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SYSTEM REVIEW

Sonographic Correlation between Endometrial Thickness and Infertility - A systematic review

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ABSTRACT

Background: Infertility is defined as not conceiving after one year of unprotected sex. Apart from age, physical and hormonal misbalance, and lifestyle or environmental factors for infertility; Endometrial thickness has an important role in conception. Females with the 8-12mm endometrial thickness in the late proliferative phase had great chances to get conceive.

Aim: To determine the sonographic diagnostic features of the endometriumthickness with Transvaginal high-resolution ultrasound are predictive of infertility.

Methods: An electronic database search was performed (Google Scholar, Science Direct, and PubMed) with the data range from 1988 to 2020.All studies, fully-available in English, assessing the endometrial thickness in the gray-scale image on TAS/TVs.

Results: Thirty-three articles were found, we evaluated the performance of ultrasound diagnostic techniques, for the measurement of endometrial thickness, our results showed that ultrasound had a high level of diagnostic capability for measuring endometrial thickness. If endometrial thickness is more than 14mm or less than 7mm then chances of pregnancy were zero, so high chances of pregnancy when the endometrial thickness is 8mm to 11mm.

Conclusion: We concluded that when the endometrial thickness was increased from 8 mm to 11 mm the chances of pregnancy were maximum, and when the thickness of endometrium was more than 14 mm or, less than 7 mm the pregnancy ratio was almost zero. Transvaginal ultrasound is an excellent imaging modality and its sensitivity is high for the measurement of endometrial thickness

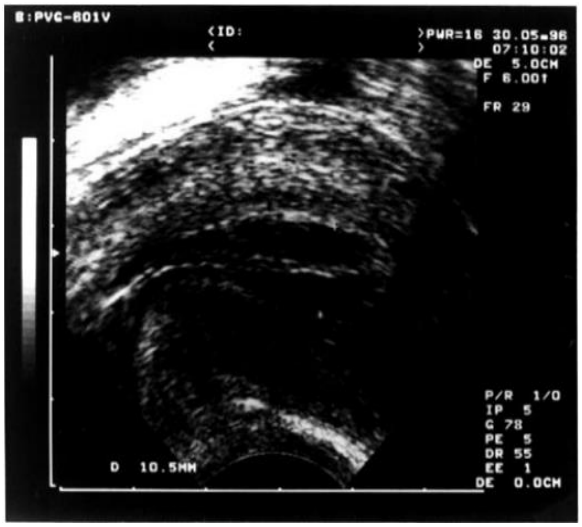
Keyword: Transvaginal sonography, endometrial thickness, Infertility

INTRODUCTION

Infertility is now defined as one year of no conception with exposed intercourse in the period of ovulation in the menstrual cycle[1]. In the period of menstruation, the endometrium experiences cyclic variations for implantation. The developing follicles secrets estradiol, so theincreasing amount of estradiol will prompt proliferative changes in endometrial thickness in the phase of follicles. Nextto ovulation, progesterone is produced by the corpus luteum that will start the secretory changes. During the time of implantation if the implantation process does not occur, then the regression of the corpus luteum starts so the endometrium will shed off[2]. The endometrium plays a very important part in the keeping of pregnancy. The functional ability of the endometrium may be evaluated in numerous ways but the gold standardfunction is to support a pregnancy[3,4]. Two main anatomical variables like endometrial thickness and patterns were suggested to estimateby ultrasound, in whichthe outer lines indicate the basal layer of the endometrium and a prominent bright-line shows the uterine cavity. The comparatively hypo-echogenic areas in the endometrium line between the 2 outer lines and the one central line may indicate the functional layer of it[5]. Sonographic features of the endometrium were observed during the normal mid-cycle of these patients like endometrial thickness, endometrial layering, endometrial blood flow[6].

Due to the estrogen normal thickness of the endometrium increases in the phase of proliferation. When ovulation is done, the endometrium makes an attachment place for initial embryos till the placenta grows. Hence, in the follicular phase, the growth of the endometrium is serious to the task of the uterus using a reproductive organ[7,8].

Fig. 1: Longitudinal axis of the uterine cavity demonstrating at 14 day endometrium thickness is 10.5 mm and had a triple-layer pattern.



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LITERATURE REVIEW

Commonly definition of infertility and subfertility plays an essential role in suitable infertility management. Generally, we say any type of decrease fertility with an extended time of undesirable non-conception is called subfertility[1,9]. The grading of subfertility is determined by the time of undesirable non-conception, which is the mainaspectthat affecting the specificnatural pregnancy prospect. The maximumnumber of pregnancies almost up to 80% casestakes place with intercourse during the fertile period in the first 6 menstrual cycles[10]. Afterward, severe subfertility must be supposed in every 2nd couple almost 10% while after twelve failed menstrual cycle's natural live birth ratio between them will extent nearly up to 55% in the following thirty-six months. In the next forty-eight months, nearly equal to 5% of the individuals are absolutesterile with analmost zero chance of spontaneous pregnancy in the future. With time, cumulative possibilities of conception decrease because the ability to produce an abundance of offspring decreases. In actually fertile individuals cumulative possibilities of conception are possibly independent of the age factor. In suitable conditions, a simple sterility examination after 6 failed cycles with fertility-focused interaction will point out individuals with important sterility complications to avoid both over and under infertility treatment, irrespective of age factor. Couples with unexplained sterility which have a reasonably better prognosis might be motivated to wait, for the reason that even with the fertility treatment they do not have a betterchance of pregnancy. The other individuals may advantage from an initial alternative to assisted reproduction management[11,12].

Table I. Grade of endometrium

04 grades
Grade 1 Presence of a halo, endometrial reflectivity increased compared with myometrium
Grade 2 Presence of a halo between the myometrium and endometrium and comparable Reflectivity between myometrium and endometrium
Grade 3 Reduced reflectivity, darker area surrounding the midline echo
Grade 4 Echogenic black region surrounding the midline echo
03 grades
Type 1 Entirely homogeneous, hyper echogenic pattern, without a central echogenic line
Type 2 Intermediate iso-echogenic pattern, with the same reflectivity as the surrounding Myometrium and a non-prominent or absent central echogenic line
Type 3 A multilayered 'triple-line' endometrium consisting of a prominent outer and central hyper echogenic line and inner hypo-echogenic or black region
02 grades
Non-multilayered Homogeneous hyper echogenic or iso-echogenic endometrium compared with themyometrium
Multilayered Triple-line multilayered pattern, 'Halo pattern' = outer peripheral layer of denser Echogenicity and a central sonolucent area

One research study was conducted in which the thickness of the endometrium was calculated by Transvaginal ultrasound on the day of initiation. On the HCG day, when the endometrium thickness is less than 7mm, in the longitudinal plane, the maximum space among the 2 borders of the endometrium of the uterus was considerably reduced[13]. In one study it was described that the unplanned rate of abortion is considerably high when endometrium thickness is more than 14mm[7]. Another research study was done on endometrium thickness described that at least 7 to 8mm endometrial thickness of the uterus is necessary to launch a pregnancy after embryo transfer or IVF[14,15].

Pregnancy has done only in individuals with a 9 to 12mm thickness of endometrium which shows that with at least 9mm thickness of the endometrium, the fertility rate was increased, and no pregnancy was done if the thickness of the endometrium was lower than 7mm and with more than 15mm thickness of the endometrium[16]. The pregnancy rate was low when the thickness of the endometrium was 14mm. Other research study results show that the individuals that achieved more than 7.5mm endometrium thickness have a better chance of pregnancy as compared to the individuals who have less than 7.5mm endometrial thickness[17,18].

A prospective research study was done in which, Transvaginal ultrasound was used which is a piece of high-resolution equipment to find out the differences in the pattern of endometrium and thickness of the endometrium. The endometrial features of 981 cases out of 1600 assisted reproductive management cycles were correlated with those of 205 untreated females. Besides, abnormal endometrium echogenic patterns were histologically considered in 44 individuals. In untreated females and females cured with IUI, the endometrium was considerably thinner as compared to the females that arecured with the injection of intracytoplasmic sperm or IVF. The endometrial proliferation was comparable in non-conception and conception phases. The probabilities for a fruitful pregnancy were considerably less in the case of a thin endometrial layer in females that arecured with IUI but not in females that are cured with the prolonged stimulus procedure for the injection of intracytoplasmic sperm or IVF. Single pregnancy was more common than the multiple numbers of pregnancies in individuals with thin endometrium. The pregnancy ratio of supported reproductive techniques is influenced only by the proliferation of endometrium and management should not be canceled due to the inadequate thickness of the endometrium. A study was done for the assessment of the value of ultrasound features as predictive signs of implantation succeeding embryo transfer and IVF (in-vitro fertilization). In research study survey comprisedof 414 normal periods, 3558 periods succeeding ovarian stimulation for embryo transfer and in-vitro fertilization, and in oocyte donation total of 411 periods with hormone replacement treatment, studying 27 reports recognized in the computer literature study[19]. The ultrasound predictive signs for implantation assessed in which endometrium pattern and peri-ovulatory thickness of endometrium and color Dopplerdimensions of blood flow of uterine artery were included.Though ultrasound features of receptivity of endometrium have a high negative rate in the setting of some lowest standards, their value as predictive signs for implantation succeeding embryo transfer has nevertheless to be verified[20].

The findings of this research study confirm the echographic investigation of the growth of endometrium in hormonal replacement periods and propose that the development of endometrium is a good factor for observing therapy results as compare to check the level of serum estradiol. Our research study confirms that serum estrogen,

which is used for checking HR cycles, is not reliable to predict the changes in the endometrial cavity by ultrasonography and did not compare with the pregnancy ratio. Individual endometriumreaction did not compare with serum erythrocytes zinc levels and patient's age[21]. Echographic examination of the endometrial cavitypermits an instantmodification of the dose and succeeding confirmation before embryo transfer. Between non-pregnant and pregnant female patients, the difference is seen in thickness of endometrial cavity, while did not significantly expect pregnancy results, and pregnancies happened in a very extensive range of endometrium thickness. Even though the number of patients is less, our research data also propose that if the thickness of the endometrial cavity lining is less than 8 mm the chance of pregnancy is lower. It's not mean to say thatthere is no chance of pregnancies with less than8mm endometrial cavity lining. In this study, we see 1 pregnancy with a 7mm endometrial thickness and Grunfeld et al. stated 1 pregnancy with a 5 ram endometrial thickness. Aspecific Pattern of endometrial cavity appeared, present no association with pregnancy chance[22]. Though, if a higher number of patientsgives this primary finding, a non-favorable development of the endometrial cavity may be an objective to study transfer and cryopreservation in succeeding cycles. On the other side, it is not identified that can we improve the endometrial lining quality by hormonal management[23]. Although the estrogen-supplemented cycles and natural echographic features of endometrial liningwere different to some extent, the pregnancy ratios were almost similar. Our subjective knowledge proposes that increase the amount of estrogen administration in succeedingphasesinfrequently has a distinctoutcome on the response of endometrium, as investigated by ultrasound. Fluctuations in individual response to hormones may rely upon the endocrine system of the patient. A research study was done in 2008 on the thickness of the endometrium, in which pathophysiologic characters of the thin endometrial cavity were defined, which shows that 8 mm thickness of endometrium has been correlated with conception. Also, individuals with endometrial thickness of less than 8mm or less than 7.5mm have shown a considerably low chance of conception[24,25].

RESULTS AND DISCUSSION

Transvaginal ultrasound is a safe diagnostic tool that gave a very good imaging diagnosis of endometrial and uterus abnormalities[8,26]. It is almost noninvasive, is finely accepted by females, and can be done in the hospital setting or the office at a comparatively low cost[27]. Fertility in human beings and other species depends totally on blastocyst development and the uterus that receiving the blastocyst, it should becapable of implantation. Receptivity of endometrium is demonstrated as the time during which the epithelium of endometriumgets functional, but the status of steroid-dependency of transient ovarian ishelpful foracceptance of blastocyst and its implantation. When inside the uterus the intact luminal epithelium has bounded the blastocyst. This time isnamedthe implantation windowwhich is limited to 20 to 24 days of the cycle of menstruation in human beings. Though, the establishment of receptivity of endometriumis a biological secret that remains unexplained despite clear improvements in our understanding of endometrium physiology succeeding broad research studies related to its function and development[28].

This review study deals with numerousmolecular, structural, and biochemical actions in the endometrial cavitysynchronized within the window of implantation that establishnecessary elements in the repertoire that indicates receptivity of endometrium and is targeted to attain an excellent understanding of its association to infertility, fertility, and the invention of antifertility elements for use of human beings. We see that the thickness and echogenicity of the endometrial cavity varies, which is depending on the menstrual cycle, parity, use of hormone therapy, and patient age[29].

CONCLUSION

In our review study, we concluded that when the endometrial thickness was increased from 8 mm to 11 mm the chances of pregnancy were maximum,and when the thickness of endometrium was more than 14 mm or, less than 7 mm the pregnancy ratio was almost zero. Transvaginal ultrasound isan excellent imaging modality and its sensitivity is high for the measurement of endometrial thickness.

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