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Upper Limb Assessment and Treatment in Cerebral Palsy

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Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av medicine doktorsexamen framläggs till offentligt försvar i Hörsal **E04**, plan **-1**, byggnad **6E**, Norrlands universitetssjukhus fredagen den **24 mars, kl. 09:00**. Avhandlingen kommer att försvaras på engelska

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Author Izabela Blaszczyk**Title** Upper Limb Assessment and Treatment in Cerebral Palsy**Abstract**

Cerebral palsy (CP) is a heterogeneous group of neurological disorders caused by fetal or infant brain damage that often involves deficits in upper limb (UL) posture and function. Knowledge about effective methods of assessment and treatment of UL in CP is not extensive. In this thesis, different aspects of these two are explored. In **Paper I** we retrospectively investigated the effect of a long-term treatment regime developed in Västerbotten county habilitation service. The treatment regime included intramuscular injections of botulinum toxin type A (BoNT-A) combined with occupational therapy (OT) and movement training. The results of passive extension of the wrist with fingers extended and the assessment of hand function in children with severe hand function impairment (initially House functional classification 0-1) were analyzed over time. Twenty-five children were divided into 3 groups depending on the treatment regime start age (before or after the age of 7) and treatment regime availability. We found significantly worse passive extension of the wrist with fingers extended in children who did not have a chance to benefit from therapy in early childhood. Additionally, an improvement in the passive movement of the wrists was noted in children who completed the treatment regime before the age of 7. Regarding hand function, a significant difference was found between children who received treatment in early childhood and those who received treatment as adolescents. The injections of BoNT-A in CP are common, however the monitoring of eventual side effects and adverse events (AEs) after this treatment is difficult to perform in clinical practice. To facilitate this process, we created a new, no previously validated questionnaire (**Paper II**). The questionnaire was given to patients or their caregivers to be completed after each BoNT-A treatment. 94% of participants returned the questionnaire. 80 % were filled in completely which proves the effectiveness of the applied form and the ease of its use in clinical practice. 61% of patients reported one or more different AEs or sides effects. In addition, we analyzed the risk for generalized and focal distal AEs reported by 38% of patients. Those may indicate the spread of BoNT-A toxin to the whole body, therefore requiring special attention. We found that females had a 1.899 relative risk with significant association ($p=0.029$) of reporting generalized and focal delayed AEs compared to males. The use of the questionnaire helped to make the decision to change or discontinue BoNT-A injections in 8 cases (11%).

In some patients with dyskinetic type of CP (DCP) treated with BoNT-A to diminish the external rotation posture of the shoulders, a loss of treatment effect was observed, which contributed to the need to look for another method of treatment. In **paper III**, a surgical method to manage the external rotation posture of the shoulders is presented. The surgical procedure consists of weakening the strength of the externally rotating muscles by cutting the attachment of one of them (release of the posterior deltoid) and complete denervation of the other (denervation of the infraspinatus). The third shoulder external rotator (teres minor) remains intact. The results of this procedure performed in 7 shoulders in 6 patients (age 14-24) were analyzed using satisfaction questionnaire and pre-/postoperative video-recordings. Five of 6 patients were very satisfied with the treatment, one was neither satisfied nor dissatisfied. Four patients had an obvious improvement in their shoulder position confirmed on video recordings. In one, overcorrection in the form of internal shoulder rotation was observed.

Assessment of the thumb in CP is important as the thumb impairment plays a crucial role in hand grip function.

Paper IV presents a new tool called CP-thumb score, which addresses the occupational therapists to follow the changes in the thumb function and its posture. CP-thumb score has two parts: descriptive and score of the thumb's CMC joint radial abduction. Thirty thumbs in 19 patients with all types of CP were assessed with CP-thumb score. All assessments were made based on available video recordings. Additionally, all thumbs were assessed using the House's thumb-in-palm classification which has been shown to be unreliable. These two thumb assessments were compared with each other.

Keywords

Cerebral palsy, upper limb, botulinum toxin type A, upper limb surgery, side effects, thumb assessment

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