IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 6, Issue 4 Ver. I (Jul. - Aug. 2017), PP 22-28
www.iosrjournals.org

Establishment of Cerebral Palsy Research Registry in North Cairo Egypt

Marian N. Shawky[1], Samah A. El Shemy[2], Faten H. Abdelazeim[3]
[1] *Physical Therapist in Shubra General Hospital, Egypt*
[2] *Assistant Professor in Department of Physical Therapy for Pediatrics, Faculty of Physical Therapy, Cairo University, Egypt*
[3]*Professor and Head of Department of Physical Therapy for Pediatrics, Faculty of Physical Therapy, Cairo University, Egypt*

Abstract
Background: *Cerebral palsy is the most common neurodevelopmental motor disability in children. There is a lack of information concerning the predominance of cerebral palsy among Egyptian children. Cerebral palsy registry appears to be appropriate tools for answering questions regarding the prevalence and the attributes of the disorder.*
Aim: *To establish a registry of cerebral palsy in North Cairo, Egypt.*
Subjects: *184 children with cerebral palsy of both genders with age ranged from 3 months to 18 years participated in this study. They selected from hospitals and private centers in North Cairo.*
Methods: *Gross Motor Function Classification System (GMFCS), Manual Ability Classification System (MACS) and Viking Speech Scale (VSS) used for assessment.*
Results: *The results revealed that the boy/ girl ratio was 1.3/1. Spastic CP was the most common type representing 90.3%. Moreover, the spastic quadriplegic type representing 54.9%. According to GMFM, MACS, VSS level V and IV had the highest percentage respectively.*
Conclusion: *Prevalence of CP was more in boys than girls. Spastic CP was the most common type with high incidence of quadriplegia. In addition, hypoxia was the most common risk factor for CP. Furthermore, there were significant relations between types of CP and gestational age, epilepsy, intellectual impairment, GMFCS, MACS and VSS findings.*
Keywords: *Cerebral palsy, Registry, North Cairo.*

I. Introduction

Cerebral palsy (CP) is a group of permanent movement disorders that appear early in life. Signs and manifestations vary among children and incorporate spasticity, poor coordination and muscle weakness. Other associated disorders incorporate seizures, cognitive problems, sensory deficits as well as hearing, vision, speech and swallowing problems [1]. Prevalence of cerebral palsy is around 2.1 per 1,000 live births. It caused by damage to the parts of the developing brain responsible for movement control, balance, and posture. Frequently the issues happen during pregnancy; however, they may also occur during childbirth, or shortly after birth. The conceivable reasons for CP incorporate issues in intrauterine development as exposure to radiation, hypoxia of the brain, trauma occurred during labor and delivery, and post neonatal factors such as head trauma or cerebral infections [2,3].Cerebral palsy classified according to muscle tone disturbance into three types including; spastic, ataxic, and athetoid types. Additionally, there is a mixed type that demonstrates a combination of features of the other three types and hypotonic type that show decrease in muscle tone. Spastic subtype classified according to the topographic distribution of muscle spasticity as diplegia, hemiplegia or quadriplegia. Athetoid (or dyskinetic) CP essentially associated with damage to the basal ganglia during brain development due to bilirubin encephalopathy and hypoxic ischemic brain injury. Ataxic CP is the least frequent form of CP and observed in 5-10% of all cases of CP. Ataxic CP brought about by damage to cerebellar structures. Children with ataxic CP experience issues in coordination, particularly in their arms, legs, and trunk [4]. Cerebral palsy research registry created to identify the disparity between population and clinical-based cerebral palsy registries and promote research in the field. This accomplished by interfacing people with CP, as well as their families, to a network of regional specialists. The registry, or core data project, consists of multiple sub cores that have specialty specific related data per patient. Cerebral palsy registries have a remarkable position to help with deciding etiological comprehension and counteractive actions by utilizing the framework of multiple causal pathways to CP. This aim concentrates on the potential for CP registries to increase awareness of CP among community and professional groups through publications, support and interactive multimedia [5]. Therefore, the purpose of the current study was to recognize the prevalence and the disability profile of CP cases from referral centers of physiotherapy and rehabilitation in North Cairo, Egypt.

II. Subjects and methods

Subjects:

184 children with CP of both genders participated in this study. Their ages ranged from 3months to 18 years. They recruited from general, private and teaching hospitals as well as private physical therapy centers that provide neuropediatric services in North Cairo. The current study approved by the Ethics Review Committee of the Faculty of Physical Therapy, Cairo University. Prior to data collection, the purposes, procedures and benefits fully explained to the parents of the participating children. All children's parents gave their informed consents to have their children participated in the study. The current study conducted from August 2016 up to January 2017. All target population of the study diagnosed as CP. Children excluded from the study if they had any disease other than CP (as myopathy, neuropathy, brain tumors or genetic disorder) or if they were outside North Cairo.

Methods:

1. The evaluation form used in this study designed form Australian Cerebral Palsy Register form [6].
2. Gross motor function classification system (GMFCS) created to describe gross motor function in children with CP and has its emphasis on self-initiated movements, specifically sitting and walking. It 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. The GMFCS includes 5 age groups; less than 2 years, 2-4 years, 4-6 years, 6-12 years and 12-18 years. The levels of GMFCS divided into level I indicates walking without limitation, level II demonstrates walking with limitations, level III indicates walking using a hand- held mobility device, level IV demonstrates self-mobility with limitations; may use powered mobility, and finally level V indicates transportation in a manual wheelchair [7].
3. Manual ability classification system (MACS) classifies how well children aged 4–18 years with CP utilize their hands when handling objects in daily activities. It designed to reflect the child's typical manual performance, not the maximal capacity. The attention is on manual ability and the MACS level influenced by environmental and personal factors. Levels of MACS divided into level I indicates handling objects easily and effectively, level II demonstrates handling most objects but with somewhat reduced quality and/or speed of achievement, level III indicates handling objects with difficulty; needs assistance to prepare and/or modify activities, level IV demonstrates handling a limited selection of easily managed objects and always requires some help from others. Finally, level V shows that the child is not able to handle objects or to complete even simple activities with their hands [8].
4. Viking speech scale developed for use with children aged 4–18 years. It utilized to classify children's speech production; particularly the ease at which children can make themselves understood using different methods of communication. Levels of VSS divided into level I demonstrates that speech is not affected by motor disorder, level II indicates that speech is inaccurate but usually understandable to unfamiliar listeners, level III demonstrates that speech is unclear and not usually understandable to unfamiliar listeners out of context and finally level IV indicates no understandable speech [9].

Procedure

The data collected from parents' interview and medical reports concerning personal history, information about birth history, causes of CP, types of CP, presence of epilepsy and associated disorders. In addition, physical examination and clinical details of each CP child determined by GMFCS, MACS and VSS results.

Statistical analysis

Statistical Package for the Social Sciences (SPSS) version 18 was used for statistical analysis. All measured variables presented as number and percentage. Results analytically tested using chi-squared (χ^2) to test the relation between study variables. Statistical tests considered significant if ($p < 0.05$).

III. Results

Study area: Cairo is the capital and largest city of Egypt. North of Cairo is the northern part of Cairo including the following neighborhoods: Shubra, Rud El Farag, El Sahel, El Sharabeya, El Zawiya El Hamra, El Waili, Haddaiq El Qubbah and El Zeitoun. The number of children with CP receives physical therapy services were184 children represent about 0.3 per 1000 live births.

Table 1 demonstrates the frequency distribution (number) and percentage of demographic characteristics of the participants as following. According to the gender distribution, there were 104 boys exhibiting 56.5% from CP cases and 80 girls representing 43.5% of the total sample. Concerning the distribution of delivery type, 91 children delivered by normal spontaneous delivery exhibiting 49% and 93 children delivered by cesarean section (CS) representing 50.5% of the total sample. Regarding the distribution of parent consanguinity, 75 children had positive consanguinity representing 40.8% and the remaining 109 children had

negative consanguinity representing 59.2% of the total sample. Considering the distribution of gestational age, there were 141 full-term children exhibiting 76.6% in addition to 36 pre-term children representing 19.6% and the remaining 7 children were post-term demonstrating 3.8% of the total sample. According to the distribution of place of delivery, 127 children delivered at hospitals that exhibiting 69% while 42 children delivered at private centers representing 22.8% and the remaining 15 children delivered at home representing 8.2% of the total sample.

Concerning the causes of CP, 106 children were born with hypoxia representing 57.6% while 26 children had hyperbilirubinemia within hours after birth exhibiting 14.1% of the total sample. On the other hand, 32 children fall in the risk of postnatal trauma before 2 years representing 17.4% and finally 20 children have CP with unknown cause demonstrating 10.9% of the total sample. Considering the presence of twins, there were 173 children did not have a history of twins representing 94% and 11 children had a history of twins exhibiting 6% of the total sample. Regarding the child birth weight, 7 children were less than 1000 gm with a percentage of 3.8% while 29 children were less than 1500 gm representing 15.8%. Furthermore, 51 children were less than 2500 gm representing 27.7% while 82 children were between 2500 gm and 4000 gm exhibiting 44.6% and finally 15 children were more than 4000 gm representing 8.2% of the total sample.

Table (1): Frequency distribution of demographic characteristics and birth history

Variables		Number	Percentage (%)
Gender	**Boys**	104	56.5
	Girls	80	43.5
Delivery mode	**Vaginal delivery**	91	49.5
	Cesarean section	93	50.5
Parent consanguinity	**Positive**	75	40.8
	Negative	109	59.2
Gestational age	**Preterm**	36	19.6
	Full term	141	76.6
	Post term	7	3.8
Place of delivery	**Hospital**	127	69
	Clinic	42	22.8
	Home	15	8.2
Causes of CP	**Hyperbilirubinemia**	26	14.1
	Hypoxia	106	57.6
	Post natal trauma	32	17.4
	Unknown	20	10.9
History of twins	**No**	173	94
	Yes	11	6
Birth weight	**ELBW <1000gm**	7	3.8
	VLBW <1500gm	29	15.8
	LBW <2500gm	51	27.7
	NBW <4000gm	82	44.6
	HBW >4000gm	15	8.2

ELBW: Elementary Low Birth weight; VLBW: Very Low Birth Weight; LBW: Low Birth Weight; NBW: Normal Birth Weight; HBW: High Birth Weight.

Table 2 shows the frequency distribution of associated impairment among CP children. Considering the visual impairment, 53.8% had no impairment while 43.5% of the total sample had some impairment and 2.7% were blind. Regarding the hearing impairment72.8% didn't have impairment while 26.1% had some impairment and 1.1% was deaf. Concerning the speech impairment, 7.6% had no impairment while 31% had some impairment and 61.4% had non verbal. Considering epilepsy, there were 38% of the total sample had no history of epilepsy while 52.7% had a history of epilepsy and 9.2% resolved from epilepsy. Concerning the intellectual impairment, 46.2% had intellectual impairment while 53.8% had no impairment. Regarding the swallowing problem, 43.5% had swallowing problem while 56.5% of the total sample had no problem.

Table (2): Frequency distribution of associated impairments

Associated impairments	Variables	Number	Percentage (%)
Visual	**No impairment**	99	53.8
	Some impairment	80	43.5
	Blind	5	2.7
Hearing	**No impairment**	134	72.8
	Some impairment	48	26.1
	Deaf	2	1.1
Speech	**No impairment**	14	7.6
	Some impairment	57	31.0

	Non verbal	113	61.4
Epilepsy	**No**	70	38.0
	Resolved	17	9.2
	Present	97	52.7
Intellectual Impairment	**No**	99	53.8
	Impairment	85	46.2
Swallowing	**No**	104	56.5
	Impairment	80	43.5

As shown from table 3 to 7, there were significant relations between types of CP and gestational age, epilepsy, intellection impairment, levels of GMFCS, levels of MACS, and finally levels of VSS as the p-value is less than 0.05. Children legible for assessment by MACS and VSS (4- 18 years) were 144 children.

Table (3): Relationship between types of cerebral palsy and gestational age

Gestational age / **Types of CP**	**Pre-term**		**Full-term**		**Post-term**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Hemiplegia	-	-	17	9.2	3	1.6	20	10.9
Diplegia	12	6.5	32	17.5	1	0.5	45	24.5
Quadriplegia	20	10.9	79	42.9	2	1.1	101	54.9
Dyskinetic	3	1.6	12	6.5	1	0.5	16	8.7
Ataxia	1	0.5	-	-	-	-	1	0.5
Hypotonia	-	-	1	0.5	-	-	1	0.5
Total	36	19.6	141	76.6	7	3.8	184	100
χ^2 = 0.298, **CC** = 0.049, **p-value** = 0.049								

χ2: Chi-square; CC: Correlation Coefficient; N: Number; %: percentage; p-value: level of significance.

Table (4): Relationship between types of cerebral palsy and associated disorders (epilepsy and intellectual impairment)

Types of CP	**Epilepsy**						**Intellectual impairment**				**Total**	
	Absent		**Resolved**		**Present**		**Yes**		**No**			
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Hemiplegia	10	5.4	-	-	10	5.4	17	9.2	3	1.6	20	10.9
Diplegia	28	15.2	5	2.7	12	6.5	33	17.9	12	6.5	45	24.5
Quadriplegia	25	13.6	11	6	65	35.3	25	13.6	76	41.3	101	8.7
Dyskinetic	7	3.8	1	0.5	8	4.3	9	4.9	7	3.8	16	0.5
Ataxia	-	-	-	-	1	0.5	1	0.5	-	-	1	0.5
Hypotonia	-	-	-	-	1	0.5	-	-	1	0.5	1	0.5
Total	70	38	17	9.2	97	52.7	85	46.2	99	53.8	184	100
	χ^2 = 25.198, **CC** = 0.347, **p-value** = 0.005						χ^2= 46.808, **CC**= 0.450, **p-value** = 0.001					

χ2: Chi-square; CC: Correlation Coefficient; N: Number; %: percentage; p-value: level of significance.

Table (5): Relationship between types of cerebral palsy and gross motor function classification system levels

GMFCS / **Types of CP**	**Level Ⅰ**		**Level Ⅱ**		**Level Ⅲ**		**Level Ⅳ**		**Level Ⅴ**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Hemiplegia	12	6.5	6	3.3	-	-	2	1.1	-	-	20	10.9
Diplegia	7	3.8	10	5.4	14	7.6	11	6	3	1.6	45	24.5
Quadriplegia	5	2.7	3	1.6	11	6	22	12	60	32.6	101	54.9
Dyskinetic	5	2.7	3	1.6	2	1.1	5	2.7	1	0.5	16	8.7
Ataxia	1	0.5	-	-	-	-	-	-	-	-	1	0.5
Hypotonia	-	-	-	-	-	-	1	0.5	-	-	1	0.5
Total	30	16.3	22	12	27	14.7	41	22.3	64	34.8	184	100
χ^2 = 111.914, **CC** = 0.1615, **p-value** = 0.001												

χ2: Chi-square; CC: Correlation Coefficient; N: Number; %: percentage; p-value: level of significance.

Table (6): Relationship between types of cerebral palsy and manual ability classification system levels

MACS / **Types of CP**	**Level Ⅰ**		**Level Ⅱ**		**Level Ⅲ**		**Level Ⅳ**		**Level Ⅴ**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Hemiplegia	8	5.6	6	4.2	2	1.4	-	-	-	-	16	11.1
Diplegia	11	7.6	18	12.5	4	2.8	-	-	2	1.4	35	24.3
Quadriplegia	1	0.7	3	2.1	12	8.3	36	25	25	17.4	77	53.5
Dyskinetic	3	2.1	7	4.9	1	0.7	4	2.8	-	-	15	10.4
Ataxia	-	-	1	0.7	-	-	-	-	-	-	1	0.7

Hypotonia	-	-	-	-	-	-	-	-	-	-	-	-
Total	23	16	35	24.3	19	13.2	40	27.8	27	18.8	144	100
χ^2 = 100.275, **CC** = 0.641, **p-value** = 0.001												

χ2: Chi-square; CC: Correlation Coefficient; N: Number; %: percentage; p-value: level of significance.

Table (7): Relationship between types of cerebral palsy and Viking speech scale levels

VSS / Types of CP	Level Ⅰ		Level Ⅱ		Level Ⅲ		Level Ⅳ		Total	
	N	%	N	%	N	%	N	%	N	%
Hemiplegia	6	4.2	5	3.5	3	2.1	2	1.4	16	11
Diplegia	4	2.8	7	4.9	9	6.3	15	10.4	35	24
Quadriplegia	-	-	3	2.1	14	9.7	60	41.7	77	53
Dyskinetic	1	0.7	3	2.1	3	2.1	8	5.6	15	10
Ataxia	1	0.7	-	-	-	-	-	-	1	0.7
Total	12	8.3	18	12.5	29	20.1	85	59	144	100
χ^2 = 58.372, **CC** = 0.537, **p-value** = 0.001										

χ2: Chi-square; CC: Correlation Coefficient; N: Number; %: percentage; p-value: level of significance.

IV. Discussion

The prevalence of CP varies considerably between studies and countries. In developing countries, prevalence of CP happens at a rate of 2-2.5 per 1000 live births [10]. Also in Egypt, El-Tallawy et al. [11] recorded the prevalence was 2.03-3.6 per 1000 live births. The current study revealed that the CP cases who referred to receive physical therapy services in North Cairo district during the period of the study were 184 children representing about 0.3 per 1000 live births. The lower prevalence could be attributed to the fact that the current study included only those children less than 18 years old receiving physiotherapy services.

According to the results of this study 104 from 184 children were boys representing 56.5% while girls were 80 from 184 representing 43.5%. A boy/girl ratio was 1.3/1which comes in agreement with the results of boy/girl ratio (1.33/1) in Europe [12]. This finding also matches with Skiöld et al. [13] who reported that the risk of CP is significantly more prominent in males than in females.

The current study demonstrated that 40.8% of cases had positive parent consanguinity while 59.2% had negative parent consanguinity. El-Tallawy et al. [11] revealed that the most commonly recorded risk factors were grandparents' consanguinity representing 50% while parent consanguinity representing 34.6% of participants. Additionally, Kruer et al. [14] reported that at least 20% of cases believed to be inherited. Consanguinity is a social issue that needs awareness through education and to be addressed by government and nongovernment agencies [15].

Regarding the delivery mode, the collected data in this study showed that children delivered by CS representing 50.5% while 49.5% had a normal delivery. Therefore, incidence of CP in children delivered normally relatively was equivalent with those delivered with CS. This finding comes in agreement with Clark and Hankins [16] who concluded that "in spite of a 5-fold increment in the rate of CS based, to some degree, on the electronically derived diagnosis of 'fetal distress,' CP prevalence has remained stable. Furthermore, Bjellmo et al. [17] reported that vaginal breech delivery was not associated with increased risk for CP.

Concerning the causes of CP, the present study revealed that 57.6% displayed by hypoxia, 17.4% exhibited by post natal trauma, 14.1% presented by hyperbilirubinemia and finally 20.9% of cases were obscure causes. These outcomes come in consistent with Daher and El-khairy [18] who reported that the strongest association with CP was with perinatal hypoxia. Additionally, El-tallawy et al. [11] announced that hypoxia and hyperbilirubinemia are the most common risk factors for CP. As indicated by Butt et al. [19] up to 80% of infants who survive with severe hypoxia develop serious complications and 10 to 20 % created serious handicap.

The current study showed that total children born with very low birth weight representing 47.3%. This finding matches with Janssen et al. [20] who revealed that the most critical risk factor for CP seems to be premature and low birth weight. Moreover, Platt et al. [21] and Cans et al. [22] reported that the highest prevalence of CP is among children whose birth weight from 1000 to 1499 grams. The present study revealed that 76.6% of CP children were full term while 19.6% were preterm and 1.3% was post-term. This finding contradicted by the work of Wu et al. [23] and Cans et al., [22] who concluded that CP occurs more commonly in children who born preterm and the prevalence of CP decreases significantly with increasing gestational age category. This distinction could attribute in terms of the high mortality rate of premature infants and higher occurrence of perinatal hypoxic events [24].

The results of this study demonstrated that spastic CP was the most common type representing 90.3% of the total sample while dyskinetic type was 8.7% and ataxic type representing 0.5% as well as hypotonic type was 0.5%. These results come in agreement with Blair and Watson [25] who reported that spasticity typically cited as the predominant motor type and occurring in 77% to 93% of cases, while dyskinetic type occurring in 2% to 15% and ataxia and hypotonia cited as the least occurring and ranged from 1% to 8%.

With respect to the subtypes of spastic CP the results showed that spastic quadriplegia was one of the most common clinical subtypes representing 54.9% followed by spastic diplegia representing 24.5% then spastic hemiplegia representing 10.9%. These findings disagree with Johnson [26] and Singhi et al., [27] who revealed that spastic diplegia is the most well- known clinical subtypes followed by spastic quadriplegia then hemiplegia and finally monoplegia and triplegia are relatively uncommon.

The results of this study concerning associated disorders showed that 46.2% of CP children had cognition disorders, 52.7% had epilepsy, 46.2% had visual problems and 27.2% had hearing impairment. These findings come in agreement with Serdaroglu et al. [28] who detailed that in 25%-80% of CP children cognitive disorders and other problems (epilepsy, auditory, language and visual, chronic pain, gastrointestinal and nutritional) can likewise be seen. Additionally, the results of the present study indicated a significant relation between types of CP and presence of epilepsy with high rate in quadriplegic type. El-Tallawy et al. [11] revealed that 70.3% of children with CP are mentally retarded, and around 52% of them have active epilepsy. Epilepsy happens between 15% and 55% of children and adults with CP [29].

According to GMFCS, the results demonstrated a significant relation between types of CP and GMFCS. Furthermore, level V had the highest percentage representing 34.8% followed by level IV representing 22.3% then level I representing 16.3% and level III representing 14.7% while level II had the least percentage representing 12%. This finding disagrees with Löwing et al. [30] who found that most of CP children were at level I and level II on GFMCS while level V was the least. This difference could attribute to the fact that quadriplegic type in the present study had the highest rate among CP cases.

Concerning MACS the results indicated a significant relation between types of CP and MACS. Moreover, level IV had the highest percentage representing 21.7% followed by level II 19% then level V 14.7% and finally level I representing 12.5%. According to this finding, level IV represented the highest percentage that could attribute to the high frequency of spastic quadriplegia among cases. This result comes in agreement with Gunel et al. [31] who stated that the children with quadriplegia had a higher frequency in level IV and level V due to spasticity in the flexor muscles of the upper limbs causing a great deal of functional restriction in the hands.

According to VSS results, there was a significant relation between types of CP and VSS. Also, the results demonstrated that 46.2% at level IV, 15.8% at level III, 9.8% at level II and 6.5% of the total sample at level I. As indicated by this result, 92.4% of CP children had speech problems that confirmed by the work of Park et al. [32] who inferred that communication difficulties could be associated with CP and may be related to restrictions in the production of movement for speech and facial expression. On the other hand, Geytenbeek [33] stated that 28% of the children had severe impairment or no speech.

V. Conclusion

The findings of the present study help to establish registry information about CP in North Cairo that enhance health services and awareness about CP. The results stress the significance of consolidating data about the CP subtypes in the light of predominant neurological findings and functional evaluations. From the obtained results, it concluded that the prevalence of CP was more in boys than girls. Spastic quadriplegic was the most common type of CP and hypoxia considered the most common risk factor for CP. Furthermore, children with CP encounter varying degrees of gross and fine motor impairments in the light of the findings of GMFCS, MACS and VSS.

Acknowledgements

The authors would like to express their appreciation to children and their parents who participated in this study as well as the managers and staff of hospitals and private physical therapy centers in North Cairo.

Funding

This research received no specific grant from any funding agency in the public, commercial, or non-profit sectors.

References

[1]. **M. Oskoui, F. Coutinho, J. Dykeman, N. Jetté et al.** An update on the prevalence of cerebral palsy: a systematic review and meta-analysis. *Dev Med Child Neurol;* 2013, 55 (6): 509–19.

[2]. **N. McCullough, J. Parkes, C. Kerr and B. McDowell.** The health of children and young people with cerebral palsy: a longitudinal, population-based study. *Int J Nurs Stud;* 2013, 50 (6):747–56.

[3]. **K. Nelson and E. Blair.** Prenatal Factors in Singletons with Cerebral Palsy Born at or near Term. *NEJM;* 2015, *373 (10):* 946– 53.

[4]. **S. Rethlefsen, D. Ryan and R. Kay.** Classification systems in cerebral palsy. *Orthop Clin North Am;* 2010, 41 (4):457–67.

[5]. **D. Hurley, T. Moulton, D. Spira, K. Krosschell et al.** Systematic review of cerebral palsy registries/surveillance groups: Relationships between registry characteristics and knowledge dissemination. *Int J Phys Rehabil Med;* 2015, 3: 266.

[6]. **N. Badawi, I. Balde, S. Goldsmith, P. Karlosson et al.** Findings from the Australian cerebral palsy register report, birth years 1993 to 2006. *Dev med Child Neurol;* 2016, 58(2):5-10.

[7]. **R. Palisano, P. Rosenbaum, S. Walter, D. Russell et al.** Development and reliability of a system to classify gross motor function in children with cerebral palsy. *Dev Med Child Neurol;* 2008, 39 (4): 214–223.

[8]. **M. Kuijper, G. Wilden, M. Ketelaar and J. Gorter.** Manual ability classification system for children with cerebral palsy. *AJOT;* 2010, 64: 614-20.
[9]. **P. Lindsay, V. Daniel, M. Tone, A. Maria et al.** Viking Speech Scale. *Res Dev Disabil;* 2013, 34(10): 3202-10.
[10]. **M. Shevell and J. Bodensteiner.** Cerebral palsy: defining the problem. *Semin pediatr neurol;* 2004, 11(1):2-4.
[11]. **H. El-Tallawy, W. Farghaly, A. Shehata, T. Rageh et al.** Cerebral palsy in Al-Quseir City, Egypt: prevalence, subtypes, and risk factors. *Neuropsych Dis Treat;* 2014, 10:1267-72.
[12]. **M. Johnston and H. Hagberg.** Sex and the pathogenesis of cerebral palsy. *Dev Med Child Neurol;* 2007, 49: 74-8.
[13]. **B. Skiöld, G. Alexandrou, N. Padilla, M. Blennow et al.** Sex differences in outcome and associations with neonatal brain morphology in extremely preterm children. *J Pediatr;* 2014, 164(5):1012-8.
[14]. **M. Kruer, T. Jepperson, S. Dutta, R. Steiner et al.** Mutations in gamma adduction are associated with inherited cerebral palsy". *Annual Neurol;* 2014, *74(6):* 805-14.
[15]. **B. Barbour and P. Salameh** Consanguinity in Lebanon; prevalence, distribution and determinations. *J Biosoc Sci;* 2009, 41 (4): 505-17.
[16]. **S. Clark and G. Hankins.** Temporal and demographic trends in cerebral palsy – fact and fiction. *AJOG;* 2003, 188:628-33.
[17]. **S. Bjellmo, T. Vik, G. Andersen, M. Martinussen et al.** Mode of delivery in breech presentation – a risk factor for cerebral palsy". Dev *Med Child Neurol;* 2016, 58(5):7-8.
[18]. **S. Daher and L. El-khairy.** Association of cerebral palsy with consanguineous parents and other risk factors in a Palestinian population. *East Mediterr Health J;* 2014, 20(7): 459-68.
[19]. **T. Butt, R. Farooque and M. Khan.** Risk factor for hypoxic ischemic encephalopathy in children". *JCPSP;* 2008, 18(7): 428-32.
[20]. **A. Janssen, P. Thiessen, C. Klein, F. Whitfield et al.** Standards for the measurement of birth weight, length and head circumference at term in neonates of European, Chinese and South Asian ancestry. *Open Medicine;* 2007, 1 (2):74-88.
[21]. **M. Platt, C. Cans, A. Johnson, G. Surman et al.** Trends in cerebral palsy among infants of very low birth weight (<1500 g) or born prematurely (<32 weeks) in 16 European centers: a database study. *Lancet;* 2007, 369(9555): 43-50.
[22]. **C. Cans, J. Cruz and M. Mermet.** Epidemiology of cerebral palsy. *Pediatr Child Health;* 2008, 18: 393-98.
[23]. **Y. Wu, G. Escobar, J. Grether, L. Creon et al.** Chorioamnionitis and cerebral palsy in term and near-term infant. *JAMA;* 2003, 290: 2677-2684.
[24]. **D. Bearden, B. Monokwane, E. Khurana, J. Baier, E. Baranov, k. Westmoreland et al.** Pediatric cerebral palsy in Botswana: Eitiology, outcomes and comorbidities. *Pediatr Neurol;* 2016, 59: 23-9.
[25]. **E. Blair and L. Watson.** Epidemiology of cerebral palsy. *Semin Fetal Neonatal Med;* 2006, 11(2): 117-25.
[26]. **B. Johnson.** Approach to children with suspected neurodegenerative disorders. *Neurosciences;* 2002, 7(1): 2-6.
[27]. **P. Singhi, M. Ray and G. Suri.** Clinical spectrum of cerebral palsy in North India-An analysis of 1000 cases. *J Trop Pediatr;* 2002, *48*:162-166.
[28]. **C. Serdaroglu, A. Cansu, S. Ozkan and S. Tezcan.** Prevalence of cerebral palsy in Turkish children between the ages of 2 and 16 years. *Dev Med Child Neurol;* 2006, 48: 413-16.
[29]. **J. Wallace** Epilepsy in cerebral palsy. *Dev Med Child Neurol;* 2001, *43*: 713- 17.
[30]. **K. Löwing, Y. Arredondo, M. Tedroff and K. Tedroff.** Introduction of the gross motor function classification system in Venezuela - a model for knowledge dissemination. *BMC Pediatr;* 2015, 4:15-111.
[31]. **M. Gunel, A. Mutlu, T. Tarsuslu and A. Livanelioglu.** Relationship among the MACS, GMFC and the functional status in children with spastic cerebral palsy. *Eur J Pediatr;* 2009, 168(4): 477-85.
[32]. **M.S. Park, S.J. Kim, C.Y. Chung, et al.** Prevalence and lifetime healthcare cost of cerebral palsy in South Korea. *Health Policy;* 2011,100 (2-3):234-238.
[33]. **J. Geytenbeek.** Prevalence of speech and communication disorders in children with CP. *Dev Med Child Neurol;* 2011, 53: 10-11.