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A CRITICAL UNDERSTANDING OF RUTUCHAKRA WITH SPECIAL REFERENCE TO GREY SCALE SONOLOGICAL IMAGING FINDINGS

Shubha Ural[1], **Mamatha KV**[2]

[1]Assistant Professor, PG Dept. of Prasuti Tantra and Stree Roga, Sri Sri College of Ayurvedic Science and Research, Bangalore, Karnataka, india
[2]Principal and Professor, PG Dept. of Prasuti Tantra and Stree Roga, SDM College of Ayurveda and Hospital, Udupi, Karnataka, India

Corresponding Author: Shubha.ural@gmail.com

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ABSTRACT

Infertility is a global health issue. One of the female factors for infertility is menstrual abnormalities. Menstrual abnormalities occur due to hormonal imbalance, ovulatory defects, or endometrial defects. In females, normal menstruation is a part of the general wellbeing. The menstrual pattern indirectly reflects the endometrial status, ovulatory status, and hormonal status. Ayurveda is the science that advocates the concept of maintenance of health and curing the diseased state. All the physiological processes including menstruation are understood with three basics framework of *tridosha*, *sapta dhatu*, and *Trimala*. Based on the concepts of *dosha*, *dhatu*, and *mala*, the menstrual abnormalities should be understood, and treatment modalities have to be framed. Gray Scale Ultra-sonography is a non-invasive investigatory tool that gives us the objective parameters of the endometrium with regard to texture and thickness and of the follicles in ovaries. In this regard, it becomes imperative to understand the normal menstruation in ayurvedic concept as well as objective sonological findings of the endometrium during a healthy menstrual cycle to have a better clinical understanding.

Keywords: *Ritukala, Rajasrava kala, Rutuvyathitha Kala*, Ultrasonography, Follicles, Endometrial thickness

INTRODUCTION

Menstruation is defined as the visible manifestation of cyclic physiological uterine bleeding due to the shedding of the endometrium following the visible interplay of the hormones mainly through the Hypothalamo-pituitary-ovarian axis[1]. *Rutuchakra* is a concept explained in ayurveda to understand the physiological phenomenon of menstruation. Like all physiological processes, the menstruation is also governed by the interplay of three *doshas* viz *vata*, *pitta*, and *kapha*. Menstruation is influenced by different factors like *vaya*, *Prakruti*, *ahithakara ahara*, *vihara*, etc. So, it is necessary to study the basic principles and physiological concept of *rutuchakra* in Ayurveda to derive proper clinical aspects to understand the physiological and pathological conditions. Grey Scale Ultrasonography is a widely used non-invasive investigational method that gives reliable information about the endometrium and ovaries during different phases of the menstrual cycle through which one can know the normalcy and pathological status of the endometrium and ovaries. By knowing the endometrial parameters in sonography one can infer the menstrual abnormality in many cases. So, it is necessary to know the ultrasonographic finding of the endometrium during *rutuchakra* with special reference to the normal menstrual cycle.

Materials and methods

The materials are collected from classical ayurvedic books like Charaka Samhitha, Sushrutha Samhitha, Astanga Sangraha, Astanga hridaya, Kashyapa Samhitha, etc., contemporary science books, and web sources.

Literary Review

Concept of *Rutu chakra*

The duration of the menstrual cycle is 1 month. It is divided into 3 phases

1. *Rajah srava kala* (menstrual phase)- 3-5 days
2. *Rutukala* (proliferative phase including ovulation)- 12 or 16 days
3. *Rutuvyathitha kala* (secretory/postovulatory phase)- 9 or 13 days

Raja srava kala

Periodic monthly expulsion of *rajas* from *yoni* is called *raja srava kala* or menstrual phase.

The duration is 3- 7 days

Acharya Charaka – 5 days [2]

Acharya Vaagbhata- 3days [3,4]

Acharya Haritha – 7 days[5]

According to Bhava prakasha[6] – the excessive flow lasting for 3 days, medium flow for 5 days, and scanty flow for 16 days should also be considered a physiological variation.

Rutukala: According to Bhava Prakasha[7] - *rutukala* is 16 days after *rajo darshana*. This period is considered the apt time for the conception. In this phase, ovulation occurs.

Period of *Rutukala*

Sushrutha[8] says that after the appearance of *arthava*, the *rutukala* is for 12 days. It can occur even in the absence of menstruation.

Vagbhata[9] says that– *rutukala* is for 12 days after the menstruation, it can even last for a whole month in the presence of healthy *yoni*, *garbhashaya*, and *arthava*. It can even exist in the absence of menstruation. He further says that women who consume ghee, milk daily, who is cheerful, *kapha prakruthi*, retain *arthava* for a longer period. In opposite condition, the *arthava* will stay for a shorter period i.e., she will get her periods in a shorter interval.[10]

***Rutu vyathitha kala* and its importance**

This is the period when the *yoni* closes and the *shukra* is not able to traverse through the *yoni marga*[11].

Shudda arthava lakshana

The characteristic features of normal menstrual blood[12,13] is - periodic flow occurring every month, devoid of *picchilatha*, burning sensation, pain, etc., and flow should be for 5 days. It should neither be heavy nor scanty, should resemble the colour of *gunja phala*, *padma*, or *indragopa*. It should be similar to rabbit's blood, *laksha rasa*, and should not stain the cloth.

The *rakta* accumulated in the uterus is flown out periodically every month for 3 days is called *ar-*

thava.[14,15] *Arthava* is *agneya* in *guna* due to the dominance of *tejo mahabhutha*.[16,17] It has all the characteristic features of *rakta*.

Origin of menstrual blood

Menstrual bleeding is from both arterial and venous systems, but arterial bleeding is appreciably greater than venous. Endometrial bleeding appears to follow the rupture of an arteriole of a coiled artery, with consequent hematoma formation.

Diagnostic use of Ultrasonography during the menstrual cycle

Ultra-sonography is a non-invasive technique based on the creating the images of the reflected ultrasound waves. Here the sound waves are reflected from various organs, structures, and medias. Reflected sound waves are called echoes. Gray scale[18] imaging displays great variations of the amplitude of echoes which come from tissues as varying shades of grey on the television screen. So, variation in the brightness displayed makes it easy the diagnosis of a particular structure. It is also called B mode ultrasonography.

The morphology of the ovary and endometrium changes in response to the intrinsic or exogenous estrogen and progesterone in a typical pattern. B mode Ultra Sonography well identifies and assesses the anatomy of the ovary and endometrium. A transvaginal scan is preferred over the Transabdominal scan for infertility follow-up. Diagnostic ultrasonography in infertility cases has two goals. The first is to assess ovarian follicular development and the second is to assess the uterine endometrial development.

USG changes in Ovary during the follicular and luteal phase

In normal women, ovaries can be seen by ultrasonography throughout the cycle.

Around 5-12 follicles are seen during the follicular phase on the 5^{th} -7^{th} day in each ovary with less than 3-4mm size. The follicle that grows to 12mm is the dominant follicle which can be seen on the 8^{th} – 12^{th} day. Ovulation occurs at 18-33mm in size on the 14^{th} or 15^{th} day[19, 20]. The rest of the follicles atrophy and regress spontaneously with time.

Soon after the ovulation, the follicle appears collapsed or the follicle can disappear and there is minimal fluid in the Pouch of Douglas.

After the ovulation, the follicle is transformed into corpus haemorrhagicum with internal echoes. The size is generally reduced and is visualized as a structure with thick hyperechogenic walls with a hypoechoic centre. The corpus luteum vanishes before the onset of the next cycle.

USG finding of Endometrium in proliferative and secretory phase[21]

Endometrial thickness is the maximum distance between the echogenic interfaces of the myometrium and the endometrium. It is measured in a plane through the central longitudinal axis of the uterus.

The endometrial pattern is the relative echogenicity of the endometrium and the myometrium as seen on a longitudinal Transvaginal Scan (TVS) or Transabdominal Scan (TAS).

The changes seen in Ultrasonography during different menstrual phases are as follows.

Table 1

Days	Phase	Morphology	Endometrial thickness
D1- D5	*Raja srava kala*/Menstrual phase	The hypoechoic area is the blood	<4mm
D6-Ovulation	/ Follicular phase	Distinct 'triple line' pattern. Later the endometrium appearance is similar to the myometrium.	7-9mm and 9-12mm at ovulation
Ovulation-D28	Luteal phase	Bright, fluffy appearance, hyperechoic, Absence of triple line	10-14mm

DISCUSSION

The word *rutuchakra* has 2 components – *rutu* and *chakra*. *Rutu* is the period during which a woman can conceive [22]. *Chakra* means the cyclic occurrence of events at regular interval. So, the word *rutuchakra* literally means the occurrence of *rutu* cyclically at regular interval.

Rutuchakra occurs from *Prathama rajodarshana* till *rajonivrutti* i.e., from 12 years to 50 years. During this period the *rutuchakra* occurs in every *Chandra masa*., 28 days. *Rutuchakra* is further described in three phases – *rajasrava kala*, *rutukala*, and *rutuvyathitha kala*.

Rajasrava kala – It is a period during which the *raja* or the *arthava* is flown out of the genital tract. There is a visible manifestation of menstrual bleeding. This phase is dominated by *Vata*.

In the ultrasonography, the menstrual blood collected inside the uterus is seen as a hypoechoic area. Since there is desquamation of the endometrium, its thickness is less than 4mm.

Rutukala – This phase comes after the *rajasrava kala*. This period is considered as *garbha grahana yogya kala*[22]. Just as at the end of the day, the lotus flower becomes closed, similarly the vagina of the woman becomes constricted after the end of *rutukala* and does not permit entry of sperms.[11] This phase is dominated by *Kapha*. This is a period in which endometrial growth occurs which facilitates the implantation later. According to Ayurveda for the regeneration, *Kapha* is essential. This represents the proliferative phase of the endometrial cycle, follicular phase of the ovarian cycle and essentially includes the event of ovulation. In the ultrasonography, the thickness of the endometrium increases up to 7-9mm and during ovulation up to 9-12mm. There is a distinct triple layer pattern. The presence of a triple layer pattern is associated with successful fertilization and implantation[23].

Rutuvyathitha kala – This phase comes after the *rutukala* and ends with the onset of *rajasrava kala*. In this phase, there is constriction of the *yoni*, because of which the *shukra* is unable to enter the uterus[11]. This phase is dominated by *Pitta*. It is a progesterone-dominated status which is a thermogenic hormone. Progesterone is secreted from the corpus luteum in the ovary. In this phase, because of progesterone, there is increased uterine secretion and endometrial stromal edema peaks. *Pitta* is responsible for thermal manifestation as well as secretions. So, *rutuvyathitha kala* can be correlated to the secretory phase of the endometrial cycle. It represents the preparation of the uterus for the implantation of the fertilized ovum. In this phase, in the Ultrasonography the endometrium appears bright, fluffy, and hyperechoic because of stromal edema. The triple-layer pattern is absent.

CONCLUSION

The complete physiology of *rutuchakra* is very well explained in Ayurvedic classics starting from the age of onset, age of cessation, duration of menstrual phase, and the clinical aspects of *rutukala* and *rutuvyathitha* kala. The *rajasrava kala*, *rutukala*, *rutuvyathitha kala* can be correlated with the menstrual phase, proliferative phase, and secretory phase respectively. Menstruation is governed by *tridoshas* and for normalcy, a balanced state of the *doshas* is necessary. A non-invasive technique like Grey Scale Ultrasonography gives us valuable information about the morphological feature of the normal endometrium during different phases of the cycle. In an Ultrasound examination, we see distinct features of the ovary and endometrium in each phase. These features can be attributed to different *doshas* considering their *guna* and *karma*. Ultrasonography is a non-invasive investigational tool, helps to understand the relationship between the ovary and endometrial status and menstrual outcome, thus providing valuable information which has great clinical utility.

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