SCIENTIFIC ARTICLE

Hand Function in Cerebral Palsy. Report of 367 Children in a Population-Based Longitudinal Health Care Program

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Purpose To describe aspects of hand function in a total population of children with cerebral palsy (CP).

Methods Upper extremity data were collected for 367 children who were born between 1992 and 2001 and were registered in a population-based health care program for children with CP. Hand function was classified according to the Manual Ability Classification System (MACS), the House functional classification, and the Zancolli classification. The type of spastic thumb-in-palm deformity was evaluated according to House.

Results In the total population of children with CP aged 4 to 14 years, 60% had more than minor problems with hand function (>MACS I). Independence in age-relevant, daily manual activities (MACS I–II) was noted in 87% of children with spastic unilateral CP and in 63% of children with spastic bilateral CP, but in only 20% of children with dyskinetic CP. According to the House functional classification, both hands were spontaneously and independently used in 55% of children (House 7–8), whereas 5% did not use either of their hands (House 0). Minor increase of flexor muscle tone (Zancolli level 1) was found in 69% of all children. Only 2% were in level 3 in both hands. Spastic thumb-in-palm deformity in 1 hand was found in 25% and in both hands in another 15%.

Conclusions Limitations in hand function are common in all types of CP, but characteristics of the disability vary considerably between different CP subtypes. The MACS classification is useful to evaluate how well children can handle objects in daily activities. The House functional classification describes grip function in each hand separately; the Zancolli classification of finger and wrist extension and the classification of thumb-in-palm deformity according to House give an estimate of dynamic spasticity. All these classifications were shown to be useful in a population-based health care program, but further studies of the psychometric properties are required. *(J Hand Surg 2008;33A:1337–1347. Copyright © 2008 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Hand function, cerebral palsy, children, total population.

LIMITED HAND FUNCTION is 1 characteristic of the movement disorders in children with cerebral palsy (CP). Hand disability varies according to the underlying pathology and the timing of the injury to the developing brain. Hand surgery, mainly muscle or tendon lengthening and tendon transfer, in selected cases has been shown to improve hand function in CP.[1–3] During recent decades, intramuscular injection

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of botulinum toxin A has become another treatment option to reduce muscle tone,[4] with variable effects on hand function.[5] In studies reporting results of these treatments, spastic unilateral upper extremity involvement is most common. Much less is known about hand function in children with spastic bilateral, dyskinetic, or ataxic types of CP. Focus in these children is often on gross motor function, such as walking ability. Some of these children may, however, also benefit from upper extremity surgery or botulinum toxin treatment. The selection of suitable candidates and timing of surgery are considered the most crucial prerequisites to obtain good results.[6,7] Background knowledge of the entire spectrum of hand disability in a total population of children with CP is of interest to hand surgeons involved in the treatment of these children.

A population-based health care program for children with CP was started in Sweden in 1994 with the main aim of preventing hip dislocation and severe contractures by early detection and intervention.[8] All children with CP born in 1990 or later and living in the area are invited to participate in the program, which is called the Cerebral Pares Uppföljnings Program (CPUP). The program includes a standardized and regular follow-up of gross motor and hand function, spasticity, and treatments. Hip joints are monitored by regular radiographic examinations. Since 2005, CPUP has been a national health care quality register in Sweden approved by the National Board of Health and Welfare. CPUP has been a successful prevention program, with statistically significant reduction of hip dislocation ($p < .001$),[8] severe contractures ($p < .01$),[9] and wind-swept deformity ($p < .01$).[10]

The aim of this study was to describe different aspects of hand function in a total population of children with CP, using the information from the CPUP database.

MATERIALS AND METHODS

Participants

Upper extremity data from the CPUP register for the counties Skåne and Blekinge in southern Sweden were collected during 2005 to 2006. The study area has a total population of 1.3 million inhabitants. The prevalence of CP in the region is approximately 2.4 per 1,000 live births,[11] which corresponds to about 35 new children with CP each year. Regular inventories of medical records are performed to identify all children with CP. The CP diagnosis is ascertained by the child's neuropediatrician after the age of 4 and defined according to Mutch et al.[12]

In the present study, all children participating in CPUP who were born from 1992 to 2001 and living in the study area on January 1, 2005, were included. There were in total 367 children, 216 boys and 151 girls, aged 4–14 (median 9) years. The number of children in each age group is shown in Figure 1. There were 18 children whose families declined participation in CPUP.

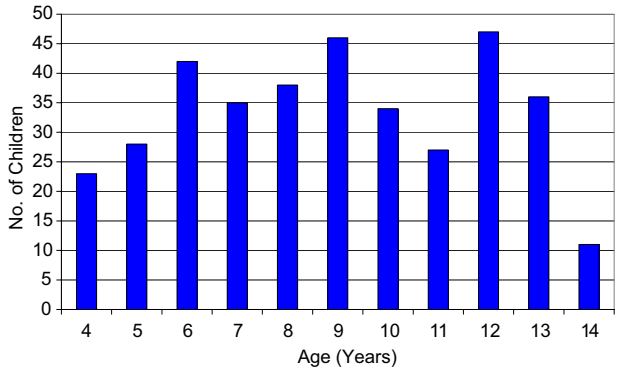

FIGURE 1: Age distribution of the 367 children with CP at time of evaluation.

The CP subtypes were determined after 4 years of age according to the internationally accepted Swedish classification (SC).[13] In this classification, spastic CP is divided into hemiplegia with unilateral involvement; diplegia, where spasticity dominates in the lower extremities; and tetraplegia, where all 4 extremities are involved. In spastic tetraplegia, the upper extremities are usually more involved than the lower, and all these children have a severe functional disability. The term *quadriplegia* in American literature is not equivalent to *tetraplegia* in the SC system. To clarify, the authors also transferred the CP subtypes to the new system by the Surveillance of Cerebral Palsy in Europe (SCPE) group.[14,15] In the SCPE, spastic diplegic and spastic tetraplegic CP are grouped together into *spastic bilateral CP* in order to create an internationally uniform system. This conjoined group, however, represents a wide variety of clinical presentations, and it is recommended that a functional classification be added.[14,15,16] In the present study, results are presented for SC subtypes.

Assessments

The children were evaluated by their occupational therapists at the local treatment center (child habilitation unit). There is a regular educational program for the assessments in order to ensure the high quality of data collection. The following assessments were used: Manual Ability Classification System (MACS), the House functional classification, the Zancolli classification of active finger and wrist extension, and evaluation of thumb-in-palm deformity.