

# Foetal Development In-utero: Modern Medical Knowledge or a Vedic Mystery?

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## Abstract

The ancient Indian Literature is a store of house of knowledge which lies yet untapped due to the limited number of individuals who can translate the scriptures and also due to a lack of awareness about the contents. Charaka Samhita provides a detailed account of the fetal development in-utero and also gives a clinical account of the signs and symptoms associated with pregnancy. A correlation of the account given in this scripture, written at the time when microscopic or imaging techniques were non-existent, with the modern day texts of embryology and fetal development brings forward two nearly identical descriptions. This attempt is intended to promote and encourage a detailed exploration of the vast ocean of knowledge contained in ancient Indian Literature in order to obtain pearls of wisdom.

Charaka Samhita, a treatise of Ayurveda, was used for teaching of Ayurvedic Sciences in the ancient Indian universities of Takshshila and Nalanda and continues to provide guidelines for treatment even in today's world of Modern Medicine. A section of Charaka Samhita deals with the 'in-utero' foetal development, various signs and symptoms in the mother, and treatment guidelines at various stages of pregnancy. An attempt has been made in this research article to correlate the facts given in Charaka Samhita with the present day knowledge of 'in-utero' foetal development. Only relevant text from Charaka Samhita has been used for this purpose and not the whole account, which is a vast sea of knowledge. Herein, the authors attempt to establish the fact that in spite of non-availability of a concrete proof of availability of any microscopic instruments or techniques in the ancient times of Vedas, still the detailed account of the 'in-utero' foetal development in the literature almost exactly matches the present day knowledge and at some places even presents some yet undiscovered facts.

The various Indian systems of medicine – Ayurveda, Yoga, Siddha and Unani (Arabs introduced it in India around the 10<sup>th</sup> century AD), together provide a major source of medical reference for all classes of people. Ayurveda, which literally means 'Science of Life' is considered to be the oldest natural medical practice on the earth. It deals elaborately with measures for healthful living during the various phases of life.

Here we give a portion of the detailed account of 'in-utero' development of the foetus as mentioned in Charaka Samhita in comparison with the present day knowledge. The first stanza is of the only main text by Ayurvedacharya Shri Jayadev Vidyalankaren Pranitiya. Sharirasthanam (Chaturtha adhyaya). Charaka Samhita, Vol 1 (Motilal Banarsidas, Banaras, 1948) in Sanskrit followed by its translation in English, and then follows the comparison with our references.

## Figure 1

i-iii) स सर्वगुणवान् गर्भत्वमापन्नः प्रथमे मासि सम्पूच्छितः सर्वधातुकलनीकृतः खेटभूतो भवत्यव्यक्तविग्रहः सदसद्भूतागांथवयः ॥

i) In the first month when sperm and ovum unite they turn into a seed-form and stick to the mucous membrane and start increasing in size. This seed divides from one into two, two to four, four to eight and so on till a round seed-form is formed.

1. Once the zygote has reached the two-cell stage, it undergoes a series of mitotic divisions, increasing the number of cells. Until the eight-cell stage they form a loosely arranged clump. Approximately 3 days after fertilization, cells of the compacted embryo divide again to form a 16-cell morula.

ii) This seed-form has the capability to give rise to all kinds of tissues and organs.

2. At a very early stage in development, the embryo proper acquires the form of a three-layered disc (three germ layers) called as embryonic disc. All the tissues of the body are derived from one or more of these layers.<sub>2</sub>

iii) There are two types of seed-forms – the inner and the outer. The outer seed-forms are bigger than the inner seed-form. After sometime, a cavity is formed which is filled with fluid in between the two seed-forms. This fluid creates a gap between the two layers.

3. About the time the morula enters the uterine cavity, fluid begins to penetrate through zona pellucida into the intercellular spaces of the inner cell mass. Gradually the intercellular spaces become confluent, and finally a single cavity, the blastocoele forms.<sub>1</sub>

### Figure 2

iv, v) तृतीये मासि सर्वेन्द्रियाणि सर्वांगावयवाश्च यौगपद्येनाभिनिर्वर्तन्ते ॥

iv) In the third month, all germinating parts appear.

4. By the end of the embryonic period the main organ systems have been established, rendering the major features of the external body form recognizable by the end of the second month.<sub>1</sub>

v) a) At this time the head is quite large. The fingers are visible. b) The male and female sex organs are formed. c) The eyelids and lips are not separated.

5. a) The head and upper limbs are still disproportionately large in the 3<sup>rd</sup> month.<sub>3</sub>

b) By the 12<sup>th</sup> week, external genitalia develop to such a degree that sex of the foetus can be determined by external examination (Ultrasonography).<sub>1</sub>

c) During the 3<sup>rd</sup> month eyelids meet and fuse. <sub>3</sub>

vi) Normally, after birth the hole in the middle flap of the heart chamber closes.

6. Foramen ovale persists through out the foetal life. After birth, foramen ovale is permanently obliterated by the fusion of the two flaps.<sub>2</sub>

### Figure 3

vii, viii) मातृजं चास्य हृदयं मातृहृदयेनाभिसंबद्धं भवति रसवाहिनीभिः संवाहिनीभिः तस्मानयोस्ताभिर्भक्तिः सम्पद्यते । तच्चेव कारणमवेषमाणा न द्वैहृदययस्य विमानितं गर्भमिच्छितं कर्तुं, विमानने ह्यस्य दृश्यते विनाशो विकृतिर्वा, समानयोगक्षेमा हि माता तदा गर्भेण केवुचिद्वर्येषु; तस्माद्व्यवहृताभ्यां गर्भिणी विशेषेणोपचरन्ति कुशलाः ॥

vii) a) The heart of the foetus is attached to mother by fluid taking vessels. b) By the third month, heart appears and also starts pumping.

7. a) Oxygenated blood from the placenta comes to the foetus through the umbilical vein, which joins the left branch of the portal vein.<sub>2</sub>

b) During the 4<sup>th</sup> to 7<sup>th</sup> weeks the heart divides into a typical four-chambered structure.<sub>1</sub>

viii) a) By the third month, foetal heart increases in size and the foetal heart chambers are formed. b) But the foetal heart sound (FHS) can be heard per abdomen around the 4<sup>th</sup> month.

8. a) During the 4<sup>th</sup> to 7<sup>th</sup> weeks the heart divides into a typical four-chambered structure.<sub>1</sub>

b) With an ordinary stethoscope FHS can be detected between 18- 20 weeks.<sub>4</sub>

### Figure 4

ix) तस्या गर्भापतेर्द्वैहृदयस्य च विज्ञानार्थं लिङ्गानि समासेनोपदेश्यामः; उपचारसाधनं ह्यस्य ज्ञाने, ज्ञानं च लिङ्गतः, तस्मादिष्टो लिङ्गोपदेशः ।

ix) The mucous membrane of the vagina gives a bluish tinge. And this sign appears by the beginning of the second month.

9. Jacquemier's or Chadwick's sign: It is the dusky hue of the vestibule and anterior vaginal wall visible at about 8<sup>th</sup> week of pregnancy. <sub>4</sub>

### Figure 5

x) चतुर्थे मासि स्थिरत्वमापद्यते गर्भः, तस्मात्तदा गर्भिणी गुरुगात्रत्वमधिकमापद्यते विशेषेण ॥

x) a) In the fourth month, the shape of the body is almost formed. The pregnant women feel the foetal movements at times in this month. b) On head and at other sites instead of hair, fine hair-like structures can be seen.

10. a) Palpation of foetal parts can be made distinctly by 20<sup>th</sup> week. Active foetal movements can be felt at intervals by placing the hand over uterus as early as 20<sup>th</sup> week.<sub>4</sub>

b) During the fourth month the covering of primary hair appears- lanugo.<sup>1</sup>

**Figure 6**

xi.xii) पञ्चमे मासि गर्भस्य मासिशोणितोपचयो भवत्यधिकमन्येभ्यो मासेभ्यः, तस्मात्तदा गर्भिणी कार्श्यमापद्यते विशेषेण ।।

xi) a) In the fifth month due to the increase in the body mass and blood of the foetus, its movements can be clearly felt by pregnant women. b) In the middle or at the end of this month a physician can hear the FHS with the help of stethoscope. FHS is 120-140/minute. In males, it is generally <130/minute and in females >130/minute.

11. a) Active foetal movements can be felt at intervals by placing the hand over uterus as early as 20<sup>th</sup> week.<sup>4</sup>

b) The heart rate varies from 140-160 per minute but gradually settles down to 120-140 per minute as the pregnancy advances.<sup>4</sup>

xii) First of all FHS is heard in the midline above the gluteal region. Later the site of FHS changes as per the presentation and lie of the foetus. This sound is heard after passing through the scapula and ribs of the foetus and therefore heard near the foetal shoulder.

12. The foetal heart sounds are best audible through the back (left scapular region) in vertex and breech presentation, where the convex portion of the back is in contact with the uterine wall. However, in face presentation, the heart sounds are heard through the foetal chest.<sup>4</sup>

**Figure 7**

xiii.xiv) षष्ठे मासि गर्भस्य मासिशोणितोपचयो भवत्यधिकमन्येभ्यो मासेभ्यः, तस्मात्तदा गर्भिणी बलवर्णहानिमापद्यते विशेषेण ।।

xiii) Prior to the sixth month the foetal skin is wrinkled.

13. During the 6<sup>th</sup> month the skin of the foetus is reddish and has a wrinkled appearance because of the lack of underlying connective tissue.<sup>1</sup>

xiv) Eyebrows and eyelids are formed and the latter are still fused.

14. Eyelids and eyebrows are now well developed in the 6<sup>th</sup> month.<sup>3</sup>

**Figure 8**

xv- xvii) सप्तमे मासि गर्भः सर्वभाविराप्याययते, तस्मात्तदा गर्भिणी सर्वाकारः क्लान्ततमा भवति ।।

xv) During the 7<sup>th</sup> month, the eyelids separate.

15. During the 7<sup>th</sup> month the eyelids themselves separate.<sup>3</sup>

xvi) The testes descend near scrotum.

16. During the 7<sup>th</sup> month, the testes abruptly and rapidly passes through the inguinal canal and gains the scrotum.<sup>3</sup>

xvii) Baby born at the end of this month can survive only if provided with the special care. Majority of the babies born in this month do not survive.

17. A foetus born during the sixth or the beginning of the seventh month has great difficulty in surviving.<sup>1</sup>

**Figure 9**

xviii) अष्टमे मासि गर्भश्च मातुतो गर्भतश्च माता रसवाहिनीभिः संवाहिनीभिर्मुहुर्मुहुरोजः परस्परत आददाते गर्भस्यासंपूर्णत्वात्, तस्मात्तदा गर्भिणी मुहुर्मुहुर्मुदा युक्ता भवति मुहुर्मुहुश्च खाना तथा गर्भः, तस्मात्तदा गर्भस्य जन्म व्यापत्तिमद्भवत्योजसोऽनवस्थितत्वात्: तं चैवमभिसमीक्ष्याष्टमं मासमगण्यमित्याचक्षते कुशलाः ।।

xviii) (Eighth month) Fat accumulates beneath the skin and the wrinkles disappear. The foetus can survive if raised carefully.

18. a) During the 7<sup>th</sup> month the skin loses its wrinkled appearance due to increased deposition of subcutaneous fat. <sup>3</sup>

b) During the end of this month, the foetus is viable and may in fact be successfully raised if born prematurely.<sup>3</sup>

**Figure 10**

xix.xx) तस्मिन्नेकदविसात्तिकान्तेऽपि नवमं मासमुपादाय प्रसवकालमित्याहुराद्वादशान्मासात्, एतपवान्कालः वैकारिकमतः परं कुशाववस्थानं गर्भस्य ।।

xix) Gestation period = 9-12 months.

19. The length of period of gestation is regarded as 9 calendar months in obstetrics practice- approximately 270 days.<sup>3</sup>

xx) a) The testes descend into scrotum in ninth month. b) The foetus measures 20 inches in length and weighs approximately 3.5 kilograms.

c) The size of the finger nails increases.

20. a) Sexual characteristics are pronounced and testes

should be in the scrotum by the ninth month,<sup>1</sup>

b) At the time of birth the weight of a normal foetus is 3000 to 3400 grams; its Crown Heel Length is about 50cms.

Foetal growth of nails is gradual and their extremities have merely reached near the tips of digits at birth, fingers being rather more advanced than those of the toes.<sup>3</sup>

The field of medicine and mankind on the whole would benefit a lot if more research is undertaken to establish the scientific basis of the Indian System of Medicine, which has been practised successfully in India and certain parts of the world since ages. A near identical nature of the two descriptions merits a detailed and in-depth research in to this

vast and yet untapped source of knowledge.

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