



A COMPREHENSIVE STUDY OF 'SROTAS DEVELOPMENT' IN FETUS W. S. R. TO SUTRA MENTIONED IN SUSHRUTA SHARIRA- STHAN. 4 / 57-58

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ABSTRACT

Ayurveda, ancient yet timeless, gives us the means of attaining and maintaining our own health and well-being. It uses the inherent principles of nature to help, maintain health in a person by keeping an individual's body, mind & spirit in perfect coherence with nature. The benefits of ayurvedic medicine have been proven over centuries of use, and its methodologies are as applicable today in the west as they were thousand of years ago in india. As any knowledge system grows through consistent researches and re-evaluations; Ayurveda also has always emphasized the same to sustain its relevance. The pledged purpose of Ayurveda as a medical system is to ensure health to the humanity. In the backdrop of the renaissance of Ayurveda as an alternative or even an ultimate answer to almost any kind of psychosomatic and life-style related diseases, the time is apt enough to initiate productive researches in such disorders where Ayurveda can offer a better solution than any other discipline of medical sciences. The developmental process from a single cell to organ primordia (the first 8 weeks of human development) is called the period of embryogenesis aka the period of organogenesis. The period from that point on until birth is called the fetal period. Observations became more sophisticated with advances in optical equipment and dissection techniques. anatomical approaches dominated early investigation. To accomplish aforesaid goal fundamentals of ayurveda have to be transcribed into globally accepted literal dialect. So it is pertinent to elucidate the pathway of Srotas-parinaman and its development vis-à-vis anatomical presence of jyotisthan with scientific evidence so that in the modern era, this theory can be upheld unanimously.

KEYWORDS: Jyoti-Sthan, Srotas, Nabhi, Vikas, Embryonic Period, Dhruvam, Fetus, Embryology.

INTRODUCTION

Ayurveda is the oldest science, still perpetuating and profoundly propagating with relevance, dealing with health i.e. 'aayu'. It possesses every parlance and parallels mentioned anywhere in the modern medical science and else. It begins by describing and propounding the origin of human life at very metaphysical level and travels far beyond to physical / physiological / biological level. It even describes the last level (purpose) of existence viz. 'moksha'. All these aspects are described in the part of ayurveda named as 'sharir'. As of our incarnation in human body, a natural riddle always keep on striking that how we are made and many related questions beyond that. The theme of growth, differentiation, specialisation and development of an individual or that of a species of a particular kind, has led to the study of embryology. The subject of human development encircles and deals with the study of individual

development. The understanding of the complex evolution of human development has been made easy by Ayurvedic biologists by knowing the role of tridosas i.e. vata, pitta and kapha. As of modern embryology It's travelogue from a single cell to a baby in 9 months-a developmental process that represents an integration of complex phenomena and is called embryology. It includes investigations of the molecular, cellular, and structural factors contributing to the formation of an organism. Greater understanding of embryology has resulted in:

- 1) New techniques for prenatal diagnoses and treatments.
- 2) Therapeutic procedures to solve the issues of infertility.
- 3) Mechanisms to prevent birth defects, the leading cause of infant mortality. These improvements are significant not only for improved birth outcomes but also for their long term effects

postnatally. The field of experimental embryology flourished in the 20th century. Numerous experiments were devised to determine their cell lineages during fetal development. These included observations of transparent embryos from tunicates that contained pigmented cells which could be seen through a microscope. Later, vital dyes were used to stain living cells to trace the path they adopt during development. Later in the 1960s, radioactive labels and autoradiographic techniques were adopted. One of the first genetic markers is chick-quail chimeras. Grafting experiments also provide the first insights into signaling between tissues.

Today, molecular approaches have been added with experimental paradigms used to study development of fetus. Numerous means of identifying cells using reporter genes, fluorescent probes, and other marking techniques have made capable to map cell fates. Using other techniques to alter gene expression, such as knockout, knock-in, and antisense technologies, have created new ways and allowed the study of a single gene's function in specific tissues. Thus, molecular biology has advanced the field of embryology to the next level. As we decipher the roles of individual genes and their interplay with environmental factors, our understanding of developmental processes progresses. In sushruta sharir sthan, chapter- 4 viz. garbhvyakaran sharir. It is as under:

तस्यान्तरेणनाभस्तुज्योतिःस्थानंध्रुवंस्मृतम्।

तदाधमतिवातस्तुदेहस्तेनास्यवर्धते ||Su.sha. 4/57||
ऊष्मणासहितश्चापिदारयत्यस्यमारुतः।

ऊर्ध्वतिर्यग्धस्ताच्चस्रोतांस्यपियथातथा ||Su.sha..4/58||

In the above shloka, it is stated that there resides a "JYOTI STHAN" in the mid area of fetal body i.e. navel. Vayu blows this Jyoti Sthan, which causes further physical development of the fetus. Furthermore, Vayu carries the thermal energy along with it, from the Jyoti Sthan and by moving in different directions help in formation of srotas of fetus. Srotas resembles tubular structures in the body providing pathway for movement of all the constituent entities of human body as per ayurveda viz. dosha, dhatu & mala.

AIM AND OBJECTIVES

1. To establish anatomy of jyoti sthan around nabhi in fetus, if any, both in view of rachana sharir of ayurved and modern embryology.
2. To establish dynamics of vaat in development of fetus, both in view of rachana sharir of ayurved and modern embryology.
3. To conceptualize and develop a crystal-clear view of srotas development of fetus with the help of

sonological evidence, if any and construct a literal bridge between ayurveda classics and modern embryology.

MATERIALS AND METHODS

Methodology for Clinical study

A) Cases

Selection of Cases

30 cases were screened for fetal study from OPD / IPD. Written consent was taken from the patient after explaining the facts.

Inclusion Criteria

1. Females of age group 18-40 years.
2. Females diagnosed with pregnancy.

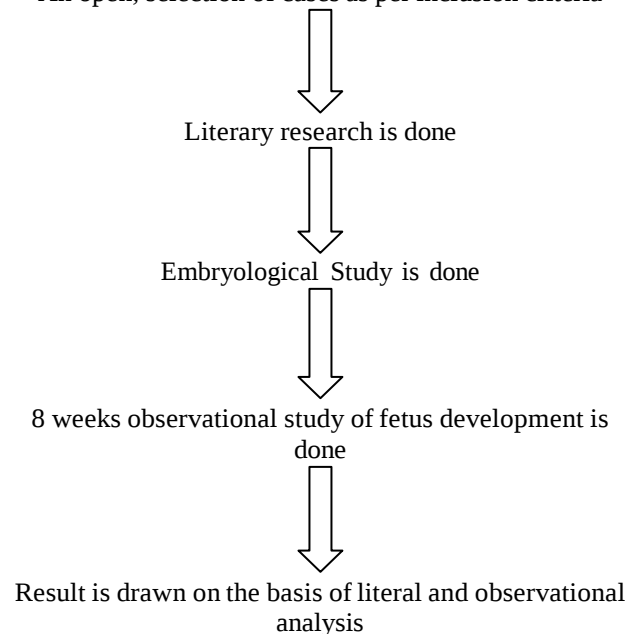
Exclusion Criteria

1. Females with co-morbidity affecting mental or physical health.
2. Females with extreme age groups more than 40 years or less than 18 years.
3. Females with terminal illness and any systemic disease like uncontrolled DM.
4. Females with positive viral markers.
5. Females with any other chronic diseases.

Place of work: - OPD & IPD Study design

Exploratory study Flow Chart

An open, selection of cases as per inclusion criteria



Criteria for assessment

A. Subjective Parameter

All cases were registered for clinical trial and they were looked for any changes in their clinical manifestations and growing feeling of, well-being. Observational study upto 8 weeks of embryo is done.

B) Objective Parameters

1) Investigations

Sonological investigations are made to study fetal

growth. Routine investigations are being done to rule out conditions of exclusion criteria.

Criteria for withdrawal

- During the course of trial if any serious condition occurs which required an urgent treatment.
- Cases himself wants to withdraw from the clinical trial.
- Those not giving proper follow up.

Criteria of assessment: Qualitative, comparative, deductive and observational.

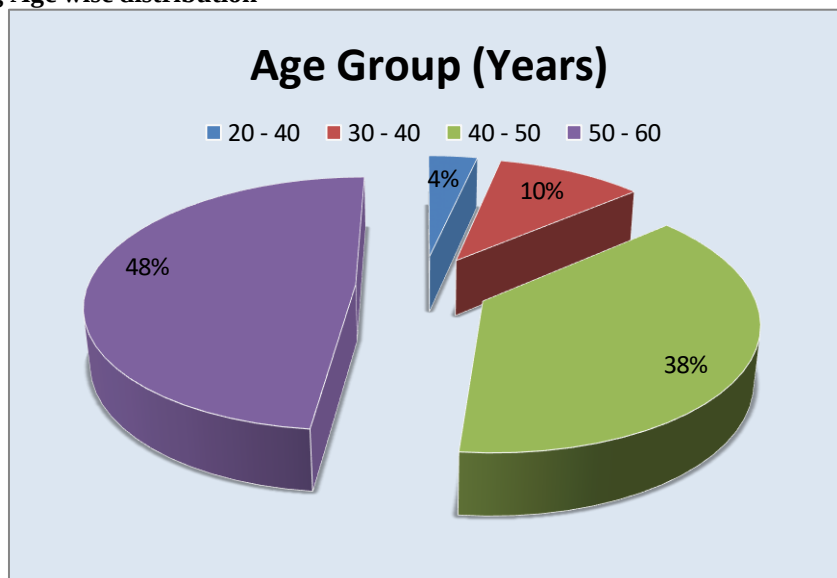
OBSERVATIONS AND RESULTS

Observation is the base of any research. Data collected during the study is termed as an observation. Result and Conclusion are implicated according to the observations.

Table Showing Age wise distribution

Age group (yrs)	No. of pts.	Percentage
20 – 25	1	3.33 %
25 – 30	3	10 %
30 – 35	11	36.67 %
35 – 40	15	50 %
Total	30	100 %

Pie Chart Showing Age wise distribution

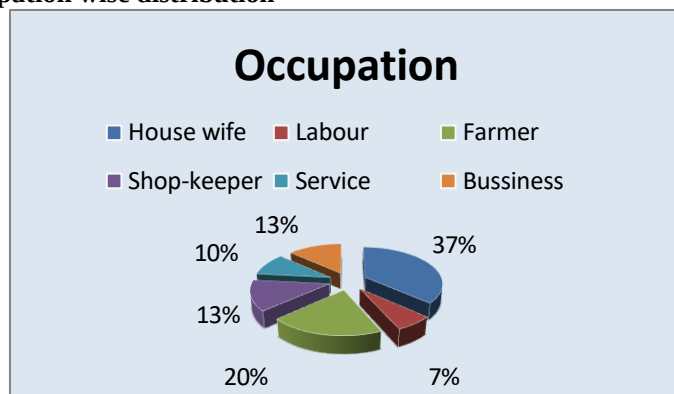


The above table and Pie chart reveals that -majority of the patients i.e. 15 (50 %) were reported in age group of 30 – 40 years, followed by 10 (33.33 %) patients observed in the age group of 40 – 50 years, 4 (13.33 %)

patients were observed in age group of 50 – 60 years, and 3 (10 %) patients were observed in age group of 20 – 30 years.

Table Showing Occupation wise distribution.

Occupation	No. of pts.	Percentage
House wife	11	36.67 %
Labourer	2	6.67 %
Farmer	6	20 %
Shop keeper	4	13.33 %
Service	3	10 %
Business	4	13.33 %
Total	30	100 %

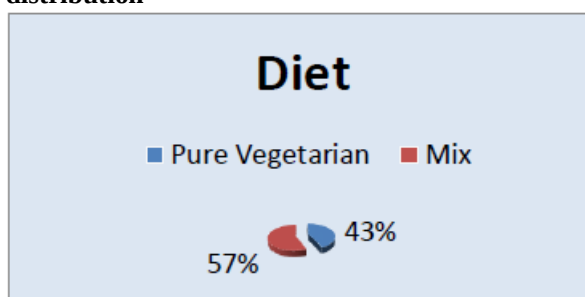
Pie Chart Showing Occupation wise distribution

The above table and Pie chart show that maximum 11 (36.67 %) patients were House wife, 6 (20 %) patients were Farmer, 4 (13.33 %) patients were Shop keeper,

and same numbers of patients were doing Bussiness, and 3 (10 %) patients were doing Service.

Table Showing Diet wise distribution.

Diet	No. of pts	Percentage
Pure Vegetarian	13	43.33 %
Mix	17	56.67 %
Total	30	100 %

Pie Chart Showing Diet wise distribution

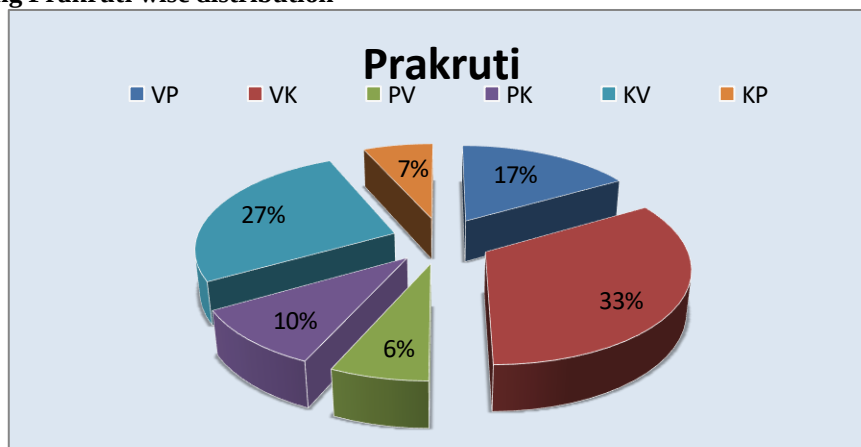
The above table and Pie chart show that maximum 17 (56.67 %) patients were having mixed type of diet,

and 13 (43.33 %) patients were pure vegetarian.

Table Showing Prakruti wise distribution.

Prakruti	No. of pts.	Percentage
Vata-pitta	5	16.67 %
Vata-kapha	10	33.33 %
Pitta-vata	2	6.67 %
Pitta-kapha	3	10 %
Kapha-vata	8	26.67 %
Kapha-pitta	2	6.67 %
Total	30	100 %

Pie Chart Showing Prakruti wise distribution



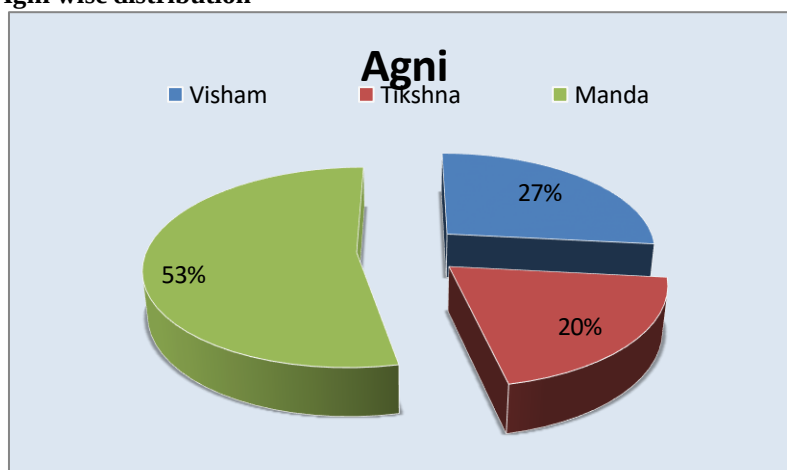
The above table and Pie chart show that maximum 10 (33.333 %) patients were having Vata- kaphaPrakruti, followed by 8 (26.67 %) patients were having Kapha-vataPrakruti, 5 (16.67 %) patients were having Vata-

pitta Prakruti, 3 (10 %) patients were having Pitta-kapha, 2 (6.67 %) patients were having Kapha-pitta and Pitta-vataPrakruti in this study.

Table Showing Agni wise distribution.

Agni	No. of pts.	Percentage
Vishama	8	26.67 %
Tikshna	6	20 %
Manda	16	53.33 %
Total	30	100 %

Pie Chart Showing Agni wise distribution



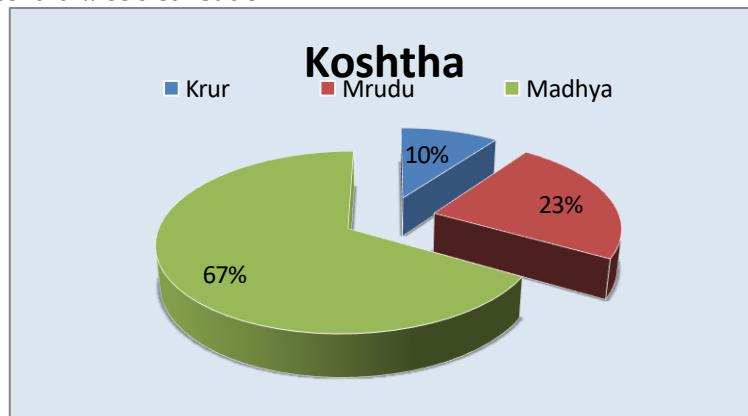
Cases are asked for their appetite between to ahar-kal and thus concluded. The above table and Pie chart show that 16 (53.33 %) patients were having Manda type of

Agni, 8 (26.67 %) patients were having Vishama type of Agni, and 6 (20 %) patients were having Tikshna type of Agni.

Table Showing Koshtha wise distribution.

Koshtha	No. of pts.	Percentage
Krura	3	10 %
Mrudu	7	23.33 %
Madhya	20	66.67 %
Total	30	100 %

Pie Chart Showing Koshtha wise distribution



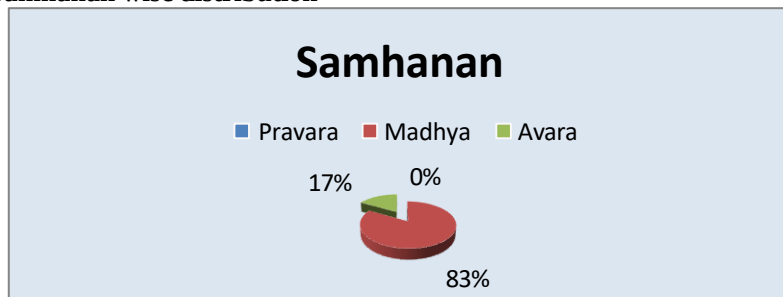
Cases are asked for their bowel habits and thus concluded. The above table and Pie chart show that 20 (66.67 %) patients were having Madhya type of

Koshtha, 7 (23.33 %) patients were having Mrudu type of Koshtha, and 3 (10 %) patients were having Krura type of Koshtha.

Table Showing Samhanan wise distribution.

Samhanan	No. of pts.	Percentage
Pravara	0	0 %
Madhyama	25	83.33 %
Avara	5	16.67 %
Total	30	100 %

Pie Chart Showing Samhanan wise distribution



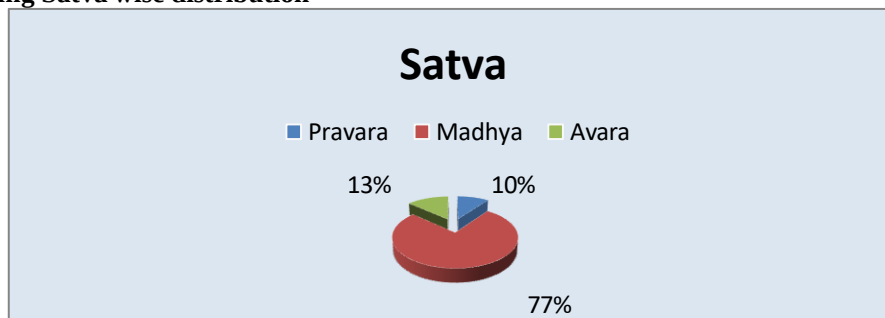
The above table and Pie chart show that maximum 25 (83.33 %) patients were having Madhyama type of

Samhanan, and 5 (16.67 %) patients were having Avara type of Samhanan.

Table Showing Satva wise distribution.

Satva	No. of pts.	Percentage
Pravara	4	13.33 %
Madhyama	23	76.67 %
Avara	3	10 %
Total	30	100 %

Pie Chart Showing Satva wise distribution



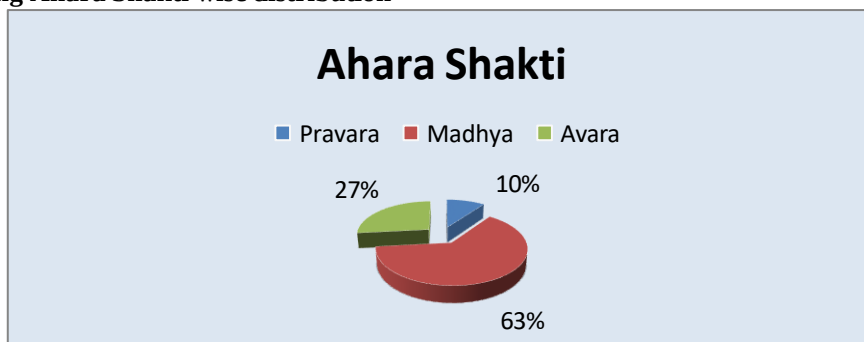
Cases are asked for their daily routine behaviour (habits and habitats) and thus concluded. The above table and Pie chart show that 23 (76.67 %) patients

were having Madhyama type of Satva, 4 (13.33 %) patients were having Pravara type of Satva and 3 (10 %) patients were having Avara type of Satva.

Table Showing Ahara Shakti wise distribution.

Ahara Shakti	No. of pts.	Percentage
Pravara	3	10 %
Madhyama	19	63.33 %
Avara	8	26.67 %
Total	30	100 %

Pie Chart Showing Ahara Shakti wise distribution



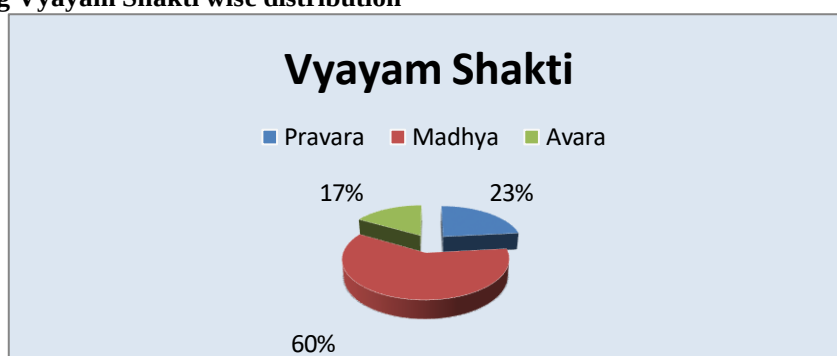
The above table and Pie chart show that maximum 19 (63.33 %) patients were having Madhyama type of Ahara Shakti, 8 (26.67 %) patients were having Avara

type of Ahara Shakti, and 3 (10 %) patient was having Pravara type of Ahara Shakti.

Table Showing Vyayam Shakti wise distribution.

Vyayam Shakti	No. of pts.	Percentage
Pravara	7	23.33 %
Madhyama	18	60 %
Avara	5	16.67 %
Total	30	100 %

Pie Chart Showing Vyayam Shakti wise distribution

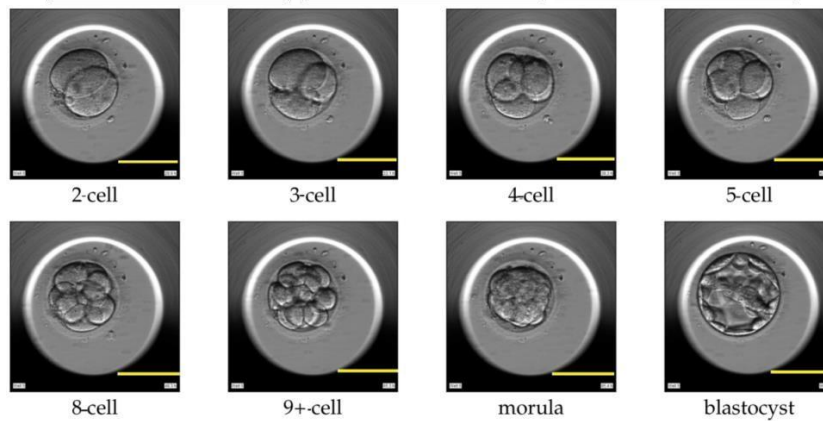
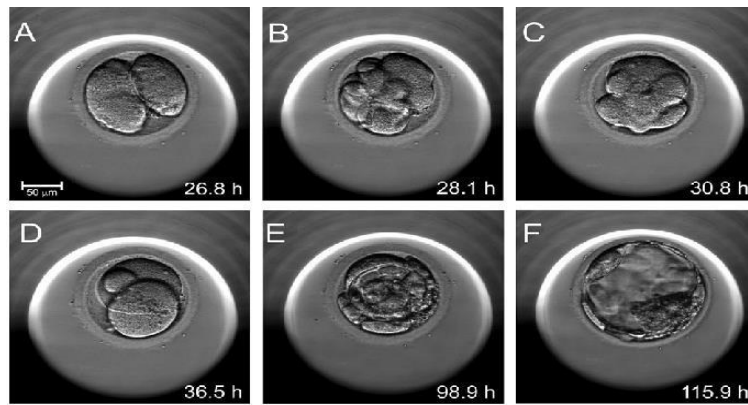
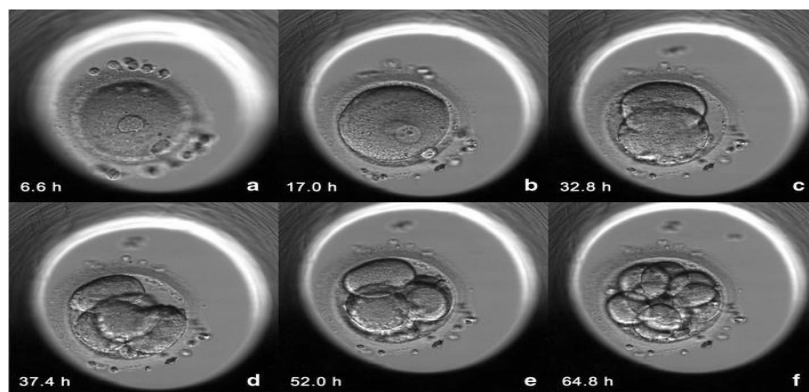
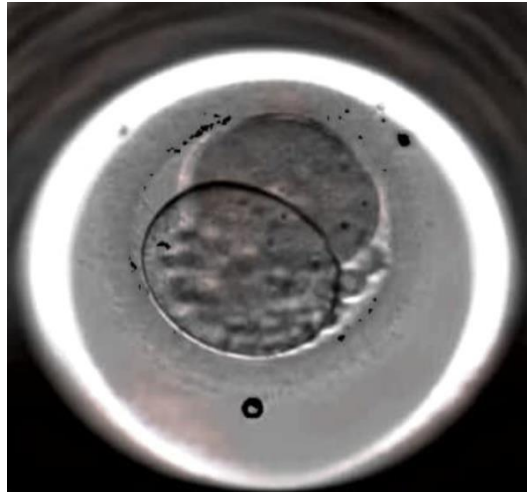


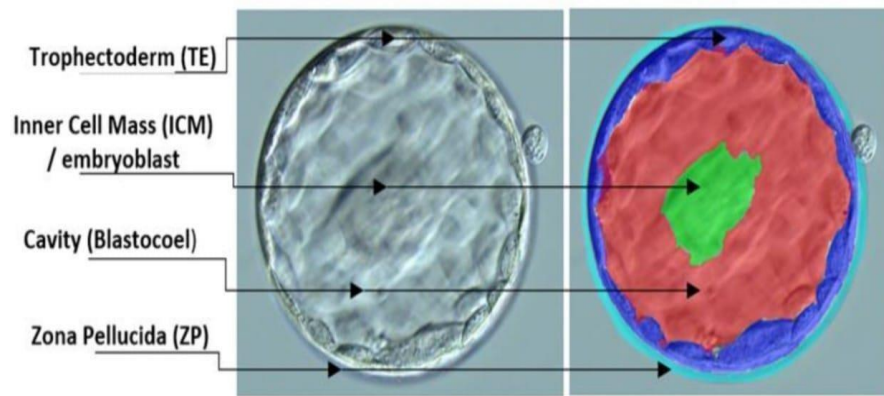
The above table and Pie chart show that maximum 18 (60 %) patients were having Madhyama type of Vyayam Shakti, 7 (23.33 %) patients were having Avara type of Vyayam Shakti, and 5 (16.67 %) patients were having Avara type of Vyayam Shakti.

Radiological observations

❖ Time-lapse images showing pre-implantation stages of an embryo

1) Time-lapse imaging showing normal fertilisation of an oocyte, post-insemination.





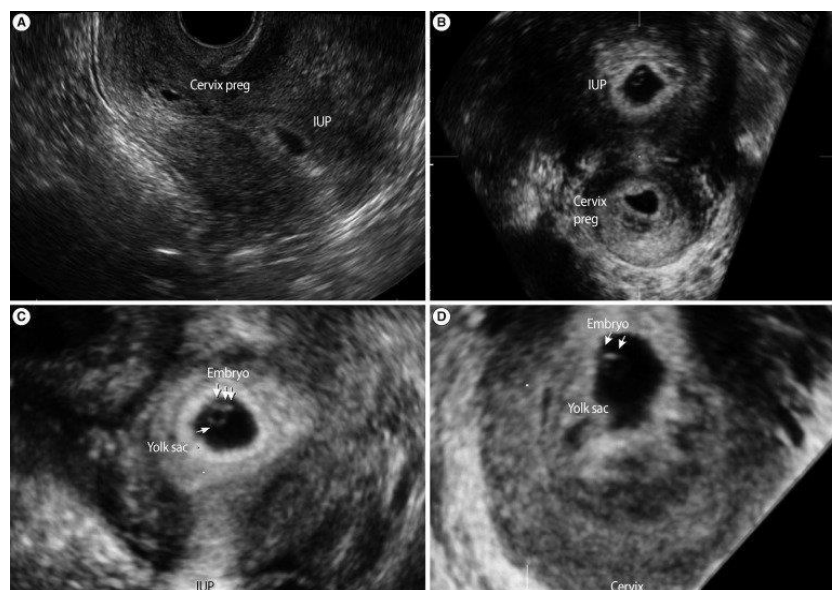
Second week (image A) and Third week (image B) USG image of embryo.



❖ Four weeks and five weeks gestation Transvaginal ultrasonography image.

(A) a cervical and intrauterine pregnancy simultaneously at 4 weeks+5 days of gestation. (B) image at 5 weeks+2 days of gestation. Two gestational sacs were confirmed. (C) One sac in the uterine cavity, measuring 13.5 mm with a live fetus (crown-rump

length measuring 3 mm with fetal heartbeat). (D) Another sac in the uterine cervix, measuring 9.6 mm with yolk sac and fetal pole and equivocal fetal heart tones. IUP, intrauterine pregnancy; cervix preg, cervical pregnancy.



Six weeks USG image



Seven weeks USG image.



Eight weeks USG image.



DISCUSSION

AcharyaVagbhatta has quoted Nabhi as a dominant place of Pitta. Nabhi is called jyothisthana and the agni in the nabhi of the garbha is fanned by vayu. The same vayu in combination with the agni spreads in srotas in vertical, horizontal and oblique direction and thus growth of the garbha takes place. Acharya Dalhana explains the term marutadhmana by saying “vata entering into the srotas in dhatus of the fetus causes their dilatation, thus providing space for its growth”. Here two factors are responsible for the development of the fetus-1.Mother’s ahara rasa 2.Vayu with agni. Here

nabhi is considered as the jyothisthana for the place of agni. AcharyaSushruta described that the nabhi surrounded by siras from all sides like spokes arising from centre of wheel. According to Ayurveda root of siras is nabhi, because from nabhi they spread upwards, downwards and obliquely. They nourish the body like river and streams in term of Jalaharini. According to Yoga philosophy, in Shadchakras the third chakra is manipura. It is situated in nabhi region. This chakra is also called as nabhi chakra. In this context the word mani is used in the sense of agni(jyoti). Both mani and agni (jyoti) have tejas

property. All organs are developed simultaneously inside the embryo at the same time. The growth and development of different organs do take place in further months of pregnancy. All Acharya define the formation of different Anga, Pratayanga, Avayava, Indriya simultaneously in third month of Garbha Vikasa Krama. The sequential development of Avayava is explained with word Yathakramamin Kashyapa Samhita. Third month onwards the Avayavado start to develop and this is explained in KashyapaSamhita as Sarva Dahtu Anga Sampurna Garbha.

DISCUSSION ON OBSERVATIONS

The observations made on 30 patients are discussed below.

Age: More patients reported in the study are from 30 to 40 yrs. of age(approx.87%). In this age group, according to modern medical science there is progressive decrease in follicular reserve and declining with age as well further, that leads to the female infertility. The remaining age group of less than 30 yrs. Signifies the life style along with dietary habits including smoking, drinking alcohol as well as casual sexual attributes of the younger generation. Hence prevalence of infertility is high in middle aged women, which is supported by the findings of the present study.

Occupation: Occupation of specific type may affect the individual. Like occupation in which individual has to remain in same posture for a longer duration may leads to physical, mental or physiological stress. moreover, occupation in which ratrijagaran is must, then this will lead to dosha-prakopa. In the present study maximum 36.67 % patients were House wife, 20 % patients were Farmers, 13.33 % patients were Shop keepers and same numbers of patients were Bussinesswomen, 10 % patients were doing service, 6.67 % patients were labourers. Physically strenuous work are imparted by housewife, farmers and others. Businesswomen have a run for profits causing more stress on mental work and prolonged typical postures also contribute to the vaatprakopa. The patients observed in this study do not have regular meal pattern which leads to vitiation of agni, at the same time vitiation of vatadosha takes place and disease may be illustrated.

Diet Pattern: Maximum numbers of patients i.e. 56.67 % of this series are having mixed diet habit while remaining 43.33 % patients are pure vegetarians. Though no definite relation to the disease can be drawn, more non-veg food habits cause raktadushti and in turn may cause the menstrual issues.

Prakruti: Maximum no. of patients i.e. 33.33 % were having Vata-kaphaprakruti, followed by 26.67 % patients were having Kapha-vataprakruti, 16.67 % patients were having Vata-pitta prakruti, 10 % and 6.67 % patients were having Pitta-kapha and Pitta-

vataprakruti respectively, and another 6.67 % patients were having Kapha-pitta prakruti. All the patients in this study belong to dwandaja type of prakruti. No patient is reported with ekadoshaja or sama- prakruti. As no definite statement can be made from such a small sample size, the female having vatajprakrutiin predominance will be more prone to such disorders.

Agni: The present study showed that majorities i.e. 53.33 % of the patients were having Mandagni followed by 26.67 % having Visham type of agni, and remaining 20 % patients were having Teekshangni. Mandagni is responsible for the vitiation of vatadosha. Proper nutrition is not provided to body because of the mandagni.

Koshtha: The present study showed that 66.67 % and 23.33 % patients were having Madhya and Mrudu type Koshtha respectively. Patients of Madhya and Mrudukoshtha were observed in maximum numbers and it may be due to the dominance of Dosha.

Samhanan, Satva, Ahara Shakti, Vyayam Shakti: The present study showed that 83.33 %, 76.67 %, 63.33 %, and 60 % patients in Madhyama type of Samhanan, Satva, Ahara Shakti and Vyayam Shakti respectively. All these parameters were observed in Madhyama type and it may be due to individuals are not following dincharya according to Ayurveda and pravara type was seen in less individuals.

Discussion on Radiological observation

This has been study of embryonic development upto 8 weeks. By observing real time as well as time lapse Embryoscopic and USG images it is quite inconspicuous with regard to anatomical perspective of jyotisthan, situated in the Nabhi of fetus at least upto eight weeks of study. It is very difficult to reach to any conclusion at this juncture, unless radiological aptitude of optimum level is attained. The only way out remains is to deduce a logical reasonable answer with the comprehensive approach of literature research.

CONCLUSION

Conclusions drawn from the present study are as follows.

- 1) Srotas is a multi-meaning term referring to a range of structures, functions and concepts in different context. For example it can be said that all the physiological functions are governed by Vata, the flow of electrical impulses via neurons and ions inducing the action potentials for each and every activity in the human body.
- 2) From a gross physiological system like gastrointestinal system to a single sub cellular structure like mitochondria can be considered as a single srotas and accordingly need to be explored vividly.
- 3) Further this work is all about the process of embryogenesis. When zygote is formed after

fertilization the nucleus of the zygote is considered as the nabhi holding the Jyotisthana of garbha; from which the message of cell division is produced which initiates the division of the zygote to further stages.

- 4) This chemical reactions occurring at the cellular level is due to Ushma or Agni which leads to cell division.
- 5) Again "vatastoadhmati" is described which can be compared with the formation of blastocyst; after which the differentiation starts for formation of umbilical stalk followed by different organ systems.
- 6) Then the umbilical point from where all the genesis start is the Jyotisthana.
- 7) Further scope of study.
 - There are numerous new concepts related with embryology, which can bring paradigm shift and create whole new specialities should be researched upon with meticulous planning and investment.
 - Ayurvedic institutions should develop a new branch of pre- applied embryology which will cover structural as well as behavioural genetics of developing fetus, constantly contained in our classics.
 - A further scientific study can be carried out from 9weeks gestation onwards. It will certainly be additive to the concept may inculcate to new principle or proposition.

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