Definition and classification of cerebral palsy

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Objectives

• The definition of cerebral palsy
• The importance of a multidimensional classification in CP
• The GMFCS and the MACS
• How to apply the GMFCS
The time is ripe for uniform definition and classification, because….

- Disciplines want to make meaningful distinctions in a heterogeneous condition like CP
- Disciplines perceive problems with classifying CP, its cause(s) and its consequences
- Disciplines need a common language to facilitate discussions
CP in the 17th century

The clinical picture of a person as a whole
CP in the 19th century

1861 Little relation between deformities and asphyxia

1897 Freud cerebral diplegia
CP in the 20th century

- An umbrella term covering
- a group of non-progressive, but often changing, motor impairments syndromes
- secondary to lesions or anomalies of the brain
- arising in the early stages of development.

*Mutch et al. Dev Med Child Neurol 1992*
CP in the 21th century

• ‘Cerebral palsy describes a group of developmental disorders of movement and posture, causing activity restriction or disability, that are attributed to disturbances occurring in the fetal or infant brain.

• The motor impairment may be accompanied by impairment of sensation, perception, cognition, communication, and behaviour, by epilepsy, and by secondary musculoskeletal problems.’

ISPO Report September 2008
Cerebral Palsy (CP)

• CP is a clinically defined diagnosis

• The definition include 3 key elements:
  – a group of disorders of the development of movement and posture
  – causing activity limitation
  – that are attributed to nonprogressive disturbances that occurred in the developing fetal or infant brain
Cerebral Palsy (CP)

• A diagnosis implies a level of certainty about the nature or cause of the condition

• However, in CP it is not always a clear picture:
  – Child’s motor problems changes over the first year of life
  – Early signs are not always predictive of later motor problems
  – The motor problem can be accompanied by a seizure disorder and by impairment of sensation, perception, cognition, communication and / or behaviour
Cerebral Palsy (CP)

• The heterogeneous nature of CP may affect and complicate the initial disclosure process of communicating a diagnosis clearly to the family.
CP
How does the picture look today?
General issues of classification

- Classification means that one converts the complexities of a disorder into a limited number of grades in an ordered system.

- Classification of CP is making decisions.

- Classification systems have to be reliable but to some degree misclassification has to be accepted.
Classification of CP

• Can the child be diagnosed as cerebral palsy: YES or NO?

• Can we classify the underlying ‘brain damage’ and its cause(s)?

• Can we classify the consequences of CP?
Classification systems in CP

• Systems should be:
  – specific to the purpose(s)
  – shown to be reliable and valid
International Classification of Functioning, Disability and Health

Health Condition

function

activity

participation

External factors

Personal factors
International Classification of Functioning, Disability and Health

Cerebral Palsy

function → activity → participation

External factors → Cerebral Palsy → Personal factors
Definition Cerebral Palsy

Cerebral palsy describes

- a group of developmental disorders
- of movement and posture,

- causing activity restriction or disability,

- that are attributed to disturbances occurring in the fetal or infant brain.
Cerebral Palsy

Timing

Cause (s) → Brain damage

Cerebral Palsy

function → activity → participation

External factors → Personal factors
Preliminary MRI-data from the Dutch PERRIN study 0-5 years

- N = 66 children with CP at age 18 months
- MRI’s available for audit n = 50

- Vascular lesion
  - Ischaemic stroke 13
  - PVL/c-PVL 10
  - GMH/IVH 8
  - Acute asphyxia 7
  - Intracerebral hemorrhage 2

- Malformation 2

- Other
  - Infection CNS 4
  - Not specified 4
Associated disorders and impairments

- Sensation
- Perception
- Cognition
- Behaviour
- Seizure disorder
- Communication (language)
- Secondary musculoskeletal pathology
Conventional classification ‘systems’

- type of motor impairment
- the number of limbs involved
- severity of motor impairment
Diagnosis

- Cerebral Palsy
  - Function
  - Activity
  - Participation

- External factors
- Personal factors
Diagnosis

Cerebral Palsy

function

activity

participation

External factors

Personal factors

SCPE
Current classification systems

- type of motor impairment
- the number of limbs involved
- severity of motor impairment

SCPE, *DMCN* 2000;42:816-824
ISPO Conference Report September 2008
Training and reference manual

SCPE group
CP

- Spastic: 88%
- Dyskinetic: 7%
- Ataxia: 3%
- Non-Classifiable: 2%
spastic

unilateral

hemiparesis

bilateral

diplegia

tetraparesis
Interrater reliability study

- Motor impairment: 0.64
- Limb distribution: 0.66


Among a group of 6 experienced clinicians:
- Motor impairment: 40% agreement
- Limb distribution: 50% agreement

Blair & Stanley Dev Med Child Neurol 1985
Consequences

Cerebral Palsy

function

activity

participation

External factors

Personal factors
Consequences

Cerebral Palsy

GMFCS
MACS

function
activity
participation

External factors
Personal factors
Gross Motor Function Classification System for Cerebral Palsy

Robert Palisano
Peter Rosenbaum
Stephen Walter
Dianne Russell
Ellen Wood
Barbara Galuppi
The GMFCS

- focuses on child’s current motor abilities & performance
- is a 5 level classification system
- Descriptions are organized by age categories
  - < 2 years old
  - 2-4 years old
  - 4-6 years old
  - 6-12 years old
  - 12-18 years old (expanded and revised GMFCS)
**GMFCS for children with CP between the ages of 6 and 12 years**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I</td>
<td>Walks without restrictions</td>
</tr>
<tr>
<td>Level II</td>
<td>Walks without assistive devices</td>
</tr>
<tr>
<td>Level III</td>
<td>Walks with assistive mobility devices</td>
</tr>
<tr>
<td>Level IV</td>
<td>Self-mobility with limitations</td>
</tr>
<tr>
<td>Level V</td>
<td>Self-mobility is severely limited</td>
</tr>
</tbody>
</table>
GMFCS descriptions for children between 6 and 12 years old

- Level I – walks without restrictions: limitations in more advanced gross motor skills
GMFCS descriptions for children between 6 and 12 years old

- Level II- walks without assistive devices; limitations walking outdoors & in the community
GMFCS descriptions for children between 6 and 12 years old

• Level III- walks with assistive mobility devices; limitations walking outdoors & in the community
GMFCS descriptions for children between 6 and 12 years old (cont’d)

- Level IV- self-mobility with limitations; children are transported or use power mobility outdoors & in the community
GMFCS descriptions for children between 6 and 12 years old (cont’d)

- Level V- self-mobility is severely limited even with use of assistive devices
Reliability GMFCS

- chance-corrected kappas
  - children < 2 yrs = 0.55
  - children 2 – 12 yrs > 0.75
  - Adolescents 12-18 yrs = unknown

- Most concerns about distinctions between level I and II and between level III and IV
- Most disagreements were between level IV and V
Get parents involved!

Agreement
parents versus professionals: excellent

(ICC 0.94, 95% BI 0.90-0.96)

Reliability of family report for the GMFCS
Morris, Galuppi & Rosenbaum, DMCN 2004;46:455-60
The GMFCS in young children with CP

Children < 2 yrs kappa = 0.55 versus children > 2 yrs kappa = 0.75

Palisano et al., DMCN 1997;39: 214-2
Population-based cohort studies in Victoria and Sweden

![Bar chart showing population-based cohort studies in Victoria and Sweden with categories I, II, III, IV, V and respective data points for Victoria and Sweden.]
GMFCS & hip displacement

Fig. 4
Incidence of hip displacement (a migration percentage of >30%) according to the Gross Motor Function Classification System (GMFCS) level.

Soo et al, JBJS 2006
Motor Growth Curves
(Rosenbaum et al, JAMA 2002)

GMFCS Level I to V

GMFM-66

Level I
Level II
Level III
Level IV
Level V

Age (yrs.)
In summary......

- There is a need to classify children’s motor abilities
- The GMFCS has demonstrated reliability and validity
Consequences

Cerebral Palsy

GMFCS
MACS

function

activity

participation

External factors

Personal factors
MANUAL ABILITY CLASSIFICATION SYSTEM
5 level MACS

I  Handles objects easily and successfully

II Handles most objects but with somewhat reduced quality and/or speed of achievement

III Handles objects with difficulty; needs help to prepare and/or modify activities

IV Handles a limited selection of easily managed objects in adapted situations

V Does not handle objects and has severely limited ability to perform even simple actions
Reliability MACS

- Reported to be good for children 4 – 18 years
  
  Ann-Christin Eliasson et al

- Possible but with caution for children under age of 5 years
  
  Plasschaert et al
The time is ripe:
towards a uniform
and multidimensional classification
of children with cerebral palsy

GMFCS: www.canchild.ca
MACS: www.macs.nu
The time is ripe, because…. 

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