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A NARRATIVE REVIEW ON DIAGNOSTIC USE OF TRANSVAGINAL ULTRASOUND FOR THE DIAGNOSIS OF FEMALE INFERTILITY AND ITS ASSOCIATED CAUSES

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ABSTRACT

Female Infertility is a well-known health problem that is very common in females. Everyone wants to have offspring but many couples fail to be parents after a year of unprotected sexual intercourse which is widely recognized as Infertility. Many factors are responsible for Female Infertility including the abnormalities of the Cervix, Ovaries, Fallopian Tubes, Uterus (polyps in the uterus), Endometriosis, Pelvic Adhesions, Irregular menstrual cycle, and syndromes like Poly Cystic Ovary Syndrome (PCOS). Some other factors that are accountable for Female Infertility are increased Age, Use of Tobacco, Use of Alcohol, and Being Overweight leading to obesity or being Underweight.Conclusion: PCOS is considered as one the major cause of Female Infertility. All the causes of Female Infertility can be managed by consulting doctors on scheduled routines and quitting bad habits of smoking, alcohol, or tobacco consumption along with keeping a healthy body weight.

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1. INTRODUCTION

Without using birth control medications, being pregnant during one year by sexual intercourse the procedure is known as fertility [1]. Infertility is a health-related problem that can result from emotional, physical, psychological, spiritual, and medical inconvenience to the patient. Without using birth control medications, and not being pregnant for one year by sexual intercourse the procedure is known as infertility. The effect of the male factor on infertility is about 20-30%, the cervical effect is about 5%, the endometriosis effect is about 5- 30%, the tubal effect is about 15%, the anovulation effect is 10-30 % and there are also some other unknown reasons count for about 15-30%. Environmental factors also influence infertility because it is also affected by your habitat [2].

1.1.Factors affecting female infertility

The factors that initiate female infertility include endometrium, uterus, cervix, fallopian tubes, peritoneum, and ovaries. [3] Thyroid disorder harms fertility. Many studies suggest that immunology, including thyroid autoimmunity, has a role in infertility [4]. It has been suggested that due to the unfavorable effect of aging on ovarian reserve, Women with increased age are more likely to be diagnosed with unexplained causes of infertility [5].

1.2. Anatomical and pathophysiological changes during pregnancy

1.2.1. Fallopian tube abnormalities

Fallopian tubes are important parts of the female reproductive system. These are muscular tubes connecting ovaries to the uterus consisting of the following parts; Fimbriae, Infundibulum, Ampulla, and Isthmus [6].

Ciliated cells line the inner surface of the tubes' epithelium. These cells are most evident at the level of the fimbriated infundibulum and here they form clusters. Furthermore, during the secretory phase of the menstrual cycle, this ciliary activity is very active. Numerous pathological problems associated with infertility have been proven to destroy cilia or decrease ciliary motion [7].

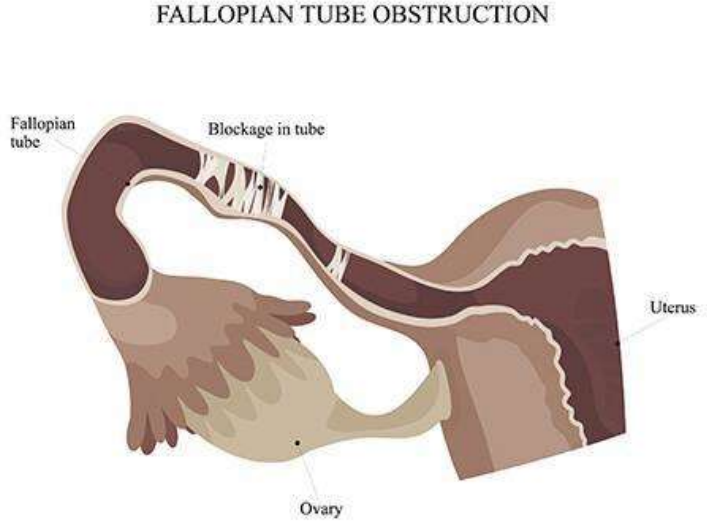

Diagram-1- This is a diagrammatic representation of blocked fallopian tubes which play a vital role in causing infertility in women.

1.2.2 Anovulation

Infertility due to anovulation happens because no oocyte is released from the ovaries each month. No fertilization will occur and hence no chance of pregnancy will be there if no oocyte is present. A decrease in Hypothalamic Gonadotrophin Releasing Hormone (GnRH) secretion will be observed due to hypothalamic amenorrhea or functional hypothalamic amenorrhea (FHA) which in turn is linked with a lot of heavy exercise and some eating disorders [8]. The secretion of gonadotropin hormone, the follicle-stimulating hormone (FSH), and luteinizing hormone (LH) from the anterior pituitary gland is reduced due to decreased levels of GnHR and increased levels of cortisol [9].

Anovulation, irregular follicle growth, and low oestrogen levels are all symptoms of these two deficits. FSH and LH levels will vary from normal to low with FSH greater than LH (this hormone ratio will be similar to that of a prepubertal girl) [9]. The levels of FSH and oestrogen in the blood will be within typical laboratory ranges. The LH might be either normal or elevated [10]. A lack of folliculogenesis, a drop in oestrogen, oocyte loss, and infertility are all symptoms associated with primary ovarian insufficiency (POI) which usually occurs in aged women between 35-40 years [11].

Fig-1 This sonographic picture shows the failure of ovulation and development of a cystic follicle which is larger than the pre-ovulatory follicle. Failure of ovulation is a cause of infertility in females.

1.2.3 Endometriosis

The presence of tissue external to the uterus is known as endometriosis.40-50% of female infertility is because of it [12, 13]. There are 4 stages of endometriosis. Stage 1 of endometriosis is minimal and stage 4 is severe [14]. Due to enhanced production of macrophage cells, cytokines cells, natural killer cells, and prostaglandins inflammation is caused and this is seen in stages 1 and 2 of endometriosis [15]. Due to pelvic adhesions tubal motility, oocyte release, and sperm motility are all impaired in Stages 3 and stage 4 that deform pelvic architecture [16]. Furthermore, severe endometriosis is thought to affect folliculogenesis (maturation of the ovarian follicle) thus lowering the chance of conception [17].

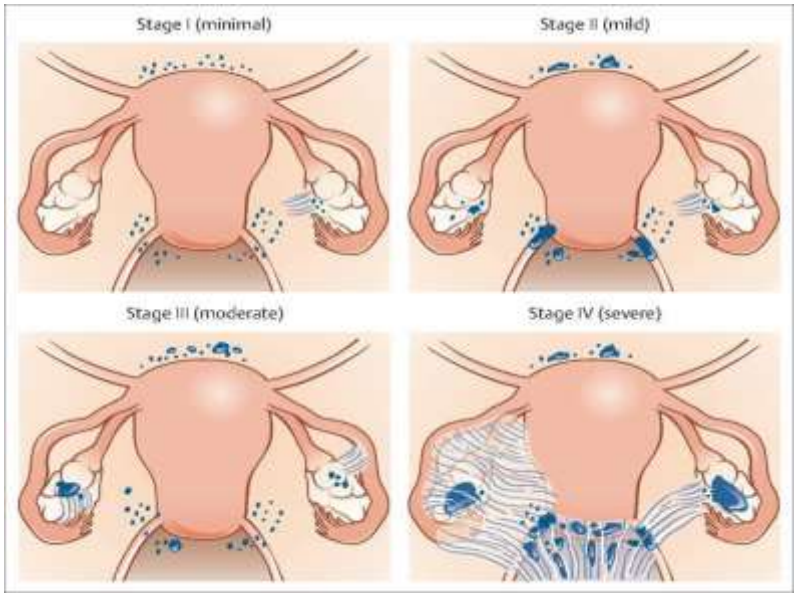

Diagram-2 shows 4 stages of endometriosis.

1.2.4. Uterine Abnormalities

The location of fibroids is the most crucial factor. Fibroids that intrude on the endometrium and deform the uterine cavity cause implantation problems and a higher chance of miscarriage [18]. Pregnancy rates are lower in women with submucosal or submucosal-intramural fibroids that deform the uterine cavity. Pregnancy and live birth rates increased after these fibroids were removed [19].

1.2.5. Endocrine disorders

Because of improper function of the pituitary gland and hypothalamus, an increased concentration of prolactin is secreted causing the inhibition of the ovulation process. Ovulation can also be delayed due to improper functioning of the adrenal and thyroid glands. The fertilized egg may not be able to implant if the corpus luteum fails to release enough progesterone to thicken the uterine lining, resulting in infertility [20].

1.3 Investigation to Be Done in Women for Diagnosis of Infertility

Following investigations can be done of the diagnosis of infertility in women; Transvaginal Ultrasonography, Laparoscopy, Hystero-salpingogram, Hysteroscopy, and Magnetic Resonance Imaging [20].

1.3.1. Diagnosis of infertility with the help of transvaginal ultrasound

Transvaginal Sonography (TVS) is an advancement in the diagnostic options for the Female pelvic region. It is Less Expensive, Rapid, Safe, and a dependable diagnostic tool for women with gynecological symptoms [21, 22]. The gynecological transvaginal sonography has the indications of bleeding after menopause, in the uterine cavity, confirmed existence of the intrauterine contraceptive device, before menopause suspected organic factors i.e. endometrial polyp/ submucousmyoma bleeding in females, and any suspected pelvic mass. The suspected pelvic mass can be observed in deep tissues even the minor details of pelvic cancer, ovary, uterine irregularity, and fallopian tubes [23, 24].

Transvaginal sonography uses a high-frequency transducer inserted in the vaginal canal Furthermore, transvaginal sonography has proven to be a useful aid in the treatment of infertile patients. A thorough investigation is required to confirm the diagnostic precision of different types of primary and secondary infertility factors and the importance of transvaginal sonography [25]. The majority of ultrasonographic investigations have focused on Eps in individuals who have abnormal uterine bleeding [26, 27]. Endometrial polyps (Eps) are a common occurrence during pregnancy years affecting up to 24% of women, and their prevalence increases as one gets older [28]. Endometrial polyps (EPS) are formed as a result of the growth of proliferation, and hypertrophy of the endometrium's basal layer, as well as the chance of developing cancer varies [29].

After a lot of studies, it becomes obvious that there are no chances of reduced pregnancy rate in polyps containing females, however, there are more chances of spontaneous abortion [30]. Researchers are increasingly interested in the value of TVS in diagnosing intrauterine abnormalities when compared to other approaches; however, there is less research on Eps detection in infertile females [31]

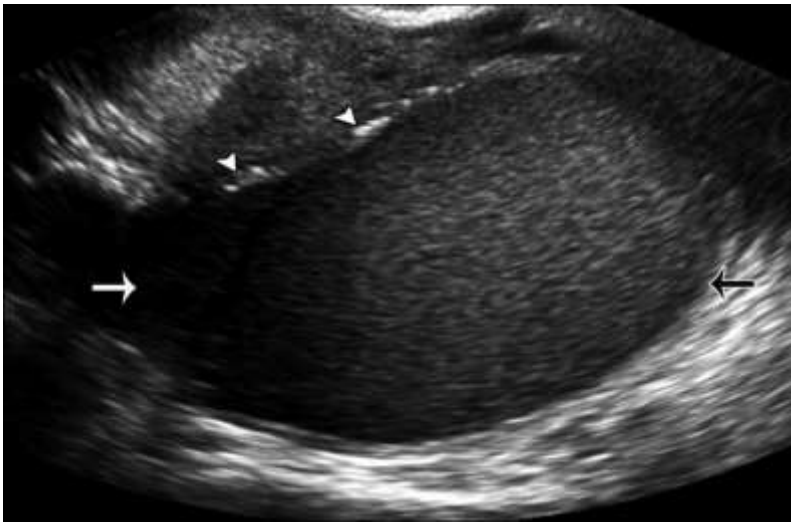

Fig-2 This is a transvaginal sagittal ultrasound image of an endometriosis history female patient in which overheads demonstrate multiple hyperechoic mural foci and arrows describing the ovarian mass having multiple precise internal echoes.

This shows a condition in which sections of the uterine lining implant in the vagina, ovaries, fallopian tubes, or pelvis. These implants form fluid-filled cysts that grow with each menstrual cycle and eventually turn into blisters and scars. These scars then block the passage of the egg and delay pregnancy even though transvaginal ultrasonography without contrast- the medium is not appropriate for the examination of the female reproductive system. This is a diagnostic without invasiveness instrument that gives strong soft tissue contrast and is used to evaluate tubal patency. The resolution might also look into the possibility of locating a few abnormalities of the Tub peritoneal [32]. The most frequent (15–20 percent) endocrine disorder in women of reproductive age is polycystic ovarian syndrome (PCOS). Although it is a common cause of infertility, its cause is unknown, and treatment is tough [33]. On the other hand, a single polycystic ovary discovery (PCO) revealed by morphology ultrasonography (USG) [12 follicles 2–9 mm in diameter and/or enlarged ovarian volume (> 10 cm3)] may be observed. Obesity, hyperandrogenism, menstrual cycle irregularity, and infertility are examples of symptoms that can occur alone or in combination [34]. Increased size of Ovaries, the ovarian stoma's echogenicity and increased frequency of little follicular-type cysts are some of the morphologic changes that can be seen on pelvic ultrasound [35].

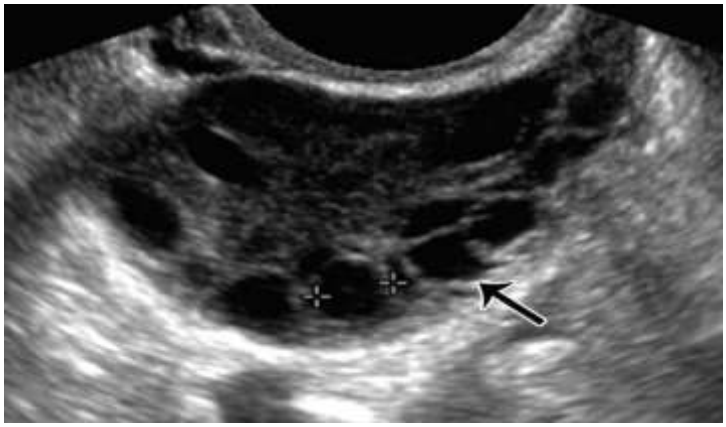

Fig-3 Multiple peripheral follicles present in the right ovary of PCOS women shown on a TVS image. These are going to interfere with the natural phenomenon of fertilization and reduce the chances of ovulation leading to infertility.

Some Hypo echoic masses that cause the natural appearance to be distorted of endometrium look like Sub mucosal Leiomyoma. Due to their stalk-like appearance, they may look like endometrial polyps [36].

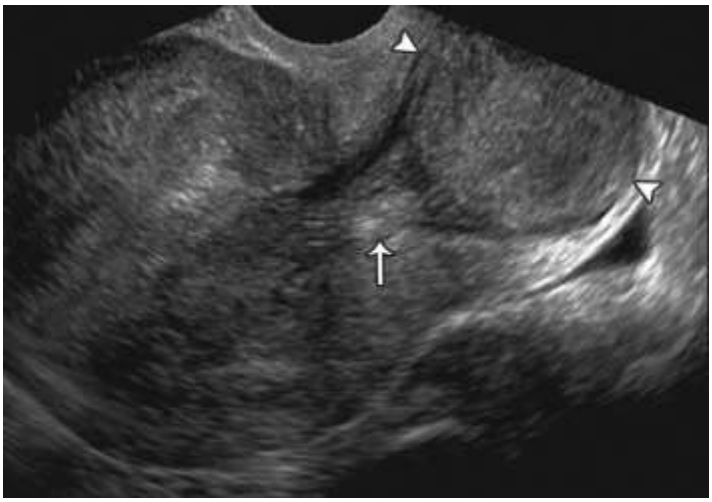

Fig-4 A solid mass with internal echogenicity similar to that of the myometrium is shown in this sonographic image, which is depicted by an arrowhead. The mass has a stalk like attachment extending from the uterus till the cervical canal as shown by the arrow.

1.4. Management of Female Infertility

The most effective ways to boost fertility are lifestyle factors such as weight loss, exercise, and quitting smoking. Temperature monitoring and LH detection kits have not been shown to improve the likelihood of pregnancy. A continuously abnormal sperm analysis necessitates a comprehensive study. During the examination and treatment of infertility couples will require a lot of help [37]. Multiple mature eggs from a woman are taken and fertilized with a man's sperm outside the womb and inside a laboratory during in-vitro fertilization (IVF). After three to five days of fertilization, the fertilized embryos are implanted in the uterus. If the eggs and sperm are severely damaged, donor sperm or even an embryo may be used to improve fertility. [20].

2. CONCLUSION:

Every human being is regarded to have the right to have children and have a family. Infertility is a medical condition that necessitates a comprehensive treatment plan. Over the last 20 years, medical science has produced improved therapies to aid reproduction. Infertility in older women has various causes than it does in younger women. Women over the age of 35 are nearly twice as likely to experience unexplained infertility. Medicines, modest surgical procedures, laparoscopic procedures, hormone therapy, and preconception failure prevention are all effective treatments for female infertility. Maintaining a healthy lifestyle, visiting the doctor regularly, and maintaining a healthy body weight can help you avoid fertility issues. Understanding folliculogenesis, ovulation, luteal function, uterine response, conception, and implantation, as well as applying this information to explain and investigate normal reproduction and infertility, has been made possible by ultrasonography. Due to rapid advances in ultrasonography technology, we can improve our knowledge and ability to care for women.

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