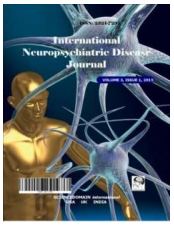

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# Clinical Profile of Children with Cerebral Palsy in Jos, North-Central Nigeria

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***Authors' contributions***

*This work was carried out in collaboration between all authors. Author EUE contributed to the concept, design, definition of intellectual content, literature search, data collection and analysis, manuscript preparation, manuscript editing and manuscript review. Author ESY contributed to literature search, manuscript preparation, manuscript editing and manuscript review. Author AODO contributed to literature search, data collection and analysis, manuscript editing and manuscript review. All authors read and approved the final manuscript.*

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## ABSTRACT

**Aim:** The aim of this study was to describe the clinical profile of children with cerebral palsy (CP) at Jos University Teaching Hospital (JUTH), Jos, North-Central Nigeria.
**Study Design:** This was a case series study.
**Place and Duration of Study:** Paediatric neurology clinic, Jos University Teaching Hospital, Nigeria between January 2015 and December 2016.
**Methodology:** We recruited consecutive patients with CP attending the paediatric neurology clinic of JUTH. We used structured questionnaires and hospital records to document all relevant information of the patients and their parents. We also conducted detailed physical examination for each patient and performed specialized examinations and investigations if necessary. Data obtained was analysed with EpiInfo version 7.2. Ethical approval for this study was obtained from the Health Research Ethical Committee of JUTH. Informed consent was obtained from the parent/guardian of each participant.
**Results:** A total of 168 children with CP were seen within the study period, 93 (55.4%) were males

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while 75 (44.6%) were females. Home delivery was the commonest place of delivery (32.7%), followed by delivery at primary health centres (25.0%). Despite the fact that no socio-economic class was spared, most (60.1%) of the children with CP were in lower class. The commonest presenting complaint observed was delayed developmental milestones. About 71% of the children with CP were malnourished while 26% were severely malnourished. Spastic hemiplegic CP was the commonest type of CP seen. Associated disabilities were very common in children with CP in our study with 92% of them having one or more disabilities. The commonest disability we observed was seizure disorder (45.2%) followed by intellectual disability (28%).

**Conclusion:** In our study, CP was commonly associated with other disabilities and malnutrition. Each child with CP should be assessed comprehensively and managed by a multidisciplinary care team comprising of all relevant professionals so that the child's long term outcome can be improved.

*Keywords: Cerebral palsy; clinical profile; associated disabilities; children; Jos; Nigeria.*

## 1. INTRODUCTION

Cerebral palsy (CP) is a chronic motor disorder that results from an injury to the developing brain. CP is caused by a broad group of developmental, genetic, metabolic, ischaemic, infectious, and other acquired aetiologies that produce a common group of neurological manifestations [1]. The injury to the developing brain may occur during the antenatal, perinatal or postnatal periods. Although CP is described as non progressive, the features could change with time as the brain matures [1]. Many factors determine the consequences of a lesion of the developing brain: the age at insult, the site, and the size of the lesion, its unilateral or bilateral nature, animal species, sex, exposure to chemical substances prior to and after the insult, and environmentally induced experience [2,3].

CP is a common problem in children; the prevalence in developed countries is 2-3 per 1000 live births [4-6]. There is paucity of information on the prevalence in developing counties. It may be associated with other disabilities some of which may be more devastating than the motor disorder [7,8]. Associated disability assessment and management could help improve the long term outcome of children with CP. CP is a chronic disorder with no known cure. Long term management of CP is very expensive. Previous studies estimated that the excess lifetime cost for cerebral palsy was approximately $800,000 and $67,044 per person in USA [9] and China [10] respectively. The productivity costs were responsible for 80% and 93% of the total economic loss respectively.

Early diagnosis of CP and early intervention could help affected children attain their maximum potential and improve the overall outcome, it also helps to alleviate family anxiety [11-14]. Describing the clinical profile of children with CP will help in early identification of affected children which will lead to early intervention, better management and improved long term outcome. The aim of this study was to describe the clinical profile of children with CP at Jos University Teaching Hospital (JUTH), Jos, North-Central Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Background of Study Area

Jos, the capital of Plateau state of Nigeria, is located in the north-central zone of the country. The Jos University Teaching Hospital (JUTH) is one of the three teaching hospitals in the zone. The population of the state was estimated at 3,206,531 in the 2006 census, with the state capital having a population of approximately 900,000 [15]. Children constitute about 45% of the total population.

### 2.2 Study Site

This study was carried out at the paediatric neurology clinic of JUTH. The clinic runs every Monday at the paediatric out-patient department of the hospital. It receives referrals from other clinics in the hospital and also from other hospitals in the state and neighbouring states. It attends to about 40 patients every clinic day.

### 2.3 Study Population

Subjects of the study were children with diagnosis of CP attending the paediatric neurology clinic of JUTH.

## 2.4 Study Design

This was a case series study.

## 2.5 Inclusion Criteria

All children less than 18 years with CP attending the paediatric neurology clinic of JUTH.

## 2.6 Exclusion Criteria

Any child whose parent or guardian did not give consent.

## 2.7 Data Collection

Consecutive patients who met the inclusion criteria that presented at the paediatric neurology clinic were recruited from January 2015 to December 2016. We used structured questionnaires and hospital records to document all relevant information of the patient and their parents. Information documented included biodata and detailed medical history: present illness, pregnancy, delivery and perinatal history, past medical history, developmental history, and family and social history. We also conducted detailed physical examination for each patient with particular emphasis on anthropometry, general and central nervous system (CNS) examination. Specialized examination and investigations were done if necessary. World Health Organization (WHO) growth chart was used to assess the nutritional status of the patients while the socio-economic status of the family was assessed with the method proposed by Oyedeji [16].

## 2.8 Data Analysis

Data obtained was analysed with EpiInfo version 7.2. Chi-square test was used to test significance of associations. *P* value <0.05 was considered significant.

## 2.9 Ethical Consideration

Ethical approval for this study was obtained from the Health Research Ethical Committee of JUTH (JUTH/DCS/ADM/127/XIX/6631). Informed consent was obtained from the parent/guardian of each participant.

## 3. RESULTS AND DISCUSSION

## 3.1 Results

A total of 168 children with CP were seen within the study period, 93 (55.4%) were males while 75 (44.6%) were females. Six (3.6%) were aged <1 year, 141 (83.9%) were aged 1-5 years, 14 (8.3%) were aged 6-12 years, while 7 (4.2%) were aged 13-17 years.

Home delivery was the commonest place of delivery (32.7%), followed by delivery at primary health centres (25.0%). 'Others' were made up of those that were delivered in the church/mosque, farm, and vehicle. One hundred and seven (63.7%) were delivered by spontaneous vaginal delivery while 38 (22.6%) were delivered by emergency caesarean section. Assisted delivery consisted of vacuum or forceps delivery, and assisted breech delivery. The commonest socio-economic class affected was lower class (60.1%) (Table 1).

**Table 1. Characteristics of children with cerebral palsy**

| Place of delivery | Number | Percentage |
|---|---|---|
| Home | 55 | 32.7 |
| Primary health centre | 42 | 25.0 |
| Secondary facilities | 20 | 11.9 |
| Maternity homes | 18 | 10.7 |
| Tertiary facilities | 15 | 8.9 |
| Private hospitals | 6 | 3.6 |
| Others | 12 | 7.1 |
| **Mode of delivery** | | |
| Spontaneous vaginal delivery | 107 | 63.7 |
| Emergency caesarean section | 38 | 22.6 |
| Elective caesarean section | 18 | 10.7 |
| Assisted delivery | 5 | 3.0 |
| **Socio-economic class** | | |
| Class 1 (Upper class) | 12 | 7.1 |
| Class 2 (Upper class) | 23 | 13.7 |
| Class 3 (Middle class) | 32 | 19.0 |
| Class 4 (Lower class) | 41 | 24.4 |
| Class 5 (Lower class) | 60 | 35.7 |

The commonest presenting complaint was delayed developmental milestone (93. 2%) followed by drooling of saliva (37.0%) and inability to use one or more limbs (5. 7%).

Spastic CP was the commonest type (64.9%) followed by dyskinetic CP (31.5%). Hemiplegic CP was the commonest spastic type (Table 2).

Seizure disorder was the commonest associated disability (45.2%) followed by intellectual disability (28.0%). Some children had more than one associated disability (Table 3).

**Table 2. Types of cerebral palsy**

| Type of cerebral palsy | Number | Percentage |
|---|---|---|
| Spastic | 109 | 64.9 |
| Hemiplegic | 72 | 42.9 |
| Quadriplegic | 31 | 18.4 |
| Diplegic | 6 | 3.6 |
| Dyskinetic | 53 | 31.5 |
| Ataxic | 2 | 1.2 |
| Mixed | 4 | 2.4 |

We did not find any significant relationship in the age distribution of males and females. Also we did not find any significant relationship between sex, type of CP and disability associated with CP (Table 4).

One hundred and twenty (71.4%) of the patients were malnourished while 44 (26.2) were severely malnourished. Thirty-one (70.5%) of those with severe malnutrition had dyskinetic CP.

**Table 3. Disabilities associated with cerebral palsy**

| Disabilities | Number | Percentage |
|---|---|---|
| Seizure disorder | 76 | 45.2 |
| Intellectual disability | 47 | 28.0 |
| Speech defect | 34 | 20.2 |
| Hearing impairment | 21 | 12.5 |
| Visual impairment | 8 | 4.8 |
| None | 14 | 8.3 |

**Table 4. Relationship between sex, age, type of CP and common associated disability**

| Variable | Male number (%) | Female number (%) | Total (%) | $X^2$ | P value |
|---|---|---|---|---|---|
| **Age** | | | | 0.73 | 0.429 |
| <1 year | 4 (2.4) | 2 (1.2) | 6 (3.6) | | |
| 1-5 years | 81 (48.2) | 60 (35.7) | 141 (83.9) | | |
| 6-12 years | 5 (3.0) | 9 (5.3) | 14 (8.3) | | |
| 13-17 years | 3 (1.8) | 4 (2.4) | 7 (4.2) | | |
| **Types of CP** | | | | | |
| Spastic hemiplegic CP | | | | 0.34 | 0.561 |
| Yes | 38 (22.6) | 34 (20.3) | 72 (42.9) | | |
| No | 55 (32.8) | 41 (24.3) | 96 (57.1) | | |
| Spastic quadriplegic CP | | | | 0.11 | 0.738 |
| Yes | 18 (10.7) | 13 (7.7) | 31 (18.4) | | |
| No | 75 (44.7) | 62 (36.9) | 137 (81.6) | | |
| Spastic diplegic CP | | | | 1.21 | 0.409 |
| Yes | 2 (1.2) | 4 (2.4) | 6 (3.6) | | |
| No | 91 (54.2) | 71 (42.2) | 162 (96.4) | | |
| Dyskinetic CP | | | | 0.78 | 0.376 |
| Yes | 32 (19.0) | 21 (12.5) | 53 (31.5) | | |
| No | 61 (36.3) | 54 (32.1) | 115 (68.5) | | |
| **Associated disability** | | | | | |
| Seizure disorder | | | | 0.08 | 0.772 |
| Yes | 43 (25.6) | 33 (19.6) | 76 (45.2) | | |
| No | 50 (29.8) | 42 (25.0) | 92 (54.8) | | |
| Intellectual disability | | | | 0.47 | 0.494 |
| Yes | 28 (16.7) | 19 (11.3) | 47 (28.0) | | |
| No | 65 (38.7) | 56 (33.3) | 121 (72.0) | | |
| Speech defect | | | | 2.17 | 0.141 |
| Yes | 15 (8.9) | 19 (11.3) | 34 (20.2) | | |
| No | 78 (46.5) | 56 (33.3) | 134 (79.8) | | |
| Hearing impairment | | | | 0.03 | 0.860 |
| Yes | 12 (7.2) | 9 (5.3) | 21 (12.5) | | |
| No | 81 (48.2) | 66 (39.3) | 147 (87.5) | | |
| Visual impairment | | | | 1.08 | 0.469 |
| Yes | 3 (1.8) | 5 (3.0) | 8 (4.8) | | |
| No | 90 (53.6) | 70 (41.6) | 160 (95.2) | | |

## 3.2 Discussion

This study was designed to describe the clinical profile of children with CP. A significant number of children with CP in our study were delivered at home. The 32.7% home delivery obtained in this study was similar to 37.2% previously reported in Port Harcourt [17]. Women that delivered at home may not have benefitted from the services of skilled birth attendants and proper newborn resuscitation would not have been done if necessary. Studies have shown that many women in developing countries still continue to deliver at home [18-21]. Factors responsible for this include poverty, ignorance, traditional and cultural beliefs and practices, far distance to and high cost of health facilities, and inadequate transportation services. Improving economic situation of families, female education, provision of basic healthcare facilities with skilled birth attendants within reach of most people, and community support will help reduce the number of women that deliver at home.

Despite the fact that no socio-economic class was spared, most of the children with CP were in lower class. This is similar to previous reports from developing countries [17,22,23]. These are children whose mother were likely to have missed antenatal care, delivered at home and would not have taken their children to a health facility if they had medical problem. The triad of poverty, ignorance and disease would have played an important role in this finding.

The commonest presenting complaint observed was delayed developmental milestones. This is also similar to what was previously reported in India [22,24]. Children with developmental delay should have thorough evaluation to ascertain the cause so that early intervention can be instituted. Developmental assessment should be performed at all points of contact with infants including the well infant and immunization clinics.

Similar to previous studies in both developed and developing countries, [5,22-25] spastic CP was the commonest physiological type observed in our study. However in contrast to reports from developed countries where spastic diplegic CP was the commonest physiological/topographical type, [5,25] spastic hemiplegic CP was the commonest type seen in our study. This also contrasts with reports from south-west Nigeria [23] and Indian [22,24] where spastic quadriplegic CP was the commonest type. The difference between the topographical types in our study and developed countries is likely because of the difference in the predisposing factors. While prematurity leading to intraventricular haemorrhage is the commonest risk factor in developed countries, [5,6,25] birth asphyxia is the commonest risk factor in developing countries [17,24,26-28]. While extremely preterm babies survive in developed countries, they usually don't survive in developing countries because of inadequate neonatal intensive care services. The difference in the type of CP seen in our study and other studies could also be as a result of the study design. While the study in USA [25] was a multicenter cohort study, ours was a case series study.

Contrary to previous reports, [22-24,27] we also found that a large number of our subjects had dyskinetic CP. This is because neonatal jaundice (NNJ) leading to bilirubin encephalopathy which is associated with dyskinetic CP still poses significant risks of avoidable mortality and severe long-term neurodevelopmental sequelae in our region. This is as a result of delay in seeking appropriate care for NNJ and lack of intensive phototherapy units for treatment of hyperbilirubinemia. The practice of using glucose water and early morning sunlight to treat NNJ is also very common in our region.

Associated disabilities were very common in children with CP in our study with 92% of them having one or more disabilities. The commonest disability we observed was seizure disorder (45.2%). This is similar to previous reports from southern parts of Nigeria [17,23,27] but contrasts with reports from India [22,24,29] where intellectual disability was the commonest associated disability accounting for 42-72.5%. In our study intellectual disability accounted for 28% of disabilities associated with CP. This difference could be as a result of high proportion of spastic quadriplegic CP seen in India. Spastic quadriplegic CP is a severe type of CP commonly associated with intellectual disability [30]. Other associated disabilities seen in our study include speech defect, hearing and visual impairments. Because of the high frequency of disabilities associated with CP, all children with CP should have thorough disability assessment to determine all their needs. This will enable the Clinician to assemble an appropriate multidisciplinary care team and provide proper referral for each child. Management of children with CP by an appropriate multidisciplinary care team has been shown to improve their overall long term outcome [31].

About 71% of children with CP in our study were malnourished while 26% had severe malnutrition. This is slightly lower than the 80% reported in India [24]. Severe malnutrition was particularly common among those with dyskinetic CP perhaps because of involuntary movements and poor coordination that could interfere with feeding. Causes of malnutrition in children with CP include feeding and swallowing difficulties, poor cognitive development and child abuse and neglect [32,33]. Nutritional assessment and dietary planning with the Nutritionist/Dietician should be part of routine management of children with CP. Caregiver should also be educated on how best to feed them. Some may benefit from a feeding tube.

Most children with CP often have poor linear growth during childhood, resulting in a diminished final adult height [34]. It has been reported that diminished circulating insulin-like growth factor 1 (IGF-1) and growth hormone (GH) concentrations may explain why children with CP are smaller than normally growing children [35]. It has also been reported that 18 months of GH therapy in children with CP is associated with significant improvements in bone mineral density, as well as increased linear growth [36].

The growth hormone insulin-like growth factor-1 system induces neurogenesis and increases brain plasticity [37]. Neuropsychological assessments have demonstrated that GH deficiency is associated with reduced cognitive performance; specifically, in the majority of studies it has been found that GH deficiency can lead to clinically relevant changes in memory, processing speed, attention, vocabulary, perceptual speed, spatial learning, and in reaction time tests [38,39]. GH substitutive treatment decreases the dopamine metabolite homovanillic acid and increases by about 30% the levels of aspartate, a neurotransmitter with important effects in terms of the hippocampal long-term potentiation and in attentional functions [40,41]. GH replacement therapy should therefore be started as early as possible, together with specific rehabilitation, once CP is detected; the conjunction of GH therapy and rehabilitation has the potential to prevent or correct most of the disabilities seen in these children [42].

## 4. CONCLUSION

In this study, developmental delay was the commonest presenting complaint observed in children with CP while spastic hemiplegic CP was the commonest type. CP was commonly associated with other disabilities and malnutrition. The commonest associated disability observed was seizure disorder. Every child with CP should be assessed comprehensively and managed by a multidisciplinary care team comprising of all relevant professionals so that the child's long term outcome can be improved.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Johnston MV. Encephalopathies. In: Kliegman RM, Stanton BMD, Behrman R, Geme JS, Schor N (ed). Nelson Textbook of Pediatrics. 18th ed. St. Louis MO: W B Saunders Co; 2007.
2. Kolb M, Mychasiuk R, Muhammad A, Gibb R. Brain plasticity in the developing brain. Prog Brain Res. 2013;207:35–64.
3. Kolb B, Mychasiuk R, Williams P, Gibb R. Brain plasticity and recovery from early cortical injury. Dev Med Child Neurol. 2011;53(Suppl 4):4–8.
4. Arneson CL, Durkin MS, Benedict RE, Kirby RS, Yeargin-Allsopp M, Braun KVN. Prevalence of cerebral palsy: Autism and developmental disability monitoring network, three sites, United States, 2004. Disability Health J. 2008;2:45–8.
5. Johnson A. Prevalence and characteristics of children with cerebral palsy in Europe. Dev Med Child Neurol. 2002;44:633-40.
6. Odding E, Roebroeck ME, Stam HJ. The epidemiology of cerebral palsy: Incidence, impairments and risk factors. Disabil Rehab. 2006;284:183-91.
7. Hutton JL. Cerebral palsy life expectancy. Clinics in Perinatology. 2006;33:545-55.
8. Strauss D, Brooks J, Rosenbloom R, Shavelle R. Life expectancy in cerebral palsy: An update. Dev Med Child Neurol. 2008;50:487-93.
9. Altman BM, Barnartt SN, Hendershot GE, Larson SA (ed.) Using survey data to study disability: Results from the National Health Survey on Disability. Research in Social Science and Disability. 2003;3:207-28.
10. Wang B, Chen Y, Zhang J, Li J, Guo Y, Hailey D. A preliminary study into economic burden of cerebral palsy in China. Health Policy. 2008;87:223–34.

11. Mattern-Baxter K, McNeil S, Mansoor JK. Effects of home-based locomotor treadmill training on gross motor function in young children with cerebral palsy: A quasi-randomized controlled trial. Arch Phys Med Rehabil. 2013;94:2061–71.
12. Eliasson AC, Sjöstrand L, Ek L, Krumlinde-Sundholm L, Tedroff K. Efficacy of baby-CIMT: study protocol for a randomised controlled trial on infants below age 12 months, with clinical signs of unilateral CP. BMC Pediatr. 2014;14:141-50.
13. Lobo MA, Harbourne RT, Dusing SC, McCoy SW. Grounding early intervention: Physical therapy cannot just be about motor skills anymore. Phys Ther. 2013;93: 94-103.
14. Vos RC, Becher JG, Ketelaar M, Smits DW, Voorman JM, Tan SS, et al. Developmental trajectories of daily activities in children and adolescents with cerebral palsy. Pediatr. 2013;132:915-23.
15. Population and Housing Census 2006: Priority table volume III, population distribution by sex, state, LGA and Senatorial District. National Population Commission of Nigeria, Abuja; 2010.
16. Oyedeji GA. Socio-economic and cultural background of hospitalized children in Ilesa. Nig J Paediatr. 1985;12:111-7.
17. Frank-Briggs A, Alikor EAD. Sociocultural issues and causes of cerebral palsy in Port Harcourt, Nigeria. Niger J Paediatr. 2011; 3:115–9.
18. Fapohunda BM, Orobaton NG. When women deliver with no one present in Nigeria: Who, What, Where and So What? PLoS One. 2013;8:695-9.
19. Ogunlesi T. The pattern of utilization of prenatal and delivery services in Ilesa, Nigeria. Int J Epid. 2005;2:26-9.
20. Umeora OU, Egwuatu VE. The role of unorthodox and traditional birth care in maternal mortality. Trop Doct. 2010;40:13-7.
21. Nyango DD, Mutihir JT, Laabes EP, Kigbu JH, Buba M. Skilled attendance: The key challenges to progress in achieving MDG-5 in north central Nigeria. Afr J Reprod Health. 2010;14:129-38.
22. Singhi Pratibha D, Ray Munni, Suri Gunmala. Clinical spectrum of cerebral palsy in North India- an analysis of 1000 cases. Tropical J of Pediatr. 2002;48: 162-6.
23. Ogunseli T, Ogundeyi M, Ogunfowora O, Olowu A. Socio-clinical issues in cerebral palsy in Sagamu, Nigeria. South Afr J Child Health. 2008;2:120-4.
24. Pattar R, Yelamali BC. Clinical spectrum and risk factors of cerebral palsy in children. Medica Innovatica. 2015;4:6-9.
25. Ehrenkranz RA, Dusick AM, Vohr BR, Wright LL, Wrage LA, Poole WK. Growth in the neonatal intensive care unit influences neurodevelopmental and growth outcomes of extremely low birth weight infants. Pediatr. 2006;117:1253-61.
26. Adogu P, Ubajaka CF, Egenti NP, Obinwa AM, Igwe W. Evaluation of risk factors of cerebral palsy in tertiary health facility, Nnewi, Nigeria: A case-control study. Int J Med Sci and Pub Health. 2016;5:1-7.
27. Okike CO, Onyire BN, Ezeonu CT, Agumadu HU, Adeniran KA, Manyike PC. Cerebral palsy among children seen in the neurology clinic of Federal Medical Centre (FMC), Asaba. J Community Health. 2013;38:257-60.
28. Belonwu RO, Gwarzo GD, Adeleke SI. Cerebral palsy in Kano, Nigeria—a review. Niger J Med. 2009;18:186-9.
29. Srivatsava V K, Laisram N, Srivatsava RK. "Cerebral Palsy", Indian Pediatr. 1992;29: 993-6.
30. Christensen D, Van Naarden BK, Doernberg NS, Maenner MJ, Arneson CL, Durkin MS, et al. Prevalence of cerebral palsy, co-occurring autism spectrum disorder, and motor functioning-Autism and Developmental Disability Monitoring Network, USA, 2008. Dev Med Child Neurol. 2014;56:59-65.
31. Trabacca A, Vespino T, Di Liddo A, Russo L. Multidisciplinary rehabilitation for patients with cerebral palsy: Improving long term care. J Multidisciplinary Healthcare. 2016;9:455-62.
32. Fung EB, Samson-Fang L, Stallings VA, Conaway M, Liptak G, Henderson RC. Feeding dysfunction is associated with poor growth and health status in children with cerebral palsy. J Am Diet Assoc. 2002;102:361-73.
33. Sullivan PB, Lambert B, Rose M, Ford-Adams M, Johnson A, Griffiths P. Prevalence and severity of feeding and nutritional problems in children with neurological impairment: Oxford Feeding Study. Dev Med Child Neurol. 2000;42: 674-80.
34. Shim ML, Moshang T, Jr., Oppenheim WL, Cohen P. Is treatment with growth

hormone effective in children with cerebral palsy. Dev Med Child Neurol. 2004;46: 569–71.
35. Kuperminc MN, Gurka MJ, Houlihan CM, et al. Puberty, statural growth, and growth hormone release in children with cerebral palsy. J Pediatr Rehabil Med. 2009;2:131–41.
36. Ali O, Shim M, Fowler E, et al. Growth hormone therapy improves bone mineral density in children with cerebral palsy: A preliminary pilot study. J Clin Endocrinol Metab. 2007;92:932-7.
37. Devesa J, Devesa P, Reimunde P. Growth hormone revisited. Med Clin. 2010;135: 665-70.
38. Maruff P, Falleti M. Cognitive function in growth hormone deficiency and growth hormone replacement. Horm Res. 2005; 64:100–8.
39. Van Dam PS. Somatropin therapy and cognitive function in adults with growth hormone deficiency: a critical review. Treat Endocrinol. 2006;5:159–70.
40. Falleti MG, Maruff P, Burman P, Harris A. The effects of growth hormone (GH) deficiency and GH replacement on cognitive performance in adults: A meta-analysis of the current literature. Psychoneuroendocrinology. 2006;31:681–91.
41. Nieves-Martinez E, Sonntag WE, et al. Early-onset GH deficiency results in spatial memory impairment in mid-life and is prevented by GH supplementation. J Endocrinol. 2010;204:31–6.
42. Devesa J, Casteleiro N, Rodicio C, López N, Reimunde P. Growth hormone deficiency and cerebral palsy. Ther Clin Risk Manag. 2010;6:413–18.



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