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Cerebral palsy: An Ayurvedic literature review

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Ayurveda is a science which aims to create harmony within the human body, to maintain health and to free the patient from diseases. Cerebral palsy(CP) is a neurodevelopmental disorder. Such disorder may be caused due to dushta shonita (vitiated ovum), dushta shukra (vitiated semen), dushta ashaya (diseased uterus), Dauhrida Avamananana (if the urges of pregnant women if not fulfilled), improper Garbhini Paricharya (indulgence in unwholesome diet or activities during pregnancy), indulging in garbhopaghatakara bhavas etc. These factors cause improper growth and development of the child leading to physical and mental disabilities such as cerebral palsy, or even death.

Cerebral palsy was described first by Dr William Little in the 1840s. The prevalence of CP in India is 2.9/1000 births and this corresponds with the global prevalence [1]. CP terminology involves a group of disorders related to movement and posture. This causes activity limitation, and are attributed to non-progressive changes in the developing brain. In CP, the motor disorders are accompanied by disturbances of sensation, cognition, communication, perception, behaviour, or seizure disorders[2]

Although the brain injury in CP is non-progressive, the co-morbidities and the functional limitations change over time, affecting the functioning and quality of life. The management of a child with CP involves a multidisciplinary team to address medical, social, psychological, educational, and therapeutic goals. The management should be directed at stimulating the child's development with the aim to obtain maximal independence in activities of daily living.[3]

There is no direct reference to cerebral palsy in ayurvedic textbooks. Scientific articles published till now have explained the aetiology, clinical manifestations, and management of CP from the ayurvedic point of view. A detailed explanation of nidana, samprapti and avasthika chikitsa is lacking.

Understanding cerebral palsy through *Ayurveda*:

Etiology:

Because of advancements in prenatal, natal, and postnatal pediatric care, the incidence, prevalence, and common causes of cerebral palsy (CP) have changed throughout time. Prenatal rubella, intranatal hypoxia, and postnatal hyperbilirubinemia are still some of the issues in underdeveloped nations, whereas the industrialized world is mostly dealing with morbidity associated with prematurity and extremely low birth weight. The causes of cerebral palsy are many and complex. Usually, brain damage sustained before or during birth is the cause. This is the primary contributing element[4,5].

CP is comparable to Shiromarma abhighataja vata vyadhi (neurological conditions brought on by brain trauma) when taking into account the various forms of CP and their corresponding clinical characteristics. Wherein, the five forms of Vata, which are one of the body humors in charge of regular bodily movements, are predominantly vitiated with pranavayu. As the seat of Pranavayu is "Shiras" (Head) it is the first vayu to become vitiated, followed by the other four vayus, namely samana, udana, vyana, and apaana.

Any of the following are possible ways that CP could manifest. Loss of movement in one half of the body (Pakshaghata), incapacity to walk (Pangu), loss of movement in both the upper and lower limbs (Sarvangaroga) or Ardita[6].

In the table below, the causes which injure the *mastishka*(brain) during the antenatal, natal and postnatal periods have been explained in detail (table 1.1)

Garbha Poorva Nidana: These are the causal elements the parents exhibit before the garbha (embryo) forms.

Tulya Gotra Vivaha: CP is caused in part by genetic predisposition. Consequently, the same faulty gene will be passed on to the progeny when members of the same gotra procreate, resulting in CP[7]

Anomalous sperm or ovum, or Beeja Dushti: The shukra (sperm) and artava (ovum) combine to produce the embryo. A specific organ will be malformed if the portion of the Beeja (ovum or sperm) that is responsible for its production is vitiated. This means that if the Bheeja bhagha, or portion of a Bheeja, that is in charge of creating Mastulunga, becomes vitiated, then it will lead to defective *Mastulunga* (anomalies in the brain) in the fetus causing CP [8]

Abnormality or vitiation of the uterus, or Ashaya Dushti: A healthy and functional uterus is necessary for a successful conception and a normal growth of the fetus. A child may have deformities as a result of vitiation or Dushti of Garbhashaya. Abnormalities in the fetus can result from inappropriate development caused by structural malformations in the reproductive organs.[9]

Dushita Kala: Three categories apply to Kala: (i) parent's age; (ii) conception date; and (iii) Ritukala (ovulation period). (i) Parents' age: To conceive, a man should be between the ages of 21 and 25 and a woman should be 16 years old [10.]When a lady is younger than 16 years old during the Garbhadharana (conception period), the fetus may not receive adequate nutrition & might experience growth retardation during pregnancy. The likelihood of genetic abnormalities

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increases if the mother is older at the time of pregnancy. Additionally, the mother's illnesses could be passed on to the unborn child.[11] Therefore, a mother's age is a significant influence in a fetus's natural growth and development.
(ii) Conception date: In general, Visarga Kala is seen to be stronger than Adana Kala because it promotes strength. If conception takes place during Adana Kala, the child may have Avara Shakti, or low immunity, for the rest of his life, which could result in episodes of encephalitis or meningitis and cause cerebral palsy.Twelve
(iii) Ritukala: an embryo created from an ovum that is not fully developed for 14 days may show signs of weakness. (i) as well as have developmental impairments. The roles of Atma Karma are as follows: Rajas, Tamas (the two doshas of Mana), and Atmakarma (past acts) govern Akriti (the basic constitution of the body) and Buddhi (intellectual capacities). Atmakarma Dushti can be regarded as the aetiology of cerebral palsy in cases where a kid is born with it, notwithstanding the positive attributes of Shukra, Shonita, and Ashaya. For this reason, the fetus may have a congenital malformation due to Atma Karma Dushti.[12,13]

Prenatal causes: Garbhopaghatakara bhavas (things that damage the fetus)
Preterm delivery and fetal abnormalities can result from the mother's specific harmful diet and activities throughout pregnancy. These diets involve overindulging in guru (strong), katu (fragrant), usna (warm), tikshna (sharp), ahara (food), and madakari dravya (drugs)[14].
Pregnancy-harming behaviors include excessive walking (adwa gamana), physical activity (daruna cheshta), riding over difficult terrain (yana), and other non-elderly advice-following activities are among the activities that are harmful to the fetus.

Natal causes:
"Bearing down when there is no labor pain" (Akala Pravahana Janya Vyadhi): When a pregnant woman gives birth without experiencing contractions, the fetus may develop vikriti, pangu (diplegia), or mukata (dumbness).[15,16]
Diseases known as Prasavakalina vyadhis (diseases resulting from incorrect delivery) include obstructed labour; forceps delivery; and birth trauma to the neonate. Vatavyadhi (disorders of vata) is caused by trauma to the mastishkagata majja or brain. They have symptoms and indicators that are comparable to cerebral palsy.
Head injuries result in ardita (hemiplegia with facial palsy), chakshuvibhrama (ocular illnesses), moha (state of confusion), cheshtanasha (loss of body functions), muka (dumbness), gadgada (voice hoarseness), lalasrava (dribbling of saliva), and svarahani (aphonia).[17]
The pranavaha srotas (~ respiratory system) becomes vitiated if there is birth asphyxia, which further impairs the function of the sense organs, or jnanendriyas, and the action organs, or karmendriyas. Therefore, in these children, there will be refractive errors, or impairment in the working of the chakshurindriya (eyes), and hearing impairment, or impairment in the functioning of the karnedriya (ear). These kids do not reach motor milestones such as head holding, sitting, standing, and walking. i.e., karmendriya (the action organs) are observed to be impaired. These indications and manifestations are all comparable to those of cerebral palsy.

Postnatal causes-Reasons after birth:
Rakta kshaya, or the reduced blood element in the body: Many causative factors are explained for *vata vyadhi (disorders of vata). Rakta kshaya(decreased body element - blood)* is one of them.[18]intraventricular haemorrhage is commonly seen in early preterm babies. This can be considered as rakta dhatu kshaya. These children, later suffer from cerebral palsy.
Marma abhighata(trauma to vital points)*: Marmabhighata* is mentioned as a cause for *Vata vyadhishiras* [19]Head is a *marma(vital point)*So trauma to this area produces the signs and symptoms which are similar to cerebral palsy.
Graha (diseases occurring due to unidentified factors such as microorganisms): *skangdagraha*(one of the nine types of graha) has features similar to hemiplegic CP.

1.1 Causes:

Sl no		FACTORS	EXPLANATION	DISEASES CAUSED
1.	*Garbha poorva nidana*	*a. Tulya Gotra Vivaha* *b. Beeja Dushti* c. *Ashaya Dushti*	a.Mother and father of the child belong to the same gotra. b. **A**bnormality of the sperm or ovum c. vitiation of the uterus	Hereditary diseases Fetal anomalies
2.	Antenatal causes	*Garbhopaghatakara bhavas* (factors that harm fetus)	Diet- *Guru,katu,usna,tikshna ahara,madakari dravya ati sevana*	Fetal anomalies Pre term birth
			Regimen – *ati adwa gamana, daruna cheshta, yana*	
3.	Natal causes	*Akala pravahana janya vyadhi*	Pregnant lady when bears down in the absence of contractions	*Pangu* *Mukata*
		Prasavakalina vyadhis	Due to obstructed labor, forceps delivery, the newborn baby's head may	*Ardita* *Chakshuvibhrama*

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			get injured during delivery	*Moha* *Cheshtanasha* *Muka(aphasia)* *Gadgada* *Lalasrava* Svarahani
		Pranavaha srotas dushti(due to birth asphyxia)	Hampers the functioning of both *jnanendriyas and karmendriyas*	*Chakshrendriya vibhrama* *Karnendriya vibhrama* *Karmendriya vibhrama*
4.	Post natal causes	*a.apaghata*	*Shiromarmabhighata*(injury caused to the *shiro marma* (brain) by various infections like meningitis, meningoencephalitis, uncontrolled neonatal jaundice	*Vata vyadhi(ardita, pakshaghata, sarvanga roga)*
		b.Rakta kshaya	*Dhatu kshaya* leads to *vatavyadhi.* In early preterm babies, intraventricular haemorrhage is common.	*Vata vyadhi*
		c.Graha	*Skandagraha* has features similar to hemiplegic CP.	*skandagraha*

Pathogenesis: Due to the causative factors in the antenatal, natal, and post-natal period the *vata* predominant *tridoshas (* 3 body humors*)* gets vitiated in the *mastishka gata majja*. The *tridoshas* also vitiate the *pranavaha srotas(respiratory system),* afflicting the *karmendriya and jnanendriyas*. Due to this the child cannot achieve the gross motor and fine motor mile stones, leading to CP.
In spastic CP, there is association of ama with vata dosha *(the energy of lubrication).*This causes *sthambha(stiffness) and gaurava(heaviness*)in the extremities and reduces the motor functions.

Nidana(antenatal, natal,post natal causes)

⬇

Tridoshas vitiated(maximum vitiation of vayu)

⬇

Sthana samsraya in *mastishka gata majja*. Vitiation of *rakta, mamsa* and *majja dhatu,snayu and kandara.*

⬇

Jnyanendriya, karmendriya karya kshaya (impairment of sensory and motor functions)

⬇

Cerebral Palsy (*Phakka,ekangavata, ardita, pakshaghata, sarvanga vata*)

Signs and symptoms:

Sl no	Diseases	Clinical features	Type of Cerebral Palsy
1	*Phakka roga*	Child is unable to walk even after one year of age.	Spastic Cerebral diplegia
2	*Ekanga roga*	Loss of motor function in one limb	Spastic Cerebral monoplegia
3	*Sarvanga roga*	Loss of motor function in all the 4 limbs	Spastic Cerebral quadriplegia
4	*Pakshaghata*	Loss of motor function in one half of the body either right or left side	Spastic Cerebral hemiplegia
5	*Pangu*	Loss of motor function in both lower limbs	Spastic Cerebral diplegia
6	*Ardita*	loss of function in one side of face and one half of the body	Spastic Cerebral hemiplegia
7	*akshepaka*	Vitiated vata affects all dhamani(vessels) of body leading to involuntary movements of body	Athetoid Cerebral palsy Ataxic cerebral palsy

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Depending on the motor abnormalities, cerebral palsy can be correlated to various diseases like *phakka vyadhi* (unable to walk even after attaining a year),*vata vyadhis* (disorders of vata) like- *ekanga roga* (monoplegia), *sarvanga roga* (quadriplegia), *pakshaghata* (hemiplegia), *pangu(*diplegia) *kubja*(humped back) *etc.*
Along with motor deficiencies CP patients also present with sensory impairment, hearing deficits, refractive errors, mental retardation, speech impairment,subnormal IQ, hyperactivity etc. The abnormalities such as mental retardation, subnormal IQ, impairment of all the sensory organs, difficulty in deglutition and spitting can be attributed to vitiated pranavayu.
Speech impairment is due to vitiated udana vayu. CP patients also suffer from enuresis and encopresis. This can be attributed to vitiated vyana vayu, hyperactivity are due to vitiated manovaha srotas.
Phakka vyadhi: the child is not able to walk after 1 year of age. In cerebral palsy non-attainment of the motor milestones like walking is seen[20]
Ekanga roga(loss of function in one side of the body): loss of motor functions in one half of the body, either right side or left side, pain in one half of the body, loss of speech. These signs are also seen in the spastic hemiplegic type of CP.
Ekanga vata(loss of function in one limb): The *prakupita vata* afflicts one part of the body /one limb and causes loss of motor functions of that part. These signs are similar to the spastic monoplegic type of CP.
Sarvanga roga(loss of function in the whole body): signs such as loss of motor functions in the whole body, pain, and loss of speech are seen[21]. These signs are similar to the signs seen in the quadriplegic type of CP
Ardita (loss of function in one side of the face and one half of the body): the aggravated *vayu(energy of movement)* afflicts one half of the body, this causes loss of motor functions in one half of the body, deviates the mouth, nose, eyebrow, forehead, eye and jaw. Blinking of the eyes is not possible[22]. These signs are similar to the spastic hemiplegic type of cp.
Akshepaka: In this disease, vitiated vata affects all dhamani of the body leading to involuntary movements of the body. In Athetoid CP there are involuntary movements and in Ataxic CP there are tremors which occur on voluntary movements. In both conditions, there are jerky movements of the body which can be compared to Akshepaka.

Treatment:
Till date, no oral medication is available to treat motor dysfunction in CP. The management involves a multidisciplinary team to address medical, social, psychological, and educational therapeutic goals. Conservative treatments include physiotherapy (PT), occupational therapy (OT), orthoses, and oral medications. Intramuscular chemodenervation with botulinum neurotoxin (BoNT) and the infrequently utilized neurolytic agents (alcohol, phenol) are invasive treatments that may be combined with conservative or surgical techniques, namely orthopedic surgery, pump-infused intrathecal baclofen (ITB) administration and selective dorsal rhizotomy [23]
Clinical trials have been conducted using various herbal formulations and panchakarma procedures and they are effective in improving motor functions and reducing spasticity [24]
There are 5 types of cerebral palsy. Spastic, ataxic,choreoathetoid, hypotonic and mixed. In spastic CP, there is an association of ama with vata dosha. Whereas in the other 4 types of CP, the vata predominant symptoms are seen.
Hence in spastic CP, the first line of treatment is to treat ama [25] Both external treatments and oral medicine which alleviate *ama dosha* is advised. Drugs which are of *Tikshna guna* and *usna veerya* have to be used for external treatment and as oral medicines.
Oral medicines such as *hingwastaka choorna, vyoshadi churna* which are *agni deepaka* are helpful. The external procedure which is *ruksha and ama hara* like *udwarthana* is effective. *Udwarthana* with *kolakulathyadi choorna is effective in spastic CP*. In clinical practice, *Sarvangadhara* using *dhanyamla* is also found to be effective in spastic CP.
Once the *ama dosha* is treated and spasticity reduces, the next line of management is to alleviate *vata dosha.* Both internal and external administration of *Sneha*(fat) is the first line of management of kevala vata vyadhi.
For oral administration drugs like *kalyanaghritam, mahakalyanaka ghritam* are effective.
The next line of management is the external administration of *Sneha.* Application of Sneha in the form of *abhyanga (*oil massage to the whole body),*sarvangadhara*(pouring medicated oil over the whole body) is found to be effective in CP.[25,26]Abhyanga and sarvangadhara are done using oils such as *bala taila, bala ashwagandhadi taila, sahacharadi taila*. These oils are *vatahara,* and are effective in vatavyadhi. *Snehana and Brihmana chikitsa* can be achieved using procedures such as *sastika lepam, sastika pinda Sweda.*
The next treatment is *basti*. *Pakwashaya* (large intestine) is the seat of *vata*. *Basti* helps to expel the vitiated *doshas* and normalize the vitiated *vata*. *Vatahara* formulations such as *bala thaila, sahacharadi thaila, dhanwanthara thaila can be used.*

General vatavyadhi chikitsa
While explaining the general line of management of vata vyadhi, Acharya sushruta has advised additional procedures like shirobasti, shiro abhyanga (head massage using vatahara oil), snaihika nasya(instilling vatahara oil in the nose)[27] Sukoshna parisheka, samvahana(oil massage). Shiro basti is difficult to administer in CP children. Instead of this, shiropichu is advised and it is found to be effective.

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Diet :mamsa rasa(meat soup), kshira(milk),mamsa(meat), sneha dravya(fats),and any other vatahara food added with Sneha is said to be beneficial.Also, food which has the property snigdha(unctuous), lavana yukta(food added with salt), amla phala(fruits which are sour in taste) have to be used.
Thick blankets made of silk, wool and cotton are very helpful

Sarvanga vata :
In Sarvanga vata, acharya sushruta has advised raktamokshana along with the above procedures. In children, we can advise jalauka (leech) application to expel the vitiated rakta dhatu[28]

Ekanga vata
Ekanga vata should be treated by shringa chikitsa(blood letting).[29]

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