Cerebral palsy: towards developmental neuroscience

Editorial

Cerebral Palsy (CP) has been discussed as a disease entity for decades. Today it is considered a group of disorders with different aetiologies, which constitutes a useful socio-medical framework for certain children with motor disabilities with special needs. Many countries run registers, which are important for service planning and for monitoring trends in CP rates.

However, it was difficult to compare results from these registers due to the lack of consensus on definition and subclassification. Therefore, a network funded by the EU, the Surveillance of Cerebral Palsy in Europe (SCPE), has worked on the standardization and harmonization of the group of disorders which constitutes CP.[1] CP is described on a neurological and functional/behavioural level relying on a video-based training manual, established and evaluated by the group. It also integrates validated functional scoring systems.[2] As a result, a common database was constructed, which allows for the analysis in subgroups e.g. birthweight-related risk for CP in gestational age groups.[3]

Major progress in CP research comes from neuroimaging. Magnetic resonance imaging (MRI) has the potential to visualize brain abnormalities, lesions, or disorders which give rise to CP. The brain undergoes complex organizational changes during early development. Pathogenic events affecting the developing brain cause abnormalities/lesions, the patterns of which depend on the stage of brain development. Identifying these patterns by means of MRI helps to time the major periods for CP pathogenesis.[4] There is increasing evidence that the majority of CP cases, e.g. 70 to 75%, show clear lesional patterns of different timing. Maldevelopments are rare. This means that CP is an acquired condition in the majority of cases. An ongoing European study (The European Cerebral Palsy Study) investigates the pathogenesis of CP by means of MRI on a broader basis. Evidence from MRI studies in CP has also led to the recommendation that MRI be the first procedure in the diagnostic work up of a child with CP (after history taking and clinical examination).[5]

CP can now be described on a functional/behavioural, neurological, and brain-morphology levels. These multiple approaches open the door to developmental neuroscience. The compensatory potential of the young nervous system following brain injury is considered to be superior to that of the adult brain (Kennard principle[6]). Children with CP and brain lesions, which are characterizing pathogenic events at different times during early brain development, can help us to understand the impact of these lesions on brain function as well as the compensatory mechanisms. Two examples from our group illustrate this. In children with unilateral spastic CP, abnormal fast conducting cortico-spinal projections from the healthy hemisphere can exert the primary motor control, when, due to large lesions, motor tracts are disrupted. Such ipsilateral projections are not seen in the adult brain after stroke. Thus, they constitute a specific compensatory mechanism of the young brain. However, their functional role seems to decrease already during late gestation.[7] Children with bilateral spastic CP can teach us that it is not necessary to be able to walk on your own to understand walking. This challenges the idea that motor experience itself is an obligatory prerequisite for the perception of human locomotion.[8] Answers to questions of compensation and reorganisation after early brain lesions will have an impact on concepts of rehabilitative therapy and thus also help individual patients.

In conclusion, CP has become an interesting model for neuroscience. However, in order to study mechanisms of plasticity in the young human brain, it is necessary to describe systematically neurological and functional deficits in CP children in addition to brain morphology.This brings us back to the call for common concepts of CP definition and classification. The approach adopted by SCPE has made substantial strides in this area. A need which has recently been acknowledged in an international workshop held in July 2004, the proceedings of which are described in the August issue, take us even further in developing a consensus on the way we understand the concept of disorders called CP.

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