

# Cerebral palsy in Saudi children

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## ABSTRACT

**Objectives:** To describe the clinical profile, and identify its risk factors, of cerebral palsy (CP) as seen in a cohort of consecutive Saudi children aged between one and 3 years of age prospectively over a one-year period.

**Methods:** Saudi children aged 1-3 years with CP (diagnosis based on specified criteria) were selected from children presenting to the Neurology service at the King Fahd Hospital of the University, Al-Khobar, Kingdom of Saudi Arabia with delayed milestones, seizures, mental retardation and difficulty with walking and evaluated at 3-monthly intervals for one year from January to December 2000. Information on gestation duration, labor and delivery, birth weight and the medical history of the mothers was obtained. Cranial computerized tomography and electroencephalography were carried out in addition to baseline investigations (toxoplasmosis, other, rubella, cytomegalovirus, and herpes simplex virus serology, serum lactate, pyruvate, amino acid screen, thyroid function tests, and chromosome analysis). Somatosensory, molecular genetics and muscle biopsy for histopathologic and histochemical studies were not performed in any of the patients.

**Results:** One hundred and eighty-seven children with CP were seen during the study period: 109 males (mean age  $20.3 \pm 8.69$  months); 78 females (mean age  $20.6 \pm 8.55$  months).

Seventy-three had microcephaly (<5th percentile) with a mean head circumference of  $44.5 \pm 3.69$  cms for males and  $43.0 \pm 4.16$  for females. The main symptoms were inability to walk independently (54%), delayed speech (52%) and seizures (45%). The main neurologic features were motor weakness (85%), spasticity (60%), language dysfunction (42%), mental retardation (31%) and head lag (30%). A history of previous CP in the family was obtained in 8 patients (4%) but none of them had other features of hereditary spastic paraplegia. Electroencephalography abnormalities, present in 113 (73%) were more frequent in those without seizures than with seizures. Cranial computerized tomography abnormalities were mainly cerebral atrophy (60%) and hydrocephalus (53.7%). Twenty-five percent were from twin pregnancies; 56 (34%) were of low birth weight, 20% were pre-term deliveries, birth asphyxia was present in 165 and breech presentation was encountered in 8%.

**Conclusion:** The main risk factors identified were twin pregnancy, pre-term delivery, prolonged labor, low birth weight and a history of previous CP in the family. Our findings suggest that improved maternal and childcare particularly in the ante and perinatal periods may reduce the incidence of CP in this environment.

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Cerebral palsy (CP), a persistent, non-progressive disorder of movement and posture remains a globally common cause of pediatric morbidity despite the technological advances in neonatal intensive care and improved maternal care over the last 2 decades.<sup>1-4</sup> Children with CP have other associated neurological disabilities including communication and learning

difficulties, epilepsy, and visual disorders.<sup>5-7</sup> The reported prevalence of CP ranges from 1.5-2.5 per 1,000 live births, and the higher rate in the lowest birth weight groups has been attributed more to the increased number of survivors as a result of improved care in this high risk group than to hazards of intensive care by itself.<sup>8-11</sup> The need for resuscitation and presence of congenital

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abnormalities were also identified as risk factors for CP.<sup>12</sup> Cerebral palsy is also a common cause of disability in Saudi children.<sup>13</sup> In this study, we examined the clinical profile of 187 consecutive CP patients who presented to the Neurology service at the University Hospital in the Eastern Province of the Kingdom of Saudi Arabia (KSA).

**Methods.** All consecutive Saudi children aged 1-3 years presenting to the Neurology service at the King Fahd Hospital of the University (KFHU), Al-Khobar, KSA with delayed developmental milestones, seizures, mental retardation, difficulty with walking and other handicaps were evaluated at 3-monthly intervals for at least a year. The diagnosis of CP was reached using predefined criteria. For the study, CP was defined as a chronic disability characterized clinically by non-progressive aberrant control of movement that appears early in life and is not caused by a recognized progressive disease or identified etiology such as encephalitis or meningitis.<sup>14</sup> The KFHU, Al-Khobar is the only referral university hospital in the Eastern Province of KSA with an estimated population of 3 million inhabitants. At the initial assessment, information on their demographic characteristics, clinical data including the duration of gestation and labor, place and method of delivery, number of fetuses and outcome, birth weight, maternal past and current medical and social histories, complications during pregnancy and labor was collected. In addition, information on stillbirths, abnormal children, antepartum hemorrhage, exposure to drugs, exanthemata, febrile illness severe enough to warrant admission to the hospital in the mother during the current pregnancy was also obtained. Baseline investigations included complete blood count, serum electrolytes, renal function tests, liver function tests, organic acid screen, toxoplasmosis, other, rubella, cytomegalovirus, and herpes simplex virus serologic tests, thyroid function tests, serum lactate and pyruvate, electroencephalography (EEG) and cranial computerized axial tomography (CT). Somatosensory studies, molecular genetics and muscle biopsies for histochemical and histopathologic studies were not performed in any of the children. Information on intrauterine growth and details of monitoring of fetal growth for any of the children was also not available. The collected data was verified and entered into a standard database file and analyzed using the statistical package for social sciences.

**Results.** During the study period, 187 CP patients (109 males, 78 females) aged 12 to 36 months were seen with an overall male:female ratio of 1.4:1. The mean age  $\pm$  standard deviation (SD) for males was  $20.3 \pm 8.69$  months and females  $20.6 \pm 8.55$  months. The mean head circumference  $\pm$  SD for males was  $44.5 \pm 3.69$  cm and females  $43 \pm 4.16$  cm. Microcephaly (head

circumference  $<$ 5th percentile using our hospital reference chart) was found in 73 (39%) of the patients. The main presenting symptoms are shown in **Table 1**, and **Table 2** shows the main neurological signs. None of the patients had numeric chromosomal abnormalities, hypothyroidism or other metabolic encephalopathies. The EEG was abnormal in 137 (73%) of the patients and abnormalities were more frequent in patients who had no seizures than those with seizures. The abnormalities seen included generalized slow wave activity (42%), epileptiform activity which was generalized in 47%, partial in 9.3%, multifocal in 5.3%, hypersarrhythmia in 4% and a burst suppression pattern was present in 1.3%. Details of these findings have been previously described.<sup>15</sup> The cranial CT was abnormal with predominant cerebral atrophy in 112 (60%); other abnormalities were hydrocephalus (53.7%), agenesis of the corpus callosum (4.5%) and porencephaly (3%). There was no attempt made to correlate the EEG findings or cranial CT abnormalities with the spectrum of clinical presentation or severity of the handicap in this study.

The mothers were generally healthy with history of hypertension, epilepsy, diabetes mellitus and renal disease noted in 3 mothers only. A history of previous CP in the family was obtained in 8 patients (4%). There was no clinically expressed hereditary neuromuscular disorder or spastic paraparesis encountered in these families. None of these children had associated urinary bladder dysfunction or peripheral neuropathy. The majority of pregnancies (75%) were singletons and 25% were twin pregnancies. Preterm delivery was found in 38 (20%) and the majority of deliveries were in hospital 174 (93%). Breech delivery was noted in 8 (4%) and antepartum hemorrhage in 2. Birth asphyxia was encountered in 16%. The overall mean birth weight was  $2.6 \pm 0.91$  kg. Low birth weight ( $<$ 2,500 gms) was found in 56 (34%) patients. Appropriate immunization schedules were completed in only 56 (30%) patients. The main risk factors for CP in our patients included twin pregnancy, preterm deliveries, complications during pregnancy such as infections and anemia and obstetric complications including prolonged labor and cesarean section.

**Discussion.** The clinical characteristics of our 187 CP consecutive children are similar to those reported in other studies.<sup>16-19</sup> The observation that some of the cases had a positive history of previous CP in the family is worthy of note. The pattern of presentation and the associated clinical features, seen presentation and the associated clinical features, particularly the absence of associated urinary bladder dysfunction and peripheral neuropathy does not conform to any of the various clinical forms of hereditary spastic paraplegia described in the literature, even though molecular genetic studies were not carried out in any of the cases.<sup>20,21</sup> These factors suggest the need for further clinical and genetics studies on CP in KSA. It is notable that a high

**Table 1** - Frequency of major symptoms in Saudi children aged 1-3 years with cerebral palsy (N=187).

Symptom	Frequency		
	Male N=109	Female N=78	Total N (%)
<b>Higher functions</b>			
Behavioral changes	57	41	<b>98 (52.4)</b>
Delayed speech	50	35	<b>85 (45.5)</b>
<b>Seizures</b>	47	37	<b>84 (44.9)</b>
Tonic/clonic	28	25	<b>53 (28.3)</b>
Myoclonic	12	7	<b>19 (10.2)</b>
Infantile spasms	6	2	<b>8 (4.3)</b>
Atonic	1	3	<b>4 (2.1)</b>
<b>Motor</b>			
Inability to independently:			
walk	52	48	<b>100 (53.5)</b>
stand	48	35	<b>83 (44.4)</b>
sit	47	32	<b>79 (42.2)</b>
roll over	43	36	<b>79 (42.2)</b>
Unsteady gait	32	23	<b>55 (29.4)</b>
Poor head control	34	19	<b>53 (28.3)</b>
Hypotonia	17	12	<b>29 (15.5)</b>
Stiffness	17	9	<b>26 (13.9)</b>
Frequent falls	24	15	<b>39 (20.8)</b>

**Table 2** - Frequency of main physical signs in Saudi children aged 1-3 years with cerebral palsy (N=187).

Physical sign	Frequency		
	Male N=109	Female N=78	Total N (%)
<b>Microcephaly</b>	70	58	<b>128 (68.4)</b>
<b>Cortical</b>			
Language difficulties	34	45	<b>79 (42.2)</b>
Mental retardation	37	22	<b>59 (31)</b>
Attention deficit	12	5	<b>17 (9.1)</b>
Hyperactivity	8	4	<b>12 (6.4)</b>
<b>Motor</b>			
Weakness	85	74	<b>159 (85)</b>
Hyper-reflexia	69	49	<b>118 (63.1)</b>
Spasticity	66	47	<b>113 (60.4)</b>
Head lag	28	28	<b>56 (29.9)</b>
Hypotonia	30	26	<b>56 (29.9)</b>
<b>Movement disorders*</b>	1	3	<b>4 (2.1)</b>
<b>Other physical signs</b>			
Ocular disturbance	7	4	<b>11 (5.9)</b>
Deafness	4	1	<b>5 (2.7)</b>
Nystagmus	2	1	<b>3 (1.6)</b>
<b>Limb contractures</b>	20	10	<b>30 (16)</b>

\* Chorea, athetosis, dystonia, cerebellar ataxia (one of each)

proportion of our patients are microcephalic (40%) and had a low birth weight (34%), both of which have been identified as risk factors for CP.<sup>22,23</sup> The frequency of seizures in our patients is comparable to the reported overall prevalence of epilepsy in patients with CP.<sup>15,24</sup> The observed higher frequency of abnormal EEG in our patients compared to the cases who actually had seizures probably reflects the presence of underlying electrical cerebral changes with no concomitant clinically expressed seizures or that the seizures had not been witnessed by the family to report them. The CT abnormalities are comparable to those reported in other studies.<sup>25,26</sup> It is suggested that further studies are required in this environment to correlate the different types of cranial CT abnormalities with the various forms of CP, underlying cerebral pathology and the possible mechanisms involved in their respective pathogenesis. The small proportion of children who had completed childhood immunization schedules observed in this study is probably related to the early age of the cases at presentation by which time only part of the expected immunization schemes would have been completed. Studies have shown that the immunization program within the kingdom had wide community coverage and is effective. This is evidenced by findings of a recent survey assessing the recent polio immunization campaign which found an overall 92% success rate.<sup>27</sup> The relative rarity of identifiable etiologies such as meningitis, encephalitis and intrauterine viral infections reflects selection bias as cases with identifiable etiologies were excluded from the study. In addition, it was not possible to validate any presumptive diagnosis of meningitis or encephalitis in the absence of accurate information on the clinical presentation or ancillary laboratory investigations particularly cerebrospinal fluid analysis.

It is observed that 93% of our patients were delivered in hospital and 16% had birth asphyxia. Thus, maternal factors during pregnancy and labor appear to play a major role in the etiopathogenesis of CP in our patients. The role of intrapartum events and CP was recently addressed.<sup>28</sup> Our findings of twin pregnancy, preterm delivery and abnormal events during pregnancy such as infections and anemia, low birth weight, prolonged labor, breech delivery and cesarean section as risk factors for CP are consistent with the results from other studies.<sup>27-32</sup>

The pattern of identified risk factors for CP in our study suggests that preventive measures directed at improving maternal anti and perinatal care might effectively reduce the incidence of CP in this environment.

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