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Cerebral Palsy: Early Diagnosis, Intervention and Risk Factors

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A B S T R A C T

Early diagnosis and intervention intensity were suggested to be crucial factor in cerebral palsy (CP) treatment. Herein we observed 347 children diagnosed for CP in Clinical Hospital Mostar, Bosnia and Herzegovina, and studied the relationship between (a) intervention start point and the final motor outcome, (b) intensity of treatment and final outcome, and (c) relationship between documented risk factors and early diagnosis of the CP. Our study suggests that it is possible to relatively accurately diagnose the CP in the first trimester. Previous miscarriages, sepsis and intracerebral haemorrhage were significantly related to early diagnosis, while delivery outcome, RDS, premature birth, intracerebral haemorrhage, sepsis, meningitis, hydrocephalus and convulsions were found as significantly related to final motor CP outcome. We have found no significant influence of the intervention intensity and final diagnosis. Our results support the idea that the intervention start point has to be considered as one of the most important factors for the effective intervention program. In future studies dealing with the CP interventions and risk factors, special attention should be paid to homogeneity and size of the sample, as well as necessity of including the non-treated controls in the investigation.

Key words: *cerebral palsy, diagnosis accuracy, neurodevelopmental treatment, motor outcome, risk factors*

Introduction

Cerebral Palsy (CP) describes a group of nonprogressive disorders of the development of movement and posture, causing activity limitations that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, and communication perception and/or by a seizure disorder[1].

Many conditions or risk factors associated with CP can be broken down into those occurring in the prenatal (hypoxia, genetic disorders, metabolic disorders, multiple gestation, intrauterine infections, maternal fever, etc.), perinatal (asphyxia, premature birth <32 weeks or <2500 g, blood incompatibility, infection, abnormal fetal presentation, etc.), or postnatal time periods (seizures within 48 hours of birth, cerebral infarction, hyperbilirubinemia, sepsis, respiratory distress, syndrome/chronic lung disease, meningitis, etc.). The incidence of cerebral palsy has remained virtually unchanged over the past 40 years at approximately 2.5 *per* 1000 live births[2,3]. This represents a great disappointment to those who anticipated that advances in perinatal care would eliminate many cases of cerebral palsy, but a relief to those that feared a drastic increase in numbers due to improved survival of critically ill newborns. This is best understood in the context of our current understanding that the etiology of most cases of cerebral palsy is prenatal in origin.

One method to classify CP is to describe the predominant motor characteristics, which include spastic, hypotonic, athetotic, dystonic, and ataxic, as well as the topographical pattern of limb involvement, such as monoplegia, diplegia, triplegia, hemiplegia, or quadriplegia. A second method divides CP into two major physiologic classifications, pyramidal (spastic) and extra pyramidal (nonspastic), indicating the area of the brain that has been affected as well as the resulting predominant motor disorder. It is possible to see many different combinations of types of CP depending on the area of brain damage disorder[1].

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The diagnosis of CP is made largely through clinical observations. The natal history can often raise suspicions and merits closer monitoring. The major signs that collectively can lead to a CP diagnosis are delayed motor milestones, abnormal neurologic examination, persistence of primitive reflexes, and abnormal postural reactions.

The individuality of each child with cerebral palsy, variations in environment, and the multisystem involvement of cerebral palsy cause samples of patients who ostensibly share the same motor problem to be highly heterogeneous[4,5] resulting in a variability that is difficult to control for – especially considering that studies typically use small numbers of participants. Another set of difficulties arise from the description and the method of physiotherapy adopted, in relation to goals and objectives and the methods used to achieve them; the instruments and measures used for assessment; the involvement of proxies (parents); variation in the adaptability of the children as they develop; and, of course, individual differences among therapists. Innocenti and White[6] suggested concentrating on the analysis of the conditions under which different interventions are effective, instead of the intervention *per se*. It has been hypothesized that the two crucial conditions for the interventions are the age at which the intervention starts and the intensity of the treatment[7–9].

Consequently, the aims of this study were to investigate (a) the relationship between start point of the intervention (treatment) and the final motor outcome, (b) the relationship between intensity of treatment and final outcome, and (c) relationship between documented risk factors and early diagnosis of the neuromotor CP status.

Materials and Methods

We included 347 subjects in our study, born between 1st January 1997 and 31st December 2004, all having signs of abnormalities in neuromotor development. Data were collected from the medical documentation of the Departement for the physical medicine and rehabilitation, Mostar, where children were firstly examined, and Department of Obstetrics and Gynecology, University Clinical hospital Mostar, Bosnia and Herzegovina. Subjects were included in the neurodevelopmental intervention on the Department for the physical medicine and rehabilitation – University Clinical Hospital Mostar, and Clinical centers in Croatia, mostly University Hospital »Sestre Milosrdnice«, Zagreb and Goljak. We followed those examinees where first neurological exam found three and more symptoms of the aberrations (abnormalities), no matter to eventual risk factors, age, and/or ultrasonic examination. Most of the children involved in the study had been suggested for CP intervention by neuropediatrician. The mean age of the subjects was from one to six months. Early diagnosis which was evidenced on the first exam was clustered according to basic signs on five subtypes. First subtype (group) consisted of children with three and more abnormalities and hypertonus (spastic); second group – hypotonic; third group – nonspastic with other abnormalities; fourth group – three evident abnormalities; fifth group – abnormalities in all positions pronounced clinical figure.

During the exam we estimated gait and posture in supination, pronation, antigravitation, spontaneous motoric, muscular tonus, primitive reflexes and postural reflex mechanisms.

In this paper we studied following risk factors: maternal health status, previous miscarriages; maintained pregnancy; EPH gestosis; delivery; C section; twin; neonatology intervention; incubator; RDS; anemia; preterm infant; hepatitis; sepsis; intracerebral haemorrhage; meningitis; hydrocephalus and convulsions.

Nonparametric Mann-Whitney test and χ^2-test were applied. Coefficients considered significant at 95% level of the significance ($p<0.005$).

Results

Final motor outcome is significantly related to intervention start point (Table 1). Median age for those patients who showed final motor disorders was 3.5 months, which was significantly higher when comparing to patients with regular motor outcome in the final (3 months). Alternative medicine is the only factor significantly related to intensita of the intervention program (Table 2). Of 18 studied risk factors, previous miscarriages, sepsis and intracerebral haemorrhage were significantly related to early diagnosis (Table 3), while delivery outcome, RDS, premature birth, intracerebral haemorrhage, sepsis, meningitis, hydrocephalus and convulsions were found as significantly related to final motor CP outcome (Table 4).

TABLE 1
THE RELATIONSHIP BETWEEN EARLY INTERVENTION AND FINAL MOTOR OUTCOME (M– MEDIAN; IQR – INTERQUARTILE RANGE; MIN – MINIMUM; MAX – MAXIMUM; MW – MANN-WHITNEY NONPARAMETRIC TEST OF THE DIFFERENCES; P – LEVEL OF THE SIGNIFICANCE)

	Final motor outcome						MW
	Evident motor disorder			Regular motor outcome			p
	M±IQR	Min	Max	M±IQR	Min	Max	
Age (months)	3.5±2	1	38	3±7	1	24	0.001

Age relates to age when included in the intervention program

TABLE 2
THE RELATIONSHIP BETWEEN INTERVENTION INTENSITY (REGULAR – IRREGULAR INTERVENTION) AND FINAL DIAGNOSIS AND STATUS; CHI SQUARE SIGNIFICANCE (P)

		Intensity of intervention		p
		regular N (%)	irregular N (%)	
Final diagnosis	Regular	84 (80.0)	196 (81.0)	0.99
	Hemiplegia	3 (2.9)	7 (2.9)	
	Paraplegia	7 (6.7)	14 (5.8)	
	Quadriplegia	11 (10.5)	25 (10.3)	
Walk	Independent	92 (87.6)	211 (87.2)	0.52
	Walking ads	2 (1.9)	10 (4.1)	
	Don't walk	11 (10.5)	21 (8.7)	
Eyesight	Regular	96 (91.4)	218 (90.1)	0.43
	Low vision	8 (7.6)	16 (6.6)	
	Blind	1 (1.0)	8 (3.3)	
Strabism	Normal	100 (95.2)	233 (96.3)	0.65
	Yes	5 (4.8)	9 (3.7)	
Hearing	Regular	102 (97.1)	234 (96.7)	0.94
	Poor	2 (1.9)	6 (2.5)	
	Deaf	1 (1.0)	2 (0.8)	
Speech	Regular	77 (73.3)	175 (72.6)	0.95
	Dyslalia	17 (16.2)	42 (17.4)	
	Alalia	11 (10.5)	24 (10.0)	
Retardation	Regular status	73 (69.5)	163 (67.4)	0.83
	Mild/moderate	15 (14.3)	41 (16.9)	
	Severe/profound	17 (16.2)	38 (15.7)	
Epilepsy	No	96 (91.4)	223 (92.1)	0.82
	Yes	9 (8.6)	19 (7.9)	
School	Regular	22 (73.3)	64 (77.1)	0.59
	Adapted	2 (6.7)	4 (4.8)	
	Special	5 (16.7)	8 (9.6)	
	Not for school	1 (3.3)	7 (8.4)	
Alternative medicine	No	89 (84.8)	226 (93.8)	0.01
	Yes	16 (15.2)	15 (6.2)	

Discussion

Mainly, we were interested is there any significant statistical relationship between early clinical diagnosis and later (final) diagnosis. More precisely, we studied the possibility of recognizing the children with neuromotor abnormalities (and therefore needed for early intervention), on the basis of the early clinical examination. Literature says that early diagnosis of the CP can not be established earlier than 6–8 months of age[10,11]. However, since some studies suggested early diagnosis as one of the crucial factors for the efficient treatment[7–9], we paid particular attention about it. In the literature we could not find similar study where authors observed children included in the early intervention program on the basis of the early neurological clinical assessment, regardless to risk factors. The studies we have found[12,13] investigated long-term results in children born with different risk factors, and/or authors sampled children with pronounced and established CP. Therefore, in most cases we lacked of comparative data. Our data note that CP diagnosis is possible and could be relatively accurate before 6 months, more precisely in the first trimester. Of all subjects involved in the intervention because of the abnormalities in neuromotor development (N=347), 67 subjects (19.3%) were finally diagnosed for CP. Final outcome showed quadriparesis in 36 subjects (27.3 %), paraparesis in 21 (6.1%) and hemi paresis in 10 (2.9%), similar to data from previous studies[14,15]. In the final diagnosis we used classification according to topographic distribution of the abnormalities (defects). By means of SCPE distribution (Surveillance of Cerebral Palsy in Europe[16]) of 67 CP cases we found 10 unilateral spastic (14.9%), 44 bilateral spastic (65.7%), 4 distonic-diskinetic (6%) and 3 ataxic (3%). Hypotonic prevailed in 7 subjects (10.4%) but this data are not to be considered as representative since most of the hypotonics shifts to spasam and/or dyskinetics[1].

Data from our study suggest that there is significant relationship between evident clinical figure and early di-

TABLE 3
EARLY DIAGNOSIS OF THE NEUROMOTOR ABNORMALITIES (NA) AND RISK FACTORS (RF); χ^2 SIGNIFICANCE (p)

RF	NA	CP spastic	CP hypotonic	CP normal tonus	CP mild abnormalities	CP evident abnormalities	χ^2
		N (%)	N (%)	N (%)	N (%)	N (%)	p
Maternal health status	Healthy	172 (95.0)	46 (92.0)	79 (94.0)	20 (100)	10 (90.9)	0.713
	Kidneys	2 (1.1)	1 (2.0)	3 (3.6)	0 (0.0)	0 (0.0)	
	Other	7 (3.9)	3 (6.0)	2 (2.4)	0 (0.0)	1 (9.1)	
Past miscarriages	No	159 (87.4)	36 (72.0)	73 (86.9)	18 (90.0)	5 (45.5)	0.001
	Yes	23 (12.6)	14 (28.0)	11 (13.1)	2 (10)	6 (54.5)	
Maintained pregnancy	No	138 (75.8)	40 (81.6)	63 (75.0)	15 (75)	9 (81.8)	0.899
	Yes	44 (24.2)	9 (18.4)	21 (25)	5 (25.0)	2 (18.2)	
EPH gestosis	No	152 (83.5)	45 (91.8)	71 (84.5)	19 (95.0)	11 (100.0)	0.227
	Yes	30 (16.5)	4 (8.2)	13 (15.5)	1 (5.0)	0 (0.0)	
Regular delivery	No	80 (44.0)	21 (42.0)	33 (39.3)	6 (30.0)	4 (36.4)	0.766
	Yes	102 (56.0)	29 (58.0)	51 (60.7)	14 (70.0)	7 (63.6)	
C section	No	131 (72.0)	42 (84.0)	63 (75.9)	15 (75.0)	9 (81.8)	0.499
	Yes	51 (28.0)	8 (16.0)	20 (24.1)	5 (25)	2 (18.2)	
Twin	No	155 (85.6)	47 (94.0)	74 (88.1)	18 (90.0)	10 (90.9)	0.732
	First	10 (5.5)	1 (2.0)	6 (7.1)	1 (5.0)	1 (9.1)	
	Second	16 (8.8)	2 (4.0)	4 (4.8)	1 (5.0)	0 (0.0)	
Neonatology intervention	No	53 (29.1)	12 (24.0)	23 (27.4)	11 (55.0)	8 (72.7)	0.003
	Yes	129 (70.9)	38 (76.0)	61 (72.6)	9 (45.0)	3 (27.3)	
Incubator	No	89 (48.9)	26 (52.0)	52 (61.9)	14 (70.0)	8 (72.7)	0.103
	Yes	93 (51.1)	24 (48.0)	32 (38.1)	6 (30.0)	3 (27.3)	
RDS	No	114 (63.0)	27 (54.0)	52 (61.9)	16 (80.0)	8 (72.7)	0.322
	Yes	67 (37.0)	23 (46.0)	32 (38.1)	4 (20.0)	3 (27.3)	
Anemia	No	164 (90.1)	46 (92.0)	76 (90.5)	19 (95.0)	10 (90.9)	0.961
	Yes	18 (9.9)	4 (8.0)	8 (9.5)	1 (5.0)	1 (9.1)	
Preterm infant	No	108 (59.3)	34 (68.0)	60 (71.4)	16 (80.0)	8 (72.7)	0.161
	Yes	74 (40.7)	16 (32.0)	24 (28.6)	4 (20.0)	3 (27.3)	
Hepatitis	No	136 (74.7)	35 (70.0)	53 (63.1)	16 (80.0)	10 (90.9)	0.155
	Yes	46 (25.3)	15 (30.0)	31 (36.9)	4 (20.0)	1 (9.1)	
Sepsis	No	154 (84.6)	37 (74.0)	77 (91.7)	19 (95.0)	10 (90.9)	0.044
	Yes	28 (15.4)	13 (26.0)	7 (8.3)	1 (5.0)	1 (9.1)	
Intracerebral haemorrhage	No	132 (72.5)	33 (66.0)	75 (89.3)	17 (85.0)	9 (81.8)	0.01
	Yes	50 (27.5)	17 (34.0)	9 (10.7)	3 (15.0)	2 (18.2)	
Meningitis	No	172 (94.5)	43 (86.0)	81 (96.4)	20 (100.0)	11 (100.0)	0.063
	Yes	10 (5.5)	7 (14.0)	3 (3.6)	0 (0.0)	0 (0.0)	
Hydrocephalus	No	174 (95.6)	48 (96.0)	83 (98.8)	20 (100.0)	11 (100.0)	0.543
	Yes	8 (4.4)	2 (4.0)	1 (1.2)	0 (0.0)	0 (0.0)	
Convulsion	No	155 (85.2)	40 (80.0)	72 (85.7)	19 (95.0)	297 (85.6)	0.333
	Yes	27 (14.8)	10 (20.0)	12 (14.3)	1 (5.0)	0 (0.0)	

agnosed hypotonic subtype, which we found similar to results from previous studies[17].

Although some kind of a general consensus is achieved about including the children in the intervention program as soon as symptoms are observed, it is interesting that we could not find any experimental study which interpreted data on the same way we did herein. Probably because of the relatively low incidence of the CP, clinical diversity of the symptoms, and unreliable motor diagnosis, the problem of the differential influence of the early *vs*. late neurodevelopmental intervention program is rarely studied[18]. Although some studies found no significant difference between early and late intervention program[12,19] some authors suggested more positive effects of such approach[20,21] we supported herein. In our study, children with the finally regular motor outcome were included in the intervention program earlier (3 months – median value) and inter-quartile range of only 2 months

TABLE 4
FINAL DIAGNOSIS OF THE CP AND RISK FACTORS (RF); χ^2 SIGNIFICANCE (p)

RF		Normal	Hemiplegia	Paraplegia	Quadriplegia	χ^2
		N (%)	N (%)	N (%)	N (%)	p
Maternal health status	Healthy	262 (93.6)	9 (100.0)	21 (100.0)	35 (97.2)	0.81
	Kidneys	6 (2.1)	0 (0.0)	0 (0.0)	0 (0.0)	
	Other	12 (4.3)	0 (0.0)	0 (0.0)	1 (2.8)	
Past miscarriages	No	240 (85.7)	9 (90.0)	14 (66.7)	28 (77.8)	0.09
	Yes	40 (14.3)	1 (10.0)	7 (33.3)	8 (22.2)	
Maintained pregnancy	No	212 (76.0)	9 (90.0)	18 (85.7)	24 (72.2)	0.49
	Yes	67 (24.0)	1 (10.0)	3 (14.3)	10 (27.8)	
EPH gestosis	No	240 (86.0)	7 (70.0)	18 (85.7)	33 (91.7)	0.37
	Yes	39 (14.0)	3 (30.0)	3 (14.3)	3 (8.3)	
Regular delivery	No	107 (38.2)	8 (80.0)	10 (47.6)	19 (52.8)	0.02
	Yes	173 (61.8)	2 (20.0)	11 (52.4)	17 (47.2)	
C section	No	210 (75.3)	5 (50.0)	17 (81.0)	28 (77.8)	0.27
	Yes	69 (24.7)	5 (50.0)	4 (19.0)	8 (22.2)	
Twin	No	245 (87.8)	9 (90.0)	20 (95.2)	30 (83.3)	0.58
	First	14 (5.0)	0 (0.0)	1 (4.8)	4 (11.1)	
	Second	20 (7.2)	1 (10.0)	0 (0.0)	2 (5.6)	
Neonatology intervention	No	89 (31.8)	2 (20.0)	10 (47.6)	6 (16.7)	0.08
	Yes	191 (68.2)	8 (80.0)	11 (52.4)	30 (83.3)	
Incubator	No	156 (55.7)	4 (40.0)	15 (71.4)	17 (38.9)	0.07
	Yes	124 (44.3)	6 (60.0)	6 (28.6)	22 (61.1)	
RDS	No	182 (65.0)	4 (40.0)	15 (71.4)	16 (45.7)	0.05
	Yes	98 (35.0)	6 (60.0)	6 (28.6)	19 (54.3)	
Preterm infant	No	187 (66.8)	4 (40.0)	18 (85.7)	17 (47.2)	0.01
	Yes	93 (33.2)	6 (60.0)	3 (14.3)	19 (52.8)	
Hepatitis	No	196 (70.0)	9 (90.0)	17 (81.0)	28 (77.8)	0.30
	Yes	84 (30.0)	1 (10.0)	4 (19.0)	8 (22.2)	
Sepsis	No	248 (88.6)	6 (60.0)	18 (85.7)	25 (69.4)	0.00
	Yes	32 (11.4)	4 (40.0)	3 (14.3)	11 (30.6)	
Intracerebral haemorrhage	no	228 (81.4)	5 (50.0)	19 (90.5)	14 (38.9)	0.00
	Yes	52 (18.6)	5 (50.0)	2 (9.5)	22 (61.1)	
Meningitis	No	269 (96.1)	9 (90.0)	20 (95.2)	29 (80.6)	0.00
	Yes	11 (3.9)	1 (10.0)	1 (4.8)	7 (19.4)	
Hydrocephalus	No	278 (99.3)	7 (70.0)	21 (100.0)	30 (83.3)	0.00
	Yes	2 (0.7)	3 (30.0)	0 (0.0)	6 (16.7)	
Convulsion	No	246 (87.9)	8 (80.0)	18 (85.7)	25 (69.4)	0.03
	Yes	34 (12.1)	2 (20.0)	3 (14.3)	11 (30.6)	

(Table 1). On the other hand, in those children where motor abnormalities were diagnosed were included in the intervention program in the age of 3.5 months (median value), and inter-quartile range of even seven months.

Regularity of the intervention program did not influence the final outcome (Table 2). More precisely, we were surprised by the fact that those children who regularly participated in the kinesitherapeutic program did not differ in the final motor outcome from children who did not participate in the intervention on the regular basis. It is theoretized that intensity of the therapy should be a key element in the early intervention effectiveness[22,23], although Bower et al.[8] in randomized controlled 6-month study did not find any difference between groups treated five- and two-times-a- week. Even more, authors suggested possible frustration of the intensive regime, especially during long time period[8]. On the other hand Trahan et al.[23] interpreted effectiveness of the intensive therapy combined with non-therapeutic periods. As a result, authors recommend intervention program consisting of 4-times-a-week in four weeks of treatment plus rest period of 8 weeks, alternate in 6-months[23]. Although the neurodevelopmental treatment (Bobath method) is a leading principle of the intervention in CP, there is no

unique approach concerning the intensity of the treatment. Very similar to misconceptions regarding early inclusion in the intervention program, the main problem herein is once again related to small and heterogenous samples of subjects and absence of the treated controls[22]. When trying to relate intervention intensity and final outcomes the only significant relationship we found between intervention intensity and alternative medicine treatments. More specifically, children who did not participate in our intervention program regularly participated in alternative medicine treatments more frequently. Such findings were already demonstrated in the study of Hurvitz et al.[24] where authors directly and extensively investigated complementary and alternative medicine (CAM) interventions in families of children with CP. CAM is defined as a group of diverse medical and health care systems, practices, and products that are not generally considered part of conventional medicine. We are of the opinion that because of the absence of the evident and quick effect of the conventional kinesitherapy treatment parents of children with diagnosed CP leans toward CAM, which is evidenced not only in CP, but also for autistic disorders, and hyperactivity[25].

Taking into account difficulties of early diagnosing of the neuromotor aberrations, in this study we analyzed relationship between some of the known risk factors in the prenatal, perinatal and postnatal period, with early diagnosis of the CP (Table 3). No significant relationship was found for early diagnosis and maternal health status, pregnancy progress, EPH gestosis, multiple pregnancy, C section, incubating, respiratory distress syndrome, anemia, immaturity, hepatitis, hydrocephalus, and newborn convulsions. However, significant relationship was found between early diagnosis and previous miscarriages, sepsis and intracerebral haemorrhage. The reason for the relatively small number of the significant relationships have to be found in the poor accuracy of the early neurological exam, which was already suggested in the studies of Nelson and Ellenberg[26,27]. Additional problem can be recognized in the inaccurate medical documentation.

As expected, final motor outcome (final CP diagnosis) and risk factors are more significantly related than early diagnosis and risk factors (Table 4). The main reason is undoubtedly – clear clinical manifestation of the CP in latter stages. Once again, maternal health status, miscarriages, pregnancy progress, multiple pregnancies, C section, and maintained pregnancy was not significantly related to CP. Similar findings were discussed in the study of Suvanand et al.[28] and Kuban et al.[29]. Conversely, delivery outcome, RDS, premature birth, intracerebral haemorrhage, sepsis, meningitis, hydrocephalus, and convulsions were found as significantly related to final motor CP outcome, already demonstrated in studies published by Reddihough and Collins[30], Himmelmann et al.[31], and O'Shea[32].

Conclusion

Based on the date from our study, the CP diagnosis it is possible to relatively accurately diagnose the CP in the first trimester.

Regularity of the intervention program did not influence the final outcome, but the children who were included in the intervention program earlier (median value 3 months of age) achieved significantly better results in final motor status than those children included latter on (median value 3.5 months of age).

Previous miscarriages, sepsis and intracerebral haemorrhage were significantly related to early diagnosis, while delivery outcome, RDS, premature birth, intracerebral haemorrhage, sepsis, meningitis, hydrocephalus and convulsions were found as significantly related to final motor CP outcome.

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CEREBRALNA PARALIZA: RANA DIJAGNOZA, INTERVENCIJA I ČIMBENICI RIZIKA

S A Ž E T A K

Rana dijagnoza i intervencija su predloženi kao glavne mjere liječenja cerebralne paralize (CP). Ovdje su prikazani rezultata istraživanja na 347 djece koja su imala CP, iz Kliničke bolnice Mostar, Bosna i Hercegovina, i povezanost s (a) početkom intervencije i njezinim ishodom, (b) intenzitetom liječenja i ishodom i (c) povezanosti CP i čimbenika rizika. Rezultati ukazuju na mogućnost rane dijagnoze već u prvom tromjesečju. Prijašnji abortusi, sepsa i intracerebralna krvarenja su bila značajno povezana s ranom dijagnozom, dok su ishod poroda, RDS, prematurni porod, intracerebralno krvarenje, sepsa, meningitis, hidrocefalus i napadaji bili značajno povezani s konačnim ishodom CP. Nismo našli značajnu povezanost intervencije i konačne dijagnoze. Ovi rezultati potvrđuju ideju da je početak intervencije jedan od najznačajnijih čimbenika. Buduća istraživanja CP trebala bi se usredotočiti na homogenost uzorka, ako i nužnost uključivanja neliječenih kontrolnih ispitanika.