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Change in physical mobility over 10 years in post-polio syndrome

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Abstract

Post-polio syndrome is characterised by progressive muscle weakness and other symptoms which can limit physical mobility. We assessed the rate of decline in mobility over 10 years in relation to strength decline; and investigated potential predictors for the rate of decline of walking capacity, a measure of mobility, in 48 patients with post-polio syndrome and proven quadriceps dysfunction at baseline. Average walking capacity and self-reported physical mobility declined over 10 years, by 6 and 14%, respectively. Concomitantly people lost an average of 15% of isometric quadriceps strength. Significantly more people used walking aids offering greater support at follow-up. Notably, there was much individual variation, with 18% of participants losing a substantial amount of walking capacity (27% decline) and concomitant self-reported physical mobility (38% decline). Loss of quadriceps strength only explained a small proportion of the variance of the decline in walking capacity ($R = 11\%$) and the rate of decline could not be predicted from baseline values for strength, walking capacity, self-reported physical mobility or basic demographics. The individual variability, yet lack of predictive factors, underscores the need for personally tailored care based on actual functional decline in patients with post-polio syndrome.

Keywords: Postpoliomyelitis syndrome; Mobility limitations; Longitudinal studies; Walking; Prognosis; Quality of life

1. Introduction

Post-polio syndrome (PPS) is characterised by progressive loss of muscle strength and/or endurance after at least 15 years of stable neurological functioning [1]. It is often accompanied by symptoms of generalised fatigue, and muscle and joint pain [1].

The pathophysiology behind PPS is not fully understood, but a combination of distal degeneration of axons of enlarged motor units caused by increased metabolic demands [2] and the normal aging process, is the most widely accepted aetiology. Additionally inflammatory mechanisms are thought to be involved [3,4]. The resulting strength decline, may negatively affect physical mobility and restrict participation in activities of daily life [1,5–8]. The rate with which physical mobility deteriorates in patients with PPS, and to what extent a continuing loss of muscle strength contributes to this decline, is however still an issue of debate [9].

Longitudinal studies to date that included measures of physical mobility such as walking capacity and self-reported physical mobility reported conflicting results [10–16]. Moreover, the direction of the change in physical mobility did not always match expectations based on concomitant strength changes [10–15]. A possible explanation for the variable results found is that the follow-up period of some of these studies was shorter than the recommended 4 years [17,18]. While the longer studies included polio survivors with and without PPS and a wide array of initial deficits and used a great variety of different outcome measures to measure physical mobility. Additionally, no study so far evaluated predictors for a decline in walking capacity in PPS, while knowledge thereof would allow for targeted and timely intervention to either prevent further decline of mobility or reduce the consequences of this decline. For these reasons, a long-term study in a homogenous cohort of patients with PPS is urgently needed.

In 2000, we assessed physical mobility and quadriceps strength in a group of 66 patients with PPS who had proven involvement of at least one quadriceps muscle [19]. By studying this homogenous group of patients with defects in a functionally important muscle after 10 years, we aimed to assess the long-term rate of decline in physical mobility in relation to strength declines and to investigate potential

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predictors of the rate of deterioration of walking capacity in PPS.

2. Materials and methods

2.1. Participants

Sixty-six adults with PPS that had completed baseline measurements in a randomised controlled trial of pyridostygmine between 1999 and 2001, were invited to participate in the present study (2010) [19]. At baseline, ambulatory individuals with PPS were included if they had (1) symptoms of fatigue; (2) symptoms of postpoliomyelitis muscle dysfunction in at least one quadriceps muscle; (3) neuromuscular transmission defects in the symptomatic quadriceps muscle; (4) a minimum quadriceps strength of 30 Nm; and (5) age between 18 and 70 years. Exclusion criteria were significant neurological, orthopaedic, cardiovascular, pulmonary, or endocrine disorders, and anaemia or thyroid dysfunction [19].

No new inclusion criteria were applied in the present follow-up. The only new exclusion criterion was the presence of any newly developed disease that affected voluntary control of the muscles. All participants provided written informed consent, and the study was approved by the institutions' Medical Ethics Committee.

2.2. Study design

In this prospective cohort study, all participants underwent a standardised assessment of functioning on 2 separate days, in most cases within 2 weeks and never more than 3 months apart (Fig. 1). Data from high-density surface EMG measurements included on day 2 have been reported elsewhere [20].

2.3. Measurements

2.3.1. Basic demographics

Age, gender, number of years since acute poliomyelitis, and the number of extremities clinically affected by the disease were registered at baseline. The number of people with new symptoms of muscle weakness, muscle fatigue, muscle pain, and atrophy were recorded both at baseline and follow-up. In addition, people reported whether each symptom had increased, decreased, or remained stable at follow-up compared to baseline.

2.3.2. Physical mobility and strength

2.3.2.1. Walking capacity. The distance walked (m) in 2 minutes at a comfortable pace on a standardised 50 m circuit was recorded [21]. Participants used the same assistive walking devices they used in daily life.

2.3.2.2. Self-reported physical mobility, Nottingham health profile (NHP). The Dutch validated NHP measures perceived health and consists of 38 polar questions in 6 subscales [22]. The subscale physical mobility (NHP-PM) consists of 8 items and the sum score ranges from 0 (good physical mobility) to 100 (poor physical mobility).

2.3.2.3. Assistive walking devices. The type of walking aid and lower limb support device (i.e. orthosis or orthopaedic shoes) used when walking outside was categorised according to severity (Table 2).

2.3.2.4. Quadriceps strength. Peak knee extension strength (Nm) was defined as the strongest of three isometric maximal voluntary contractions performed on a hard surfaced fixed chair

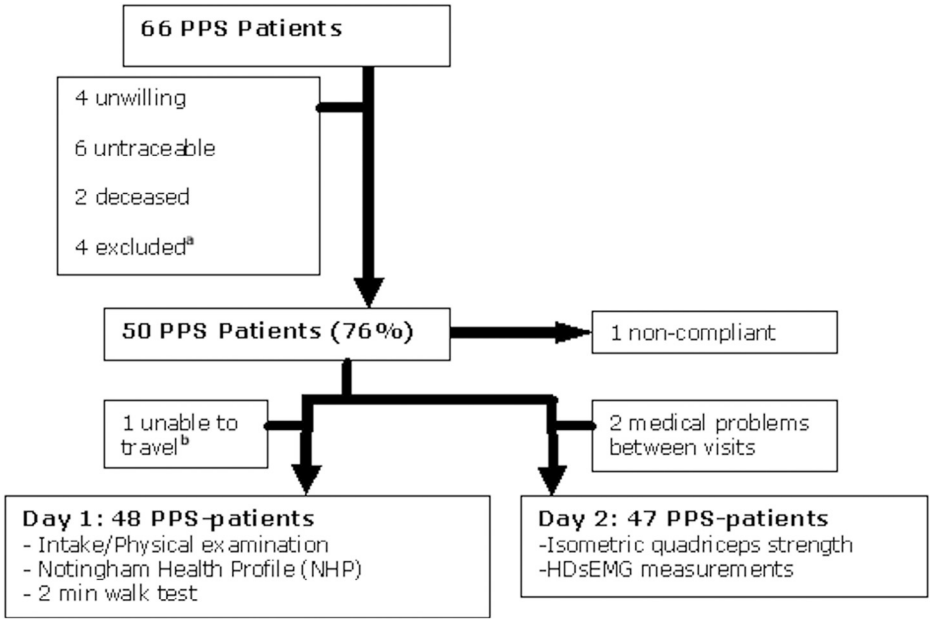

Fig. 1. Inclusion figure and overview of measurements performed on each testing day. PPS = post-polio syndrome; HDsEMG = high-density surface electromyography. [a]Four patients were excluded for co-morbidities that may have affected the quadriceps under investigation: 1 was in hospital for treatment at the time of measurement, 1 had a prosthetic joint infection and loosening of a knee prosthesis and 2 were suffering from lower limb muscle sprains and strains after a fall. [b]For the subject unable to travel to the day 1 location, intake and questionnaires were completed on day 2, data from 2 minute walk test remained missing.