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Review Article

Ultrasonographic Findings of Common Pelvic Pathologies Causing Infertility

Sana Saleem[1*], Syeda Khadija Tul Sughra[2], Mishal Javaid[3], Muhammad Bilal[4], Nosheen Arshad[5]

[1]Al Mustafa Eye Hospital, Lahore, Pakistan
[2]Assistant Professor, Department of Allied Health Sciences, The University of Lahore, Pakistan
[3]University Institute of Radiological Sciences and Medical Imaging Technology, The University of Lahore, Lahore, Pakistan
[4]Department of Diagnostic and Interventional Radiology, Sir Ganga Ram Hospital, Lahore Pakistan
[5]Lecturer, University of Lahore, Gujrat, Pakistan

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***Corresponding Author:** Sana Saleem
Al Mustafa Eye Hospital, Lahore, Pakistan

Abstract

***Background*:** Imaging plays a key role in the diagnostic evaluation of women for infertility. The pelvic causes of female infertility are varied and range from tubal and peritubal abnormalities to uterine, cervical, and ovarian disorders.
Keywords: Female infertility, ovarian dysfunction, polycystic ovary, transvaginal ultrasound.

INTRODUCTION

Infertility is characterized as, after 12 months of unprotected intercourse, the failure to conceive a planned pregnancy. Infertility affects about ten percent of married couples. Both men and women are impacted in the same way. Congenital malformations, Infection, localized lesions, uterine synechiae, cervical stenosis, scar in intrauterine cavity, decreased in perfusion of uterine cavity, and differences in thickness of endometrium and vascularity are only a few of the causes of female infertility [1]. Infertility has many reasons, and variables for example physical issues, hormones, lifestyle, and environment can all play a role in infertility [2]. The majority of female infertility issues have to do with ovum production, with early ovarian failure being a typical reason. The ovary's functions are interrupted before menopause begins due to this condition [3].

Infertility and PCOS

PCOS has been recognized as a primary cause, with a significant impact on ovulation. It's a condition in which the eggs aren't released on a regular basis or produce harmful eggs. 4 Infertility in young women is caused by polycystic ovary syndrome, which accounts for 70 percent of un-ovulation infertility and 15.6 percent of primary infertilities. In another study, this percentage was reported to be 39.2 percent [4].

Infertility and Ovarian dysfunction

Primary ovarian insufficiency is a category of ovarian dysfunction. This triad of amenorrhea for at least 4 months is used to classify ovarian dysfunction [5]. Ovarian dysfunction refers to the cessation of menstruation before the expected age of menopause as a result of a variety of ovarian illnesses [6]. Women of reproductive age and those receiving infertility treatments are more likely to develop ovarian cysts. Polycystic ovaries are characterized by an increase in the volume of the ovary as a result of a increase number of small immature follicles of uniform size and stroma volume compared to normal ovaries [7]. Before the age of 40, the failure of ovarian functions known as premature ovarian failure, and it affects around 1% of the population. Only around 5-10% of POF women are able to become pregnant on their own [8].

Pelvic inflammatory disease affects 3.1 percent of initial infertility cases and 16.7 percent of secondary infertility cases, respectively [4].

Infertility and Endometriosis

Anatomical deformities and adhesions can occur as a result of endometriosis. Endometriotic

lesions are thought to emit specific chemicals that are damaging to gametes and embryos. Endometriosis has been linked to 12.5 percent of primary infertility and 11.1 percent of secondary infertility, respectively. Only 6.3 percent of individuals with initial but not secondary infertility had an ovarian cyst. Tubal blockage, endometriosis, and per tubal and per ovarian adhesions were the most prevalent causes of infertility [9].

Transvaginal sonography looks into the pelvis, observes the deeper tissues, and even notes the minute details of organs like the fallopian tube and ovary using a high-frequency transducer inserted in the vagina near the pelvic structure. Transvaginal sonography has been shown to be a very useful technique in the treatment of infertile patients. The study's purpose is to confirm the value of transvaginal sonography and its diagnostic accuracy in a wide range of infertile situations [10].

METHODS AND MATERIALS

This systematic literature search is conducted to the preferred reporting items for the systematic review statement. MEDICINE and EMBASE research databases including: Google scholar, PubMed, NCBI, Scopus, and Crossref databases from 2000 up to 2021 were searched for the study. The keywords are; Female infertility, ovarian dysfunction, polycystic ovary, transvaginal ultrasound. To increase the affectability of the search the Google scholar was utilized with similar keywords, taking the newly available research studies in the sonography of hepatocellular carcinoma.

INCLUSION AND EXCLUSION CRITERIA

Articles published before 2021 were considered and included in this review. Only articles presenting the prevalence of infertility among females and their relation with PCOS, ovarian dysfunction and endometriosis are considered in this review.

ETHICAL CONSIDERATIONS

No ethical consideration is required for this type of study design.

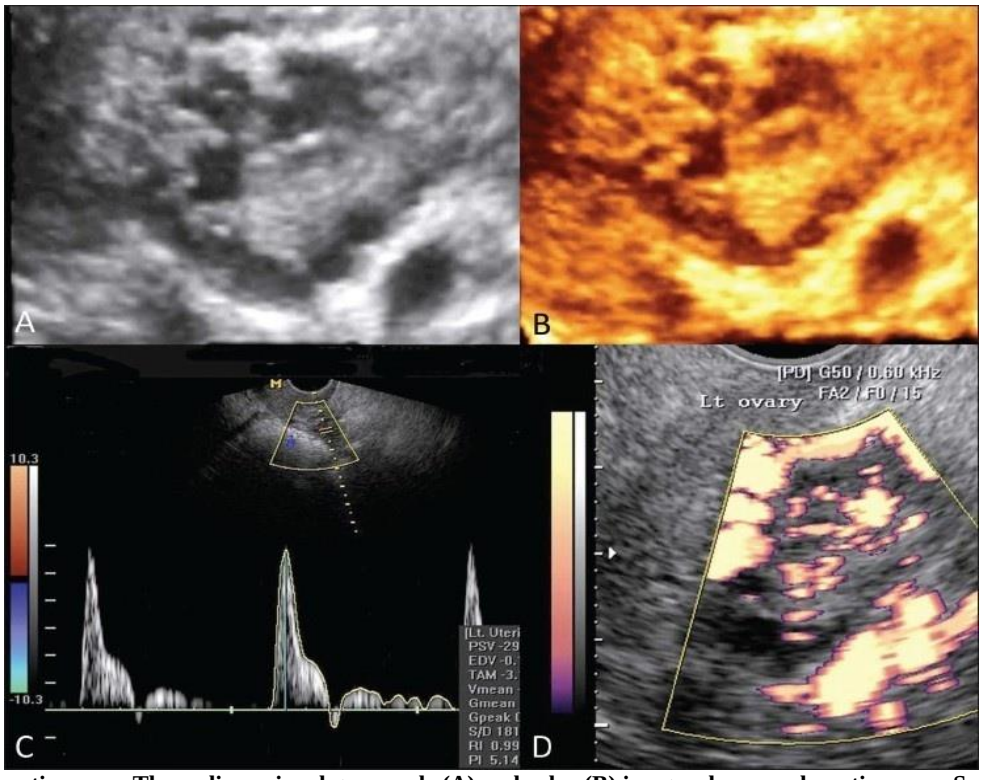

Figure 1: Polycystic ovary. Three-dimensional gray-scale (A) and color (B) images show a polycystic ovary. Spectral Doppler (C) and power Doppler (D) images show reduction in diastolic flow, reverse diastolic component, and increased stromal vascularity in polycystic ovary

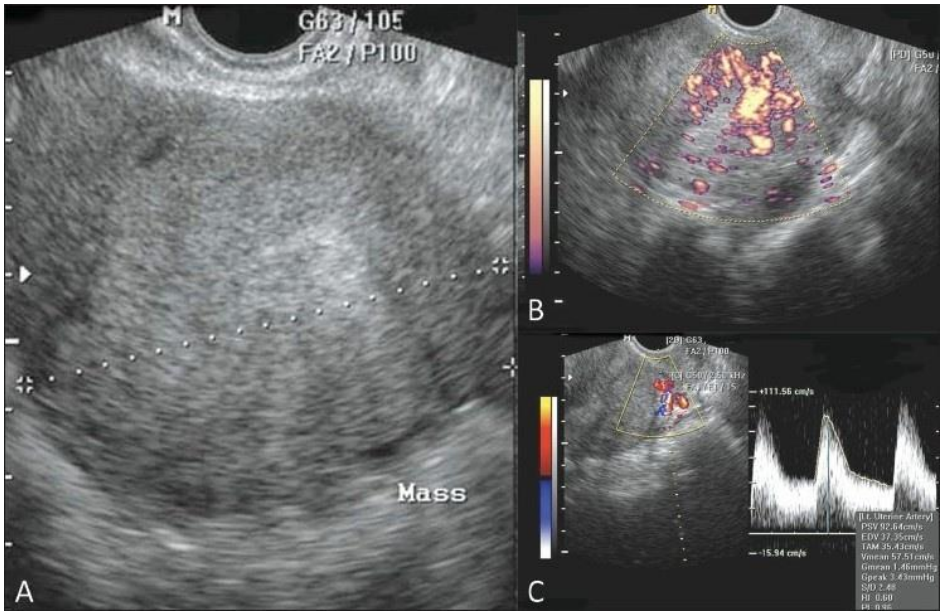

Figure 2: Adenomyoma. Transvaginal 2D gray-scale (A), power Doppler (B) and triplex Doppler (C) USG images show a uterine adenomyoma

Table 1: The studies of common pelvic pathologies causing infertility

REFERENCES	YEAR	COUNTRY	JOURNAL	STUDY DESIGN	SAMPLE SIZE	FINAL RESULTS
Nafeesa Binti Hussain [12]	2017	India	ChattagramMaa-O-Shishu Hospital Medical Journal		100	All the 100 cases undergone TVS study where PCO was found among 69(69%) cases, chronic pelvic inflammatory disease 14(14%) fibroids 6(6%) anatomical problems 19(19%) endometrial/cervical polyp 18(18%) free fluid in pelvic/abdominal cavity 7(7%) endometritis 5(5%) endometriosis 4(4%) adenomyosis 5(5%) chocolate cyst 8(8%) tubo-ovarian mass 2(2%) intrauterine and intra pelvic adhesions 2(2%) septate uterus 292%) pelvic abscess 1(1%) and ectopic pregnancy 1(1%)
F. Ubaldi [13]	2014	Belgium	Human Reproduction		133	In all scans with TVUS, Endometriomas were diagnosed with an efficiency of 96.4%. Vaginal sonographic characterization of pelvic adhesions was 61.1% with a specificity and positive predictive value of 98.2 and 84.6%. Non-endometriotic cysts were diagnosed by TVUS in 21 patients of 120.
Wiesenfeld [14]	2012	Pennsylvania	Obstetrics & Gynecology	observational cohort	418	50 in 120 (42%) women were with subclinical PID and 96 in 187 (51%) women without subclinical PID. Women with subclinical PID diagnosed at enrollment had a 40% reduced incidence of pregnancy compared with women without subclinical PID.
Luma Naji [15]	2018	Iraq	Journal of Health, Medicine and Nursing	quantitative study	225	Ovarian factors were present in 35.69% of the selected population and the most common findingswere the PCO, which present in 88 patients. Uterine factors presented in 9.8%. Other factors such as

						endometriosis and PID are presented in only 1.18% of the population.
Priyanka Sanjay Deshpande [16]	2019	India	Journal of Human Reproductive Sciences	cross-sectional, observational	120	Primary infertility (57.5%) was more prevalent than secondary infertility (42.5%). Female factor accounted for 46.6% of the cases with polycystic ovarian syndrome (PCOS) being the leading cause (46%). Infertility was seen equally in lean and obese PCOS cases. Infectious causes such as pelvic inflammatory disease and tuberculosis were significantly associated with tubal factor infertility ($P = 0.001$).
Maysa S. Elkerdawy [17]	2020		The Medical Journal of Cairo University			Uterine abnormalities represent about 60%, cervical abnormalities represent 3.3% and ovarian abnormalities represent 23.3%, while tubal abnormalities represent 13.3% of the study group.
EB Mendelson [18]	1985		American Journal of Roentgenology	Retrospective study	211	In 259 sonographically monitored cycles reviewed, follicular size and configuration were not different for the two groups. The cumulus oophorus was seen in 28% of pregnant patients (8/28) and in only two nonpregnant patients. Low-level echoes were seen in the mature follicles of 11 patients but not in the large follicles of nonpregnant patients.
Yagoub [19]	2012	Sudan	College of Medical Radiologic Science		42	More than 40% of cases were found to have polycystic ovaries. Four patients have ovarian cysts of different sizes. Five patients were subjected to follicle monitoring during natural menstrual cycles for evidence of spontaneous ovulation. One patient with pelvic inflammatory disease and a patient with Gartners cyst were diagnosed with ultrasonography.
Tommaso Capezzuoli [20]	2019	China	Gynecological Endocrinology	retrospective cohort study	419	The US coexistence of endometriosis with uterine fibroids and adenomyosis was investigated according to three age intervals (<35years; 35 ≥ years <45; ≥45 years). The US diagnosis of fibroids was made in 3.1% of cases, adenomyosis was found in 21.2%, and the co-existence of both uterine disorders with endometriosis was reported in 14.6% of patients. When analyzed according to age, patients aged >35 years were more likely to be affected by uterine fibroids ($p = .003$), adenomyosis ($p = .030$) and both adenomyosis and fibroids ($p < .0001$)
Lavanya Rajashekar [21]	June 2003 to February 2008	India	Journal of Human Reproductive Sciences	Retrospective analysis	2270	Of the 2270 infertility patients, 46.50% (1057) had PCOS

DISCUSSION

Mais *et al*., reported TVUS was found to be 97 percent effective in the screening of endometriomas, compared to 80 percent in previous investigations that employed transabdominal ultrasonography (Cochrane and Thomas, 1974). The use of transvaginal colour and pulsed Doppler sonography can greatly enhance these results, with a sensitivity and specificity of 99.02 and 99.64 percent, respectively, in discriminating ovarian endometriosis from other benign and malignant ovarian diseases. Despite these impressive outcomes, the significance of ultrasonography in the first infertility evaluation is unclear [22]. Yogoub recorded and reviewed the ultrasound findings of 42 infertile women in Dongola District from April to August 2001 in a research. Using vaginal ultrasonography, polycystic ovaries were discovered in more than 40% of patients. Ovarian cysts of various diameters are present in four cases. During normal menstrual cycles, five individuals had their follicles monitored for signs of spontaneous ovulation. After an ovulation induction procedure, one patient was determined to have a hyperstimulated ovarian [19]. Juan Luis Alca'zar conducted studies in which 69 women had the lump surgically removed. Those who have benign masses 1 pedunculated uterine leiomyoma, 2 hydrosalpinges, 5 endometriomata, 5 dermoid cysts, 1 simple cyst 14 women with benign tumours chose conservative treatment. Overall, 41% of Masses were "Malignant," whereas 59% were "Benign" [23].

CONCLUSION

Female infertility may occur in the form of lack of ovulation, blocked fallopian tubes, endometriosis or uterine abnormalities. Our review suggests that there is a strong relationship between infertility and causes of infertility such as ovarian dysfunction, endometriosis, PCOS etc. Patients with pelvic pathologies have chances of infertility.

Ethical Issues: Not applicable.

Conflict of Interests: The authors declare no conflict of interests.

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