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Evaluation Of Second Month Development In Gestation As Per *Sushruta* With Contemporary Medical Science: A Conceptual Study

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ABSTRACT: -

In *Sushruta* Samhita *Sharira Sthana*, sex differentiation of human embryo is mentioned and same concept is mentioned in modern embryology with different terminology. The external genitalia in both male and female develop from the genital tubercle. The development includes speculation, induction and maintenance of outgrowth of the genital tubercle. The concept of growth of genital tubercle in the 2nd month of gestation, development of sex on that basis and justification of shape and constitution as *Pinda* (condensed round mass), *Peshi* (muscle) and *Arbuda* (tumor) as mentioned in Sushruta Samhita is studied in this article. It is matter of concern that how deep meaning is mentioned by Sushruta as *Pinda*, *Peshi and Arbuda* for the gender of fetus. The structure like- *Pinda, Peshi and Arbuda* are justified as genital tubercle and phallus rather than whole embryo constitution. Visualization of the external genitalia during ultrasound is clinically important for severe X linked disorders, ambiguous genitalia and disorders of sex development.

Keywords - Ayurveda, External genitalia, Genital tubercle, *Peshi*, *Pinda*, Phallus.

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INTRODUCTION

The key details of embryology are most valuable for the persons who study anatomy because it is based on the development and structure of the human body in a very precise format from the fertilization till birth and further postnatal stage. Ayurveda is a practical and applied science. The description of prenatal life in *Sharira Sthana* of Samhita of Ayurveda shows its practical applicability. In description of *Garbha* as per classical sages, the development of male or female progeny in second month of pregnancy is mentioned in Sushruta Samhita.[1]

The external genitalia develop from the genital tubercle, the precursor for both. The development includes speculation, induction and maintenance of outgrowth of the genital tubercle.[2]

In Sushruta Samhita Sharira Sthana, sex differentiation of human embryo is mentioned and same concept is mentioned in modern embryology with different terminology. The concept of growth of genital tubercle in the 2nd month of gestation and development of sex on that basis and justification of *Pinda, Peshi and Arbuda* as mentioned in Sushruta Samhita is studied in this article.

Classical literature with commentaries, literature of embryology, journals articles and internet materials were reviewed for the topic and related information. References were collected and analysed systematically to understand sex differentiation on the basis of shape and constitution as mentioned in second month of development as per Sushruta Samhita with corresponding contemporary medical science.

Ayurveda Perspective [3]

During the second month it becomes hard mass due to aggregation of *Panchmahabhutas* getting worked on this mass and by the action of *Bhutas* mainly *Prithivi, Jala and Vayu*. *Doshas* that act are *Kapha* which gives *Snighadata, Pitta* which gives *Ushanata and Vayu* gives spaces so that enhancement of body structures occurs and further growth and development in body worked. The main action in second month are the growth of genital system in which Sushruta mentions that if this masses assumes a round shape, it grows as a male foetus, if it assumes a elongated shape like the muscles, it grows as a female foetus; if it is like *Arbuda*, mass of irregular shape it grow like hermaphrodite.

The different commentators use different word which shows the specification of male, female, heterosexual growth in second month of development are :-

	SUSHRUTA [4]	**DHALHANA [5]**	**BHOJA/GAYADASA [6]**
Pumān	*PINDA*	*Pinda Vartula Akriti*	*Vritta Pinda Ghana*
Strī	*PESHI*	*Peshi Dhergha Akriti*	*Chaturasatra –Peshi*
Napuṃsakam	*ARBUDA*	*Arbudha VartulaPhallaardha*	*Shalmalimukula Akara Arbudha*

Table no.1 showing opinion of Sushruta and different commentators on specification of male, female and heterosexual growth in second month of development

MODERN PERSPECTIVE

Primordial germ cells are first recognizable at 24days after fertilization among the endodermal cells of umbilical vesicle near the origin of allantois and migrate into developing gonads during 6th week, where they differentiate into germ cells.[7]

Before the 7th week, gonads of two sexes are identical in appearance and are called indifferent gonads and this initial period of genital development is an indifferent stage of sexual development.[8]

Development of external genitalia: male and female: [9],[10] Up to the 7th week of development, gonads do not attain sex differentiation characters as per morphologically. Distinguishing sexual characteristics begins to appear at the end of 8th week, but the external genitalia are not fully differentiated until the 12th week.

Early in the fourth week, proliferating mesenchyme produces a genital tubercle (primordium of penis or clitoris) in both sexes at the cranial end of the cloacal membrane. The cloacal ectoderm is believed to be the source of genital initiation signal which involves Fgf8 expression.

Labioscrotal swellings and urogenital folds soon develop on each side of cloacal membrane. The genital tubercle elongates to form a primordial phallus. The urogenital membrane lies in the floor of median cleft, the urethral groove, which is bounded by the urethral folds.

The sex of the embryo is determined genetically at the time of fertilization. Sex differentiation of male / female is a complex process. This involves many steps & many genes are functional. SRY gene (sex determining region on Y) for testis determining factor (TDF) determines testicular differentiation in the development of male phenotype. Testosterone produced by fetal testes and AMH (antimullerian hormone) determines normal male sexual differentiation, which began in the 7th week. Ovarian development occurs when no Y chromosome is present, which begun about 12th week. [11]

Rapid elongation of genital tubercle is called the phallus, it pulls the urethra folds forward so, that they form the lateral wall of urethral groove. At second month completion the two urethral folds close over the urethral plate forming the spongy urethra. Labioscrotal swellings grow toward each other and fuse to form scrotum. [12]

In females the genital tubercle elongates only slightly and forms the clitoris. Urethral folds do not fuse, as in the male, but develop into the labia minora. Although the genital tubercle does not elongate extensively in the females, it is larger than in the male during the early stages of development. In fact, using tubercle length as a criterion (USG) has resulted in mistakes in identification of sexes during first trimester. Labioscrotal folds fuse to form posterior and anterior labial commissure, mons pubis and labia majora. [13]

Errors in sex determination and differentiation result in various degree of intermediate sex, ambiguous genitalia and disorders of sex development (DSD). These are ovo testicular DSD (true hermaphroditism), 46XX, DSD (female pseudo-hermaphroditism) and 46XY, DSD (male pseudo-hermaphroditism) [14]

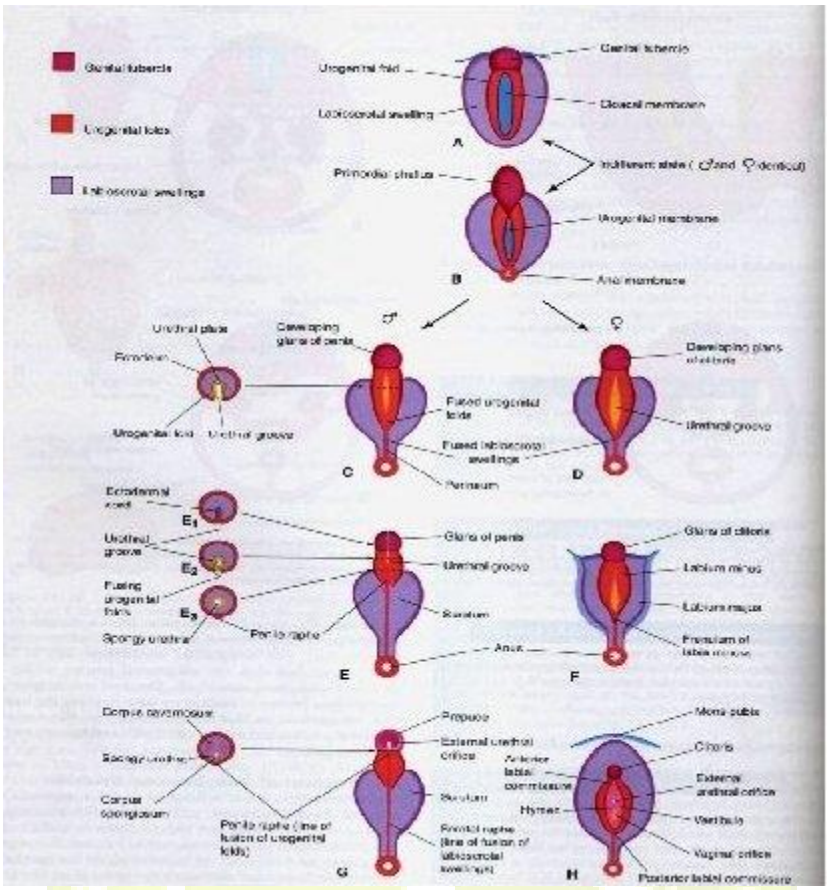

Figure no.1 showing development of genital genitalia. A &B diagram shows appearance of genitalia during 4th to 7th week. C,E,G diagram shows stages in development of male external genitalia. D,F,H diagram shows stages in development of female external genitalia.[15]

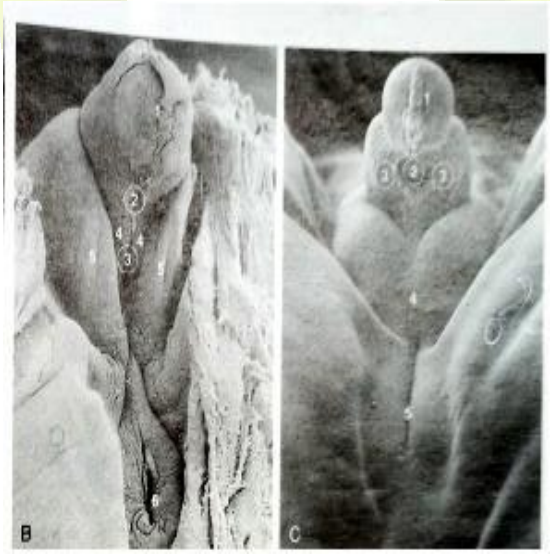

Figure no.2 showing external genitalia of 10 week female fetus and external genitalia of 10 week male fetus.[16]

DISCUSSION

The sex of the baby is formed in the second month of pregnancy. And the authenticity of same can be determined before birth by ultrasound examination. Development of the gonads & genitalia are derived from same primordial i.e. genital tubercle in both male and female. The primordial genital tubercle at the stage of 7th week is undifferentiated whether it develops in male or female. During the process of development from 4th to 12th week this genital tubercle convert into phallus and form respectively body and glans penis, corpora cavernosa and corpus spongiosum in male and clitoris, glans of clitoris, corpora cavernosa of clitoris in female.[17] The genital tubercle lengthen extensively in the females as compared in male for the duration of the early phase of development.[18] During this phase of development the external genitalia of female fetus as shown in USG and electron microscopy seems to be elongated and strip like structure and that of male is oval rounded as shown in diagram2. This structure shows justification of resemblance to the *Pinda and Peshi* specification of Sushruta of 2nd month. *Garbha as Pinda* means *Vritta,* oval, rounded structure and *Peshi means Deergha* elongated structure. The external genitalia of male fetus is oval rounded and that of female is elongated strip like at the end of second month as per modern embryology also which is seen only via the mode of technology as these are extremely minute structures to be seen by naked eyes. It is matter of concern that how deep meaning is mentioned by Sushruta as *Pinda, Peshi and Arbuda* for the gender of fetus. The structure like- Pinda, *Peshi and Arbuda* are justified as genital tubercle and phallus rather than whole embryo constitution.

In hermaphrodites, abnormal development of the gonads and genitalia occurs as a result of that, person develop both male and female characteristics at the same time and hence the genitalia of anomaly foetus looks like a tumor structure showing resemblance with *Shalmali* which shows abnormal development. Visualization of the external genitalia during USG is clinically important for several reasons, including detection of fetuses at risk of severe X linked disorders, ambiguous genitalia and DSD.[19] So, if it necessary to do invasive testing at 2nd month or weeks corresponding to this month to exclude these disorders and anomaly.

CONCLUSION

The present article explored the fundamental concept of sex differentiation in the second month of development according to Sushruta as well as comprehensive embryological explanation of same and justification of shape and constitution of embryo as per both literatures has also been presented.

Genital tubercle and primordial phallus which develops into male external genitalia show *Pinda* appearance i.e. round structure and which develop into female external genitalia looks *Peshi* like structure i.e. elongated structure. The structure like- Pinda, *Peshi and Arbuda* are justified as genital tubercle and phallus rather than whole embryo constitution for determining the sex of fetus. It is necessary for visualization of the external genitalia during USG at 2nd month of development to exclude ambiguous genitalia and DSD.

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Source Of Diagrams: Keith L.Moore, T.V.N Persaud, Mark G.Torchia. the developing human clinically oriented embryology. 9th edition. Philadelpia: saunders (an imprint of Elsevier); 2013.

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