International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 4, 2025
https://www.theaspd.com/ijes.php

Understanding The Pathophysiology Of Cerebral Palsy In Ayurveda- Justified Through Clinical Case Series

Dr. Azizahmed I. Arbar[1], Dr. Mahesh Kamate[2], Dr. Basavaraj Tubaki[3], Dr. Puja Pathak[4] , Dr. Rasulabi Arbar[5]
[1]Professor, KAHER, Shri BMK Ayurveda Mahavidyalaya, Shahapur, Belagavi, azizarbar@gmail.Com,
[2]Professor, Department Of Pediatrics, KAHER, J.N. Medical College, Belagavi, drmaheshkamate@gmail.com,
[3]Profesor, Department Of Kayachikitsa, KAHER, Shri BMK Ayurveda Mahavidyalaya, Shahapur, Belagavi, basavarajtubaki.kaher@kleayurworld.edu.in
[4]Assistant Professor, Department Of Kaumarabhritya, Shri Ramchandra Vaidya Ayurvedic Medical College, Lucknow.dr.pujapathak19@gmail.com
[5]Consultant, Arbar Polyclinic, Jeevak Natural Foundation For Child Health, Belagavi, rasulaaziz@gmail.com

Abstract:
Background: *The pathophysiology of Cerebral Palsy has been an area of interest for the modern paediatric researchers for decades, and finally got the form in which it is present today. Cerebral Palsy is not a single disease but a symptom complex or group pf disorders which is usually diagnosed on the basis of developmental delay. Since the number of out patients and in-patients of Cerebral palsy has been increasing in the ayurveda hospitals, thus it is important to understand the pathophysiology of this disease from the perspective of Ayurveda. There have been few attempts in this area in the past but they all vary and there is no common consent. Thus, the present article is an attempt to bridge the missing links and propose a probable samprapti.*
Aims and objectives: *To understand the pathophysiology of Cerebral Palsy, in perspective of Ayurveda and propose a probable Samprapti based on reviews.*
Materials and methods: *This, is based on reviews, opinions, clinical experiences of the Ayurveda Paediatricians and the classic textual references.*
Results: *After careful observation of each type of cases of cerebral palsy, expert opinions and classic textual references, Ayurveda pathophysiology of the disease has been proposed. The pathophysiology can be understood at three different levels ultimately leading to Cerebral Palsy*
Conclusion: *In general, Cerebral Palsy can be considered as the symptoms or symptom complexes mainly under the broad term of Vata vyadhis, either occurring independently because of Vata or in association with Pitta and Kapha.*
Keywords: *Cerebral Palsy, Developmental Delay, Vata vyadhi, Garbhopghatakara bhavas, Agni Dushti, Khavaigunya,*

INTRODUCTION:

Bala Samvardhana Vikara mainly Cerebral Palsy is the second most common reason for disability in children after Poliomyelitis. 10% of the global population is estimated to suffer from some form of disability. Statistics from different sources suggest that in India almost 3.8% of the people suffer from some form of disability.

Cut-off from the social life of the people with disability has revolutionised the paediatric approach to children with developmental disability, so that their quality of life is improved and they're able to cope up with the present- day world. The tasks involved for the betterment of such children, is tedious and improvement rate is quite slow.

In India every 3rd child per 1000 live births is affected by some or the other form of Cerebral Palsy and 77.4% of these are estimated to be suffering from Spastic type of Cerebral Palsy. With the changing trends, parents of such children are diverting their attention more towards Ayurveda and thus the number of such patients in both OPD and IPD of Ayurveda hospitals have been raising.

As similar symptoms or symptom complexes, as present in Cerebral Palsy are discretely available in our Ayurveda *Classic Texts*, hence based on *lakshanas,* the chief *Dosha* involvement was identified as *Vata* and so it has been broadly considered under *Vata Vyadhis* for the purpose of preparing the treatment protocols. Most of the symptoms and symptom complexes present in Cerebral Palsy are all seen in *Vata Vikaras.* Also, as this disorder is mainly seen as a result of damage or insult to the developing brain thus in recent years it has also been considered as *Shiro-marma-abhighata janya Vata Vyadhi* as *Shiro-marma-abhighata* is also one of the reasons for *Vata Vyadhi.* Considering all these perspectives when various treatment modalities mentioned under *vata Vikaras* have been used over time and found to be helpful. Also, that, this is a growth and development disorder, *Balya* and *Rasayana Therapy* also play important role.

Though all these developments have been happening in the area of *Ayurveda* paediatrics, still better results could be obtained if the precise *Samprapti* of the disease is known. Therefore, this study has been taken up to frame out the probable *Samprapti* of Cerebral Palsy.

AIMS AND OBJECTIVES OF THE STUDY:

To understand the pathophysiology of Cerebral Palsy in Ayurveda perspective and propose the probable *Samprapti* of the disease.

Materials and Methods: To frame the *samprapti* of Cerebral Palsy, Ayurveda classic texts and modern literature was reviewed thoroughly, along with the articles published in the indexed Journals. To substantiate the data collected, expert opinions were taken and further inputs were implemented. And after a series of discussion and suggestions the *samprapti* was be framed.

***Ayurveda* understanding of *Samprapti* of Cerebral Palsy:** As Cerebral Palsy has numerous causative factors eventually leading to the disease, thus, *Samprapti* of the disease depends on these causative factors. This can be understood by grouping and summing up the etiologies into following three levels.

Level I of *Samprapti* – Before Birth/Antenatal (*Adibala Pravritta and Janmabala Pravritta Nidana)-Adibala Pravritta Nidana* may include the deeds of previous birth of the parents as well as the *Garbha* which is formed. At this level even *Garbha Kaleeena Nidanas* may be considered.

Garbha poorva Nidana includes those causative factors which may exist even before conception. The factors responsible for conception are stated as ***Ritu, Kshetra, Ambu and Beeja*** mainly. The *Dushti* of these factors may cause some or the other kind of defects in the child. *Dushti* of ***Ritu*** may be understood as ***Kala Dushti***. Time is an important factor right from the age of parents, time of conception to delivery. Age pf parents ideal for conception has been mentioned in our *Classics* as 21-25 years for male and 16 years for female. Thus, if age of mother is less than 16 years it may lead to Intra-uterine growth retardation and if mother is too elderly it increases the risk for genetic aberrations in the foetus. Similarly considering the *Ritu,* ***Visarga Kala*** is more powerful than ***Aadana Kala***. Hence child conceived during *Visarga Kala* will have *Pravara Shakti* and may have good immunity, preventing repeated attack of the diseases throughout his life. Also, *Ritukala* has been considered important and *Acharyas* have laid down the rules and regulations for copulation and strictly advised for copulation on fourth day of menstruation for a healthy progeny.

Kshetra is another important factor required for the normal growth and development of the foetus. This is where the implantation of the product of conception takes place and foetus grows throughout pregnancy. Thus, any kind of intra-uterine infection or injury to this ***Aaashaya*** may increase the risk of Cerebral Palsy. Toxoplasmosis infection during pregnancy have been associated with ophthalmic impairment and Central Nervous system defects.

Bija, is also one of the important factors responsible for a healthy progeny. Any vitiation or diseased condition of the *Bija* (sperm or ovum) may lead to various teratological abnormalities. Any defect in any part of the *Bija* can cause defect or malformation of the respective organ. For example, any vitiation in the ***Bija Bhaga*** responsible for the formation of brain may lead to malformation of brain or may hinder the normal development of the brain.

Apart from these, the ***Asamana*** *or* ***Atulya Gotra Vivaha*** has been advised by *Acharyas,* to prevent all types of *Sahaj* and *Aadibalapravritta Vyadhi.* This is seen in contemporary science as well where consanguineous marriages have shown relation with incidence of Cerebral Palsy.

The happy mental or psychological status of the parents play a very crucial role in *Garbha* formation. *Atma Karma* is also known to impact the dynamism and well-being of the body. *Garbha* is the union of *Shukra, Shonita* along with *Atma.* As per *Acharyas, Atma* along with four subtle *bhutas* and with the speed of mind transmigrates from one body to the other on the basis of past deeds. Thus, the unknown aetiology of Cerebral Palsy can be attributed to the ***Atmakarma Dushti***.

Considering the *Garbha Kaleena Nidana,* the following may be considered.

Improper Garbhini Paricharya: During pregnancy, certain *Ahara* and *Vihara* are contraindicated like *Ati ushna-Tikshna Ahara, Abhighata, Vishama Asana, Shoka* etc. These are considered harmful to the well-being of the foetus. Researches have related mild stress during pregnancy as high risk of a child being born with cerebral palsy. Specific dietetics on monthly basis have been mentioned for *Garbhini* in our classics. These when followed leads to proper growth and development of the foetus in-utero.

Masanumasik Paricharya benefits*:* Majority of pregnant women are unable to take proper diet during first trimester because of nausea and vomiting. Thus, our *Acharyas* have advised use of *Madhur* group drugs along with cold and sweet liquid diet and milk as this has anabolic effect and supply the required nourishment. Since, fourth month of pregnancy additional proteins are required for the growth of muscular tissues and so the use of meat soup is advised. By the end of Sixth month most women suffer from oedema of feet and other complications and hence use of *Gokshura* is mentioned in sixth month of pregnancy.

- *Dauhrid Apachara:* Foetus expresses its desires through mother and the same is understood as ***Dauhrida*** condition in pregnant woman. Unfulfillment of mother's desires may lead to various features which are also present in children with cerebral palsy. For example, *Kubjatva, Pangutva, Minminatva* (Nasal twang in voice) etc.
- *Krimi (Infections-TORCH etc.):* Foetal growth and development is also affected by various pre-natal infections and infections during delivery present in pregnant woman. Some infections in mother can lead to *Garbha vichyuti. Garbhavichyuti* is a broad term under which repeated abortions, pre-term deliveries can be considered.
- *Abhighata: Abhighata* (Trauma/Injury) can be either *Sharirika* or *Mansika* which can also be either *Bahya Abhighata* or *Doshabhighata*. *Sharirika abhighata* can cause placental haemorrhage which can lead to Intra-uterine death, preterm labour, cord around neck or growth retardation in foetus etc. similarly over exposure to X-rays may cause genetic abnormality in foetus leading to Cerebral Palsy. *Manobhighata* in the form of *Bhaya, shoka, chinta* etc causes *vata vridhhi* which may lead to Cerebral Palsy. Both, *Bahya* and *Doshabhighata* create imbalance at the *Doshic* level. Birth asphyxia, Hypoglycaemia, Kernicterus, Intra-ventricular haemorrhage etc can also be considered under *Abhighata* and all these conditions which some or the other way cause injury to foetal brain are responsible for causing cerebral palsy.
- *Dhooma Pana:* Though it is therapeutic, its strictly prohibited in pregnant lady.[16]And if pregnant lady smokes excessively it may cause the child to become *Kuni* (crippled arm), *Andha* (Blind) and *Durbalendriya* (sensory weakness).[17]Smoking during pregnancy results in lower average birth weight which can lead to several conditions including Cerebral Palsy. Genetic abnormalities, neural tube defects, impairment of the sensory organs can also be seen as bad effects of smoking.
- *Vata-Prakopak Aahara and Vihara: Vata prakopak Ahara* and *Vihara* can lead to vitiation of *Vata* in body and due to *Khavaigunya* in *Mashtishka* (brain) of foetus or due to *mastulunga majja Dushti* may cause affect the *Shiromarma or Shira*. Eg. conditions like Cranial haemorrhages (IVH, SDH etc.), Hypoxic Ischemic Encephalopathy. Conditions like *Pangu, Mooka Kubja* are all related to *vataprakopa* and are seen as common features in Cerebral Palsy.

The above causes lead to *Agnidushti* (at all three levels i.e., *Bhutagni, Jatharagni and Dhatwagni*). After this there can be two pathways one where this *agnidushti* leads to *Vata* dominant *Dosha Vikriti* and eventually *Dhatu vikriti.* And the other pathway where, due to above causes, the *Agnidushti* (again at all three levels)

leads to *Khavaigunya* in different parts of *garbha,* depending on *Nidana* and its severity. Depending on degree of *Dosha-Dushya Sammoorchhana and Sthanasamshraya,* disease might begin but it is not detectable in-utero and becomes obvious with passage of time after birth.
Case observed at this level: A 5.5 years old male child brought by his guardian with complaints of frequent fall while walking, weakness of left hand and left leg noticed since 3 years of age and difficulty in speaking as appropriate for age. Patient is a known case of Epilepsy since, 3 years of age and is on continuous medication. Parents had second degree consanguineous marriage. Antenatal history presented with Hypertension throughout pregnancy and there was PV Bleeding.
Level II of *Samprapti-* At the time of birth. *(Janmabala Pravritta Nidana)*-Level II can exist independently or in association with Level I of *Samprapti. Prasava Kaleena Nidana* can be understood under following headings.
Vilambita Avi: The process of delivery gets delayed if the uterine contractions are feeble or extended. This may cause birth asphyxia and thus may lead to intra-cranial injury risking the child to developmental delay in future.
Akala Paravahana: While in labour if the lady bears down effort in absence of actual pain, it may result in *Badhirta (Deaf), Mookta (Dumb), Vyastahanu, Moordhabhighata, etc.*in the baby.[19]As *Moordha or Shira* is one of the three most important Marmas, thus injury to the same sometimes results in intracranial or hypoxic ischemic injury which may lead to encephalopathy leading to Cerebral palsy.
Kaalateet Prasava: Birth asphyxia and MAS (Meconium aspiration syndrome) like conditions are likely to present in post term deliveries which if not attended properly may lead to Cerebral Palsy in child.
Moordhabhighata: Akalapravahana may cause *Moordha-abhighata.* This can be regarded as *Shiromarma-abhighata, which may manifest as Ardita, Mookta, Chestanasha etc.*
The *Samprapti* at Level II can exist independently or in association with either Level I, thus there will be two pathways. The *Samprapti* at Level II can independently lead to agnidushti, directly and causes *Vata* dominant *Dosha Dushti* which further may lead to *Dhatu vikriti.* The other pathway where there is association of the Level I there will be further worsening of the already *Dushit Agni* and lead to *Vata Dosha Vikriti* and *Dhatu vikriti.* Depending on degree of *Dosha-Dushya Sammoorchhna and sthana samshraya*, signs and symptoms may or may not manifest and may or may not be detectable immediately or may be detectable along with the developing phases of the child. Severity is dependent on cause.
Case observed at this level: A 5.5 years old male child brought by his guardian with complaints of frequent fall while walking, weakness of left hand and left leg noticed since 3 years of age and difficulty in speaking as appropriate for age. Patient is a known case of Epilepsy since 3 years of age and is on continuous medication.
Level III of *Samprapti-* Post-natal (*Doshabala Pravritta Nidana)*-Now again Level III can exist independently or in association with Level I and Level II of *Samprapti. Prasavottar Nidana* can be considered under the following headings;
Improper/Delayed *Prana Pratyagaman:* Newborn-Resuscitation or *Prana pratyagaman* are the measures to save life or help it to establish respiration and other vital activities after exhaustive birth procedure. Delay in *Prana Pratyagamana Vidhi* may cause delay in respiration which may lead to ventricular damage to the newborn brain by interruption of oxygen (Prana Vayu) supply. Also, forceful prolonged oxygenation leads to similar condition leading to impaired functioning of *Indriya*[22].
• Attack *Of BalaGrahas* (Infectious disorders)*:* Certain *balagrahas* like *Skanda and Skandapasmara and others which can be related to infections of Central Nervous system, make the child permanently handicapped. Acharya Kashyapa has mentioned about Jataharini, foetal death or delivery of a child with reduced life span occurs due to this.*
• *Nija and Agantuja Disorders: Vyadhi Sambhava Phakka* may be considered as one of the conditions, resembling CP. This is usually cause secondary to diseases like diarrhoea *(Atisara),* anaemia *(Pandu*) and metabolic disorders etc.
Stanya Dushti: Kapha dushit Stanya when consumed by baby, leads to *Kapha* vriddhi in infant. This, leads to blockage of the *Rasavaha* and *manovaha srotas*, which results in impairment of cognition i.e., *Jada.*

Similarly, *Tridosha Stanyadushti* can result in conditions namely *Pangu, Jadata,* and *Mookata* observed in Cerebral Palsy.

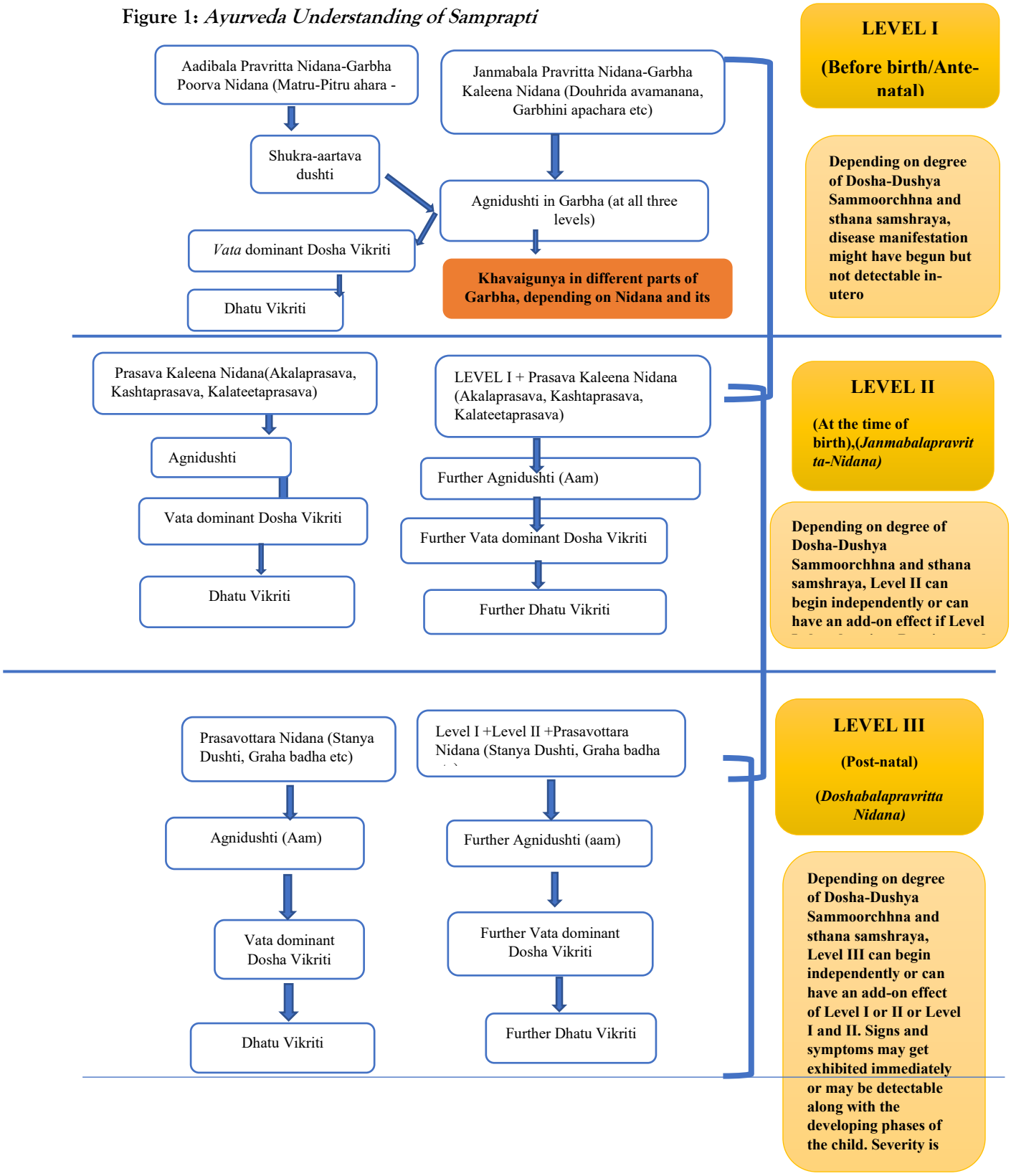
The *Samprapti* at Level III can exist independently or in association with either Level I or Level II or in association with both Levels I and II, thus there will be two pathways. The *Samprapti* at Level III can independently lead to agnidushti, directly and causes *Vata* dominant *Dosha Dushti* which further may lead to *Dhatu vikriti.* The other pathway where there is association of the Level I or Level II or combinedly both there will be further worsening of the already *Dushit Agni* and lead to *Vata Dosha Vikriti* and *Dhatu vikriti.* Depending on degree of *Dosha-Dushya Sammoorchhna and sthana samshraya*, signs and symptoms may get exhibited immediately or may be detectable along with the developing phases of the child. Severity is dependent on cause.

All the three levels of *Samprapti* can exist independently or in combination or sequentially and evenly lead to *Sthanasamshraya* of *prakupit Vata* in the body parts with *Khavaigunya.* Later, on this *prakupit Vata dosha,* exhibits itself depending on the part of body it has moved to. For example, if this *prakupit Vata* lodges in *Jihva* it may lead to *Mookata* or *gadagadata.* If in *Karna- Badhirya, Hasta-kampa, ekangavata* and likewise.

However, severity of disease also depends on the *anubandha* of other *Doshas* with the *prakupit Vata.* If there is *Vata anubandha* the symptoms are severe like *Sarvanaga Vata or* quadriplegia. *Pitta anubandha* exhibits as irritability, cognitive impairment etc. whereas *Kapha anubandha* is exhibited as hypotonia, co-ordination problems. Thus, Cerebral Palsy can be understood mainly under *Vata vikaras in Ayurveda.*

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 4, 2025
https://www.theaspd.com/ijes.php

Figure 1: *Ayurveda Understanding of Samprapti*



International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 4, 2025
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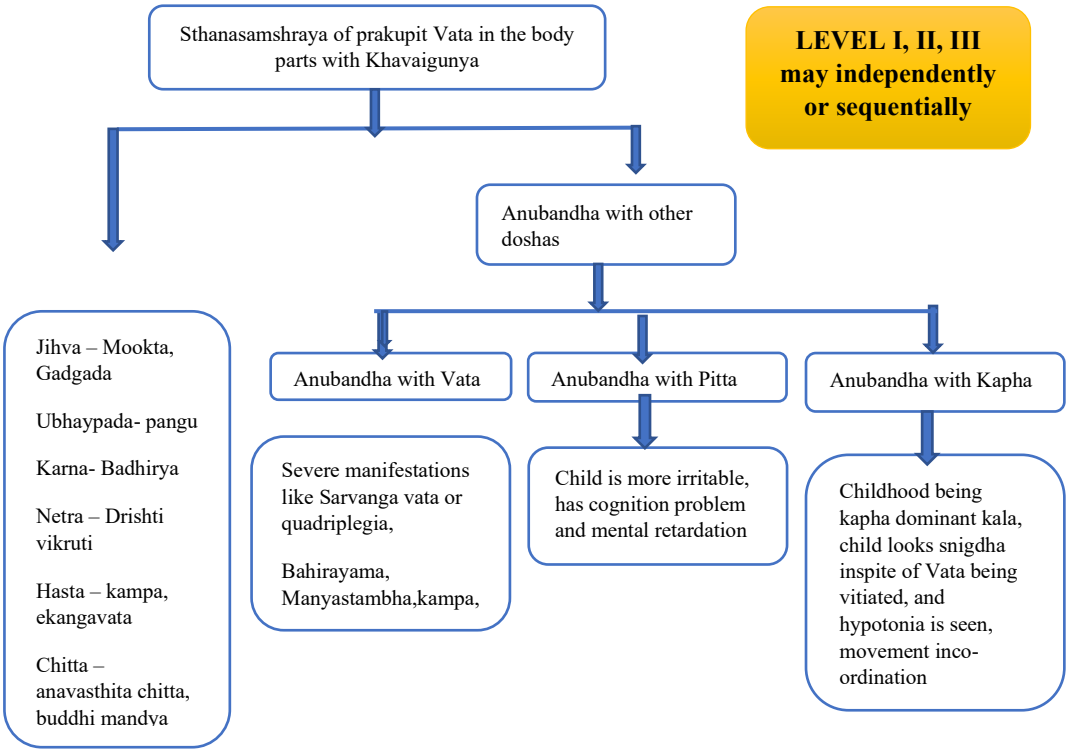

DISCUSSION:

This proposed *Samprapti* may help in both preventive and management aspects of Cerebral Palsy. Considering the preventive aspect, it is important to consider the pre-conception counselling for every couple desirous of conception.

Preventive aspects:

Level I

Awareness about the significance of *Atulya Gotra Vivaha* should be created among masses to prevent consanguinity which is an established risk factor for developmental disorders. Certain rules have been laid down by *Acharyas* for the *Garbhadhaan. Acharyas* have already mentioned about the pre-procedures like *shodhan* of the couple followed by intake of *Ghrita* and milk medicated with drugs of *Madhur varga (Ashwagandha, Yasthimadhu, Mashaparni, Jeevanti.)* by male and *Taila* and *Masha* by female, before conceiving. Similarly, days of conception have been mentioned in *Classics.*

Level II

Selection of a well-equipped hospital, is very much important to prevent the hap-hazards and manage the emergencies timely and effectively, during delivery. At this level before the *Samprapti* sets in, the child needs to be helped out. Even in rural hospitals, availability of a well-equipped vehicle for referral to higher centre should be ensured.

Level III

As part of post-natal counselling, mother should be encouraged for breast-feeding and should be taught proper techniques. Maintenance of hygiene, *Rakshakarma, Dhoopanakarma as mentioned in classics* may be advised to prevent the infections and diseases. Mother should be advised on *Ahara-vihara* which would prevent *Stanya-dushti* and baby gets proper nourishment. Also monitoring of the developmental milestones through *Samskaras* may help in early diagnosis of the condition

Management:

Early diagnosis of the condition can help arrest the deeper penetration of the *Doshas* and manifestation of the disease and thus help revive child to normal course of development.

Understanding of *samprapti* may help in planning the preventive and management goals. Knowledge of *Samprapti* allows to diagnose the condition based on *ayurveda* parameters and helps in framing *ayurveda protocol* more precisely.
Diagnosis of CP which is done on modern assessment parameters and manged through *Ayurveda Protocol* may land up in confusions and improper selection of interventions.
Thus, for the better understanding of the symptom, or symptom complexes, its probable etiology and pathology as per *Ayurveda*, the above *Samprapti* has been proposed.

CONCLUSION:

For the prevention and effective treatment of any disease, it is important to know the pathway which leads to the condition. As there is scattered information available about Cerebral Palsy in *Ayurveda*, therefore this review work has been carried out to propose the probable *Samprapti* of Cerebral Palsy.

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