



**Karolinska  
Institutet**

**Institutionen för neurobiologi, vårdvetenskap och samhälle**

## **Walking in adults with spastic cerebral palsy – the relation to pain, fatigue, gait and balance**

**AKADEMISK AVHANDLING**

som för avläggande av medicine doktorsexamen vid Karolinska Institutet offentlig försvaras i Hörsal H1, Zanderska huset, Alfred Nobels Allé 23, Karolinska Institutet, Huddinge.

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## ABSTRACT

**Background:** Cerebral palsy (CP) is a disorder of movement and posture, and reduced gross motor function has been reported in several studies. Walking is an important function in everyday life, and important for independence. Studies on walking deterioration in adults with spastic CP are lacking.

**Objectives:** The main aim of this thesis was to investigate walking over a seven year period, to characterise and investigate the critical variables associated with walking deterioration, the changes in these variables over seven years, and to compare and characterise gait and balance in relation to walking deterioration.

**Methods:** Studies I and II were seven-year follow-up studies (N=149) using the same questionnaire as previously. Self-reported walking deterioration was assessed and compared. Pain, fatigue and gross motor function were compared over seven years, and the relationship between these variables and walking deterioration was examined (Study I). The relationship between number of pain sites and mental and physical components of Health-Related Quality of Life (HRQoL) was investigated, as well as pain site prevalence (Study II). For the inclusion to Studies III and IV, individuals in the critical age and sub-diagnosis for walking deterioration were identified. Three-dimensional gait analysis was used to obtain work of walking and kinematic gait variables in adults with spastic bilateral CP, <40 years in 2006 (N=16). The variables were compared between those reporting walking deterioration and those who did not. Gait was characterised across all (Study III). Number of falls was recorded. Balance confidence, fear of falling, balance ability were compared between those reporting walking deterioration and those who did not, and characterised across all (Study IV).

**Results:** Walking deterioration increased, and was most common in bilateral CP, especially in the 35-40 year age groups. Pain intensity and number of pain sites were unchanged, while pain frequency and HRQoL domain of bodily pain had worsened. Pain and physical fatigue scores were significantly higher in those reporting walking deterioration (Study I). Mental components of HRQoL did not correlate with the number of pain sites. Back, neck and foot/ankle were the most common pain sites (Study II). No differences in gait and balance variables were found between those reporting walking deterioration and those who did not (Studies III-IV). Across all, gait was characterized by increased anterior pelvic tilt, hip and knee flexion and deviating foot progression angle. Almost half was categorised as crouch gait (Study III). A high frequency of falls was found. Reduced balance in all subsystems was found. Postural responses and anticipatory postural adjustments seemed most affected (Study IV).

**Discussion/Conclusion:** Walking deterioration was associated with pain and fatigue. In contrast to the general population, psychological health was not associated with the number of pain sites, suggesting adequate coping strategies. The experience of walking deterioration was not explained by gait and balance variables, suggesting that other factors, possibly from all ICF domains, may be important. Balance was at the same level as elderly after fractures and the high number of falls may lead to activity and participation restrictions for these young individuals. These findings indicate a need for specialised and individualised follow-up programmes with a life-span perspective focusing on prevention of secondary consequences and of additional balance and gait deterioration.

**Key words:** Cerebral palsy, spastic, pain, fatigue, walking, gait, postural control, balance, kinematics, kinetics

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