iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** X **Month of publication:** October 2024

DOI: https://doi.org/10.22214/ijraset.2024.64485

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue X Oct 2024- Available at www.ijraset.com

Study of *Masanumasika Garbha Vikas Krama* (Monthwise Devlopment during Pregnancy) in Context to Embryogenesis and Foetal Development

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Abstract: ***Sushruta Samhita is a significant Ayurvedic text on human anatomy and physiology. It provides detailed information on Garbha Vriddhi and Vikas Krama (Growth and Development) Various texts express different opinions regarding Garbha Utpatti (Fertilization) and Garbha Vriddhi. Acharyas have explained Garbhini Lakshana (Gravida symptoms) also. Which are helpful in early pregnancy diagnosis. Charaka has explained month wise symptoms in Garbhini during pregnancy. Now days, obstetrics is a fundamental field of study dealing with human reproduction, offering comprehensive information on fetal growth and development. Contemporary obstetrics has undergone extensive research and development. Neonatal mortality and fetal fatality are always the causes of concern. Samhitas provide pertinent resources on these topics. Acharyas have discussed about these in the reference of Garbhini. It takes a great deal of research and debate to comprehend the old Garbha Utpatti or Garbhavkranti notion. Examining both contemporary and Ayurvedic literature will aid in learning more about this. The goal of this study is to compare and clarify the concepts of embryogenesis from antiquity to the present.***

Keywords: Garbhavkranti, Foetal development, Garbha Vikasa Krama, Embryogenesis ,Monthwise Devlopment, Gravida symptoms.

I. INTRODUCTION

According to *Ayurveda* the process of fertilization is considered the beginning of life. It has been described in detail in the *Garbha Utpatti* reference by *Acharya Sushruta* in *Shaarira Sthana* (Chapter related to human anatomy & physiology*)*.The term *"Garbhavkranti"* translates to "the descent of the soul into the womb." The fetal development process is described step by step, starting with fertilization or *Shukra-Shonit*a *Samyoga (* fertilization*)*. Medical research, particularly in obstetrics, has advanced significantly. Cutting-edge diagnostic and imaging methods make it easier to monitor the growth and development of the fetus. This allows for a better understanding of pre natal development. It would be beneficial to evaluate *Ayurvedic* and contemporary medical perspectives to gain insights into prenatal care.

II. MATERIALS AND TECHNIQUES

A. Source

The Internet, medical journals, published research papers *Ayurvedic Samhitas* and their commentary, contemporary medical text books and articles.

B. Method

Study Type: Literary review study

1) A literature search was conducted using the title to find legitimate books, articles, research papers, medical journals and online sources.
2) Data to ascertain the literature's importance in comprehending the subject gathered was analyzed.

III. OBSERVATION

A. First Month Explanation

1) *Sushruta:* In the first month *Kalala* (a round structure) is formed. *Kalala* has a gentle structure and a halting tone. According to *Vagbhata*, *Kalala* development occurs in the first week of the first month. *Charaka* explains that following conception, all *Dhatus* come together to form *Kalala* . *Kalala* bears similarities to *Kheta* (phlegm or fluid type) and contains each and every bodily component and organ, although in minuscule form.

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2) *According to Modern:* In obstetrics during the first month, a fertilized egg develops inside an amniotic sac filled with water. The placenta, which serves nutritional and excretory purposes also develops simultaneously After fertilization, embryogenesis begins with the formation of morula from embryoblasts. The morula is a fluid-filled, multi cellular mass. As the pregnancy progresses, the morula develops into blastocyst. The blastocyst forms three germ layers: 1. Endoderm 2. Ectoderm 3. Mesoderm, which are the source of all bodily tissues.

B. Second Month Explanation

1) *Sushruta:* In the second month, *Panchamahabhutas* (i.e. five basic elements)combine with *Pitta, Vata,* and *Kapha (*physiological control components in body*).*This results in the formation of a solid mass called *Garbha*. According to *Acharya,* it is believed that the gender of the fetus can be predicted during this month. If this solid mass appears to be spherical, it indicates that the fetus will be male. On the other hand, if it appears elongated like a muscle, it suggests that the fetus will be female.But ,if it appears to be in an irregular shape ,then it will be a trans gender.
2) *Charaka and Vagbhata:* Have also mentioned similar explanation.
3) *Modern Science:* The baby's heart starts to divide into four chambers around the sixth week of life and beats roughly 150 times per minute. The embryo's head becomes larger in comparison to the trunk. During this time, the development of the digestive system nervous system and sensory organs begins. Early neural pathways in the fetal brain develop due to the branching of nerve cells. Genitals are formed at 9 weeks, though an ultrasound cannot determine the gender of the fetus until after 15 weeks.

C. Third Month Explantion

Sushruta: Pancha Pidaka or *Gatra Panchka* (five tiny bud like projection) begin to form in the third month. Upper limbs,lower limbs and head later form from these projections. Additionally, minute differences between major and minor bodily components become visible.

Vagbhata: Garbha (Foetus) may experience the expressions of pleasure and suffering both.

Charaka: Every sensory organ and limb arises at the same time.

Modern Science: Onset of ossification occurs in the third month. The development of toes and fingers shows variation. Skin, nails and hair begin to form. Changes in external genitalia start to take place.

D. Fourth Month Explanation

1) *Sushruta:* According to *Vedic* literature, every part of the body either big or small, can be clearly identified. It states that heart is the abode for the soul(*Atma or Chetna).* The completion of heart development occurs in the fourth month of pregnancy and enables the expression of the *Atma* or *Chetana* there. A pregnant woman in this month is referred to as *Dauhridini* as she is having two hearts during this time. It is believed that the fetus starts communicating its needs to the mother from this month. Ignorance of these needs can lead to congenital deformities such as hunched back, dwarfism, malformed eyes, limbs and sense organs as well as speech impairments. The fulfillment of these needs facilitates a healthy delivery of the child.
2) *Vagbhata:* Every body portion attains its own unique identity.
3) *Charaka*: The mother begins to gain weight substantially and experiences physical heaviness
4) *Modern Science:* Around the thirteenth week of pregnancy, the fetus's midbrain starts to mature, indicated by the development of eye movements. At this stage, the part of the fetal brain responsible for complex thinking, problem-solving and memory begins to form. It is also possible to determine the sex of the fetus as the external genitalia start to show clear male or female characteristics. A healthy woman typically gains around 11 kg in weight.

E. Fifth Month Explanation

1) *Sushruta:* Mind gets activated in this month.
2) *Vagbhata*: *Chetana* i.e. consciousness materializes in this month.
3) *Charaka*: The mother loses the weight because the fetus consumes a higher rate of metabolised nutritional contents especially of blood & muscle tissue .
4) *Modern Science:* In week 19, the fetus becomes more active. The entire body becomes covered in fine hair called lanugo and the scalp is covered by hair. The cochlear function starts to mature, allowing the fetus to react to sound. The fetal brain begins to divide into distinct sections dedicated to the senses of smell, taste, hearing, vision and touch.

F. Six Month Explanation

1) *Sushruta: Buddhi (*Intellectual capacity) starts developing in fetus.
2) *Vagbhata: Snayu, Sira, Roma, Bala, Varna, Nakha* and *Twacha* start manifesting.
3) *Charaka:* The fetus develop a higher accession of strength and complexion.
4) *Modern Science:* Eyelashes and eye brows start to project. Lung development finishes almost. The lack of terminal sacs causes a fetus born at this time to perish. The neurological pain awareness system starts developing.

G. Seven Month Explanation

1) *Sushruta:* Every major and minor organ becomes evident as the fetus develops into a well-nourished and fully developed human being.
2) *Charaka:* The mother feels sleepy and exhausted because of the over all development of fetus.
3) *Modern Science:* Vernix caseosa causes the skin to become red and coated. In the fetus, isolated eye blinking becomes visible. Between the seventh and eighth month, the bone marrow starts producing blood cells. Before the seventh month, this process takes place in the liver and spleen.

H. Eighth Month Explanation

1) *Sushruta:* In this month, *Oja* becomes unstable as it moves frequently between the mother and the fetus. There is a risk of the fetal or mother death , if delivery occurs in this month because of the lack of *Oja* in either one. *Sushruta* believes that *Nairitya* are demonic or evil spirits and states that babies born in the eighth month may die due to these spirits.
2) *Vagbhata*: He also referenced a similar point, saying that there is a danger of the mother's death if the birth takes place in this month.
3) *Charaka: Charaka* agrees with *Vaghbhata* . He has mentioned eight month is *"Aganya"* which means that in this month parturition should not be taken into account i.e. parturition should not be processed in this month due to instability of *Oja* as . Pregnant women experience fluctuations in mood as *Oja* continue to move either in her or in the fetus.This may cause harm to mother or the baby if parturition is done .
4) *Modern Science:* Substantial development of brain takes place .The hardening of bones continues. Smoother skin is formed. The majority of internal systems get sophisticated. Mood fluctuations and anxious feelings might occur throughout the latter trimester of pregnancy. Mood-regulating brain chemicals are impacted by changes in hormone levels that occur during pregnancy. It is more usual for irritability and mood swings to occur between the first and third trimesters.

I. Ninth month Explanation

1) *Sushruta:* Birth can occur in any month—the ninth, tenth, eleventh, or twelfth.
2) *Vagbhata:* The time for childbirth is after the eight month this may be even the very next day after the completion of eight month .
3) *Charaka:* The best time to deliver is after the eighth month up to the eleventh month.
4) *Modern Science:* When this month comes to finish, the pregnancy is termed to be a full term pregnancy. Meconium is produced after birth when a fetus swallows vernix caseosa and lanugo hair .

IV. DISCUSSION

As was indicated in the introduction, the goal of this study is to evaluate the two points of view i.e the *Ayurvedic* & contemparay modern medical perspectives.

1) According to *Ayurveda* during the first month of fetal development the embryo is said to resemble a jelly-like substance or phlegm i.e *Kalala*. This stage may be linked to the morula stage, which consists of fluid and cell mass. *Charaka* claims that all bodily components and organs are present in the *"Kalala"* stage and modern science also marks similar references in the form of germ layers, which are essential in the process of organogenesis.
2) In the second month of development, research shows that the formation of fetal genitalia begins around week nine. Modern methods enable us to observe every change that takes place during fetal development, allowing us to determine whether we can predict the gender of an embryo based on its shape. *Ayurvedic* perspective also indicates the gender determination in this month.

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3) *Charak*a stated that all sensory cells (Indriyas) in the fetus undergo branching to establish early neural pathways at the eighth week (2 month). This is similar to current obstetrics' assertion that the organs emerge in the third month. These two perspectives exhibit similarities. In the eighth week, the knee and elbow also start to solidify. *Sushruta* described the genesis of *Pancha Pidaka*, which thereafter gives rise to the head and extremities. This shows correlation between these modern & *Ayurvedic* perspective.

4) The fourth month of pregnancy is significant for the development of the fetus. This is because *Chetana Dhatu*, the expression of the soul,gets active according to *Sushruta. Chetana* has several connotations, such as sentient, living, cognizant, intelligent and alive. It is believed that the region of the fetus's brain responsible for sophisticated thinking, such as memory and problem solving, begins to develop in the thirteenth week of pregnancy. This is why pregnant women are regarded as *Dauhridini* in this month. Most expectant mothers experience odd cravings and dietetic feelings during the second trimester, known as *Dauhridavastha.* When these cravings are full filled, pregnant women receive nutrition and mental satisfaction, which promotes healthy fetal development. Recent studies have supported this idea, showing that psychological discomfort during pregnancy can lead to unfavorable outcomes in the offspring, such as low birth weight, long-term cognitive development deficits, behavioral issues in childhood and elevated baseline levels of stress-related chemicals. *Charaka* also claimed that pregnant women may feel physical heaviness. This could be due to the weight gain that typically occurs during the second trimester.

5) In the 5th month of fetal development, the brain starts to divide into distinct regions, each responsible for the senses of smell, taste, hearing, vision, and touch. According to *Sushruta*, the mind begins to activate at this time. *Charaka* believed that the senses can perceive only what they are meant to when driven by *Mana* or the mind. *Mana* connected with *Indriya*, enables people to interpret their experiences through the senses, referred to as *Indriya*, in conjunction with *Artha*, referring to the knowledge that the sense organs perceive. These view points indicate the modern perspective about the development of the sense organs.

6) In the sixth month of pregnancy, according to *Sushruta*, the fetus's cognition develops the most. Obstetricians claim that a fetus's brain grows rapidly at the 24th week. It is undeniable that brain growth and development is linked to intellectual development. At the twenty-fourth week, a condition called chloasma gravidarum, or pregnancy mask is a observed. This is a type of pigmentation, appearing around the eyes, forehead and cheeks which can be severe. *Charaka* noted a condition called *Varna Haani*, which is damage to the skin tone. Hyperpigmentation resulting from *Varna Haani* and chloasma exhibit similarities.

7) According to both streams the growth of the fetus in the seventh month takes place substantially . All the organs almost developed .

8) According to *Ayurveda*, if a child is born in the eighth month, it is believed that it may cause death either of mother or baby due to the theory of demonic possession. These references may have been relevant in the past, but with today's advanced neo natal care facilitiess, newborn deaths in preterm infants are extremely rare. However, references to mood fluctuations are seen in both perspectives.

9) In ninth month , parturition takes place according to both perspectives .

V. CONCLUSION

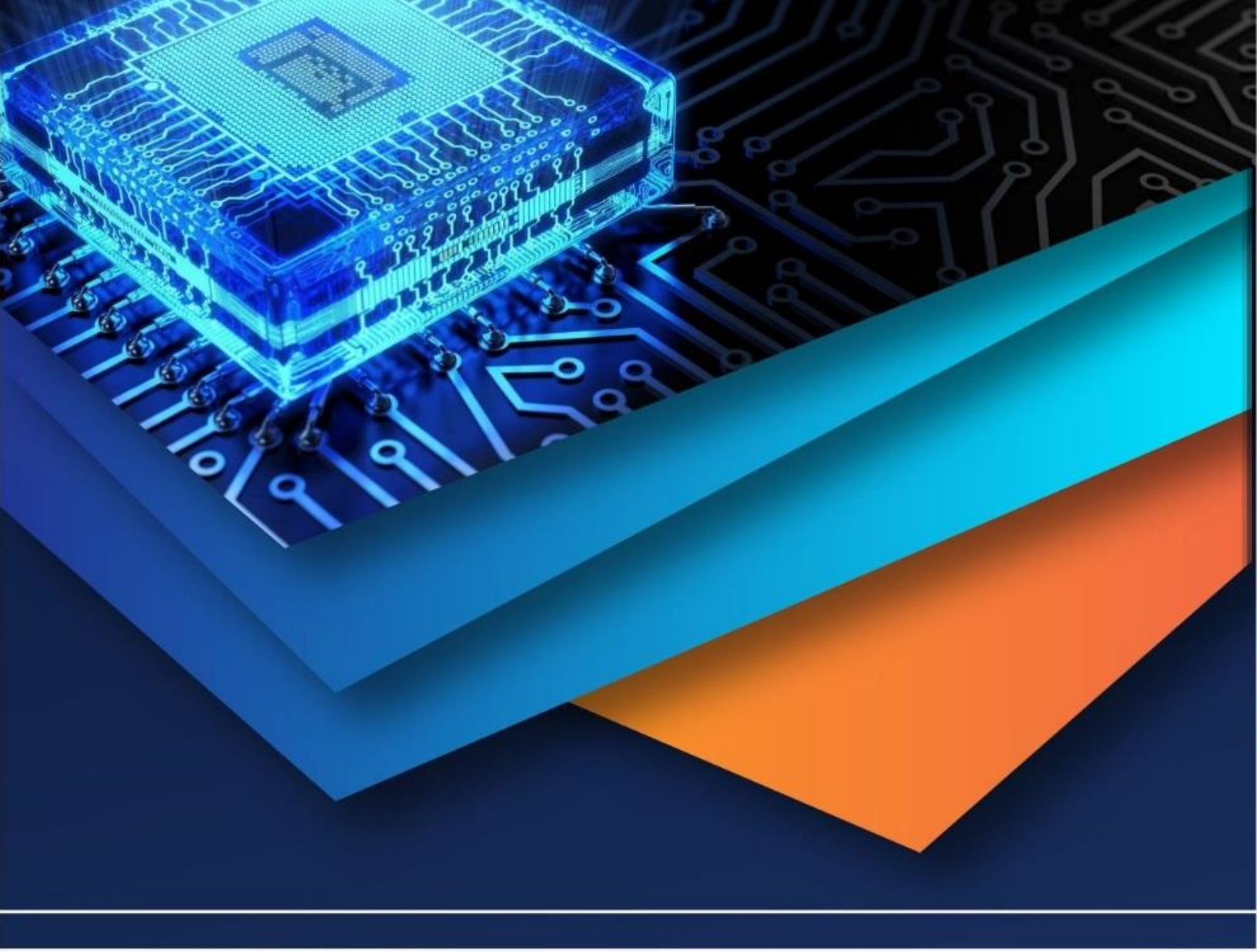
As we evaluate both perspectives, we find significant similarities between *Ayurvedic Garbha Vikas*a and modern fetal development.Despite the absence of advanced techniques, the *Acharyas* provided a detailed description of fetal development that still holds relevance today. Modern science is continuously advancing, with new discoveries being made every day. This study marks the way for further research that aims to validate ancient insights using modern tools.

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