International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 10s, 2025
https://theaspd.com/index.php

ROLE OF ULTRASONOGRAPHY IN THE EVALUATION OF FEMALE INFERTILITY IN A RURAL TERTIARY CARE CENTER

Prof. Dr. Ravindra S Pukale[1], Dr. Divya Tagore[2], Dr Nikhitha B[3]
[1]Professor and Unit Chief, Department of OBG, Adichunchanagiri Hospital, B.G Nagara, Karnataka
[2]Junior resident, Department of OBG, Adichunchanagiri Hospital, B.G Nagara, Karnataka
[3]Assistant professor; Department of OBG, Adichunchanagiri Hospital, B.G Nagara, Karnataka
Corresponding author: Dr Divya Tagore, Junior resident, Department of OBG, Adichunchanagiri Hospital, B.G Nagara, Karnataka
Email ID; **divyatag.06@gmail.com**

ABSTRACT

Introduction: *Infertility is a significant public health issue, particularly in rural areas where diagnostic resources are limited. Female infertility can arise from a variety of anatomical and physiological abnormalities. Ultrasonography, especially transvaginal sonography (TVS), is a non-invasive, cost-effective, and readily accessible diagnostic modality that plays a crucial role in identifying underlying causes of infertility.*

Objectives: *To evaluate the role of ultrasonography in diagnosing the causes of female infertility in a rural tertiary care setting and to determine the frequency of specific pathologies detected using this imaging technique.*

Materials and Methods: *This cross-sectional observational study was conducted over 6 months at a rural tertiary care center and included 50 women aged 20–40 years with clinically diagnosed primary or secondary infertility. After detailed history-taking and clinical examination, all participants underwent pelvic ultrasonography, including transabdominal and transvaginal approaches as needed. Ultrasonographic findings were analyzed to identify common etiologies contributing to infertility.*

Results: *The most common ultrasonographic finding was polycystic ovary syndrome (PCOS) (28%), followed by uterine fibroids (16%), ovarian cysts (14%), and endometrial abnormalities (10%). Tubal factors and uterine malformations were each noted in 6% of cases, while 20% of participants had normal ultrasonographic findings. Primary infertility was more prevalent (64%) than secondary infertility (36%).*

Conclusion: *Ultrasonography, particularly TVS, is an effective first-line diagnostic tool in the evaluation of female infertility. Its accessibility, affordability, and diagnostic reliability make it especially valuable in rural healthcare settings.*

Key Words: *Female infertility, Transvaginal sonography, Rural healthcare*

INTRODUCTION

Infertility, defined as the inability to achieve pregnancy after one year of regular unprotected intercourse, has emerged as a significant public health concern globally. [1] It affects an estimated 15.5% of women worldwide, cutting across socioeconomic, cultural, and geographic boundaries. [2] In India, the prevalence of infertility is variable, ranging from 3.9% to 16.8%, depending on regional and demographic factors. Approximately 15% of Indian couples experience infertility, with female factors accounting for nearly half of these cases. [3] Despite being a common condition, infertility remains stigmatized, especially in rural areas, where awareness and access to specialized reproductive care are often limited. [4] The etiology of female infertility is complex and multifactorial, involving disruptions in ovarian function, tubal patency, endometrial receptivity, uterine anatomy, and cervical integrity. [5] Early and accurate diagnosis of these contributing factors is essential for timely and effective intervention. Clinical evaluation typically begins after a couple fails to conceive within 12 months of regular, unprotected sexual activity—a time frame during which approximately 85–90% of couples are expected to achieve pregnancy naturally. [6] Identifying the root cause of infertility requires a combination of history-taking, clinical examination, and diagnostic investigations. [7] Among the diagnostic tools available, ultrasonography has gained prominence as a first-line, non-invasive modality in infertility workups. [8] Transvaginal ultrasonography

(TVS), in particular, allows for high-resolution imaging of the pelvic organs and has become instrumental in assessing ovarian morphology, endometrial thickness and pattern, and uterine and adnexal pathologies. [9] It can detect conditions such as polycystic ovary syndrome (PCOS), ovarian cysts, uterine fibroids, and endometrial abnormalities with considerable accuracy. [9] Its advantages include wide availability, affordability, and the absence of ionizing radiation—making it especially useful in resource-limited rural settings. In rural tertiary care centers, where access to advanced imaging and specialized infertility services may be constrained, ultrasonography serves as a crucial diagnostic tool. It enables healthcare providers to make informed decisions about management and referral, ultimately improving reproductive outcomes. [8] Moreover, early identification of treatable causes of infertility through ultrasonography can significantly reduce the psychological and financial burden on affected couples. [10] The present study aimed to evaluate the role of ultrasonography in diagnosing various causes of female infertility in a rural tertiary care setting. Specific objectives included determining the frequency of different infertility causes as detected by ultrasonography, assessing ovarian reserve and endometrial health, and identifying the most common ultrasonographic findings in women presenting with infertility. This research seeks to reinforce the utility of ultrasonography as a cornerstone in the initial assessment and stratification of infertile women in resource-limited environments.

MATERIALS AND METHODS

This cross-sectional observational study was conducted at a rural tertiary care center over an 6-month period from January 2024 to July 2024. A total of 50 women diagnosed with infertility were included in the study. Participants were recruited based on defined eligibility criteria to ensure uniformity and relevance to the study objectives. The study focused on evaluating the role of ultrasonography in identifying various etiological factors contributing to infertility among women of reproductive age.

INCLUSION CRITERIA:

Age group 20- 40 years
Women with a diagnosis of primary or secondary infertility (infertility duration ≥ 12 months).
Women willing to undergo ultrasonographic examination as part of the fertility evaluation.

EXCLUSION CRITERIA:

Women with known gynecological malignancies. Women with severe medical conditions such as uncontrolled diabetes, thyroid dysfunction, or autoimmune diseases. Participants were enrolled only after providing written informed consent and undergoing thorough counselling regarding the purpose and procedures of the study. Upon recruitment, a detailed history was taken from each participant. Information regarding age, parity, type and duration of infertility, past medical and surgical history, menstrual patterns, and any previous treatments or investigations related to infertility was systematically recorded. This data helped establish a comprehensive clinical profile for each subject, allowing for better correlation with imaging findings. All participants underwent a pelvic ultrasound as part of their diagnostic evaluation. Transabdominal ultrasonography was performed initially to assess overall pelvic anatomy. In cases where more detailed visualization of pelvic organs was necessary, especially the ovaries and endometrium, transvaginal ultrasonography was subsequently carried out. The ultrasonographic examination aimed to identify common pathologies such as polycystic ovary syndrome (PCOS), ovarian cysts, uterine fibroids, endometrial hyperplasia or thinning, tubal dilatation or obstruction, and cervical structural anomalies. Ultrasonographic findings were analyzed and each imaging report was reviewed by experienced radiologists, ensuring consistency and diagnostic accuracy. The collected data was systematically tabulated and analyzed to identify the frequency of various causes of infertility, thus highlighting the diagnostic utility of ultrasonography in the infertility workup at a rural tertiary care setting.

RESULTS

The majority of participants in the study were in the 26–30 years age group, accounting for 46% of the total, followed by 34% in the 20–25 years group. Participants aged 31–35 and 36–40 years constituted

12% and 8%, respectively. In terms of socioeconomic status, 48% belonged to the lower-middle class, 40% were from the lower class, and only 12% were in the upper-middle class. The marital duration of the participants revealed that 40% had been married for 5–10 years, while 30% each had a marital duration of less than 5 years and more than 10 years (Table 1).

Table 1: Demographic Profile of Study Participants (N = 50)

Parameter	Category	Frequency (n)	Percentage (%)
Age Distribution (years)	20–25	17	34%
	26–30	23	46%
	31–35	6	12%
	36–40	4	8%
Socioeconomic Status	Lower Class	20	40%
	Lower-Middle Class	24	48%
	Upper-Middle Class	6	12%
Duration of Marriage	<5 years	15	30%
	5–10 years	20	40%
	>10 years	15	30%

Most women in the study had a normal BMI (60%), while 22% were overweight and 18% were obese. Regular menstrual cycles were reported by 76% of participants, with 24% experiencing irregular cycles. Primary infertility was more commonly observed than secondary infertility, affecting 64% of the study population (Table 2).

Table 2: Clinical Profile of Study Participants

Parameter	Category	Frequency (n)	Percentage (%)
BMI Status	Normal	30	60%
	Overweight	11	22%
	Obese	9	18%
Menstrual Cycle Regularity	Regular	38	76%
	Irregular	12	24%
Type of Infertility	Primary	32	64%
	Secondary	18	36%

Ultrasonographic evaluation revealed polycystic ovary syndrome (PCOS) as the most frequent finding, present in 28% of the women. Uterine fibroids and ovarian cysts were identified in 16% and 14% of cases, respectively. Endometrial hyperplasia accounted for 10% of the findings, while tubal factors and uterine malformations were observed in 6% each. Interestingly, 20% of the women showed normal ultrasonographic findings despite clinical infertility (Table 3).

Table 3: Ultrasonographic Findings in Female Infertility (N = 50)

Finding	Frequency (n)	Percentage (%)
Polycystic Ovary Syndrome (PCOS)	14	28%
Uterine Fibroids	8	16%
Ovarian Cysts	7	14%
Endometrial factors	5	10%
Tubal Factors	3	6%
Uterine Malformations	3	6%
Normal Ultrasonography	10	20%

DISCUSSION

Infertility poses a profound physical, emotional, and social burden, particularly in rural areas where access to specialist care is limited. This study highlights the value of ultrasonography as a vital diagnostic modality in identifying female infertility etiologies within a resource-constrained, rural tertiary care context.The evaluation of female infertility remains a multifaceted challenge, particularly in rural settings where access to advanced reproductive technologies is limited. Diagnostic imaging especially transvaginal sonography (TVS) plays an indispensable role in this context. While no globally accepted consensus exists

regarding a standardized workup protocol for infertility, most clinical pathways begin with baseline TVS providing anatomical and functional insights into the female reproductive tract.Our study, conducted in a rural tertiary care center, reinforces the diagnostic utility of TVS, particularly as a readily available, cost-effective, and non-ionizing imaging modality. The majority of structural abnormalities contributing to infertility such as polycystic ovary syndrome (PCOS), uterine fibroids, ovarian cysts, endometrial pathology, and tubal dilatation were successfully identified through ultrasound, underscoring its role as a frontline investigation in infertility workups.The age distribution in our study reflects a reproductive-age cohort actively seeking conception support, with the peak prevalence observed in the 26–30-year age group. This aligns with broader demographic trends reported in infertility research, emphasizing that diagnostic services should be tailored to this critical reproductive window. Socioeconomic analysis revealed that a substantial proportion of women belonged to lower and lower-middle income classes. This further emphasizes the need for low-cost, widely available diagnostic techniques such as ultrasonography to bridge the care gap in underserved communities.The clinical characteristics observed in the cohort such as the predominance of primary infertility (64%) and largely regular menstrual cycles (76%)—suggest that many women may present with underlying subclinical or structural abnormalities not evident on clinical history alone. Polycystic ovary syndrome was the most common ultrasonographic abnormality (28%), a finding consistent with the study by Ferdows JA et al. [12], where PCOS accounted for approximately 30% of infertility cases. TVS is the gold standard imaging technique for diagnosing PCOS due to its capacity to clearly visualize the characteristic appearance of enlarged ovaries with multiple small peripheral follicles. In addition, TVS is essential for assessing folliculogenesis during assisted reproductive treatment (ART), making it an indispensable tool not just in diagnosis, but also in treatment monitoring. Beyond PCOS, the present study revealed a substantial incidence of uterine fibroids (16%) and ovarian cysts (14%), findings echoed by Ferdows JA et al. [12] study. These structural lesions can impair fertility through mechanical distortion of the uterine cavity or disruption of normal ovulatory cycles. Similarly, ovarian cysts, whether functional or pathological (e.g., endometriomas), can disrupt normal ovulatory cycles. The identification of such pathologies using ultrasonography provides actionable insights, often prompting surgical or medical interventions that can improve fertility outcomes.Our data also identified endometrial abnormalities in 10% of women, reaffirming the utility of TVS in evaluating endometrial receptivity. Endometrial thickness and pattern are critical determinants of successful implantation, and their assessment using TVS is non-invasive, repeatable, and well-suited to outpatient care. This is especially important during ART cycles where precise endometrial monitoring can influence timing and outcomes. Though HSG and laparoscopy remain definitive for tubal evaluation, TVS can detect sequelae of pelvic inflammatory disease (PID), such as hydrosalpinx, and provide early suspicion of tubal blockage. In our study, tubal factors were visualized in 6% of participants, enabling pre-emptive planning for more advanced diagnostic procedures. These findings are congruent with the Ferdows JA et al. [12] study, which reported a slightly higher incidence of tubal pathology (8%) and uterine malformations (5%).

Another notable observation is the presence of normal ultrasonographic findings in 20% of women. This reinforces the understanding that infertility is often multifactorial, with potential contributions from endocrine dysfunction, subclinical infections, immunologic factors, or male factor infertility. While TVS is a powerful tool, it must be interpreted within the context of clinical, biochemical, and semen analysis data to achieve a complete picture. In allignment to our study findings, Ferdos JA et al. [12] concluded that TVS is painless, quicker, costeffective and can be done as a OPD procedure. It can be used as a first-line diagnostic procedure for infertility. Another study by Phillips et al. [11] concluded that while HSG is superior for evaluation of tubal pathologies, TVS is superior for evaluation of myometrial pathology. Both the modalities are complimentary to each other in diagnosis of female infertility. In conclusion, TVS is not only the imaging modality of choice for diagnosing PCOS and assessing endometrial and adnexal patholgy, but also an essential tool for monitoring ovarian response during ART. Its low cost, safety, and diagnostic versatility make it an ideal first-line investigation in both urban and rural contexts. Coupled with structured protocols and appropriate training for clinicians, the widespread adoption of ultrasonography particularly TVS has the potential to transform infertility care by enabling early diagnosis, minimizing delays, and guiding effective treatment pathways. This is particularly relevant in rural settings where tertiary referral is often delayed due to geographic and financial constraints.

CONCLUSION

Ultrasonography, particularly transvaginal sonography (TVS), plays a pivotal role in the initial evaluation of female infertility, especially in rural tertiary care settings where advanced diagnostic modalities may be inaccessible. This study underscores the diagnostic utility of ultrasonography in identifying common etiologies such as PCOS, uterine fibroids, ovarian cysts, and endometrial abnormalities, enabling timely and appropriate clinical interventions. Its affordability, non-invasiveness, and diagnostic accuracy make it an indispensable, frontline tool in infertility workups. Integrating ultrasonography into routine infertility assessment protocols can significantly enhance reproductive healthcare delivery, reduce diagnostic delays, and improve outcomes for women in resource-limited regions.

STRENGTH AND LIMITATIONS OF THE STUDY

Strength

1.Focused rural context:The study specifically targets a rural tertiary care center, addressing a population often underrepresented in infertility research and where resources are limited.

2. Use of Non-invasive and Cost-effective Diagnostic Tool:Emphasizes the utility of ultrasonography, particularly transvaginal sonography (TVS), which is safe, affordable, and suitable for outpatient and rural settings.

3. Real-world Clinical Relevance:Reflects common causes of infertility seen in everyday rural practice, making the findings highly applicable for general practitioners and gynecologists in similar contexts.

4. Cross-sectional Design:Enables assessment of a variety of infertility causes within a specific time frame, capturing the diversity of etiologies in a cost-effective manner.

Limitations

1. Small Sample Size (N = 50):The limited number of participants may reduce statistical power and limit the generalizability of results.

2. Single-center Study:Conducted at one rural tertiary care center, which may not reflect findings from other geographic or healthcare settings.

3. Cross-sectional Nature:Provides a snapshot in time without following up on treatment outcomes or longitudinal fertility status.

4. Lack of Male Factor Evaluation:Focuses exclusively on female infertility without integrating male partner assessment, which is critical in infertility diagnosis.

REFERENCES

1. Feng J, Wu Q, Liang Y, Liang Y, Bin Q. Epidemiological characteristics of infertility, 1990-2021, and 15-year forecasts: an analysis based on the global burden of disease study 2021. Reprod Health. 2025;22(1):26.
2. Thaker N, Dhande R. The role of transvaginal sonography in diagnosis of female infertility: a study protocol. F1000Research 2023, 12:1335.
3. Sharma R, Bakshi H, Patel P, Patel B, Gajjar S, Dave R, et al. Burden of Infertility, Its Risk Factors, Perceptions and Challenges Faced by Women of Peri-urban Community from Ahmedabad City: Mixed Method Study. Indian J Community Med. 2024;49(5):687-694.
4. Kundu S, Ali B, Dhillon P. Surging trends of infertility and its behavioural determinants in India. PLoS One. 2023;18(7):e0289096.
5. Thatipelli RC, Parunandi Y, Nousheen S, Shenkeshi S, Fathima H, Anitha A. An observational study on causes of female infertility. Int J Reprod Contracept Obstet Gynecol. 2024;13(9):2450-6.
6. Carson SA, Kallen AN. Diagnosis and Management of Infertility: A Review. JAMA. 2021;326(1):65-76.
7. Garolla A, Pizzol D, Carosso AR, Borini A, Ubaldi FM, Calogero AE, et al. Practical Clinical and Diagnostic Pathway for the Investigation of the Infertile Couple. Front Endocrinol (Lausanne). 2021;11:591837.
8. Okeke TC, Agwuna KK, Ezenyeaku CC, Ikeako LC. Application of ultrasonography in female infertility: a comprehensive review. Int J Reprod Contracept Obstet Gynecol. 2017;4(5):1246-5.
9. Thaker N, Dhande R, Parihar P. Role of Transvaginal Sonography in the Diagnosis of Female Infertility: A Comprehensive Review. Cureus. 2023;15(12):e50048.
10. Sharma A, Shrivastava D. Psychological Problems Related to Infertility. Cureus. 2022 Oct 15;14(10):e30320.
11. Phillips CH, Benson CB, Ginsburg ES, Frates MC. Comparison of uterine and tubal pathology identified by transvaginal sonography, hysterosalpingography, and hysteroscopy in female patients with infertility. Fertility Research and Practice. 2015;1(1): 1-20
12. Ferdows JA, Jahan I, Joty FS, Jahan R, Susan ZS, Ghani A. Role of Transvaginal Ultrasound in Infertility: Experience at a Tertiary Care Hospital in Dhaka City. Journal of Science Foundation. 2018 Aug 28;15(2):41–7.