**Introduction**

Cerebral Palsy (CP) is a cluster of clinical signs which includes abnormal muscle tone and movement, and associated loss of function due to a non-progressive lesion or abnormality of brain. It displays a variability of disability profiles in cognitive performance, communication and behaviour, epilepsy, visual-spatial or perceptual problems, or a combination of these features (Himmelmann, Beckung, Hagberg & Uvebrant, 2006; Shevell, Dagenais & Hall, 2009). A variety of prenatal and perinatal risk factors have been identified for CP including low birth weight, premature delivery, infections during pregnancy, jaundice and so on. Apart from these risk factors that occur prior to or around the time of birth, post natal factors can also lead to CP, which is termed as post neonatal CP. CP of post neonatal origin is defined by the presence of a specific event or episode that happened after 28 days of age (Cans et al., 2004; Odding, Roebroeck, & Stam, 2006). Various viral infections, especially the acute exanthematous diseases of childhood, may be accompanied by, or followed by, clinical manifestations of widespread involvement of the Central Nervous System (CNS) which is often far more serious than the primary infection. This can even result in post-infectious (or para-infectious) encephalomyelitis or immune mediated encephalomyelitis, a serious condition which needs to be taken care immediately. It is indicated that bacterial meningitis is one of the leading postnatal cause of developmental disabilities. Other factors like head injury, paediatric stroke, epileptic attack can also lead to post neonatal CP (Paneth, 1993; Odding, Roebroeck & Stam, 2006).

Of these risk factors, Status epilepticus (SE) is a medical emergency associated with significant mortality and major morbidity which presents with continuous seizure lasting more than 30 min, or two or more seizures without full recovery of consciousness between any of them (Lowenstein & Alldredge, 1998). Longer duration of seizures is associated with increased risk of morbidity and mortality. Delayed treatment may increase the frequency of SE. Therefore, early seizure termination is paramount for the treatment of SE (Eriksson & Koivikko, 1997). This is followed by early management options. Various disorders with communication and physical disability remain unchanged due to lack of early intervention. Thus, rehabilitation at the earliest is an important factor to be noted in the prognosis of disordered population.

Patients with no prior history of epilepsy who present in status epilepticus are most likely to have meningitis, encephalitis, hypoxic-ischemic encephalopathy, or a large stroke. This may be accompanied by, or followed by, clinical manifestations of widespread involvement of the CNS. The prognosis for these patients is worse. The longer a patient is in status, the worse the outcome (Brazier & Coceani, 1976). This is partly because the duration is more likely to be prolonged in patients with more severe underlying disease, but there is also a great deal of experimental evidence that status epilepticus itself damages the brain and that the degree of damage is a function of duration. There are some evidence that convulsive status epileticus (CSE), especially febrile CSE, might cause hippocampal injury (Raspall-Chaure, 2006).

Sadarangani et al. (2008) provided a data on the incidence and outcome of convulsive status epilepticus which stated that prevention and appropriate early management of seizures might reduce the incidence and improve the outcome of convulsive status epilepticus in children. Few studies reported that longer seizure duration, cerebral insult, and refractory convulsive status epilepticus are strongly associated with poor outcomes (Legriel, Azoulay, Resche-Rigon, Lemiale, Mourvillier, & Kouatchet, 2010). Specific learning difficulties have been reported in children who have febrile convulsions which include problems with drawing and arithmetic and a delay in speech development. Behavior disorders and attention deficits have also been found after febrile convulsions. The incidence of neurologic sequelae and mental retardation was reported to be higher when the first febrile convulsion occurred at an early age (Verity, Greenwood, & Golding, 1998). The characteristic features pave way for a holistic and multifaceted early rehabilitative process.

Transdisciplinary approach includes the sharing of roles across disciplinary boundaries so that communication, interaction, and cooperation are maximized among team members (Davies, 2007; Johnson et al., 1994). This approach adopts a framework for allowing members of an educational team to contribute knowledge and skills, collaborate with other members, and collectively determine the services that most would benefit a child. This would more beneficial when rehabilitation services are provided at an earlier age. The goals of early rehabilitation are to maintain functioning or to minimize the loss of functioning and to optimize recovery and early autonomy. The maintenance or early restoration of functioning is of particular importance in patients at risk (Johnston, Wood & Fiedler, 2003).

Profiling a condition like this in terms of its characteristics, mainly communication and motor skills would be an effective tool to track the prognosis. Thus, the present study was aimed at profiling the condition of post neonatal CP due to status epilepticus in a 14 year old child and highlighting the importance of early team rehabilitation.

**Case Report**

 The participant in this study, “AZ”, was 10 years when they reported to our institute. She had an attack of febrile seizures at the age of 4.6 years. At the time of her illness onset, she was enjoying the rhymes and plays of kindergarten. There was no prior medical history of note.

AZ was initially admitted to a local hospital following high fever (1020 F) with seizures. She was in a complete unconscious state. She was kept in ICU for 2 weeks and followed by a week in ventilator. Asleep EEG report reveals generalized epileptiform discharges and bihemispheric dysfunction.She was medically diagnosed as status epitepticus secondary to encephalitis sequelae.She had several episodes of very high temperatures with seizures for the next 2 years. She was under medications which included Tegretol(5 ml) and Epilex (8 ml) for the attack of seizures.However, there was no marked difference in the episodes of seizures and she was discharged from the hospital. Later, medications such as Parkin (2 mg), Lamictal (50 mg) and Epilexin (8ml) were included**.**

10 years after discharge, the child was brought to our center on with the complaint of poor speech and language skills and inability to walk and stand. She presented with very limited responses to external sensory stimuli and was completely dependent for her activities of daily living. A detailed speech-language, physical, psychological and neurological evaluations were carried out. On speech and language evaluation, she was unable to vocalize meaningfully and exhibited severe drooling. She also presented with difficulty in swallowing and choking. Frequent attack of seizures about two times a day was present. Motor evaluation revealed she was wheel chair bounded and was hypotonic except Tendo **Achilles** (TA). Poor psychomotor coordination and impaired sitting balance were other associated features present. Despite these, she exhibited overflow of movements when her body hits somewhere, sleeplessness and unable to sit in one place for more than few minutes. Psychological evaluation using Vineland Social Maturity Scale was carried out to evaluate the social competence of the child and revealed a functional level of 1.6 years. On neurological evaluation, the child was given a diagnosis of post encephalitic sequelae.

**Speech language Evaluation**

Comprehensive speech and language evaluations were done. Receptive Expressive Emergent Language Scale (REELS) was initially used obtain a screening level of the receptive and expressive language age of the child. The scores was found to be between 4-5 months for both reception and expression. To elaborate, child was able to localize familiar voice and could respond to her own name by producing the sound /m/ with 50% consistency (5/10 times). The child was also able to produce vowel like sounds similar to /o/ and /u/ in response to vocal play. She exhibited poor response to name call and poor communication intent. Pre-linguistic skills were relatively poor. The child was not able to attend to stimuli for more than 4 seconds. She has poor attention and concentration to speech stimuli (3-4 sec). Informal visual assessment reveals poor visual attention and visual scanning.

The child also presented with complex array of oro-motor and vegetative issues such as like drooling because of poor lip closure and feeding issues. On oro motor evaluation, lip seal was absent as a result excessive drooling was present. Usually, the drool drips off chin and onto clothing which suggests severe drooling. She had an open mouth posture all the time, even when a food was placed inside the mouth. The protrusion, elevation, lateralization functions of the tongue was severely affected. Tongue movements were limited for bolus formation. She had difficulty in biting and chewing solid food. She was generally on semisolid diet, fed using a syringe. She had difficulty in blowing and sucking also. On administration of the Com-DEALL Oro Motor Checklist (Archana, 2008), a total score of 10 was obtained, indicating poor oromotor skills. The scores obtained in individual subsections of the checklist displayed greater difficulties in the lip movements and speech.

**Physiotherapy Evaluation**

Motor Assessment Scale (MAS) to evaluate the motor functions of the child and Berg Balance Scale (BBS) to test the static and dynamic balance abilities was used in physiotherapy assessment. MAS Score of grade 4 and BBS score of 23 was obtained and the scores reveals TA tightness, poor static and dynamic balance and poor posture.

Overall, the results indicated a generalized and severe communicative and motor regression. On the basis of these assessment results, AZ was diagnosed as Global regression secondary to post nenatal CP (encephalitis sequelae) and was enrolled for speech language and physical rehabilitation at the institute.

**Rehabilitation profile**

Given evidence to severe communication and physical difficulties, it was indispensable to introduce a transdisciplinary approach. As the main concern of AZ’s parents was communication and motor movements, the focus was enforced on restorative and compensatory speech-language therapy and physiotherapy goals. The speech-language therapy focused to:

a) enhance pre-linguistic skills attention and concentration span, visual stimulation,

b) communicative responses to auditory stimuli such as response to name call

c) comprehension of daily communicative vocabulary and simple commands, greetings

d) vocalizations and expressions of basic needs

e) reduce drooling, improve lip closure, and oromotor strength

And supportively, the physiotherapy goals targeted on balance training, positioning (better seating and neck control) to reduce the TA tightness and to facilititate active or dynamic movements.

**Review Assessment**

With evidence of diminished drooling and good balance, a re-evaluation was carried out after 8 months. A slight degree of improvement was evident. The drooling has decreased but it generally depended on the attack of seizures and associated medical issues. The severity of drooling has decreased as it doesn’t drips onto clothing. The lip seal has partially improved with lip strengthening exercises. Attention and concentration span has improved to 6-8 seconds. Visual scanning, especially to glowing objects presented in a contrastive background has improved. Localising by slight head turn is present for name call. Receptive Expressive Emergent Language Scale (REELS) was carried out and a language age of 5-6 months (scattered) was obtained for both receptive and expressive age. A total score of 14 was obtained on administering the Com-DEALL Oro Motor Checklist suggesting slight progress in the oromotor skills, mainly in jaw and tongue movements.

The re-assessment done in physiotherapy using Motor Asessment Scale and Berg Balance Scale reveals a significant improvement in motor functions and balance abilities. TA tightness has reduced and other improvements in trunk balance and control and range of motion are appreciable. Results of review assessment are shown in Table 1 & 2.

Table 1.

*Review assessment result of speech language therapy*

|  |  |  |
| --- | --- | --- |
| S.No | Goals focussed | Review Assessment Result |
| 1 | Drooling | Partially improved- drool doesn’t drips off onto clothing |
| 2 | Lip closure | Tries to do /^m/ for closing the lips when verbal prompts are given |
| 3 | Attention and concentration | Improved to 6-8 secondsVisual scanning has improved  |
| 4 | Response to name call | 50% consistency with unfamiliar voices alsoLocalises by head turningSmiling present |
| 5 | Communication intent | Started looking for the object which express a need to have an object40% consistency |

Table 2.

*Review assessment result of physiotherapy*

|  |  |  |
| --- | --- | --- |
| S.No | Goals focussed | Review Assessment Result |
| 1 | TA tightness | Tightness reducedPost MAS score of grade 1+ |
| 2 | Balance training | Trunk balance and control improvedSitting: Dynamic balance improvedStanding: Standing with minimal support improved.Post BBS score of 48 |
| 3 | Posture Correction | Full range of motion is present.Quadripodal position improved.Kneeling with minimal support present.Initiation of active or dynamic movementsImprovement in heel strike and stance phase in gait |

Comparing pre and post therapeutic results, it is evident that the goals taken up for therapy were significant as there was improvement in all the targeted areas. Pre and post comparison result are shown in Table 3 & 4. Although there was 8 months interval between the assessments, the minimal progress suggests impact of transdisciplinary rehabilitation. The significant improvements made in balance and position provided a facilitatory benefit to the drooling control and enhanced vocalizations. Similarly, the activities targeted to improve the neck control eventually helped in the speech-language therapy during the massaging and strengthening of the lips and cheeks muscles. The speed in progress is suggestively propositional to the age at which rehabilitation is initiated. So the delay in rehabilitation in our case could be a reasonable factor for the slow progression in overall development. These results correspond to the outcome of the systematic intervention strategies of speech-language and physical rehabilitation. Further, extensive control in the limbs and seating exercises is a prognostic indicator for the advances overall communication skills in the child.

Table 3.

*Pre and post therapeutic results in speech language therapy*

|  |  |  |  |
| --- | --- | --- | --- |
| S.No | Goals focussed | Pre therapy | Post therapy |
| 1 | Drooling | Frequently drool drips off chin & onto clothing | Partially improved with regular massaging of cheeks.  |
| 2 | Lip closure | Open mouth posture | Tries to do /^m/ for closing the lips with lip strengthening exercises when verbal prompts are given |
| 3 | Attention and concentration | Attention span was around 3-4 secondsPoor visual scanning  | Improved to 6-8 seconds Visual scanning has improved with visual stimulation activities |
| 4 | Response to name call | 50% consistency with familiar voices No head turn for response to name call | 50% consistency with unfamiliar voices also using modelling techniqueLocalises by head turningSmiling present |
| 5 | Communication intent | Cries to express her needs | Started looking for the object which expresses a need to have an object with 40% consitency using modelling technique |

Table 4.

*Pre and post therapeutic results in physiotherapy*

|  |  |  |  |
| --- | --- | --- | --- |
| S.No | Goals focussed | Pre therapy | Post therapy |
| 1 | TA tightness | MAS score of grade 4 | Tightness reducedMAS score of grade 1+ |
| 2 | Balance training | Poor static and dynamic balance Poor postureBBS score of 23 | Trunk balance and control improvedSitting: Dynamic balance improvedStanding: Standing with minimal support improved.BBS score of 48 |
| 3 | Posture correction | Limited range of motion | Full range of motion is present.Quadripodal position improved.Kneeling with minimal support presentInitiation of active or dynamic movementsImprovement in heel strike and stance phase in gait |

**Conclusion**

This study profiled the condition, post neonatal cerebral palsy due to status epilepticus in speech-language and motor skills. The profiling offers an understanding that the condition can remain unchanged if appropriate and effective management strategies are not being taken at the right time. It provides an insight that a subtle improvement would be more appreciable than a state being unchanged. The article has also highlighted the importance of team management in bringing back the lost functional abilities and quality of life. As a future direction, the use of Augmentative And Alternative Communication (AAC) would be suggested in maintaining the fundamental communication.

**References**

Archana, G. (2008). A Manual from Communicaid: Assessment of Oro Motor Skills in Toddlers. Bangalore: The Com DEALL Trust.

Brazier M. A. B., & Coceani, F. (Eds.). (1976) *Brain dysfunction in infantile febrile convulsions*. New York: Raven Press

Cans, C., McManus, V., Crowley, M., Guillem, P., Platt, M. J., Johnson, A., & Arnaud, C.(2004). Cerebral palsy of post-neonatal origin: characteristics and risk factors. *Paediatric amd Perinatal Epidemiology,* *18,* 214-20.

Davies, S. (Ed.). (2007). *Team around the child: Working together in early childhood education.* Wagga Wagga, New South Wales, Australia: Kurrajong Early Intervention Service.

Eriksson, K. J., & Koivikko, M. J. (1997). Status epilepticus in children: aetiology, treatment, and outcome. *Developmental Medicine & Child Neurology, 39,* 652-658.

Himmelmann, K., Hagberg, G., Beckung, E., & Uvebrant, P. (2006).Gross and fine motor function and accompanying impairments in cerebral palsy. *Developmental Medicine & Child Neurology*, *48,* 417-423.

Johnson, L. J., Gallagher, R. J., La Montagne, M. J., Jordan, J. B., Gallagher, J. J., Hutinger, P. L., et al. (Eds.). (1994). *Meeting early intervention challenges: Issues from birth to three* (2nd ed.). Baltimore: Paul H. Brookes.

Johnston, M. Y., Wood, K. D., & Fiedler, R. (2003) Characteristics of effective and efficient rehabilitation programs. *Archives of Physical Medicine and Rehabilitation, 84,* 410 – 418.

Legriel, S., Azoulay, E., Resche-Rigon, M., Lemiale, V., Mourvillier, B., Kouatchet, A., Troche, G., Wolf, M., Galliot, R., Dessertaine, G., Combaux, D., Jacobs, F., Beuret, P., Megarbane, B., Carli, P., Lambert ,Y., Bruneel, F.,& Bedos J.P. (2010). Functional outcome after convulsive status epilepticus. *Critical care medicine, 38,* 2295-2303.

# Lowenstein, D.H., & Alldredge, B.H. (1998). Status Epilepticus. *New England Journal Of Medicine,* *338,* 970-976.

# Odding, E., Roebroeck, M. E., & Stam, H. J. (2006). The epidemiology of cerebral palsy: Incidence, impairments and risk factors. *Disability and Rehabilitation*, *28,* 183-191.

Paneth, N. (1993). The causes of cerebral palsy. Recent evidence. *Clinical and Investigative Medicine,* *16,* 95-102.

# Raspall-Chaure, M., Chin, R. F., Neville, B. G., & Scott, R. C.(2006). Outcome of paediatric convulsive status epilepticus: a systematic review. *The Lancet. Neurology, 9,* 769-79.

# Sadarangani, M., Seaton, C., Scott, J. A., Ogutu, B., Edwards, T., Prins, A., Gatakaa, H., Idro, R., Berkley, J. A., Peshu, N., Neville, B. G., & Newton, C.R. (2008). Incidence and outcome of convulsive status epilepticus in Kenyan children: a cohort study. *The Lancet. Neurology,7,* 145-150.

# Shevell, M. I., Dagenais, L., & Hall, N. (2009). The relationship of cerebral palsy subtype and functional motor impairment: a poulation based study. *Developmental Medicine & Child Neurology*, *51,* 872-877.

Verity, M., Greenwood, R., & Golding, J. (1998). Long-term intellectual and behavioral outcomes of children with febrile convulsions. *New England Journal Of Medicine,**338,* 1723-1728.