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Head-Up Tilt Sleeping to Treat Orthostatic Intolerance in a Patient with Advanced Parkinson's Disease: A Case Report

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Keywords
Orthostatic hypotension · Autonomic dysfunction · Non-pharmacological treatment · Movement disorders · Case report

Abstract
Introduction: Orthostatic hypotension is common in people with Parkinson's disease (PD) due to autonomic dysfunction and medication use and can have a significant negative impact on quality of life. Pharmacological treatment is often complicated due to complex blood pressure regulation problems. This case report presents a patient whose symptoms of orthostatic intolerance were successfully treated with the non-pharmacological method of head-up tilt sleeping (HUTS). ***Case Presentation:*** A 69-year-old man with PD and prominent autonomic failure received recommendation from the neurologist to use HUTS to battle orthostatic intolerance, of which complaints were worst in the early morning. The patient noted a marked improvement of the orthostatic intolerance after a period in which he slowly step-by-step inclined the bed to an angle just over 10°. When ceasing HUTS for a brief period, complaints of orthostatic intolerance immediately returned and the patient returned to tilted sleeping right away. After a follow-up of 3 months, the patient did not report orthostatic

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intolerance during a standing test. ***Conclusion:*** This case illuminates that, despite difficulties intrinsic to this method, whole-body HUTS can ameliorate orthostatic intolerance and improve the daily life of people with advanced movement disorders.

Introduction

Autonomic dysfunction is a common symptom of Parkinson's disease (PD), often presenting with problems in maintaining blood pressure homoeostasis [1]. Blood pressure is closely regulated by the baroreflex, which coordinates vascular resistance and heart rate based on the pressure changes that it registers [2]. When the autonomic nervous system is affected by a neurogenerative process (e.g., in PD or a form of atypical Parkinsonism such as multiple system atrophy), this can result in baroreflex failure. In PD, peripheral denervation is an important factor for baroreflex failure, while in multiple system, atrophy the problem lies at the pre-ganglionic level [3]. In both cases, the system can no longer respond to challenges such as the volume shift caused by standing up, resulting in orthostatic hypotension (OH) with debilitating symptoms of orthostatic intolerance. The prevalence of OH is about 1 in 3 for people with PD and 4 in 5 for people with multiple system atrophy [1]. OH and other co-occurring blood pressure abnormalities (e.g., supine hypertension) have a direct negative influence on quality of life, largely due to a reduced mobility, and are also associated with long-term health risks such as cardiovascular events and dementia [4, 5]. Pharmacological treatment is difficult because of the often complex blood pressure regulation problems and extensive medication regimens in PD (where dopaminergic medication may worsen OH). Moreover, caution is warranted because pharmacological treatment of OH can cause or worsen supine hypertension as a side effect. Non-pharmacological interventions are therefore an attractive alternative treatment approach, as these have limited to no side effects. Methods include increasing salt and water intake, physical counter manoeuvres, and strength training [6, 7]. One method that has been hypothesised to positively affect OH is sleeping with the head of the bed elevated: head-up tilt sleeping (HUTS). It is thought to alleviate orthostatic intolerance by reducing pressure natriuresis overnight and by creating increased extracellular volume – and thereby pressure – in the legs preventing excessive venous pooling upon standing [8, 9]. HUTS was first introduced over 80 years ago, and even though widely known, it is not often applied [10, 11]. In this case report, we present a patient whose symptoms of orthostatic intolerance were successfully treated with HUTS. The CARE Checklist has been completed for this case report and is included as online supplementary material (for all online suppl. material, see https://doi.org/10.1159/000541424).

Case Presentation

A 69-year-old man with a history of PD and depression was seen in December 2022 by a neurologist at the outpatient clinic of the Radboud University Medical Centre, Nijmegen, the Netherlands, for a consultation concerning several non-motor symptoms related to PD and medication use. The first symptoms of PD occurred 20 years prior to the visit and started with hyposmia. A diagnosis of PD was established 10 years ago based on the presence of bradykinesia, right-sided rigidity, and mild postural tremor in the right arm. The disease course was atypical, with cognitive problems already present at the time of diagnosis (short-term

memory problems that affected daily life, difficulty concentrating, and problems with planning and logical thinking). A differential diagnosis of multiple system atrophy was considered for several years due to the early prominent presence of autonomic dysfunction and a small perceived effect of levodopa use. Multiple system atrophy was considered but was deemed less likely than PD because of the small but nevertheless clearly present response to levodopa, the presence of hyposmia (which is not seen in MSA) and the slowly progressive course. Throughout the years, autonomic dysfunction became more prominent. The complaints occurred primarily as urogenital dysfunction (urge with miction – but no incontinence – and impotence). Orthostatic intolerance appeared 3 years prior to the visit. At the moment of the latest visit, the patient reported feeling insecure due to orthostatic intolerance, in relation to which he reported consistent near falls after getting out of bed in the morning. At this point, a rapid eye movement sleep behaviour disorder had also been established based on the unambiguous presence of dream enactment behaviour. The Hoehn and Yahr stage was II, and autonomic dysfunction could be quantified with a Scale for Outcomes in Parkinson's Disease-Autonomic Dysfunction [12] score of 37 out of 69. At this time, the patient was using four medications, including clomipramine (daily dose 50 mg) and levodopa/benserazide (net daily dose 1,673/184 mg) which could affect symptoms of cardiovascular autonomic dysfunction. The patient was then recommended to increase fluid and salt intake, which resulted in more nycturia and only slight improvement of orthostatic symptoms. Because of the nycturia and orthostatic complaints, which were the worst in the morning, the patient was also recommended to start HUTS, which he was able to implement 2 months later. This resulted in amelioration of the orthostatic intolerance, where the patient had less complaints of dizziness. Almost a year after starting HUTS, he attempted to sleep horizontally for two nights to test the effects, and dizziness returned with several episodes of pre-syncope in the following days. The patient immediately returned to HUTS and has slept in the tilted position every night since then.

The patient implemented HUTS at home by gradually increasing the height of the head of the bed over a period of 2 months in steps of approximately 10 cm and currently sleeps at a 38 cm elevation (11° tilt; Fig. 1). At this height the patient reported improvements in the symptoms of orthostatic intolerance, which was not observed at the lower angles. The patient also noticed an improvement in breathing and coughing during the night which he had experienced prior to adopting a tilted sleeping position. He never attempted further increasing the angle. No blood pressure measurements before HUTS and after the development of orthostasis are available to us. Three months after starting HUTS, a standing test showed only a limited blood pressure drop with a supine blood pressure of 107/75 mm Hg and an orthostatic blood pressure of 97/64 mm Hg after 3 min of standing, only just meeting the diastolic criterion for OH [13].

Discussion

Practical application of HUTS can be challenging. The method is still used only sporadically, presumably because healthcare professionals do not know which method and angle to recommend. Additionally, in the Netherlands – and we suspect in many other countries as well – a bed that allows the anti-Trendelenburg position with a concurrent footboard to prevent sliding is hard to come by through healthcare organisations. The patient described here is illustrative in this regard, as it took him several months to acquire this special bed. There is currently no evidence base on which to suggest a specific tilt angle that is likely to be most efficacious, so many individuals are left to a process of trial and error at home. This is again exemplified by the present case history, where the patient gradually increased the tilt

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Fig. 1. Application of the HUTSin the patient's home. The patient uses an automatic bed which can be moved up and down in the anti-Trendelenburg position freely. This eliminates the difficulty of getting in and out of a tilted bed. After lying down, the patient uses the remote control to raise the bed to the desired position. The head of the bed is elevated by just under 40 cm, at an angle slightly over 10° as measured with a degree gauge. The footboard of the bed provides a safety barrier to prevent him from sliding out of the bed at night. A pillow underneath the feet prevents discomfort and is positioned in such a way as to avoid lifting the legs. This specific bed is also equipped with an overhead trapeze to help with turning during the night and with getting in and out of bed.

angle until a sufficient reduction in complaints of the incapacitating morning orthostatic intolerance was experienced by him. Self-experimenting with such a gradual increase in angle seems helpful from a feasibility perspective, and to increase the likelihood that an effective and tolerable angle can be found for each individual patient, which can then be applied permanently. The individual differences between patients in specific symptoms, sleep comfort, severity of orthostatic intolerance and potential improvement following HUTS make it essential to weigh the pros and cons of HUTS for each individual, thus aiming to find the best personally tailored approaches to tilted sleeping. There is only limited evidence to support the efficacy of HUTS as a treatment of orthostatic intolerance [14], but the present patient reported definite improvement of orthostatic symptoms, especially in the morning, where he experienced less dizziness upon standing, suggesting there is indeed a continuing effect that is enabled during the night. The efficacy in this case is emphasised by worsening of the symptoms upon discontinuation of HUTS, which was also noted in previous case reports but has unfortunately not been documented in clinical studies to date [10].

The successful use of HUTS by this patient highlights the potential merits of this hitherto underutilised non-pharmacological treatment for OH while also offering a good perspective on the practical challenges that come with introducing this treatment in a patient's own home situation. HUTS also had a beneficial effect on nocturnal breathing, which we explained via decreased gravitational pressure preventing obstruction of the upper airways [15]. We hope that these findings, albeit at the $n = 1$ level, can serve as a motivation for dedicated further research studies, aiming to test different angles applied in an increasing order. Well-designed randomised controlled trials could presumably give a better insight into what a minimally effective tilt angle is and what a good starting position would be for most patients. Such research can also look into compliance issues since sleeping in a more vertical position is perceived as uncomfortable by some individuals. These new studies should also examine which patient profiles are particularly eligible for this type of intervention, thereby gaining better insight into the mechanism by which HUTS increases orthostatic tolerance. The specific

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patient group discussed here (persons with movement disorders) has not been represented in prior clinical trials that evaluated this intervention. Future work must include this population, so the results can offer guidance with respect to patient-specific advice on using HUTS. Such work is currently ongoing at our centre [16].

Statement of Ethics

The patient was treated as part of regular care. Ethical approval is not required for this study in accordance with national guidelines. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Conflict of Interest Statement

A.H.S., S.S., and M.K.B. declare no competing interest. N.M.V. serves as an associate editor of the *Journal of Parkinson's Disease* and receives funding from the Michael J. Fox Foundation for Parkinson's Research, the Netherlands Organisation for Health Sciences and Development and from Verily Life Sciences. B.R.B. currently serves as an associate editor for the *Journal of Parkinson's Disease*, has received honoraria from serving on the scientific advisory board for Zambon and Kyowa Kirin, has received fees for speaking at conferences from AbbVie, Zambon, and Bial, and has received research support from the Netherlands Organization for Scientific Research (NWO), the Michael J. Fox Foundation for Parkinson's Research, UCB, the Stichting Parkinson Fonds, the Hersenstichting Nederland, the Parkinson's Foundation, Verily Life Sciences, Top Sector Life Sciences and Health, and the Parkinson Vereniging. R.D.T. reports consultancy and speakers' fees from Union Chimique Belge, Angellini, GlaxoSmithKline, Theravance, Novartis, and Zogenix; and grants from the Dutch National Epilepsy Fund (EpilepsieNL), the Michael J. Fox Foundation for Parkinson's Research (MJFF-020200), Christelijke Vereniging voor de Verpleging van Lijders aan Epilepsie, Medtronic, New Life Wearables, VriendenLoterij, and the Netherlands Organisation for Health Research and Development (114025101).

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Author Contributions

Neurologists B.R.B. and M.K.B. saw the described patient. A.H.S. drafted the manuscript. S.S., B.R.B., N.M.V., and R.D.T. conceptualised the study. S.S., N.M.V., M.K.B., R.D.T., and B.R.B. revised the manuscript, and all authors approved the manuscript.

Data Availability Statement

All data generated or analysed during this study are included in this article and its online supplementary material. Further enquiries can be directed to the corresponding author.

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