Classification of Cerebral Palsy: Clinical Physiotherapist's Perspective
การจำแนกประเภทสมองพิการ: มุมมองของนักกายภาพบำบัด

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Abstract

Cerebral Palsy (CP) is a common childhood-onset physical disability that results from abnormal development of the brain which occurs during pregnancy or early childhood. CP results in changes to physical, sensory, and cognitive behavior and also communication which depends on severity, type of CP or GMFCS level. There are three main classifications for CP namely 1) Traditional classification 2) Modified traditional classification and 3) Gross Motor Function Classification System (GMFCS). These classifications help physiotherapists to set demands, goals, and therapeutic interventions for individual patient. GMFCS has been correlated with Gross Motor Function Measure (GMFM) that is a measurement of changes in gross motor function performance after therapeutic interventions. This measurement has been widely used in research and in clinical as outcome measurement to measure functional abilities of CP. A Minimal Clinically Important Difference (MCID) is important in clinical practice because it shows the smallest change in an outcome of treatment. The roles of physiotherapist are to promote, prevent, treatment and rehabilitation of patients' physical., psychological and social wellbeing. Aim of physiotherapy is to solve problems by improving functional abilities and movement skills by focusing on physical and emotional needs of children. Therefore, this review will provide perspective of classifications for CP, GMFM and MCID of GMFM that may help physiotherapists to create suitable approach and management in individual patient with CP.

Keyword: *cerebral palsy, Gross Motor Function Classification System, Gross Motor Function Measure, Minimal Clinically Important Difference, physiotherapy*

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บทคัดย่อ

สมองพิการเป็นภาวะความพิการทางกายที่พบได้บ่อยในวัยเด็ก ซึ่งเกิดจากสมองพัฒนาผิดปกติขณะตั้งครรภ์หรือในวัยเด็ก สมองพิการส่งผลต่อการเปลี่ยนแปลงของร่างกาย การรับความรู้สึก ระดับสติปัญญา พฤติกรรมและการสื่อสาร ซึ่งขึ้นอยู่กับความรุนแรง ประเภท และระดับความสามารถด้านการเคลื่อนไหว สมองพิการจำแนกได้ 3 ประเภท ดังนี้คือ จำแนกแบบดั้งเดิม จำแนกแบบดั้งเดิมประยุกต์ และจำแนกตามระดับความสามารถด้านการเคลื่อนไหว การจำแนกประเภทสมองพิการช่วยนักกายภาพบำบัดในการตั้งเป้าหมายและให้การรักษาในผู้ป่วยแต่ละราย การจำแนกตามระดับความสามารถด้านการเคลื่อนไหวมีความสัมพันธ์กับเครื่องมือมาตรฐานที่ใช้วัดการทำงานของกล้ามเนื้อมัดใหญ่ เครื่องมือนี้สามารถวัดการเปลี่ยนแปลงภายหลังรับการรักษา และมีการนิยมใช้อย่างแพร่หลายทั้งงานวิจัยและทางคลินิก นิยามค่าความแตกต่างที่เกิดขึ้นน้อยที่สุดทางคลินิกอย่างมีนัยสำคัญ หมายถึง การเปลี่ยนแปลงทางคลินิกที่น้อยที่สุดของผลลัพธ์การรักษา บทบาทของนักกายภาพบำบัดในเด็กสมองพิการ คือ ส่งเสริม ป้องกัน รักษา และฟื้นฟูร่างกาย สภาพจิตใจ และการเข้าสังคม วัตถุประสงค์ของกายภาพบำบัด คือ แก้ปัญหาโดยพัฒนาความสามารถในการใช้งานและทักษะการเคลื่อนไหว โดยเน้นที่ความต้องการทางร่างกายและอารมณ์ของเด็ก ดั้งนั้น บทความนี้จึงเสนอมุมมองเรื่องการจำแนกประเภทสมองพิการ เครื่องมือมาตรฐานที่ใช้วัดการทำงานของกล้ามเนื้อมัดใหญ่ค่าความแตกต่างที่เกิดขึ้นน้อยที่สุดทางคลินิกอย่างมีนัยสำคัญ ซึ่งอาจช่วยให้นักกายภาพบำบัดสามารถจัดการทางกายภาพบำบัดสำหรับผู้ป่วยสมองพิการแต่ละคนได้อย่างเหมาะสม

คำสำคัญ: *สมองพิการ การจำแนกตามระดับความสามารถด้านการเคลื่อนไหว เครื่องมือมาตรฐานที่ใช้วัดการทำงานของกล้ามเนื้อมัดใหญ่ ค่าความแตกต่างที่เกิดขึ้นน้อยที่สุดทางคลินิกอย่างมีนัยสำคัญ กายภาพบำบัด*

Introduction to CP

Cerebral palsy (CP) is a common childhood-onset that shows physical disability (Bax et al., 2005). This condition effects on activities daily living (ADL) and participation (Palisano, Rosenbaum, Walter, Russell, Wood, & Galuppi, 1997; Van den Broeck et al., 2010). CP affects between 1.88 and 3.3 out of every thousand live births worldwide (Pakula, Braun, & Yeargin-Allsopp, 2009; Touyama, Touyama, Toyokawa, & Kobayahi, 2016). CP results from a damaged or abnormal development of brain, particularly central nervous system (CNS). The main cause of CP is a laxity of oxygen in the brain (brain anoxia) during pregnancy, prenatal, or postnatal (Liptak, 2005; Neale, 1955). The damaged brain is a caused of sensorimotor function impairment (Cans, 2000). This then leads to cognitive, behaviors and communication problems that effects on a participation limitation and ADL (Rosenbaum et al., 2007). It also impacts on physical problem (Thompson, Stebbins, Seniorou, & Newham, 2011), especially muscle tone (Lehmann, Price, deLateur, Hinderer, & Traynor, 1989). Problem in muscle tone leads to a delayed gross and fine motor skills (Fowler, 2010), poor postural control (Woollacott & Shumway-Cook, 2005), balance

disorders (Flett, 2003), bone abnormalities (such as long bone torsion strain), foot deformities and hip dislocation or subluxation (Tecklin, 2015).

According to a prevalence, it can be seen that physiotherapist has a role to management of CP. Then, to understand the classification and the standardized test may help the physiotherapist in order to set an appropriate management and a brief of physiotherapy for CP.

Classifications for CP

The objectives of classification for CP are to: 1) predict and describe the current and future service needs of individuals with CP, 2) describe and provide detail about an individual with CP, clearly delineating the nature of the problem and its severity, 3) evaluate changes, which then allows an individual with CP to be compared over different points in time, and 4) allow a number of CP cases gathered from different sources to be reasonably compared. A benefit of applying a CP classification is to set the proper managements including aims, objectives, demands, goals and plans of treatment for individual CP. There are three used common classification systems. First of all, the traditional classification classifies based on a pattern of affected extremities (Eunson, 2012), for example, hemiplegia (impairment of upper and lower extremity on the same side), diplegia (impairment of bilateral lower extremities), and quadriplegia (impairment of all four extremities) (Tecklin, 2015). Second classification system is the modified traditional classification is based on the location of the injured brain. This classification describes the predominant movement abnormalities and muscle tone types and consists of types such as pyramidal (spastic - hypertonic), extrapyramidal (dyskinesis: uncontrolled and involuntary movement, ataxia: incoordination and dystonia: fluctuation tone) and mixed-type CP (Tecklin, 2015). Finally, Gross Motor Function Classification System (GMFCS) is an approved tool that can be used to classify a population with CP into different levels based on each individual's functional limitations (Eek & Beckung, 2008).

Gross Motor Function Classification System (GMFCS)

GMFCS is a standardized tool which measures movement disability in CP based on self-initiated movement of gross motor function. It has been shown to be valid and reliable measurement (Bodkin, Robinson, & Perales, 2003). In the past, GMFCS is used to assessment CP at aged 2-12 (Palisano et al., 1997), but nowadays updated version of GMFCS was changed to Gross Motor Function Classification System Expanded and Revised (GMFCS – E & R). GMFCS – E & R is suitable to assess CP at aged 12-18 (Palisano, Rosenbaum, Bartlett, & Livingston, 2007). Both of them are useful in clinical practice (Carnahan, Arner, & Hägglund, 2007). GMFCS is related to ability but it does not actually indicate an individual's level of physical activity or participation (Palisano et al., 1997). There are five levels of GMFCS. Each level represents function mobility of CP

(Palisano, Cameron, Rosenbaum, Walter, & Russell, 2006), and there are five levels (Palisano, Rosenbaum, Bartlett, & Livingston, 2007). Level I represents CP cases with little or no disability affecting community mobility. Children with CP at this level are high functioning and able to walk without restriction or at least have the potential to do so (Carnahan et al., 2007). At the other end of the spectrum, level V describes populations with CP who are entirely dependent on external assistance for mobility. It also represents individuals with very limited self-mobility who require a very high level of support (Palisano et al., 2007). Therefore, GMFCS is a useful tool to help physiotherapists describe motor function and predict gross motor development in individual patients (Wood & Rosenbaum, 2000), as the demands and goals are different for each level (Palisano, Haley, & Brown, 1992).

Gross Motor Function Measure (GMFM)

GMFM is a standardized observational instrument for populations with CP designed to evaluate changes in gross motor function. There are two versions of GMFM (GMFM-88 and GMFM-66) (Russell, Rosenbaum, Avery, & Lane, 2002). Differences between GMFM-88 and GMFM-66 are GMFM-88 takes almost 60 minutes whereas GMFM-66 which is cut 22 fewer items spends less than 45 minutes in order to complete the test (Tecklin, 2015). Moreover, GMFM-66 provides detailed information on level of difficulty of each item. Both of them have 4-point scoring for each item. However, score of GMFM-88 can be calculated from raw scores whereas GMFM-66 has to be calculated by computer program that called Gross Motor Ability Estimator (Palisano et al., 2007). GMFM is a useful measurement tool because it has been correlated with CP distributions and types of motor impairment (Gorter et al., 2004). These measurement tools have been presented to be valid and reliable measurement tools. These tools have been used to assess gross motor function both in research and clinical practice (Nordmark, Hagglund, & Jarnlo, 1997; Russell, Rosenbaum, Cadman, Gowland, Hardy, & Jarvis, 1989; Ross & Engsberg, 2007). Moreover, it helps identify changes in gross motor function performance after therapeutic interventions or over time (Russell et al., 2002). GMFM looks at five dimensions when measuring gross motor function in a population with CP, namely a) lying and rolling, b) sitting, c) crawling and kneeling, d) standing, and e) walking, running and jumping (Russell et al. 2002; Ross & Engsberg, 2007).

Minimal Clinically Important Differences (MCID) in GMFM

MCID means the smallest changes in an outcome that patients would regard as important after receiving treatment (Jaeschke, Singer, & Guyatt, 1989; McCrum-Gardner, 2010). It is also important to clinical used because it represent the treatment outcomes (Oeffinger et al., 2007; Stratford, Binkley, & Riddle, 1996; Wang & Yang,

2006). The benefits of using MCID in clinical setting is to identify the effectiveness of treatment to both physiotherapist and patient (Copay, Subach, Glassman, Polly, & Schuler, 2007; Sterne & Smith, 2001). There are different proposed MCID for GMFM-66 and GMFM-88. For GMFM-88, the smallest changes of approximately 5.1 score, while GMFM-66, the smallest changes of approximately 3.2 score can be regarded as MCID (Wang & Yang, 2006)

Physiotherapy for CP

According to several problems including physical, sensory and cognitive behaviors. CP needs various professional which is called a team of multidisciplinary management. This team consists of physicians, nurses, occupational therapists, educator, speech pathologist, physiotherapists, family and child (Tecklin, 2015). A central role of a physiotherapist is a management in CP. The management includes promote, prevent, treatment, and rehabilitation (Anttila, Autti-Ramo, Suoranta, Makela, & Malmivaara, 2008; Papavasiliou, 2009). Physiotherapists focus on the motor development pattern and the correct movement which help children with CP use the optimal potential to do the ADL (Tecklin, 2015). Moreover, physiotherapists also consider the psychological and social wellbeing of children with CP as well (Campbell, Vander Linden, & Palisano, 2006). Therefore, physiotherapist treatment session should cultivate enjoyment and encouragement in order to help the children to perform their ability as much as possible.

There are various physiotherapy intervention such as traditional intervention, for example, neurodevelopmental (NDT) - NDT is known as Bobath approach. The aim of this intervention is to facilitate motor learning and carry over from treatment session to daily life (Bobath & Bobath, 1984). The concept of NDT is an inhibition of abnormal motor pattern and facilitation of normal motor pattern through handling techniques which stimulate sensori-motor system (Knox & Evans, 2002; Tecklin 2015), Proprioceptive Neuro muscular Facilitation (PNF) – the PNF is based on normal motor development and movement (Levitt, 2013), sensory integration - sensory integration is an approach using external stimulation in order to enhance brain and stimulate children's motivations. This technique normally combined with NDT to gain more effectiveness, and Vojta therapy – The concept of Vojta therapy is based on reflex locomotion that consists of reflex creeping and reflex rolling. This technique believe that every movement was controlled by these reflexes. Therefore, it is important to activate the reflex locomotion in order to create normal movement in CP. Meanwhile, the alternative or recreational interventions for CP such as hippotherapy (Hur, 1995) and hydrotherapy (Levitt, 2013). Hippotherapy which is called a movement of the horse – this technique based in 3 dimension movement of the horse which is smooth rhythm, repetitive, and similar to human gait pattern.

Furthermore, while sitting on the walking horse, the heat will decrease tone of hip adductor muscle (Brunton & Bartlett, 2010). While hydrotherapy or water-based exercise which use to address specify impairments and functional limitations (Tecklin, 2015). In case of CP, the buoyancy in the water allows CP to move the affected side easily. Therefore, the children will feel good when achieve the movement their goal.

Conclusion

Cerebral palsy is affected physical, sensory, social behavior and communication problems. CP can be classified according to severity of functional limitation using GMFCS level. GMG is a standardized measurement that helps physiotherapist to find specific gross motor function problem. Providing that physiotherapists who play an important role in managing children with CP can understand the severity of each individual patient, they might be able to set the suitable goals and create the plan of treatment for each children with CP in order to improve functional abilities and movement skills.

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