Original Article

Correlation of Gross Motor Function with Topographical Diagnosis in Children with Cerebral Palsy

Tufail Muzaffar[1], Nonica Laisram[2], S Y Kothari[3]

Abstract

There is a need for appropriate classification to describe gross motor function status in a child with cerebral palsy (CP). It was hypothesised that: greater the number of limbs involved, higher would be the Gross Motor Function Classification System (GMFCS) level; and, there would be spectrum of GMFCS level for each of the topographical types of the cerebral palsy.

A cross-sectional study of 182 children of both sexes in the age group of 7 months to 30 years having spastic CP who attended CP clinic from 2008 to 2009 in tertiary care hospital were assessed for topographical diagnosis and GMFCS levels. Topographical distribution showed diplegia (42%), quadriplegia (30%), hemiplegia (23%), triplegia (4%) and monoplegia (1%). GMFCS levels were almost evenly distributed, level II (26%) was most common followed by level V (23%). Statistical analysis was done using Cramer's ratio and Pearson's Chi-square test.

Cramer's ratio of 0.277 showed fairly weak correlation between GMFCS levels and topographical CP types. Pearson's Chi-square (12) =41.7, p=0.000 indicates that there is significant difference between expected and observed values of number of limbs involved in GMFCS levels, further substantiating the weak correlation.

These results mean that GMFCS in different topographical groups have different distributions. It was also observed that GMFCS had weak correlation with the number of limbs involved, thus reflecting that the GMFCS is a better indicator of gross motor function impairment than the traditional topographical categorisation of CP that specifies the number of limbs involved.

Key words : **Cerebral palsy, topographical, correlation, spasticity.**

Introduction:

Assessing the cerebral palsy (CP) child remains an enigma for researchers and clinicians. This study is an attempt to analyse the gross motor function status in accordance with the Gross Motor Function Classification System (GMFCS), and its correlation with the topographical diagnosis in CP.

CP describes a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing foetal or infant brain. The motor disorders of CP are often accompanied by disturbances of sensation, perception, cognition, communication, and behaviour; by epilepsy, and by secondary musculoskeletal problems.[1]

CP is a clinical description and by itself is not informative about the outlook of these infants. The lesions in the developing brain or CP aetiology alone also do not provide information about function and prognosis. In our day to day practice of CP rehabilitation, it is important to follow a classification system that tells the parents and patients about the functional status and future prognosis, at the same time helping the managing team to plan intervention for the CP child, as well as for measuring the

Author's affiliations:
[1] MBBS PGT DNB (PMR), Department of PMR VMMC and Safdarjang Hospital
[2] MBBS, DCH, DPMR, DNB(PMR), Professor and Senior Specialist PMR, Department of PMR VMMC and Safdarjang Hospital
[3] MBBS, MS(Orth.), DNB(PMR), Special DGHS

Cite as :
Muzaffar T, Laisram N, Kothari S Y. Correlation of Gross Motor Function with Topographical Diagnosis in Children with Cerebral Palsy. IJPMR March 2012; Vol. 23(1): 10-4.

Correspondence :
Dr Nonica Laisram MBBS, DCH, DPMR, DNB(PMR)
Professor and Senior Specialist PMR
Department of PMR VMMC and Safdarjang Hospital,
New Delhi 29.
E-mail: drnonica@gmail.com

Received on 07/02/2012, Revised on 14/03/2012, Accepted on 21/03/2012

outcome of rehabilitation. Unfortunately the many different classifications of the various types of CP that are in use lead to great confusion, and uniformity of observation is impeded at a time when increasing attention to disabled children gives some promise of real advances in management.[2]

Given the complex and variable nature of the movement disorders in children with CP, experts believed that consensus should be reached as an essential step in the development of a valid classification system and subsequent use of the system in clinical practice and research. The results of the nominal group process and Delphi survey consensus methods provided evidence of the validity of the GMFCS.[3] The international groups of experts were unanimous in their agreement that there is a need for a classification system for children with CP that is based on the construct of disability and functional limitation. The GMFCS is a five-level classification that differentiates children with CP based on the child's current gross motor abilities; limitations in gross motor function, and need for assistive technology and wheeled mobility.[3]

Until recently, the severity of CP was described in subjective terms such as mild, moderate, and severe. The Gross Motor Classification System (GMFCS) provides the physiatrists, orthopaedic surgeons, neurologists, paediatricians and therapists with a common language to describe functional status of children with CP. It is reliable and stable over time. It is easy to learn and can be worked out for specific child in about five minutes. The use of common classification to describe gross motor function in a child with CP improves communication and understanding between all professionals taking care of the CP child.

The purpose of this study was to observe correlation of GMFCS with topographical diagnosis in children with spastic cerebral palsy. It was hypothesised that (1) greater the number of limbs involved, higher would be the MFCS level, (2) there would be a spectrum of GMFCS level for each of the topographical CP types.

Patients and Method:

A cross-sectional study was done in 182 CP children of both sexes in the age group of 7 months to 30 years who attended CP clinic in Department of PMR, VMMC and Safdarjang Hospital, New Delhi from March 2008 to May 2009. Children were assessed for number of limbs involved (topographical diagnosis) and corresponding GMFCS levels. Only those patients with spasticity who were diagnosed as CP, (as per definition of Executive committee Chaired by Rosenbaum *et al*)[1] were included in the study. Data obtained from the clinical examination was recorded and interpreted. For statistical analysis, the data were coded and compiled accordingly and processed by using computer based program SPSS version16. Pearson Chi-square test with 95% confidence interval and Cramer's ratio were done to see the level of significance of correlation.

Results:

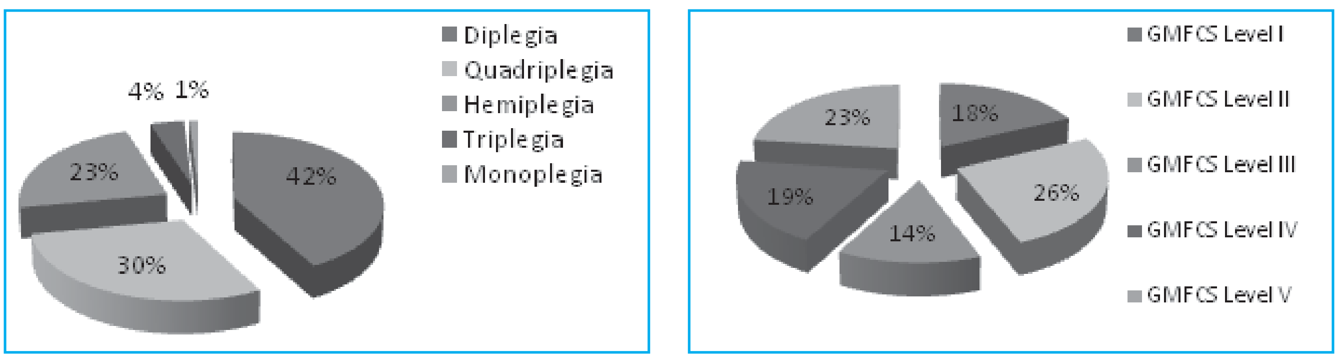
Male: female ratio 3:2; male predominance.

Table 1: ***Age Distribution (n=182)***

Age	No. of cases	Percentage (%)
Upto 2 years	50	27
>2-4 years	47	26
>4-6 years	45	25
>6-12 years	37	20
More than 12 years	3	2

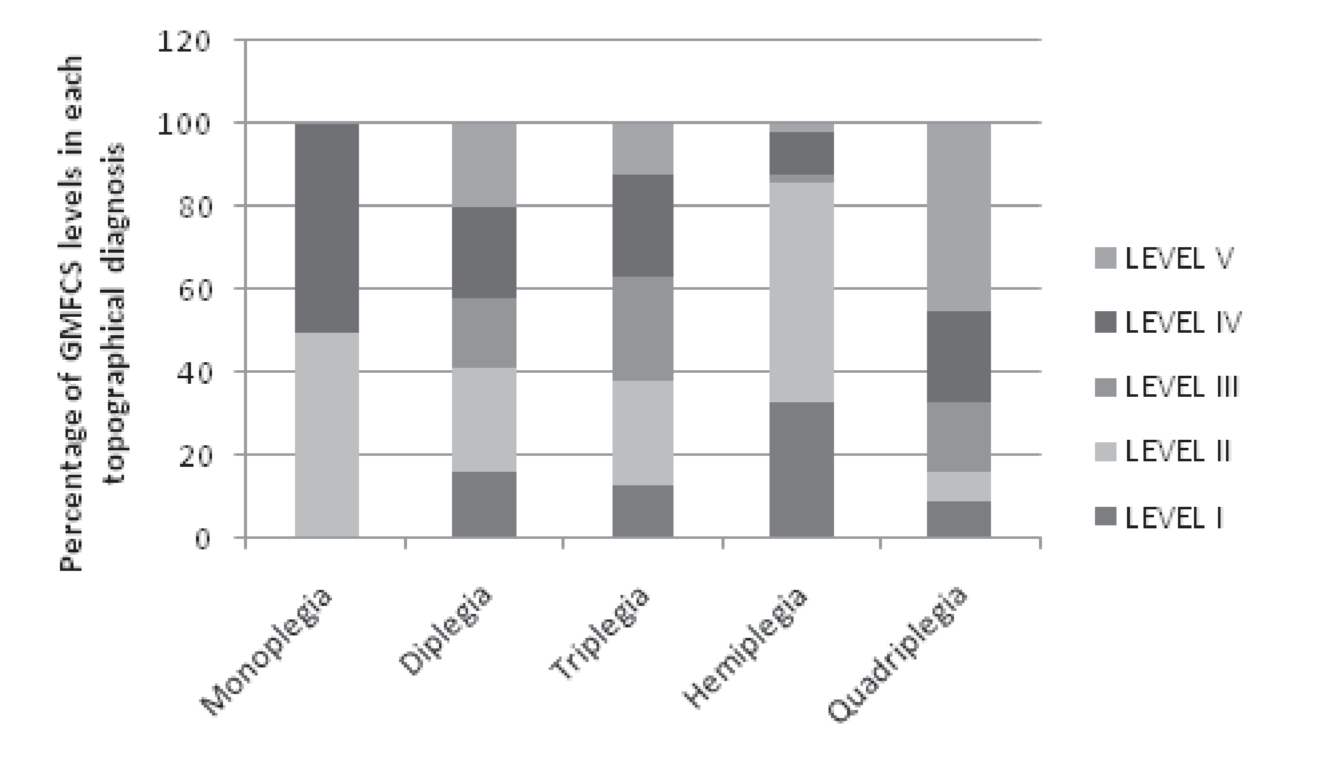
*Age distribution was almost uniform from 2 to 12 years of age

Fig 1: ***Percentage Representation of Each Topographical Type and Each GMFCS Level (n=182)***



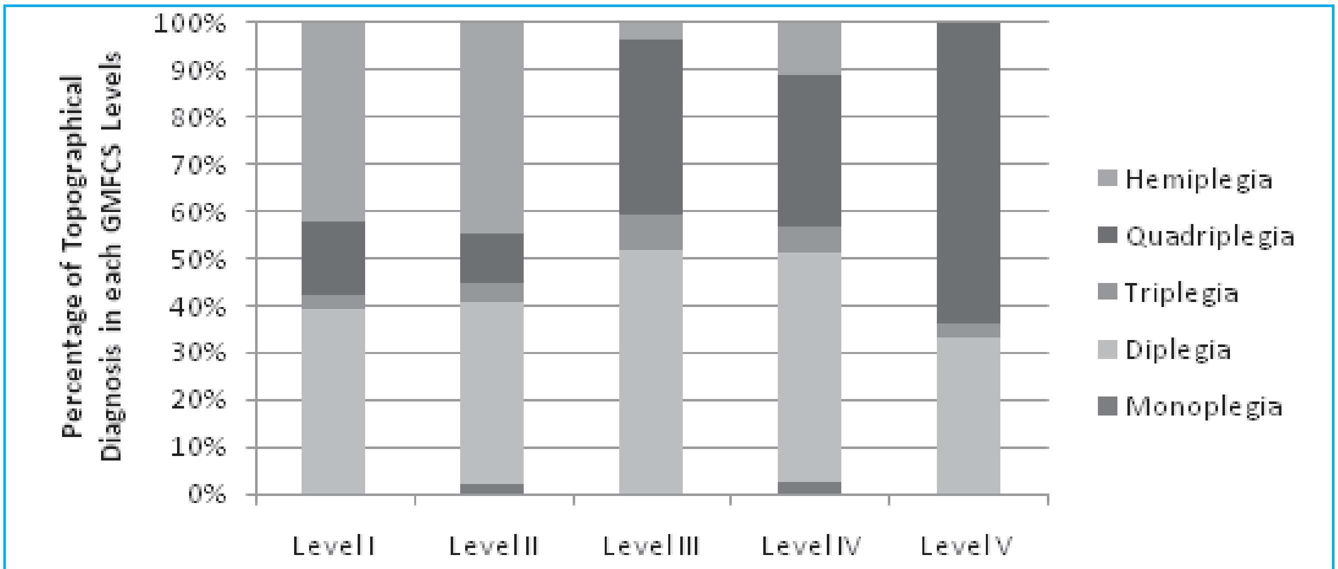
*In our study (Fig 1) topographical distribution was diplegia (42%), quadriplegia (30%), hemiplegia (23%), triplegia (4%) and monoplegia (1%). GMFCS levels had almost uniform distribution; level II (26%) was most common followed by level V (23%).

Fig 2: ***GMFCS Levels within Different Types of Topographical Diagnosis (n =182)***



***** In diplegics GMFCS levels I to V was almost evenly distributed. Quadriplegia had (63.6%) on the severe side of spectrum; levels IV and V, however it had significant percentage representations in other levels as well. Hemiplegia had more favorable GMFCS levels (level I -34% and level II 54 %.). Triplegia had equal (25%) representation in levels II to IV and (12.5%) on either end of spectrum in level I and level V. Of the two cases of monoplegia where there was upper limb involvement in both cases, one had GMFCS level II and other had level IV.

Fig 3: ***Topographical Diagnosis within Different GMFCS Levels (n=182)***



*In level I diplegia (39%) and hemiplegia (42%) were dominating which continued in level II as well (diplegia 39% and hemiplegia 45 %.). Level III and IV had maximum number of diplegia and quadriplegia combined (more than 80% in each level), with a continued trend of rise of level V in Quadriplegia, while hemiplegia was just (4%) and (11%) respectively. In GMFCS level V quadriplegic group had maximum (54%) representation followed by diplegia (33%) with only minimal representation in the other topographic types. Our results in Figs 2 and 3 show that a CP child can have varied levels of function with different number of limbs involved.

Table 2: *Comparison with Other International Studies*

GMFCS level	I %	II %	III %	IV %	V%	Total
SJH India	17.60% (n=32)	25.80% (n=47)	13.70% (n=25)	19.20% (n=35)	22.50% (n=41)	100% (n=182)
Victoria [8]	35.30% (n=114)	16.40% (n=53)	14.20% (n=46)	16.10% (n=52)	18.00% (n=58)	100% (n=323)
Ontario [8]	27.90% (n=183)	12.20% (n=80)	18.60% (n=122)	20.90% (n=137)	20.50% (n=135)	100% (n=657)
Sweden [8]	40.70% (n=68)	18.60% (n=31)	13.80% (n=23)	11.40% (n=19)	15.60% (n=26)	100% (n=167)

*In our study least percentage(13.7%) of cases were in GMFCS level III and highest (25.8%) in level II. Representations in levels I, IV and V are comparable to those of internationally observed results.

In our study it was hypothesised that more the number of limbs involved, higher the GMFCS levels. However on statistical analysis with Cramer's ratio (for correlation of two variables), result was 0.277 implying that topographical classification and GMFCS are weakly correlated. On Pearson's Chi-square test of significance at degree of freedom 12, the value was 41.7 with significance of p=0.000. This tells us that there is significant difference between expected and observed values of number of limbs involved in GMFCS levels, further substantiating the weak correlation of GMFCS with topographical diagnosis.

Discussion:

Male : female (3:2) with higher incidence of male children in our study is comparable to other studies.[4-9] In our observation diplegia (42%) was the most common topographical group followed by quadriplegia (30%) and hemiplegia (23%) respectively; triplegia (4%) and monoplegia (1%) were least common. These findings are in accordance to Vohr *et al*[10] where the most common type of CP was spastic diplegia (39%) followed by quadriplegia (27.3%), hemiplegia (13.8%), hypotonic CP (9.9%), triplegia (6.0%), and monoplegia (3.9%). However there was significant difference in topography compared to Howard *et al*[8] in Victorian study where hemiplegia (35%), diplegia (28%) and quadriplegia (37%) were found. In a study of adults with CP by Margre *et al*[9] in Brazil, quadriplegia was the most common group followed by diplegia and hemiplegia.

Our study showed that GMFCS level II was most common (26%) followed by level V (23%), level III was least common (14%). Similar observations were found in Victorian study where level I was most common (35%) followed by level V (18%), and level III was least common (14%).[8]

Vohr *et al*[10] studied a longitudinal cohort of 282 children with CP and found children with more limbs involved had more abnormal GMFCS levels reflecting more severe functional limitations. Spearman rank-order correlations were run to assess the relationships among the topography classification for spastic CP, and the GMFCS levels. There was strong correlation between topography and the GMFCS (r = 0.894; p =.0001). However, for each CP topographical category, there was a spectrum of gross motor functional levels. Though our results had a spectrum of GMFCS for each topographical type, in contrast to Vohr *et al*[10] the two classifications were not as strongly correlated.

Howard *et al*[8] in Victorian study found within the spastic group, differences in motor function among the three topography groups were extremely clear-cut. Compared to children with hemiplegic distribution, children with diplegia were more severe on the GMFCS scale. Children with spastic quadriplegia had the lowest levels of function, being significantly higher on the GMFCS scale than those with hemiplegia and diplegia. Our observation of hemiplegic children are in accordance with those of Howard *et al*[8] who also found hemiplegic children had better functional profile than bilateral syndromes. However our study did not show statistically strong correlation between number of limbs involved and GMFCS levels.

Gorter *et al*[11] also found that majority (87.8%) of children with hemiplegia were classified as level I as observed in our study where hemiplegic children had maximum representation in levels I and II (34% and 54%) respectively. They also observed children with a bilateral syndrome were represented in all GMFCS levels, with most in levels III, IV, and V which is similar to our study.

In our study we found GMFCS and topographic diagnosis had a fairly weak correlation with Cramer's ratio and Pearson's Chi-square test. Similar observation was made by Gorter *et al*[11] who found classifications by GMFCS and 'limb distribution' or by GMFCS and 'type of motor impairments' were significantly associated, though the correlation for limb distribution by GMFCS was low. The association between limb distribution and GMFCS levels was modest at best. Gorter *et al*[12] found that GMFCS classification in infants is less precise than classification over time in older children. Children can be classified by the GMFCS early on, but there is a need for reclassification at age 2 or older as more clinical information becomes available.

Conclusion:

GMFCS and topographical distribution of limb involvement are weakly correlated. There is a variable spectrum of GMFCS levels in each topographical type of CP. A mild quadriplegia with GMFCS II can differ vastly from a severe quadriplegia with GMFCS V. The GMFCS is hence a better indicator for grading the child's gross motor functional performance than the topographical diagnosis. . GMFCS is a simple, intuitive and reliable tool to classify gross motor function in children with CP. GMFCS tells the parents and the patient about the functional status and the future prognosis, at the same time helping the managing team to set goals for measuring the outcome of rehabilitation.

References:

1. Rosenbaum P, Paneth N, Leviton A, Goldstein M, Bax M, Damiano D, *et al.* A report: The definition and classification of cerebral palsy. *Dev Med Child Neuro* 2006; **109:** 8–14.
2. Mukherjee S, Deborah J, Spira G. Cerebral Palsy. [book auth.] Randall L Braddom. Physical medicine and rehabilitation. *New Delhi : Elsevier,* 2007: 1241–67.
3. Palisano R, Rosenbaum P, Walter S, Russell D, Wood E, Galuppi B. Gross motor function classification system expanded and revised. *Dev Med Child Neurol* 1997; **39:** 214–23.
4. Laisram N, Srivastava VK, Srivastava RK. Cerebral palsy–an etiological study. *Indian J Pediatr* 1992; **59:** 723–8.
5. Pharoah POD, Cooke T, Rosenbloom I, Cooke RWI. Trends in birth prevalence of cerebral palsy. *Arch Dis Child* 1987; **62:** 379-84.
6. Jarvis S, Glinianaia SV, Arnaud C, Fauconnier J, Johnson A, McManus V, *et al.* Case gender and severity in cerebral palsy varies with intrauterine growth. *Arch Dis Child* 2005; **90:** 474–9.
7. Beverly P, Fiona S, Diane H.Cerebral palsy in multiple births in Western Australia: genetic aspects. *Am J Med Genet* 1990; **37:** 346–51.
8 Howard J, Soo B, Graham HK, Boyd RN, Reid S, Lanigan A, *et al.* Cerebral palsy in Victoria: motor types, topography and gross motor function. *J. Paediatr. Child Health* 2005; **41:** 479–83.
9. Margre ALM, Reis MGL, Morais RLS. Characterization of adults with cerebral palsy. *Rev Bras Fisioter* 2010; **14:** 417–25.
10. Vohr BR, Msall ME, Wilson D, Wright LL, McDonald S, Poole WK. Spectrum of gross motor function in extremely low birth weight children with cerebral palsy at 18 months of age. *Pediatrics* 2005; **116:** 123–9.
11. Gorter JW, Rosenbaum PL, Hanna SE, Palisano RJ, Bartlett DJ, Russell DJ, *et al.* Limb distribution, motor impairment, and functional classification of cerebral palsy. *Dev Med Child Neurol* 2004; **46:** 461–7.
12. Gorter JW Ketelaar M, Rosenbaum PL, Helders PJM , Palisano R. Use of the GMFCS in infants with CP: the need for reclassificationat age 2 years or older. *Dev Med Child Neurol* 2008; **51:** 46–52.