Review Article

www.ijrap.net

AYURVEDIC MANAGEMENT OF DEVELOPMENTAL DISABILITIES IN CASES OF CEREBRAL PALSY: A CRITICAL REVIEW

Arvind Kumar [1]*, Laxmi [2]

[1]PG Scholar, Department of Kaumarabhritya, State Ayurvedic College & Hospital, Lucknow, U.P, India

[2]Assistant Professor, Department of Kaumarabhritya, State Ayurvedic College & Hospital, Lucknow, U.P, India

Received on: 09/05/18 Accepted on: 11/06/18

***Corresponding author**

E-mail: arvindrathoreakki@gmail.com

DOI: 10.7897/2277-4343.094124

ABSTRACT

Cerebral palsy (CP) is a non-progressive, neuromotor disorder of cerebral origin that causes impairment of movement, posture and tone. The conditions or factors which ultimately causes injury to the developing brain is responsible for the disease and can arise during prenatal, natal and postnatal periods. The global incidence of cerebral palsy among children is almost 2/1000 live births. As such there is no straight correlation of CP in Ayurvedic classics, but there are description of many conditions and causative factors resembles the etiopathology for such type of disorders condition described in many chapters in different texts. Skandagraha, Ekangavata, Sarvangavata and Jadtwa are the few conditions in Ayurveda which are seen in the cases of CP, depending on the site and severity of CNS lesion. Although there is no specific treatment for cerebral palsy is yet established but in many cases, through Ayurvedic management tremendous results have been noticed in reducing developmental disability. The present article is the collection of some important medicinal herbs which will be helpful to understand & form an effective treatment protocol for CP in paediatric cases.

Keywords: Cerebral palsy, neuromotor, developmental disabilities etc.

INTRODUCTION

Cerebral palsy (CP) is defined as a non-progressive neuromotor disorder of cerebral origin. It was first described by "William John Little" he defined it as a disorder of motor control due to static lesion of the developing brain. It includes a group of heterogeneous clinical states of variable etiology and severity ranging from minor incapacitation to total handicap it means paralysis of brain. Most of the cases have multiple neurological deficits and variable mental handicap.[1] The prevalence of cerebral palsy among children is almost 2/1000 live births.[2,3,4] There are approximate 25lakhs cerebral palsy affected children in India.[5] The World Health Organization estimates that about 10% of the population have some form of disability.[6] Statistics from a different source indicates that 3.8% of the population has some form of disability in India.[7] Nearly 15-20% of total physical handicapped children suffer from cerebral palsy.[8]

In Ayurveda classics, there is no disease described as such like Cerebral palsy, but many conditions which seems equivalent to such type of disease condition described in different texts. Cerebral palsy in Ayurveda can be considered as Shiro-Marmabhigathaja Bala Vata Vyadhi, which may manifest itself in any of the following main clinical presentations such as Ekanga Roga (spastic monoplegia), Pakshavadha (hemiplegia), Pangu (spastic diplegia), Sarvanga Roga (spastic quadriplegia), Vepathu (choreoathetoid) and ataxia, which are described under Vata Vyadhi in the texts.[8] Skanda vyadhi (A.S.U 3/10),which is described in Balgrah, Ekangavata, Sarvangavata and Jadtwa also having similar symptoms as found in cerebral palsy. In Ayurvedic classics while describing Shiromarmabhighata, there is description of certain Vata vikar such as Chesta-nasha, Gadgada etc. which indicates towards mental impairment.[9]

Contributory factors like inappropriate ritu (ovulation cycle), kshetra (uterus), ambu (amniotic fluid and fetal nutrition) and bija (sperm and ovum)[10], dauhridaavamanana[11] (neglect of urges during dauhrid stage of pregnant women), presence of garbhupghatkar bhaav (substances which can cause defects or death many of fetus)[12], incompatible garbhavriddhikar bhav (normal requisites for growth and development of fetus)[13] and improper garbhiniparicharya (antenatal regimen) may have hazardous effects on the fetus hampering its normal growth and development consequently leading to disease, deformities and even death. In pediatric case Acharya Kashyapa explained disorder of similar presentation known as "Phakka" means unable to walk without support.

Although specific treatment for cerebral palsy is not yet established but in many cases, through Ayurvedic management tremendous results have been noticed in reducing developmental disability. In recent years many researches have been conducted to evaluate the effect of herbal medicine on C.P. The present article is the collection of herbal medicines which have been proved to be effective in Brain development, memory, speech and locomotor disabilities.

The available literature related to cerebral palsy has been collected from different Ayurvedic texts, Modern texts, reputed journals, Internet & retrospective studies done in various Institutions.

HERBS USED IN MANAGEMENT OF CEREBRAL PALSY

Herbs with nootropic action

Romanian psychologist and chemist Dr. Corneliu E. Giurgea, the founding father of nootropic, was the first to attempt descriptive criteria for what qualifies as a nootropic, which includes:

1. Enhancement of memory and learning
2. Improved cognition under stress
3. Protection of brain cells (neuroprotective)
4. Facilitation of cell-to-cell communication
5. Backed by human research demonstrating brain bioactivity
6. Absence of usual pharmacological effects of psychotropic drugs

Brahmi (*Bacopa monnieri*)
To assess the cognitive functioning effect of extract of *Bacopa monnieri*, a double blind placebo controlled independent group design clinical study was performed on 107 healthy participants for 90 days. Sixty-two participants completed the study with 80 % treatment compliance. Neuropsychological testing using the cognitive drug research cognitive assessment system was conducted at baseline and after 90 days of treatment with a special extract of *Bacopa monnieri* (2 x 150 mg Keen Mind) or placebo. The *Bacopa monnieri* product significantly improved performance on the working memory factor, more specifically spatial working memory accuracy.[14]

Mandukaparni (*Centella asiatica*)
A double blind trial of *Centella asiatica* conducted on 30 children. The children were given one tablet (0.5 gm.) a day for 6 months. Placebo tablets were made of starch and suitably coloured to match the drug. The drug and placebo tablets were allocated to children randomly. Neither the person who administered the drug nor the assessor had access as to who was getting the drug or placebo and worked independently of each other. The result indicated that there was a significant increase in the general mental ability of mentally retarded children after 3 months and 6 months of drug administration. In the behavioural area, significant improvement was found in the overall general adjustment and attention & concentration after 6 months.[15]

Ashwagandha (*Withania somnifera* L.)
A double blind randomized placebo-controlled adjunctive study was conducted to assess the cognitive enhancing effects of an extract of *Withania somnifera* (500 mg/day) in 60 DSM-IV bipolar disorder patients as a procognitive agent added adjunctively to the medications being used as maintenance treatment for bipolar disorder. 53 patients completed the study (WSE, n = 24; placebo, n = 29), assessment done after 8 weeks and the 2 groups were matched in terms of demographic, illness, and treatment characteristics. Compared to placebo, WSE provided significant benefits for 3 cognitive tasks: digit span backward (P = .035), Flanker neutral response time (P = .033), and the social cognition response rating of the Penn Emotional Acuity Test (P = .045). WSE appears to improve auditory-verbal working memory (digit span backward), a measure of reaction time, and a measure of social cognition in bipolar disorder.[16]

Vidarikanda (*Pueraria tuberosa* DC)
A study to evaluate the nootropic effect of alcoholic (ALE; 50, 75, 100 mg/kg) and aqueous (AQE; 100, 200, 400 mg/kg) extracts of *P. tuberosa* was conducted by using EPM, scopolamine-induced amnesia (SIA), diazepam-induced amnesia (DIA), clonidine-induced (NA-mediated) hypothermia (CIH), lithium-induced (5-HT mediated) head twitches (LIH) and haloperidol-induced (DA- mediated) catalepsy (HIC) models. Piracetam was used as the standard drug. The results indicate that ALE and AQE of tuber of P. tuberose having significant nootropic effect in mice and rats by interacting with cholinergic, GABAnergic, adrenergic and serotonergic systems. Phytoconstituents like flavonoids have been reported for their nootropic effect and these are present in both ALE and AQE extracts of tubers of *P. tuberosa* (Roxb) and these active principles may be responsible for nootropic activity.[17]

Shankhpushpi (*Evolvulus alsinoides*)
An experimental study with ethanol extract of EA and its ethyl acetate and aqueous fractions were conducted to evaluate their memory enhancing properties. Two doses (100 and 200 mg/kg p.o.) of the ethanol extract and ethyl acetate and aqueous fractions were administered in separate groups of animals. Both doses of all the extracts of EA significantly improved learning and memory in rats. Furthermore, these doses significantly reversed the amnesia induced by scopolamine (0.3 mg/kg i.p.). Nootropic activity was compared using Piracetam as the standard.[18]

Herbs with Anti-spastic action

Anti-spastics, also known as muscles relaxers, are prescribed to relax contracted, overactive, or stiff muscles. Anti-spastic medications are often the first treatment choice for reducing tremors or controlling widespread spasticity, as they are easy to use and non-invasive.

Vidarikanda (*Pueraria tuberose* DC)
In a clinical study Methocarbamol and dantrolene sodium were used as positive controls. In addition, a low dose (50 mg/kg i.p.) of each test compound had no muscle relaxant activity. However, a high dose (100 mg/kg, i.p.) of equol, the reductive metabolite of daidzin, daidzein and genistein, had significant muscle relaxant activity at 15, 30 and 45 min after administration, and its potency been moderate. Potent muscle relaxant activity was observed in vivo with p-ethylphenol (100 mg/kg, i.p.), the degraded metabolite of genistein.[19]

Bhringaraj (*Eclipta alba* (L.) Hassk.)
In an experimental study standardized and phytochemically evaluated aqueous and hydro alcoholic extracts of the plant *Eclipta alba* were assessed for sedative, muscle-relaxant, anxiolytic, nootropic and anti-stress activities. The aqueous and hydro alcoholic extracts were administered in a dose of 150 and 300 mg/kg, p.o., while the hydrolyzed fraction was administered in a dose of 30 mg/kg, p.o.. The results point towards the potential neuropharmacological activity of the plant *Eclipta alba* as a nootropic and also having the property of attenuating stress induced alterations.[20]

Herbs with Neuro-regenerative action

Neuroregeneration refers to the regrowth or repair of nervous tissues, cells or cell products. Such mechanisms may include generation of new neurons, glia, axons, myelin, or synapses.

Mandukaparni (*Centella asiatica* Linn.)
In an experimental study *Centella asiatica* ethanolic extract (100 microg mL-1) elicits a marked increase in neurite outgrowth in human SH-SY5Y cells in the presence of nerve growth factor. But a water extract of Centella was found ineffective at similar dose. Sub-fractions of *Centella* ethanolic extract, obtained through silica-gel chromatography, were tested (100 microg mL-1) for neurite elongation in the presence of NGF. Greatest activity was found with a non-polar fraction (GKF4). Relatively polar

fractions (GKF10 to GKF13) also showed activity, albeit less than GKF4. Thus, Centella contains more than one active component.

Male Sprague-Dawley rats given Centella ethanolic extract in their drinking water (300-330 mg kg-1 daily) demonstrated more rapid functional recovery and increased axonal regeneration (larger calibre axons and greater numbers of myelinated axons) compared with controls, indicating that the axons grew at a faster rate. Taken together, our findings indicate that components in Centella ethanolic extract may be useful for accelerating repair of damaged neurons[21].

Ashwagandha (*Withania somnifera* Dunal)
In an experimental study this was found that six of the 18 compounds isolated from the methanol extract enhanced neurite outgrowth in human neuroblastoma SH-SY5Y cells. Double immunostaining was performed in rat cortical neurons using antibodies to phosphorylated NF-H as an axonal marker, and to MAP2 as a dendritic marker. In withanolide A-treated cells, the length of NF-H-positive processes was significantly increased compared with vehicle-treated cells, whereas, the length of MAP2-positive processes was increased by withanosides IV and VI. These results suggest that axons are predominantly extended by withanolide A and dendrites by withanosides IV and VI.[22]

Herbs with neuroprotective action

Neuroprotection refers to the relative preservation of neuronal structure and /or function. In the case of an ongoing insult (a neurodegenerative insult) the relative preservation of neuronal integrity implies a reduction in the rate of neuronal loss over time, which can be expressed as a differential equation. It is a widely explored treatment option for many central nervous system (CNS) disorders including neurodegenerative diseases, stroke, traumatic brain injury, spinal cord injury, and acute management of neurotoxin consumption (i.e. methamphetamine overdoses). Neuroprotection aims to prevent or slow disease progression and secondary injuries by halting or at least slowing the loss of neurons.

Mandukaparni (*Centella asiatica* Linn.)
A study was conducted to show Neuroprotective effect of aqueous extract of *Centella asiatica* in scopolamine induced cognitive impairment in mice. The improvement of cognitive impairment with *Centella asiatica* was compared against standard drug (Donepezil 50 µg/kg). Swiss albino mice (20–25 g) of either sex were randomly divided into 5 groups of 6 animals each. The trial completed in 14 days, the Neuroprotective effect was assessed by elevated plus maze (EPM). In elevated plus maze (EPM) models, it implies that *Centella asiatica* (CA) 300 mg/kg (group IV) significantly ($p<0.001$) decreases the retention transfer latency. This study demonstrates statistically significant Neuroprotective activity of *Centella asiatica*.[23]

Shatavari (*Asparagus racemosus* Willd)
To assess the neuroprotective effects of the root extract of *Asparagus racemosus* study conducted in both animal models and clinical patients. Swiss albino mice were subjected to 3 hrs unpredictable swim stress daily up to 30days to develop region specific neurodegeneration. Separate group of animals were given 100mg/kg BW dose of *A. racemosus* root extract daily up to 30 days, orally. Histological and behavioural studies were carried out. For clinical study, registered patients both male and female of approximately similar age groups, were subjected to memory retention and recall test. After assessment result proved neuroprotective efficacy of the root extract of A. racemosus.[24]

Herbs with anticonvulsant action

Anticonvulsants (antiepileptics or AEDs) helps to normalise the way nerve impulses travel along the nerve cells which helps prevent or treat seizures

Shankhapushpi (*Convolvulus* microphyllus Sieb)
In this experimental study methanolic extracts of whole plant, stem and leaf callus were tested for anticonvulsant activity against standard drug Phenytoin using maximal electroshock model on mice. It was observed that the animal treated with methanolic extracts of stem callus, leaf callus and whole plant (200 mg/kg, oral) showed significant protection against tonic convulsions induced by trans corneal electroshock. Anticonvulsant activity of methanolic extract of stem callus was comparable to the standard drug phenytoin.[25]

Jatamansi (*Nardostachys jatamansi* DC)
Ethanol extract of the roots of *Nardostachys jatamansi* DC. (Valerianaceae) was studied to assess its anticonvulsant activity and neurotoxicity, alone and in combination with phenytoin in rats. The results demonstrated a significant increase in the seizure threshold by *Nardostachys jatamansi* root extract against maximal electroshock seizure (MES) model as indicated by a decrease in the extension/flexion (E/F) ratio. However, the extract was ineffective against pentylenetetrazole (PTZ)-induced seizures. *Nardostachys jatamansi* root extract also showed minimal neurotoxicity against rotarod test at doses that increased the seizure threshold. Further, pre-treatment of rats with phenytoin at a dose of 12.5, 25, 50 and 75 mg/kg in combination with 50mg/kg of *Nardostachys jatamansi* root extract resulted in a significant increase in the protective index (PI) of phenytoin from 3.63 to 13.18. The dose response studies of phenytoin alone and in combination with *Nardostachys jatamansi* extract on the serum levels of phenytoin clearly demonstrated the synergistic action of both the drugs.[26]

Yasthimadhu (*Glycyrrhiza glabra* Linn.)
In this study anticonvulsant activity of ethanolic extract of roots and rhizomes of *Glycyrrhiza glabra* (10, 30, 100 and 500 mg/kg, i.p.) in mice was assessed using maximum electroshock seizure (MES) test and pentylenetetrazol (PTZ) using albino mice. The lithium-pilocarpine model of status epilepticus was also used to assess the anticonvulsant activity in rats.The ethanolic extract of *G. glabra* did not reduce the duration of tonic hind leg extension in the MES test even in the dose of 500 mg/kg. However, the extract significantly and dose-dependently delayed the onset of clonic convulsions induced by pentylenetetrazol. The dose of 100 mg/kg afforded protection to all animals. The extract also protected rats against seizures induced by lithium-pilocarpine. The ethanolic extract of *G. glabra* inhibits PTZ and lithium-pilocarpine-induced convulsions but not MES-induced convulsions.[27]

CONCLUSION

Cerebral palsy (CP) is a chronic, non-progressive, neuromotor disorder of cerebral origin that causes impairment of movement, posture and tone. Direct correlation of CP with any disease in Ayurveda is not possible because it is a multifactorial disease. Skandagraha, Ekangavata, Sarvangavata, Phakka and Jadtwa are the few conditions in ayurveda which are seen in the cases of CP, depending on the site and severity of CNS lesion. Although there is no specific treatment for cerebral palsy is yet established but in many cases, through Ayurvedic management tremendous results have been noticed in reducing developmental disability and other CP related sign and symptoms. Various important herbs with different pharmacological activity mentioned in this article have

tremendous result in management of CP affected children. In this way Ayurveda can provide alternative, economical and more effective treatment option for children affected with CP. However, more scientific researches are required for betterment of Ayurvedic therapy in CP.

REFERENCES

1. Ghai O.P. Paul V.K. Bagga A.; editors. Ghai Essential Pediatrics ; 7th Edition, CBS Publishers & Distributors Pvt. Ltd. New Delhi 2009. p. 559
2. Parthasarathy A.,Menon PSN, Gupta P., Nair MKC, Agrawal R., Sukumaran TU; editors , IAP Textbook of Pediatrics 5th edition, IAP National Publication House ;2013. p. 390
3. Bax M, Goldstein M, Rosenbaum P, Leviton A, Paneth N, Dan B, et al. Proposed definition and classification of cerebral palsy, April 2005. Dev Med Child Neurol 2005; 47:571-6.
4. Odding E, Roebroeck ME, Stam HJ. The epidemiology of cerebral palsy: Incidence, impairments and risk factors. Disabil Rehabil 2006; 28:183-91.
5. Nair MK, Pejaver RK. Child Development 2000 and Beyond. Bangalore: Prism Books Pvt. Ltd.; 2000. pp. 9.
6. Anjaiah B. Clinical Pediatrics. 3 rd ed. Hyderabad: Paras Medical Publisher; 2006. pp. 230. Boyle CA, Yeargin-Allsopp M, Doernberg NS, Holmgreen P, Murphy CC, Schendel DE. Prevalence of selected developmental disabilities in children 3-10 years of age: The Metropolitan Atlanta Developmental Disabilities Surveillance Program, 1991. MMWR CDC Surveill Summ 1996; 45: 1-14.
7. Nair MK, George B, Padmamohan J, Sunitha RM, Resmi VR, Prasanna GL, et al. Developmental delay and disability among under - 5 children in a rural ICDS block. Indian Pediatr 2009;46 Suppl: s75-8
8. Shailaja U, Jain CM. Ayurvedic approach towards cerebral palsy. AYU 2009; 30: 158-63.
9. Agnivesha, Charaka, Dridhabala, Charaka Samhita, translated by Sharma RK and Bhagwan Dash, Vol. 2, Reprint. ed. Chaukhambha Sanskrit Series Office, Varanasi; 2012. Trimarmeeyam Siddhim Adhyaya 9/6, Siddhi Sthana. p. 329.
10. Trikamji Y.,Acharya Sushruta, Sushruta Samhita,. Chaukhamba sanskrit sansthana; 2009. Sharira Sthan 2/33. p. 248
11. Trikamji Y. Varanasi: Ayurved Dipika, Chaukhamba prakasan; 2009. Agnivesha, Charak, Dridhabala, Chakrapani, Charak Samhita, Sharira sthan 4/16; p.320
12. Agnivesha, Charaka, Dridhabala, Chakrapani, Charaka Samhita ,. Varanasi: Chaukhamba prakashana; 2007. Mahati Garbhava kranti Adhyaya 4/18 Sharira sthana, p.320
13. Agnivesha, Charaka, Dridhabala, Chakrapani, Charaka Samhita , Varanasi: Chaukhamba prakashana; 2007. Mahati Garbhava kranti Adhyaya 4/27 Sharira sthana, p.321
14. Con Stough et.al. Examining the nootropic effects of a special extracts of *Bacopa monniera* Linn. on human cognitive functioning; 90 days double blind placebo controlled randomized trial. Phytother Research 2008; 22(12):1629-34.PMid: 18683852
15. Late Rao Appa et.al. The effect of *Centella asiatica* on the general mental ability of mentally retarded children, Indian J. Psychiat 1977; 19(4)54-59
16. Chengappa KN, Bowie CR, Schlicht PJ, Fleet D, Brar JS, Jindal R. Randomized placebo- controlled adjunctive study of an extract of *Withania somnifera* for cognitive dysfunction in bipolar disorder. J Clin Psychiatry. 2013 Nov; 74(11):1076-83. doi: 10.4088/JCP.13m08413. PMID: 24330893
17. Rao NV et.al. Nootropic activity of tuber extract of Pueraria tuberose (Roxb)., Indian Journal of Experimental Biology 2008; 46(8); 591-8Nahata A, et.al. Effect of *Evolvulus alsinoides* Linn. on learning behaviour and memory enhancement activity in rodents , Phytotherapy research 2010; 24(4) : 486-93
18. Takaaki Yasuda et.al. Antipyretic, Analgesic and Muscle relaxant activities of Pueraria Isoflavonoids and their metabolites from Pueraria lobata O
19. hwi- a traditional Chinese Drug; Biol. Pharm. Bull. 2005; 28(7) ; 1224-8 PMid: 15997103
20. Thakur VD et.al. Neuro pharmacological profile of *Eclipta alba* (L.) Hassk. (Linn.) Hassk Journal of Ethno pharmacology 2005; 102 (1): 23-31
21. Soumyanath A, et.al. *Centella asiatica* accelerates nerve regeneration upon oral administration and contains multiple active fractions increasing neurite elongation in vitro, J Pharm Pharmacol 2005; 57(9): 1221-9
22. Kuboyama T et.al. Axon or dendrite predominant outgrowth induced by constituents from Ashwagandha. Neuroreport 2002;13(14); 1715-20, PMid;12395110
23. Sunanda BPV , Latha K, Rammohan B , Uma Maheswari MS and Surapaneni Krishna Mohan, Evaluation of the Neuroprotective Effects of *Centella asiatica* Against Scopolamine Induced Cognitive Impairment in Mice, Indian Journal of Pharmaceutical Education and Research | Vol 48 | Issue 4 | Oct–Dec, 2014
24. Saxena Garima , Singh Mamta et.al. Neuroprotective effects of *Asparagus racemosus* Linn. root extract : an experimental and clinical study . Journal of herbal Medicine and Toxicology 2010; 4(1): 69-76
25. Ahmad S, Zafar RU, et.al. Anticonvulsant potential of callus cultures of *Convolvulus microphyllus* Sieb. OPEM 2007; 1: 46-50
26. Rao Vidya S, Rao Anjali, et.al. Anticonvulsant and neurotoxicity profile of *Nardostachys jatamansi* in rats . Journal of Ethno pharmacology 2005; 102 (3): 351-356
27. Ambawade SD, Kasture VS et.al. Anticonvulsant activity of roots and rhizomes of *Glycyrrhiza glabra* . Ind. J. Pharmacol 2002; 34(4): 251-255

Cite this article as:

Arvind Kumar & Laxmi. Ayurvedic management of developmental disabilities in cases of cerebral palsy: A critical review. Int. J. Res. Ayurveda Pharm. 2018;9(4):115-118 http://dx.doi.org/10.7897/2277-4343.094124

Source of support: Nil, Conflict of interest: None Declared