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INSIGHT OF EMBRYOLOGY IN CHARAKA SAMHITA SHAREERA STHANA: AN INTERPRETATIVE ANALYSIS

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ABSTRACT

Charaka Samhita (*Shareera Sthana*) provides a detailed account of human origin, development, and eventual death. The concept of *Garbhavakranti* (embryology) specifically deals with the formation of the embryo, its sequential development, and the process of childbirth. Knowledge of embryology is essential for ensuring healthy progeny and effective antenatal care. In *Charaka Samhita*, embryological concepts are described in a comprehensive and largely understandable manner; however, certain aspects require interpretation for clearer scientific understanding. The aim of this review is to elaborate these concepts and make them more accessible and relevant in the context of modern science. In the present study, key embryological topics—such as *Garbhotpattikar Bhava (*The factors required for progeny*)*, the composition of *Shukra* (semen), *Garbha Masanumasika Vriddhi Krama* (month-wise foetal development), 'Genetic material' concept in the form of *Beejabhaga* and *Beejabhaga Avayava*, as well as *Garbha Vikriti* (Birth defects and their causes)—have been selected from *Shareera Sthana* of *Charaka Samhita*. These concepts were further analysed and correlated with modern scientific literature. After interpretation and comparative analysis, it was observed that the description of embryology in *Charaka Samhita* is logical, systematic, and possesses significant scientific relevance.

KEYWORDS: *Garbhavakranti*, Embryology, *Garbhotpattikar Bhava*, *Garbh Masanumasika Vriddhi*, *Beejabhaga*, *Beejabhaga Avayava*, *Garbha Vikriti*, *Shareera Sthana* of *Charaka Samhita*.

1.1 INTRODUCTION

The incidence of neonatal mortality and unhealthy progeny remains high in India. One of the contributing factors to this may be inadequate understanding of embryology. To prescribe specific diet and medicine, proper knowledge of Embryology is mandatory. In addition to the Ayurvedic *Samhitas*, several other ancient texts—such as the *Garbhopanishad* and Buddhist literature including *Sanyuktanika*, *Milindapanho*, and *Jataka*—also describe aspects of embryology. However, in the *Charaka Samhita*, these descriptions are presented in a more systematic, clear, and seemingly scientific manner compared to other ancient sources.

To establish its scientific relevance and authenticity, it is essential to study and critically evaluate these concepts in the light of modern obstetrics, which is supported by established scientific evidences.

'Embryology' is the science of knowing the concepts 'Conception', growth and development of Embryo. 'Embryology' is described in Charaka Samhita and termed it as '*Garbha-Avkranti Shareera*'. In '*Garbha-Avkranti*' different concept is described such as -

- *Shukra Sangathan* (Composition)
- *Garbha-Utpattikar Bhava* (Required material for Foetus Birth),
- *Garbha Masanumasik Vriddhi* (Embryogenesis),
- *Beejabhaga* and *Beejabhaga Avyava* (Genetic material)
- Nutrition of foetus
- *Garbha* or *Praja Vikriti* (Birth defects and its causes)

The above concepts are not clearly understood, as they are described in a concise manner using ancient stylistic language. These descriptions were formulated in accordance with the knowledge, context, and limitations of that period, and were based on the available resources, observations, and prevailing conditions of the time. To achieve a clearer understanding, it is necessary to critically analyse these concepts through interpretation and correlation with modern obstetrics literature. Such systematic interpretation may help in evaluating and establishing their scientific relevance.

1.2 MATERIALS AND METHOD

The critical analysis was conducted in two stages: first, the collection and description of data. and second, its interpretation. Following concepts related to *Garbha-Avakranti* were selected from *Charaka Samhita Shareera Sthana* Chapter 2nd, 3rd and 4th.

- *Shukra Sangathan* (Composition)
- *Garbha-Utpattikar Bhava* (Required material for Foetus Birth)
- *Garbha Masanumasik Vriddhi* (Embryogenesis).
- *Beejabhaga* and *Beejabhaga Avyava* (Genetic material)
- *Garbha* or *Praja Vikriti* (Birth defects and its causes)

After selection and description, analysis was done on the basis of interpretation in the light of modern Obstetrics literature collected from different articles and websites.

1.2.1 *Garbhotpattikar Bhav*[1]- 6 factors which are responsible for formation of Embryo.

- *Matrija Bhav* (Maternal factor in the form of Ovum and Uterus),
- *Pitraja Bhava* (Paternal Factor in the the form of sperm),
- *Rasaja Bhav* (Dietary Factor),
- *Satvaja Bhav* (Psychic factor),
- *Satmyaja Bhava* (Environmental factor),
- *Atmaja Bhav* (Conscious factor).

1.2.2 COMPOSITION OF '*SHUKRA*' (SEMEN)- According to *Acharya Charaka*, the attributes of *Shukra* (semen) are *Snigdha* (Unctuous), *Sandra* (Viscous), *Picchilta* (slimy), *Madhura Rasa* (Sweet taste), *Sphatikabha* (Quartz colour). In *Shareera sthana*, Semen is described as consisting all 6 *Rasa* (taste); *Madhura*, *Amla*, *Lavana*, *katu*, *Tikta* and *Kashaya*.[2] From these two references, it can be said that Semen is of *Madhura Ras* dominance along with it also consist 5 *Ras*.

This can be interpreted in terms of component present in Semen-

Table 1: 6 *Rasa* (Taste) and their respective interpretation.

	Rasa (Taste)	Compound present in Semen
1-	*Madhura* (Sweet)	Fructose, galactose, Lipids, phosphorylcholine ergothioneine [3]
2-	*Amla* (Sour)	Citric acid, Ascorbic acid, Amino Acid [4]
3-	*Lavana* (Salty)	Mineral sodium
4-	*Katu* (Pungent)	Spermin [5]
5-	*Tikta* (Bitter)	Zinc [6]
6-	*Kashaya* (Astringent)	Zinc [7]

- The proteins present in semen can be described as possessing tastes such as sweet, sour, pungent, etc.

1.2.3 PROCESS OF 'FERTILIZATION'- The sperm and ovum fuses to form 'Zygote'. Beside sperm and Ovum there is also fusion of '*Atma'* with the help of *Mana* (Mind).

1.2.4 *GARBHA MASANUMASIK VRIDDHI* (EMBRYOGENESIS)- Following fertilization, the zygote undergoes successive growth and development. This continuous process, extending until birth, is referred to as *Garbha Vriddhi*. In the *Charaka Samhita*, this developmental sequence is described on a month-by-month basis and is therefore termed *Masanumasika Vriddhi Krama*.

First month- All the tissues unite and intermingle, resulting in changes in their form and colour and leading to the formation of *Kalala.*[8]

The ovum (female gamete) is spherical and consists of a single cell. After fertilization by sperm, it begins to divide. As a result of repeated divisions, it forms a solid ball of multiple cells, which is called *Kalala* or Morula.[9] Thus, *Kalala* is a solid mass of cells.

After this stage, a fluid-filled cavity develops, leading to the formation of the Blastula. The blastula initially consists of a single layer, but due to the inward movement of the outer layer, it becomes three-layered, which is called the Gastrula. These three layers are known as endoderm, mesoderm, and ectoderm.

The three germ layers can be compared with the three types of *Rogamarga* described in the *Charaka Samhita*, namely *Abhyantara* (internal), *Madhyama* (middle), and *Bahya* (external) pathways of disease. This comparison is based on the similarity that, in both frameworks, the origin of organs and tissues is attributed to specific layers or regions. For instance, the GI tract is the site of *Abhyantar Rogmarga* (internal Pathway) and originated from Endoderm. Ligaments, tendons, and vital organs (*Marma*) such as the heart and kidneys is the site of *Madhyama Rogamarga* (middle pathway) and derived from mesoderm. Skin is the site of *Bahya Rogamarga* (external pathway).[10] This *Rogamarga* are named on the basis of site or location. These sites of *Rogamarga* can be interpreted as origin place. Hence here these *Rogamarga* are correlated with 3 germ layers.

Second month- In 2nd month of pregnancy, embryo takes three types of shapes; *Ghan*, *peshi* or *Arbuda*. *Ghan* is a future indicator of Male sex or child, *Peshi* is an indicator of Female sex or child and *Arbuda* is an indicator of Hermaphrodite. According to Chakrapani, *Ghan*, *Peshi* and *Arbuda* are commented as *kathin* (Hard or solid mass), *Deergha Mansapeshi* (Elongated muscles) and *vartul*, *Unnata* (Round and elevated) respectively.[11] According to modern Obstetrics, embryo grows from the size of an apple pip at week 5 to about the size of a raisin by week 8. During this time, it begins to resemble a tadpole; however, the tail gradually disappears and develops into the lower part of the back.[12], Apple pip may be correlated to *Ghan* (Solid mass), Tadpole shape with *Peshi* (Elongated shape) and Tadpole without tail with *Arbuda*.

Third Month- In the third month, all the sense organs, body parts, and their substructures are formed.[13] According to *Acharya Gangadhara*, with reference to the *Sushruta Samhita*, in the first half of the third month, five prominences (*Pindikas*)—namely the hands, feet, and head—are formed, and in the latter half, all the sense organs, body parts, and their subdivisions become manifested.[14] During this same period, the *Charaka Samhita* also mentions the development of teeth and the reproductive organs (genitalia).

Above described five prominence (*Pindika*) is termed as 'Buds' but it is formed in 6 weeks of pregnancy. According to modern science as well, by the end of the first trimester, all major organs are formed, although their maturation continues further. The hands, feet, and head develop during this stage. Sensory organs such as the tongue, salivary glands, external ears, mouth, eyes, and skin are formed. Other organs include the liver, spleen, urinary system, and circulatory system. The organs of action (*karmendriyas*) also become evident, as some transient movements can be observed in the hands and feet In obstetrics too, it is stated that the development of teeth and genitalia begins in the third month; however, the sex is not yet fully distinguishable.[15]

Fourth Month- In the fourth month, *Sthirta* (stability) is attained in the foetus. Stability can be understood as the foetus becoming well-established, thereby reducing the chances of miscarriage or abortion. This is possible only when the formation of the foetus is complete and the placenta, through which the foetus is attached to the uterus, is also fully developed.

According to *Acharya Chakrapani* and *Acharya Yogindranath Sen*, the term "stability" also implies compactness or density (*nibidata*). In the third month, the bones begin to harden, and

by the end of the third month, they become solid to a certain extent; this can be interpreted as increasing density.[16] By the end of the third month, all organs are also formed, which significantly reduces the likelihood of miscarriage.[17]

After the third month, the placenta grows further and becomes fully functional. By the end of the fourth month, its thickness increases considerably, while its expansion in size continues thereafter. Due to this, the foetus remains stable and the chances of miscarriage are minimized.[18]

Fifth Month- In the fifth month, there is an increase (accumulation) of muscle tissue (*Mamsa*) and blood (*Shonita*).[19] The increase in blood occurs because, during the fifth month, blood formation shifts from the liver to the bone marrow.[20]

The increase or growth of muscle tissue can be understood from the fact that, in this month, the mother experiences foetal movements (quickening) for the first time. This happens because the hands and feet have grown to a definite proportion, and neural connections between the muscles and the brain are established.[21]

Sixth Month- In the sixth month, there is an increase in strength (*Bala*) and complexion (*Varna*).[22] According to modern science, the skin colour of the foetus is determined from the time of conception; however, it is not permanently established until around the sixth month. By this time, the foetal skin appears reddish and thin, with visible veins.[23]

Seventh month- In the seventh month, all the characteristics (Organs, tissues) of the foetus become fully nourished and developed.[24] In Obstetrics, 'The foetus continues to mature and develop reserves of body fat. The foetus changes position frequently and respond to stimuli, including sound, pain and light. The amniotic fluid begins to diminish. More body fat makes the foetus's skin less wrinkled and plumper. Its nervous system is quickly maturing. The foetus makes melanin, the substance that gives skin and eyes their colour. The foetus's lungs start to make surfactant, a substance that helps it breathe after birth. The foetus can open its eyes and blink. It also has eyelashes. The foetus may begin turning head-down in your uterus as it gets ready for birth.[25]

Eighth Month- In the eighth month, *Ojas* is said to alternate between the mother and the foetus. When *Ojas* resides in the foetus, the foetus survives; however, when *Ojas* is present in the mother, the chances of the newborn surviving after birth become reduced. Due to unstable

position of Oja between mother and child, there is less survival chances of baby. According to modern obstetrics, it is superstition.[26]

Ninth Month- From 1st day of nine month, there is *Prasava kala* (Time of delivery). It may extend up to twelfth month.

1.2.5 FOETAL ANOMALIES/ BIRTH DEFECT – There are some congenital and genetical deformity which are termed as '*Praja Vikriti*' in *Charak Samhita*.[29] These are classified according to defect in

1. *Sansthan* (Shape)
2. *Varna* (Skin Colour or skin disorder)
3. *Indriya- Gyana Indriya* (Sensory organ), *Karma Indriya* (Organ of action; Limbs, Voice, etc) and Mind

Charaka Samhita describe the congenital defect; *Jada* (Mentally impaired), *Andha* (Blind), *Kubja* (Kyphosis), *Mooka* (Congenital Mutism), *Minmin* Voice (Mumbling or indistinct voice), *Vaamana* (Dwarfism), *Vyanga* (Abnormal skin pigmentation), *Unmatta* (Mania), *Kushtha* and *Kilasa* (Skin disorders and Vitiligo).[28][29]

- **Defect in *Sansthan* (Shape)-** *Kubja* (Kyphosis), *Vaamana* (Dwarfism), *Adhikangi* (Polydactyly), *Heenangi* (Missing fingers), Cleft Palate, etc.
- ***Varna* (Colour)-** *Vyanga* (Abnormal skin pigmentation), Skin disorders, *Kilasa* (Vitiligo), abnormal eye colour etc.
- ***Indriya*** - *Jada* (Mentally impaired), *Andhata* (Blindness), *Mookata* (Mutism), *Badhirta* (Deafness), *Minmin* Voice (Mumbling or indistinct voice), *Unmatta* (Mania), etc.

  In Down syndrome, some of the above features are- Mental impairment, late speech, Dwarfism, Blindness, Mumbling or Nosy speech due to cleft palate.

1.2.6 GENETIC MATERIAL DESCRIBED IN CHARAKA SAMHITA- Genetic material in *Charak Samhita* is termed as *Beejabhaga* and *Beejabhaga-avyava*. In has been described in the context that why some parents don't transfer their disease to their progeny. In answer to this query, *Acharya Punarvasu* said if there is vitiation of *Beejbhaga*, then there will be transfer of disease.[30] Another context of *Beejabhaga* and *Beejabhaga-avyava* is '*Beeja Dosha Vikara'* (reproductive disorders due to Chromosomal Abnormalities). *Beeja-Bhaga* is a part of *Beeja* and *Beejabhag-Avyava* is a component of that part.[31] These can be correlated to DNA and genes which are responsible for transporting one features from parents to Child.

1.2.7 CAUSES OF CONGENITAL DISORDERS- In Charaka Samhita, there is description regarding causes of Congenital and genetic disorders.[32][33]

1. *Beeja Dosha* -Genetic cause and Consanguinity (when parents are related by blood)
2. *Garbhashaya Dosha* (Uterine Disorders)
3. *Kala Dosha* (Maternal Late age)
4. *Shareeka* and *Manasik Dosha* (Disease of mother)
5. *Karma Dosha* (Socioeconomic factor)
6. *Matri Aahara* (Dietary or nutritional factor, alcohol intake)
7. *Aatma Dosha*- Unknown Factors
8. *Matri- Vihara* – Exposure to unhygienic environment.

1.2.8 NUTRITION OF THE FETUS – In *Charaka Samhita*, it is stated that in the early pregnancy the nourishment of the fetus occurs through *Upasneha* and *Upasweda* of mother. In the early stages of pregnancy, before the formation of the placenta, the embryo has chorionic villi in the trophoblast, through which nutrients reach the embryo by diffusion.[34] In the uterine lining, glands secrete glucose, which is stored in the form of glycogen.[35] This can be understood as *Upasneha*. *Upasweda* can be interpreted here as the effect of body heat or temperature. Proper body temperature is essential for the diffusion of nutrients.[36] It is also responsible for various biochemical processes occurring in the fetus. Many functions in the developing fetus, such as digestion and metabolism, can occur only at an appropriate temperature. Therefore, proper growth of each organ and tissue of the fetus takes place within the uterus. *Upsneha*, can also be correlated as fatty acids which is received from the mother. These fatty acids are essential for the physical growth as well as mental (brain) development of the baby. They also help in reducing the chances of preterm birth.

1.3 DISCUSSION

This work represents an attempt by the author to interpret classical concepts through comparative analysis. A substantial portion of the knowledge and information demonstrates close correspondence and is therefore comparable across the two systems. However, certain aspects remain subjects of ongoing inquiry and interpretation. For instance, the description of the successive growth and development of the zygote during the first and second month of gestation, as presented in *Charaka Samhita*, does not fully align with explanations in modern obstetrics. Although various commentators have offered clarifications, differences in opinion still persist.

The unstable position of *Ojas* between the mother and the foetus is traditionally considered to reduce the chances of neonatal survival. However, from the perspective of modern obstetrics, this concept is regarded as a superstition. With the advancement of medical technology, including sophisticated machines, equipment, and improved healthcare facilities, such beliefs are no longer considered relevant in the present era.

Similarly, the author has attempted to correlate the concept of the three germ layers with the Ayurvedic concept of *Rogamarga*. Many descriptions of *Rogamarga* show parallels with the three germ layers. However, in the specific comparison between *Bahya Rogamarga* and the ectoderm, only the skin demonstrates a clear correspondence. Other tissues associated with *Bahya Rogamarga*, such as *Rakta*, *Mamsa*, and *Meda*, are not derived from the ectoderm according to modern embryology.

In *Charaka Samhita*, there is a concept of '*Punarjanma'* (Rebirth), which tells that the *Sukhshma Shareera* (the liberated Soul from the body at the time of death of body), at the time of conception comes again in the contact of *panchabhautika* (Penta-elemental) *Shukra* and *Shonita* with the help of *Mana*. Thus, the life begins. Due to this *Avkranti* (Descent), the whole process (starting from zygote formation to Child Birth) is termed as '*Garbha-Avkranti* and study of science '*Garbhavkranti Shareera'* in Charaka Samhita.

There are several additional concepts that could be analysed in a similar manner; however, due to limitations in scope, they have not been included in the present discussion.

1.4 CONCLUSION

Most of the knowledge regarding embryology is similar to modern embryology, particularly in describing the anatomical changes of the embryo and foetus from the 3rd to the 9th month. In the ancient era, despite the absence of advanced techniques, there was a remarkable understanding of embryology, which highlights and validates its scientific relevance.

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