationale is that communication between the various disciplines will have a synergistic impact on the outcome of the intervention. One may therefore argue, with reason, that considerations that facilitate interaction between disciplines, such as physical proximity of the various disciplines, accessibility, ease of communication and scheduling flexibility, will further increase the likelihood of a positive outcome. Team reviews of cases are the standard of care for inpatient rehabilitation programs and there is no reason to not adopt a similar approach in the outpatient

setting. Inclusion of patients and care partner, or family members in the multidisciplinary meetings will further ensure future implementation of recommendations beyond discharge from the program. It has been the experience of this author that providing patients and care partners with written directions, additional educational material and recordings of care conferences is both useful and appreciated at the time of discharge and beyond.

■ Setting

Although the majority of the literature on the multidisciplinary treatment of PD refers to interventions in the ambulatory setting, there has been excellent work done and published in hospitalized PD patients [10,73]; also in the recent setting of postoperative care following deep brain stimulation surgery for PD [74]. Constraints from the current reimbursement structure for hospitalization in the USA may have hindered more in-depth studies of the effectiveness of inpatient multidisciplinary rehabilitation in PD; however, there is certainly evidence to suggest that this approach may in fact prove cost effective. More large, well-designed studies will be necessary to prove the point and alter current practice.

■ Follow-up

Much of the existing literature on the subject lacks follow-up data. Long-term benefits of the therapeutic disciplines mentioned above are entirely unknown. Thus, it is reasonable to ask, for example, whether early participation in a structured exercise program will improve a patient's prognosis in terms of fall-related adverse disease outcomes. One might argue that a trained individual will be able to better

handle the balance challenges of advanced PD. It has been hypothesized, with good reason, that there may be physiological alterations caused by exercise that may have long-term effects in the pathophysiological processes underlying the symptoms of PD [75]. But even in terms of short-term follow-up very little is known from the existing literature. How long can one expect the benefits of a certain intervention to last? Is there a need for follow-up visits? Is there a point for periodic 'refresher' or 'booster' sessions? It would be therefore desirable that future studies of multidisciplinary interventions in PD include some type of both short- and long-term follow-up assessments.

Conclusion & future perspective

In summary, the multidisciplinary treatment of PD remains a poorly studied but rather promising field, in terms of need for further research, but also in terms of improving the lives of PD patients and their families. In an era of evidence-based medicine, it is important that new studies are undertaken, preferably taking into account the considerations discussed in this article and using rigorous scientific standards that can stand up to the requirements of evidence-based reviews.

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- **Website**
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