УДК 616.831-009.11-053.2: 615.217.5

A.A. Akanova, R.B. Issayeva,V.N. Lokshin, R.Zh. Seisebaeva, Sh.K. Sarmuldaeva, G.T. Myrzabekov
Kazakh Medical Education of Continuing Education, Almaty, Kazakhstan

INTERNATIONAL DEFINITIONS OF CEREBRAL PALSIES (REVIEW)

Cerebral palsy is a non-progressive disorder of movement originating from neural lesions in the perinatal period,and is associated with a wide range of common comorbidities. The average age for diagnosis has been around 18 months; recent evidence has suggested that cerebral palsy can be detected as early as three to four months using tests such as Prechtl's Qualitative Assessment of General Movements and medical resonance imaging. At the time being, 27 existing surveillance programs on cerebral palsy apply fivedefinitions of cerebral palsy with 46% of surveillance programs using more than one definition. As analysis showed, the definition suggested by Surveillance of Cerebral Palsy in Europe is most cited (63%), followed by the definition of Rosenbaum et al. 2007 (54%). Therefore, several most widely cited CP definitions will be outlined in this short review article.
Keywords: *cerebral palsies, definition, early diagnosis, neuroimaging*

Introduction.
Cerebral palsy is a non-progressive disorder of movement originating from neural lesions in the perinatal period,and is associated with a wide range of common comorbidities.Many of these respond well to interventions in early childhood, when brain plasticity is at its greatestand developmental trajectories can be altered with maximal benefit into adulthood.In large research networks, investigators have successfully decreased the age at cerebral palsy diagnosis to 19 months [1].However, in most clinical settings the age for diagnosis of cerebral palsy is on average two years or beyond.Late diagnosis of cerebral palsy is associated with worse long-term function and participation, parental dissatisfaction, and higher rates of mental health conditions, including depression [2]. The average age for diagnosis has been around 18 months; recent evidence has suggested that cerebral palsy can be detected as early as three to four months using tests such as PrechtlsQualitative Assessment of General Movements and medical resonance imaging [3]. Today, cerebral palsy is still a clinical description, but registries and surveillance programs, such as those in Australia, the United Kingdom, and Europe, highlight five key elements that reflect the core features of cerebral palsy, provided in definitions, and proposed by the Surveillance of Cerebral Palsy in Europe (SCPE): (i) it is an 'umbrella term'; (ii) it is permanent but not unchanging; (iii) it involves a disorder of movement, posture, motor function, or a combination; (iv) it is due to a non-progressive interference, lesion, or abnormality; and (v) the interference, lesion, or abnormality arose in the developing or immature brain [4] (. Nevertheless, most existing definitions alsofail to acknowledge the very clinically pertinent fact that CP is not a single disease with a clear etiology, such as Down syndrome and Duchenne muscular dystrophy, but is instead a collection of often diverse movement disorders, each of which may require different intervention strategies [5].Particularly, the following 4 motor types exist but may emerge and change during the first 2 years of life: spasticity (85%-91%); dyskinesia (4%-7%), including dystonia and athetosis; ataxia (4%-6%); and hypotonia (2%), which is not classified in all countries (ACPR, 2016).2 Dyskinesia, ataxia, and hypotonia usually affect all 4 limbs, whereas spasticity is categorized topographically as unilateral (hemiplegia) (38%) and bilateral, including diplegia (lower limbs affected more than upper limbs) (37%) and quadriplegia (all 4 limbs and trunk affected) (24%) [6] Comorbidities and functional limitations are common and disabling, including chronic pain (75%), epilepsy (35%), intellectual disability (49%), musculoskeletal problems (eg, hip displacement) (28%), behavioral disorders (26%), sleep disorders (23%), functional blindness (11%), and hearing impairment (4%) [6]. This reality underscores the importance of developing a classification system that differentiates these disorders more accurately for both clinical and research purposes. According to study by Goldsmith and colleagues, 27 existing surveillance programs on CP apply 5definitions of CP with 46% of surveillance programmes using more than one definition. The SCPE definition was most cited (63%), followed by that of Rosenbaum et al. 2007 (54%) [7].Therefore, several most widely cited CP definitions will be outlined in this short review article.
From the mid-1940s the founding fathers of the American Academy for Cerebral Palsy and Developmental Medicine (Carlson, Crothers, Deaver, Fay, Perlstein, and Phelps) in the USA, and Mac Keith, Polani, Bax, and Ingram of the Little Club in the UK, were among the leaders who moved the concepts and descriptions of CP forward, and caused this condition to become the focus of treatment services, advocacy, and research efforts [7].Pertinent material wasreviewed at an international symposium participated in byselected leaders in the preclinical and clinical sciences.Suggestions were made about the content of a reviseddefinition and classification of CP that would meet the needsof clinicians, investigators, and health officials, and provide acommon language for improved communication. Withleadership and direction from an Executive Committee, panelsutilized this information and have generated a revisedDefinition and Classification of Cerebral Palsy[8].
Nowadays, the definition by Bach become a classic and is still widely cited:
It stated that CP is 'a disorder of movement and posturedue to a defect or lesion of the immature brain. For practical purposes it is usual to exclude from cerebral palsy those disorders of posture and movement which are (1) of short duration, (2) due to progressive disease, or (3) due solely to mental deficiency.' [9]The label does however encompass a variety of syndromes and some, therefore, prefer the term **cerebral palsies.** The heterogeneity of disorders covered by the term CP, as well as advances in understanding of development in infants with early brain damage, led Mutch and colleagues to modify the definition of CP in 1992 as follows: 'an umbrella term covering a group of non-progressive, but often changing, motor impairment syndromes secondary to lesions or anomalies of the brain arising in the early stages of development.' [10] This definition continued to emphasize the motor impairment and acknowledged its variability, previously underscored in the MacKeith and Polani definition; it also excluded progressive disease, a point introduced in Bax's annotation [11].
Another most widely used definition was suggested by Mutch and colleagues in 1992, resulting in a further revised definition to underline the heterogeneity of the condition: 'an umbrella term covering a group of non-progressive, but often changing, motor impairment syndromes secondary to lesions or anomalies of the brain arising in the early stages of development'. Notably this annotation also included a revised Swedish classification system which, whilst still not perfect, offered simplicity as its major asset. The three neurological categories were spastic, ataxic, and dyskinetic; these were subcategorized in mixed ways as hemiplegia, tetraplegia, or diplegia for spastic cases; as either diplegic or congenital for ataxic cases, and as either mainly chorioathetotic or mainly dystonic for dyskinetic cases. Whilst noting that at the time it remained beyond their capability, the authors resuscitated the yearning for an aetiologically- based classification system [12].
The Gross Motor Function Classification System (GMFCS) was developed in response to the need to have a standardized system for classifying the severity of movement disability among children with CP [13]. Previous descriptive systems had included three levels, such as: (1) mild, moderate, or severe; or four levels such as (2) nonambulatory or physiological, household and community walkers; and (3) the Evans system: not walking, restricting lifestyle, functional but not fluent, or walks fluently. A five level description of children's ambulatory ability was reported by Hutton et al. in their study of factors affecting life expectancy, though they collapsed the data into only two categories of 'walking' and 'not walking' for their analyses [14]. It should be underlined, that no evaluation of the validity and reliability of any of these systems until the development of the GMFCS took place. The GMFCS describes movement ability of children with CP in one of five ordinal levels. The GMFCS currently includes descriptions of children's abilities for each level across four age bands: less than 2 years, 2 to 4 years, 4 to 6 years, and 6 to 12 years, with an adolescent age band currently under development. Children in Level I can perform all the activities of

their age-matched peers, albeit with some difficulty with speed, balance, and coordination; children in Level V have difficulty controlling their head and trunk posture in most positions and achieving any voluntary control of movement. The GMFCS has now become the principal way to describe the severity of motor disability for children with CP. The system has had good uptake internationally and across the spectrum of health care professions for use in research and clinical practice by providing a system for clearly communicating about children's gross motor function [14].

To move the scientific study of CP forward the recent definitions and classifications proposed by SCPE and Bax's group actually perform in practice were re-considered.Particularly, pertinent material was reviewed on July 11–13 at an International Workshop on Definition and Classification of Cerebral Palsy in Bethesda, Maryland, July 11–13 2004, co-sponsored by the United Cerebral Palsy Research and Educational Foundation in Washington and the Castang Foundation in the UK, with special support provided by the National Institute of Health/National Institute of Neurological Disorders and Stroke, 2004.At the workshop, it was agreed that the concept 'cerebral palsy' should be retained. Suggestions were made about the content of a revised definition and classification of CP that would meet the needs of clinicians, investigators, health officials, families and the public and would provide a common language for improved communication, so CP definition was suggested:

Cerebral palsy (CP) describes a group of disorders of thedevelopment of movement and posture, causing activitylimitation, that are attributed to non-progressive disturbancesthat occurred in the developing fetal or infantbrain. The motor disorders of cerebral palsy are oftenaccompanied by disturbances of sensation, cognition,communication, perception, and/or behaviour, and/or bya seizure disorder [11].

The task of the participants (listing follows)was to revisit and update the definition and classificationof cerebral palsy in light of emerging understanding ofdevelopmental neurobiology and changing concepts aboutimpairments, functional status and personal 'participation'.Reassessment of the definition of CP was prompted by a hostof factors: changes in delivery of care to children with disabilities;recognition that children with slowly progressive inbornerrors of metabolism can present with motor difficulties attimes indistinguishable from those of children with non-progressivedisease; increased availability of high-quality brainimaging to identify impairments in brain structure; acknowledgmentthat developmental motor impairment is almostinvariably associated with a range of other disabilities; andincreased understanding about associated antecedents andcorrelates of CP. The Executive Committee for the Definition of Cerebral Palsy (CP) suggested further: this definition bedescribed as a group of permanent disordersof the development of movement and posture,causing activity limitation, that are attributed to nonprogressivedisturbances that occurred in the developingfetal or infant brain. The motor disorders of cerebralpalsy are often accompanied by disturbances of sensation,perception, cognition, communication, and behaviour,by epilepsy, and by secondary musculoskeletalproblems [12].According to 2007 report this definition was further revisited: "Cerebral palsy is 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 fetal or infant brain." [15] Cerebral palsy is a clinical diagnosis based on a combination of clinical and neurological signs. Diagnosis typically occurs between age 12 and 24 months [16, 17].

Neuro-imaging findings as a tool to classify CP.

Until recently, correlations between neuroimaging findings andclinical presentation in cerebral palsy were weak. However,advances both in imaging technology and in quantitative motorassessments are changing this picture. The goal of categorizingall patients based on specific neuroimaging findings willrequire more development before implementation. The recommendationof the American Academy of Neurologyto obtain neuroimaging findings on all children withcerebral palsy should be followed whenever feasible.Imaging using various imaging modalities shows pathology in 77%, when computed tomography (CT) is used and in 89% when magnetic resonance imaging (MRI) is employed [18].Neuroradiology is capable of defining different kinds of brain pathology including various congenital malformations and different destructive lesions in white and grey matter [19].Although timing of an insult is the most important factor in determining the pattern of pathology, the duration and severity of the insult are other important factors. Thus profound asphyxia causes lesions different from those due to partial hypoxia in the mature brain but also in the immaturebrain before 34 gestational weeks [20]. Timing and pathology: The finding of a congenital malformation by MR is usually indicative of an injury during the first half of the pregnancy. Detailed classification of the malformation may further limit the period during which the insult has operated. An abnormality of cleavage, e.g. holoprosencephaly is a very early lesion, 4th to 6th week, while an abnormality of cortical organization, e.g. polymicrogyria is an example ofa very late lesion which may occur as late as 20 gestational weeks or later, depending on specific type [21].Neuroradiological demonstration of primary white matter damage, e.g. periventricular leukomalacia (PVL) or periventricular haemorrhagic infarction (PVH) represents residualfrom insults operating between 24 and 34 gestational weeks. While the lower limit, 24 weeks, may be difficult to define, it appears as if the later limit 34 gestational weeks is unusually well defined [22]. It is not difficult to find statements in the literature, textbooks in particular, saying that PVL can occur even later than 34 gestational weeks. However, the scientific supportfor this opinion is weak and most reports refer to cases in which the findings were detected and the diagnosis of PVL made after a full-length pregnancy but without solid evidencewhen the damage indeed occurred. When found in a neonate born at term, PVL should be considered as having occurred in utero. Systematic use of neuroimaging in populations at risk for developing CP have shown that children born preterm have neuroradiological findings of PVL in 32% while only 9% had CP [23]. Jacobson and her group have shown that children withPVL may have significant symptoms with visual cognitive defects from their brain injury even without motor deficits. At the same time precise relationships between morphologicallesions and motor disability has been shown using sophisticated analysis of conventional and functional MR. In CP, the pattern of injury to a child's brain is believed to be influenced by neural development, vascular anatomy, and the many other factors that affect injury and recovery [24]. Neuroimaging studies suggest that there are particular patterns of injury that occur with relatively high frequency, including periventricular white matter injury, cerebrovascular occlusion, and selective neuronal injury [25].

Discussion.

It is increasingly apparent that cerebral palsy may result fromthe interaction of multiple risk factors, and in many cases,no identifiable cause may be found. Therefore, while everyreasonable effort should be undertaken to investigate causesor causal pathways, clear-cut categorization by cause isunrealistic at the present time. It is possible that by lookingfurther downstream from putative cause to commonmechanisms of injury, and by grouping cases on that basis,a more salient method of classification may be developed.For the present, timing of insult should only be notedwhen reasonably firm evidence indicates that thecausative agent, or a major component of the cause, wasoperative in a specific time-window,as for example, withpost-natal meningitis in a previously well infant. Whilerecording adverse events in the prenatal, perinatal and postnatallife of a child with CP is necessary, clinicians shouldavoid making the assumption that the presence of suchvents is sufficient to permit an etiologic classification thatimplies a causal role for these events in the genesis of CPin the affected individual.In many individuals with cerebral palsy, other impairmentsinterfere with the ability to function in daily life, and may attimes produce even greater activity limitation than the motorimpairments that are the hallmark of cerebral palsy. Theseimpairments may have resulted from the same or similarpathophysiologic processes that led to the motor disorder,but they nonetheless require separate enumeration. Examplesinclude seizure disorders, hearing and visual problems, cognitiveand attentional deficits, emotional and behavioral issues,and later-developing musculoskeletal problems. These impairmentsshould be classified as present or absent, and if present,the extent to which they interfere with the individual'sability to function or participate in desired activities and rolesshould be described. In concurrence with the SCPE recommendation,the presence or absence of epilepsy (definedas two or more afebrile, non-neonatal seizures) be recorded,and IQ, hearing and vision be assessed [4]. While SCPEprovides terminology for describing different degrees of cognitive,hearing and visual impairment, the IQ score, correctedvision in each eye, and decibel loss (if any) in each ear berecorded whenever this information is available [4]. Standardizedinstruments are available to measure IQ, vision and hearing,and categories describing specific levels of dysfunction (e.g.,visual impairment, profound hearing loss, mild mental retardation)have come to be generally accepted.

Another definition, provided by ICF and WHO.

Conceptual advances regarding health are reshaping terminology, so the concept of disability is giving way to a healthstatus construct in which biological, social, and personalattributes determine activity and participation in society.These concepts are embodied in the InternationalClassification of Function, Disability and Health (ICF) developedby the World Health Organization [26]. The ICF is linkedto causes of impairments and disabilities through the International Classification of Diseases (ICD). CP, as captured in the International Classification of Diseases (ICD)-10 with code (G80) [27].There are four 'components' to the classification: Body structure andfunction, Activity, Participation, and Environmental factors.It defines 'Participation' as involvement in life situations [27].This concept applies to all people, not just those with disabilities.It has positive, rather than negative, connotations andthe difficulties are understood to reside in the interactionbetween the individual and their environment and not in theindividual alone. The ICF recognizes that improvement maybe achieved through manipulation of a child's environmentand therapy requiring a change in the child's body. Therefore,the classification is in agreement with the social model of disability. The ICF also recognizes the importance ofQuality of Life (QoL), a person's subjective account of howthey feel about their life, including their view of their ownParticipation. There are now instruments such as KIDSCREEN,KINDL, TACQOL, and PEDSQL which are capable of capturingthis subjective QoL in childhood.Therefore, a classification of children with CP should have clear classification on CP type, associated impairments, functional effect across trunk and limbs, child's participation as well as the child's quality of life.

ACPR definition of CP.

The Gross Motor Function Classification Scale (GMFCS)was developed to group children with CP into five levels offunctional mobility based on the key function of ambulation [13].This outcome measure is currently being used in a large randomizedclinical trial for the primary prevention of CP (The'BEAM' trial – Beneficial Effects of Antenatal Magnesium) [28]. First,the presence or absence of CP at age 2 is determined by definitefindings in any two of the following areas: (1) delay in motormilestones; motor quotient of 70 or less; (2) abnormalities oftone, deep tendon reflexes, co-ordination and movement; and(3) aberration in primitive reflexes, positive support reflex,tonic labyrinthine reflex, and/or postural reactions. If CP isdetermined to be present, then the GMFCS is used at the finalvisit at age 2 years to determine level of severity of CP. In orderto incorporate hand and arm function, it has been amended inthis trial by adding the ability to be able to grasp and releasewith both hands as a requirement for scoring above level III [29].InAustralia, in its turn, any child acquiring a motor disorder asa result of a brain-damaging event before the age of 5 years is considered to have CP [16]. However, those whose neurological impairment followsa well-documented causal event after the age of 28 daysand before the age of 5 years are grouped separately as postneonatallyacquired CP. The age of 28 days defines the end ofthe neonatal period and usually differentiates events relatedto gestation and delivery from those largely independent of it.Summary of additional criteria: To summarize, in order torefine the specificity of the generally accepted criteria for CP,it is suggested to: (1) define the lower limit of severitytogether with the standards on which that definition isbased; (2) specify known syndromes that are included in orexcluded from the data set; (3) define the age of ascertainmentat which progression or resolution is decided; (4)define the minimum age of inclusion and the criteria whichmust be met should the child die before the age of ascertainment;and (5) specify the upper age limit of acquired braininjury to be included [16].

CP definition by SCPE.

At the beginning of the SCPE work, researchers faced with difficulties remained when poolingand comparing information from different sources. The persistingproblems were mainly due to the matter of languagesince not all partners from the different countries wereEnglish native speakers. Not everyone had derived the samemeaning from terms such as 'increased tone' and 'walkingfluently'. Thus, during the next 3 years, collaborative effortswere put together, mainly between child neuro-paediatricians,in order to develop a video-based tool, the SCPEReference and Training Manual (SCPE R&TM) [4]. The aim ofthis tool was to promote a shared understanding of thewords and phrases used to describe the clinical, functional,and neurological features of CP. Text and video material werefirst discussed within the small group of child neuro-paediatriciansand then proposed to illustrate these features and todiscuss pitfalls in diagnosis and classification. Interobserverexercise has been performed before spreading widely theuse of this SCPE R&TM [30]. After a few years of use, the hope isthat it will help to improve the harmonization and standardizationlevel between different CP registers/studies, and thatit will encourage new registers in new countries to join theSCPE network [30].During the latest years of the SCPE, collaborative researchers are working on the data quality and also toward the improvementof available information on denominators within theEURO-PERISTAT project.To summarize, SCPE suggested the following definition:

Cerebral Palsy is a group of permanent, but notunchanging, disorders of movement and/or posture and ofmotor function, which are due to a non-progressive interference,lesion, or abnormality of the developing/immaturebrain [31]. This definition specifically excludes progressive disordersof motor function, defined as loss of skills previouslyacquired in the first 5 years of life.For any study of CP to be valid, there must be agreementon the 'similar characteristics' of the cases eligible for inclusion.SCPE has spent time agreeing on inclusion and exclusion criteriathat should accompany CP definition [30].

Inclusion criteria: Optimal age: CP is not an easy diagnosis and it requires time to be confirmed.Premature diagnosis mightlead to over-ascertainment (because of transient anomaliesin preterm babies) or under-ascertainment, e.g. in mild unilateralspastic cases or ataxic cases. CP, as stated above, is notan unchanging condition, with the clinical picture in somecases altering as a child develops. It was agreed that age 5years was the optimal age for confirmation of diagnosis.What about children who die early? It is recognized thatsome children with severe CP are correctly diagnosed at ayoung age, but die before their 5th birthday. Exclusion ofthese children could result in under-estimation of the prevalenceof CP in Europe. Also when studying the aetiology, itwould be better to include these cases, for instance cases ofhypoxic–ischemic encephalopathy who die early [30]. In fact, acompromise was needed, and as a group, SCPE had followedthe recommendation from Hagberg that children who die too early, i.e. before the ageof 2 years, and those children with clear signs of CP who diebetween the ages of 2 and 5 years must be included.No upper age limit of onset of CP (in children with a postneonatalcause) was identified. But it is useful to isolate CPcases of post-neonatal origin, defined as cases arising froman aetiological event 27 completed days after birth.Exclusion criteria: All progressive conditions resulting in lossof acquired skills are excluded. However, we recognize thatsome progressive disorders might be registered wrongly as CP,due to the delay required, in some circumstances, to confirma diagnosis of progressive disorder. However, the proportionof these misdiagnosed CP cases does not represent morethan a few per cent of all CP cases, at least in the SCPE data.Children with hypotonia as the sole clinical feature andchildren with isolated spinal neural tube defects should alsobe excluded from the CP cases.

SCPE CP classification scheme: Classification means'the basic cognitive process of distributing children withCP into classes or categories of the same type'. Differentclassification systems for CP serve different functions, butfor epidemiological purposes, classifications systems basedon clinical findings are currently the most widely used.Drawing on published work, SCPE has classified CP intothree main groups, which are based on clear neurologicalsigns indicating pathology in the cerebral motor systems, e.g.spastic, ataxic, and dyskinetic CP.All CP subtypes have an abnormal pattern of movementand posture in common.Spastic CP cases have increased tone and pathologicalreflexes, either increased reflexes, e.g. hyper-reflexia or pyramidalsigns, such as Babinski response. Increased tone inspasticity is characterized by an increased resistance which isvelocity dependent [32]. A spastic catch is feltsome time after onset of movement. Clonus is often associatedwith hyper-reflexia. It is considered pathological when itis prolonged or does not stop spontaneously. Pathologicalposturing of lower limbs is characterized by: (1) internalrotation of the hip; (2) hip adduction; and (3) equinus foot,resulting in a 'scissored' position.Dyskinetic CP cases present involuntary, uncontrolled,recurring, and occasionally stereotyped movements. Theprimitive reflex patterns predominate, and the muscle toneis varying. SCPE uses dystonic and choreo-athetotic CP subtypesfor subgrouping.Dystonic CP is dominated by abnormal postures (may givethe impression of hypokinesia) and hypertonia (tone fluctuating,but easily elicitable tone increase).Characteristics are involuntary movements, distorted voluntary movements, and abnormal postures due to sustainedmuscle

contractions (slow rotation, extension, and flexion of bodyparts). Choreo-athetotic CP is dominated by: hyperkinesiaand hypotonia (tone fluctuating, but mainly decreased).Chorea means rapid involuntary, jerky, often fragmentedmovements. Athetosis means slower, constantly changing,writhing, or contorting movements.In some cases, however, it may be difficult to delineatethese subgroups when features are present from both. Thenthe term dyskinetic CP should be used.Ataxic CP cases present loss of orderly muscular coordination,so that movements are performed with abnormal force,rhythm, and accuracy. Abnormal pattern of movement inataxic CP is characterized by: (1) Loss of orderly muscularcoordination, so that movements are performed with abnormalforce, rhythm, and accuracy. Typical features are trunkand gait ataxia (disturbed balance) and past pointing (overorundershooting of goal directed movements). (2) Tremoris another common sign (mainly a slow intention tremor).(3) Low tone is also a prominent feature.Mixed CP forms: When it is a mixed CP form, i.e. spasticitywith ataxia and/or dyskinesia, the child should be classifiedaccording to the dominant clinical feature.Pure dyskinetic movement disorder does not show hyperreflexiawith clonus nor pyramidal signs. But in dyskineticCP, these signs of spastic disorder may be present. The dominatingfeatures should determine subtype classification.Also, in spastic CP, some dystonic features are often present,especially when the upper extremities are involved. A dystonicposturing of the hand would, however, not be sufficientto classify a child as having the dystonic form ofdyskinetic CP. The dystonic posturing of the trunk, arms, andface in the presence of lower-limb spasticity would qualify,however, as predominant dyskinetic features, thus, dystonic CP.Motor function impairment in CP children: SCPE choice wasto recommend the scoring of motor function according to: the Gross Motor Function Classification System (GMFCS) forthe lower limbs function [13] and Bimanual Fine Motor Function (BFMF) for theupper limbs function [33]. This last choice was achieved only veryrecently, and in order to conform to the S property (simplicity).However it has not yet been validated.Since SCPE does not recommend the use of diplegia/quadriplegiaterms, and recommends using instead the term bilateralspastic CP subtypes, the two motor function scales canthen be used for describing children with CP according to thefunctional grading given. For instance, a child with bilateralspastic CP may be 'scored' as GMFCS Level IV and BFMF LevelII – which for the clinician involved would give the feature of adiplegia – and another child with unilateral spastic CP may bescored as GMFCS Level II and BFMF Level I.Associated impairments in CP children: The SCPE collaborativegroup recommends collecting information on fourassociated impairments [31]. These recommendations are theminimum information that should be collected for thosewishing to pool data or to compare it with data from othercentres/countries.For visual and hearing impairment, the recommendation isto determine the presence or absence of such impairment,and then to classify the impairment as severe or not, accordingto the visual acuity (<0,1 in both eyes after correction)or hearing loss (more than 70 dB in the better ear beforecorrection).Epilepsy can be defined as two unprovoked seizures,neonatal seizures being excluded. Firstly it must be known ifthe child 'had ever' or 'never had' epilepsy. Then it will begrouped as severe epilepsy if the epilepsy is still active.SCPE trees are used for categorizingchildren with CP [34]. Firstly, the decision tree is based on thepresence of disorder of 'movement and/or posture' and ofmotor function. Secondly, the classification tree relies onneurological signs and topography for distinction betweenCP subtypes. By doing so, CP cases that are difficult to classifyare not so numerous and less than 5% are observed in datafrom European centres [34][34].At the beginning of the SCPE network, it was decided touse the words 'bilateral/unilateral spastic', with, in addition, thenumbers of limbs involved, instead of using the words 'diplegia,tetraplegia'. After a while, the disappointment was greatwhen we observed persisting important differences betweencentres on the 'theoretically' harmonized data. The overlapbetween the 'diplegia/quadriplegia' groups in CP classificationshas been well described in a recent paper [35].These differences, between two andfour limbs for example, could not be explained by anythingelse than by coding differences. Despite having agreed on atext definition and classification categories, large variationsin classifying CP cases were still shown in a cross-validationexercise. The distinction between the number of limbsaffected, used by several centres, in opposition to the numberof limbs predominantly affected used by other centres,was the main reason responsible for these differences.Thus SCPE's recommendation moved to a simplercategorization, i.e. classifying spastic CP cases in unilateralversus bilateral CP cases [35]. Bilateral spastic CP was notfurthersubdivided into arm/leg-dominated, diplegia/quadriplegia,nor 2-limb/3-limb/4-limb dominated, due to the great variability when these terms are not defined using functional scores respectively for upper and lower limbs.In a different way the Australian group gives an examplethat harmonization within one country may authorize moredetailed description and classification than what is possiblewhen dealing with several different countries. They are usingfour levels (minimal, mild, moderate, severe) to describe severityof neurological signs in each limb. However, there is stilldiscussion in Australia about the overlap between triplegia,diplegia, and quadriplegia CP subtypes, and the need for aninternational consultation was expressed (Blair and Watson2005). However, these scoringsystems are very helpful for epidemiological purposes andevaluation of care.The reasons for SCPE choosing the BFMF scoring systemrather than the MACS (Eliasson et al. 2006) are that: (1)BFMF takes into account possible asymmetry in the handfunctions, whilst MACS does not; and that (2) BFMF can beretrieved from written medical records whilst MACS cannot.When collecting data on children with CP for CP registers orsurveys, the situation of not directly examining the child isquite common.In the US, there was an attempt to classify children with CPaccording to severity criteria based on the functional abilityof the most affected limbs, i.e. severe involvement meaningno useful function, and moderate involvement meaning thepreservation of some function with or without the use ofassistive devices [36].

Conclusion. To summarize, CP is a clinical description of heterogeneous pathology that underlies not only ante, intra but also post-natal brain injury. CP is one of the socially significant disorders in the world; however, one of them main issues is absence of clear definition of CP, which in turn affects further classification and therapeutic approaches to improve the quality of life of affected children. Therefore, there is a need not only in further research on etiology of CP but also in the development of clear standardized classification system of CP as a heterogeneous disorder.

REFERENCES

1 Novak I., Morgan C., Adde L. et al. Early, Accurate Diagnosis and Early Intervention in Cerebral Palsy Advances in Diagnosis and Treatment // JAMA Pediatr. – 2017. - №171(9). – P. 897-907. doi: 10.1001/jamapediatrics.2017.1689.
2 Bosanquet M, Copeland L, Ware R, et al., A systematic review of tests to predict cerebral palsy in young children // Developmental Medicine and Child Neurology. – 2013. - №55(5). – P. 418–426.
3 Morgan C, Crowle C, Goyen T-A et al., Sensitivity and specificity of General Movements Assessment for diagnostic accuracy of detecting cerebral palsy early in an Australian context // Journal of Paediatrics and Child Health. – 2016. - №52(1). – P. 54–59.
4 Christine C, Dolk H, Platt MJ et al., SCPE Collaborative Group. Recommendations from the SCPE collaborative group for defining and classifying cerebral palsy. Developmental medicine and child neurology // Supplement. – 2007. - №109. – P. 35-38.
5 Surveillance of Cerebral Palsy in Europe (SCPE). (2000) Surveillance of Cerebral Palsy in Europe: a collaboration of cerebral palsy surveys and registers // DevMed ChildNeurol. – 2000. - №42. – P. 816-824.
6 Smithers-Sheedy H, Badawi N, Blair E et al., What constitutes cerebral palsy in the twenty-first century? // Developmental Medicine and Child Neurology. – 2014. - №56. – P. 323–328.
7 Stavsky M., Mor O., Mastrolia S.A. et al.,Cerebral Palsy—Trends in epidemiology and Recent Development in Prenatal Mechanisms of Disease, Treatment, and Prevention // Frontiers in Pediatrics. – 2017. - №5(21). – P.1-10. Published: doi: 10.3389/fped.2017.00021
8 Goldsmith Sh., McIntyre S., Smithers-Sheedy H. et al. On Behalf Of The Australian Cerebral Palsy Register Group an international survey of cerebral palsy registers and surveillance systems // Dev Med Child Neurol. – 2016. - №58, Suppl 2. – P. 11–17. Published online 2016 Jan 19. doi: 10.1111/dmcn.12999
9 Bax M, Goldstein M, Rosenbaum P et al.Executive Committee for the Definition of Cerebral Palsy. Proposed definition and classification of cerebral palsy, April 2005 // Dev Med Child Neurol. – 2005. - №47(8). – P. 571-576.

10 Bax MC. (1964) Terminology and classification of cerebral palsy // Developmental Medicine and Child Neurology. – 1964. - №11. – P. 295–297.
11 Mutch L, Alberman E, Hagberg B. et al., Cerebral palsy epidemiology: where are we now and where are we going? // Developmental Medicine and Child Neurology. – 1992. - №34. – P. 547–551.
12 Baxter P CP or not CP? // Dev Med Child Neurol. – 2005. - №47(8). – P. 507-511.
13 Rosenbaum P, Paneth N, Leviton A, et al. A report: the definition and classification of cerebral palsy April 2006 // Dev Med Child Neurol Suppl. – 2007. - №109. – P. 8–14.
14 Palisano R, Rosenbaum P, Walter S et al., Development and reliability of a system to classify gross motor function in children with cerebral palsy // Dev Med Child Neurol. – 1997. - №39. – P. 214-223.
15 Graham H.K., Rosenbaum P., Paneth N.et al.Cerebral palsy // Nat Rev Dis Primers. – 2016. - №2. – P. 150-182. doi: 10.1038/nrdp.2015.82.
16 Blair E,Watson L. Epidemiology of cerebral palsy // Semin Fetal Neonatal Med. – 2006. - №11(2). – P. 117-125.
17 Report of the Australian Cerebral Palsy Register, Birth Years 1993-2009, September 2016. https: //www.cpregister.com/pubs/pdf/ACPR-Report_Web_2016.pdf
18 Hubermann L, Boychuck Z, Shevell M. et al. Age at referral of children for initial diagnosis of cerebral palsy and rehabilitation: current practices // J Child Neurol. – 2016. - №31(3). – P. 364-369.
19 Linsell L., Malouf R., Morris J. et al. Prognostic factors for cerebral palsy and motor impairment in children born very preterm or very low birthweight: a systematic review // Dev Med Child Neurol. – 2016. - №58(6). – P. 554–569. doi:10.1111/dmcn.12972
20 McIntyre S., Taitz D., Keogh J.et al. A systematic review of risk factors for cerebral palsy in children born at term in developed countries // Dev Med Child Neurol. – 2013. - №55(6). – P. 499-508. doi: 10.1111/dmcn.12017.
21 Novak I, Hines M, Goldsmith S et al. Clinical prognostic messages from a systematic review on cerebral palsy // Pediatrics. – 2012. - №130(5). – P. 1285-1312. doi: 10.1542/peds.2012-0924
22 Himpens E, Van den Broeck C, Oostra A et al. Prevalence, type, distribution, and severity of cerebral palsy in relation to gestational age: a meta-analytic review // Developmental Medicine and Child Neurology. – 2008. - №50.- P. 334–340.
23 Bangash AS, Hanafi MZ, Idrees R et al. Risk factors and types of cerebral palsy // J Pak Med Assoc. – 2014. - №64(1). – P. 103-107.
24 Pagnozzi A.M., Dowson N., Doecke J. et al. Automated, quantitative measures of grey and white matter lesion burden correlates with motor and cognitive function in children with unilateral cerebral palsy // Neuroimage Clin. – 2016. - №1. – P. 751–759. doi:10.1016/j. nicl.2016.05.018 73.
25 MacLennan AH, Thompson SC, Gecz J. Cerebral palsy: causes, pathways, and the role of genetic variants // American Journal of Obstetrics and Gynecology. – 2015. - №213(6). – P. 779–788.
26 Shepherd E, Salam RA, Middleton P. et al. Antenatal and intrapartum interventions for preventing cerebral palsy: an overview of Cochrane systematic reviews // Cochrane Database Syst Rev. – 2017. - №8. – P. 8-18. doi:10.1002/14651858.CD012077.pub2.
27 World Health Organization, The Fifty-fourth World Health Assembly, 2001. International Classification of Functioning, Disability and Health (ICF) http://apps.who.int/gb/archive/pdf_files/WHA54/ea54r21.pdf?ua=1
28 World Health Organization, International Code Diseases, http://apps.who.int/iris/bitstream/handle/10665/246208/9789241549165-V2-eng.pdf?sequence=2&isAllowed=y&ua=1
29 Edwards J.M, Edwards L.E, Swamy G.K. et al. Effect of Cord Blood Magnesium Level at Birth on Non-neurologic Neonatal Outcomes // Am J Perinatol. – 2018. – P. 52-58. doi: 10.1055/s-0038-1627097. [Epub ahead of print]
30 Kent Heyborne and Watson A Bowes, Jr. The use of antenatal magnesium sulfate for neuroprotection for infants born prematurely F1000 // Med Rep. – 2010. - №2. – P. 78-85.
31 Krägeloh-Mann I, Cans C. Cerebral palsy update // Brain Dev. – 2009. - №31(7). – P. 537-544. doi: 10.1016/j.braindev.2009.03.009. Epub 2009 Apr 21.
32 Christine C, Dolk H, Platt MJ et al; SCPE Collaborative Group. Recommendations from the SCPE collaborative group for defining and classifying cerebral palsy // Dev Med Child Neurol Suppl. – 2007. - №109. – P. 35-38.
33 Sanger TD, Delgado MR, Gaebler-Spira D et al.Classification and definition of disorders causing hypertonia in childhood // Pediatrics. – 2003. - №111. – P. 89-97.
34 Elvrum A.G, Beckung E, Sæther R et al. Bimanual Capacity of Children with Cerebral Palsy: Intra- and Interrater Reliability of a Revised Edition of the BimanualFineMotorFunction Classification // Phys OccupTherPediatr. – 2017. - №37(3). – P. 239-251. doi: 10.1080/01942638.2016.1185507. Epub 2016 Aug 26.
35 Surveillance of Cerebral Palsy in Europe, Prevalence and characteristics of children with cerebral palsy in Europe // Dev Med Child Neurol. – 2002. - №44(9). – P. 633-640.
36 Colver A, F, Sethumadhavan T. The term diplegiashould be abandoned // Arch Dis Child. – 2003. - №88(4). – P. 286-290.
37 Graham H.K., Rosenbaum P., Paneth N. et al.Cerebralpalsy // Nat Rev Dis Primers. – 2016. - №2. – P. 150-182. doi: 10.1038/nrdp.2015.82.

А.А. Аканова, Р.Б. Исаева, В.Н. Локшин, Р.Ж. Сейсебаева, Ш.К. Сармулдаева, Г.Т. Мырзабекова
Қазақ медициналық үздіксіз білім беру университеті, Алматы, Қазақстан

БАЛАЛАР ЦЕРЕБРАЛДЫ САЛ АУРУЫНЫҢ ХАЛЫҚАРАЛЫҚ АНЫҚТАМАСЫ (ӘДЕБИ ШОЛУ)

Түйін: Балалар церебралды сал ауруы - бұл нерв жүйесінің перинаталдық кезеңде бұзылуының нәтижесі болып табылатын және ілеспе аурулардың кең спекторымен байланысты прогрессивті мотор бұзылуы. Диагностикалауүшін орташа жасы шамамен 18 айды құрайды; алайда, деректер көрсеткендей, Прехтла шкаласы бойынша мотористаны сапалы бағалай отырып,сондай-ақ резонанстық визуализацияәдістерімен церебралды сал ауруынүш-төрт айлық жастан диагностикалау мүмкін. Қазіргі уақытта, церебральді сал ауруын эпидемиологиялық қадағалаудың 27 халықаралық бағдарламалары 5 церебралды сал ұйғарымдарына қолданылады, сонымен қатар олардың 46%, бір ғана церебралды салдыанықтауға қолданады. Жүргізілген мета-талдауғасәйкес ең жиі айтылатын анықтау Европалық бағдарламасымен ұсынылған церебралды сал ауруын қадағалау (63%), Розенбаумұсынған дефиниция және т. б. 2007 (54%). Осылайша, осы шолуда церебралды сал ауруының анықтамасы неғұрлым кеңінен сипатталған, сондай-ақ талқылау осы анықтамалардың дұрыстығын көрсетті.
Түйінді сөздер: церебралды сал ауруы, анықтама, ерте диагностика, нейровизуализация

А.А. Аканова, Р.Б. Исаева, В.Н. Локшин, Р.Ж. Сейсебаева, Ш.К. Сармулдаева, Г.Т. Мырзабекова
Казахский медицинский университет непрерывного образования, Алматы, Казахстан

МЕЖДУНАРОДНОЕ ОПРЕДЕЛЕНИЕ ДЕТСКОГО ЦЕРЕБРАЛЬНОГО ПАРАЛИЧА (ОБЗОР ЛИТЕРАТУРЫ)

Резюме: Церебральный паралич - это прогрессирующее моторное расстройство, являющееся результатом поражения нервной системы в перинатальном периоде, и связано с широким спектром сопутствующих заболеваний. Средний возраст для диагностики составляет около 18 месяцев; однако, недавние данные свидетельствуют о том, что церебральный паралич может быть диагностирован в возрасте трех-четырех месяцев с использованием качественной оценки моторики по шкале Прехтла, а также методами резонансной визуализации. В настоящее время, 27 международных программ эпидемиологического надзора за церебральным параличом применяют пять определений церебрального паралича, при этом 46% их них используют более одного определения церебрального паралича. Согласно проведенному мета-анализу, наиболее часто упоминается определение, предложенное Европейской программой надзора за церебральным параличом (63%), за которым следует дефиниция, предложенная Розенбаумом и др. 2007 (54%). таким образом, в данном обзоре будут описаны наиболее широко цитируемые определения церебрального паралича, а также обсуждение достоверности этих определений.
Ключевые слова: церебральные параличи, определение, ранняя диагностика, нейровизуализация