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ROLE OF ULTRASOUND IN THE DIAGNOSIS OF PELVIC CAUSES OF FEMALE INFERTILITY

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ABSTRACT

Introduction: Infertility, defined by the WHO as the inability to conceive after 12 months of unprotected intercourse, affects about 180 million people worldwide, with varying rates across different regions. Pelvic causes of female infertility include uterine, ovarian, and tubal abnormalities, and advancements in ultrasound technology, especially transvaginal ultrasound, have become crucial for diagnosing and treating these conditions. Despite its widespread use, there is limited research on the effectiveness of ultrasound in identifying the pelvic causes of female infertility, prompting further studies.

Aim-To evaluate the role of ultrasound in the in the diagnosis of pelvic cause of female infertility

Materials and Methods: A cross sectional observational study was conducted at at Maharaja Yeshwantrao (M.Y.) Hospital in Indore, India, from February 2023 to February 2024, involving 200 infertile female patients , referred to to our department of radiodiagnosis were evaluated with trans-abdominal and transvaginal ultrasound and the results were observed

Results- Among the infertile female patients, this study assessed the causes of female infertility by evaluating 200 women with infertility who attended the hospital. The mean age of the women with infertility was 29 ± years, with most of them between 31-35 years 40%, 22.5% between 26-30 years old, 15% between 21-25 years old and 19% were ≥45were. Of the sample, 56.5% had primary infertility, while 43.5% had secondary infertility. A statistical significant association was found between age and the type of infertility($p < 0.05$) with polycystic ovary disease being the most common cause of infertility 29 %, followed by fibroids 6.5%, Endometrial polyps 3.5%, Adenomyosis 6%, Hydrosalpinx 4%, Congenital abnormality 2.5% and other causes was 1%. Our findings demonstrate the usefulness of ultrasound in diagnosing and evaluating female infertility. The causes of female infertility are polycystic ovary disease, fibroids, Endometrial polyps, Adenomyosis, Hydrosalpinx and congenital anomalies

Conclusion- Infertility is the term used to describe the inability to fall pregnant after a year of regular sexual intercourse, and ultrasound is a helpful diagnostic tool when assessing female infertility. Most Causes of female infertile are diagnosed using trans-vaginal and trans-abdominal ultrasound. The cause of female infertility are polycystic ovarian morphology, fibroids, Endometrial polyps, Adenomyosis, Hydrosalpinx and congenital anomalies The study recommends that every female patient with suspected infertility issues should get an ultrasound examination done.

Keywords: Female infertility ,pelvic causes , polycystic ovarian morphology, ultrasound, infertile women.

INTRODUCTION

Infertility, defined by the WHO as the inability to conceive after 12 months of regular, unprotected intercourse, affects around 180 million people globally, with prevalence ranging from 5-8% in developed countries to 5.8-44.2% in developing regions [1]. The primary causes include male factors (20-30%), anovulation (10-30%), tubal factors (15%), cervical factors (5%), endometriosis (5-25%), and unexplained factors (15-30%), with variations across different regions.Female infertility is often due to pelvic issues such as uterine, ovarian, and tubal disorders. Uterine causes include congenital anomalies, fibroids, and infections; ovarian causes include PCOS, endometriosis, and luteal phase defects; and tubal causes often involve infections or obstructions. Advances in assisted reproductive technology (ART), particularly ultrasound, have revolutionized infertility diagnosis and treatment [2]. Ultrasound, especially transvaginal, is preferred for its non-invasive nature, high spatial resolution, and ability to provide detailed imaging of the uterus, ovaries, and fallopian tubes.Transvaginal ultrasound is crucial for assessing uterine and ovarian morphology, monitoring ovarian cycles, and guiding procedures like oocyte retrieval and embryo transfer [4]. Despite its widespread use, there is limited research on the effectiveness of ultrasound in diagnosing pelvic causes of female infertility, prompting further studies to evaluate its role and capabilities.

MATERIALS AND METHODS

A time-bound, hospital-based, cross-sectional observational study comprising of 200 infertile females was conducted after approval from the institutional ethics and scientific review committee [EC/MGM/sep-23/142] in M.Y. Hospital, Indore (Madhya Pradesh, India) from February 2023 to February 2024. A total of 200 female patients with infertility referred to our department with infertility for ultrasound evaluation were included in this study.

INCLUSION CRITERIA –

- Patients between 18 to 45 years of age
- Failure to achieve a pregnancy after 12 months of appropriate timed unprotected intercourse or therapeutic donor insemination

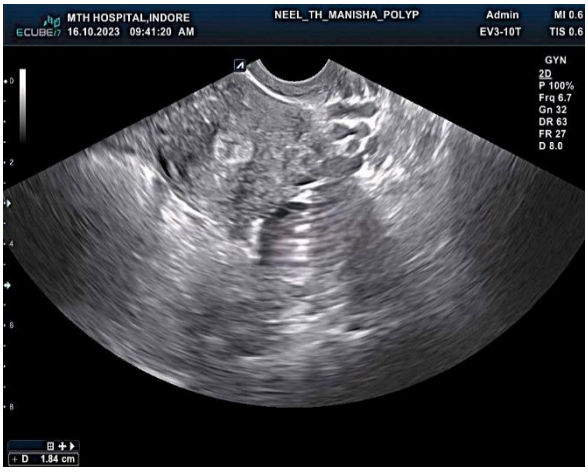
EXCLUSION CRITERIA

- Patients of minor age (<18 years of age)
- Patients who are not willing to give consent to take partin the study
- Other than Pelvic Causes of Female Infertility and Their Hormonal &Biochemical causes.

All the patients were subjected to the following:

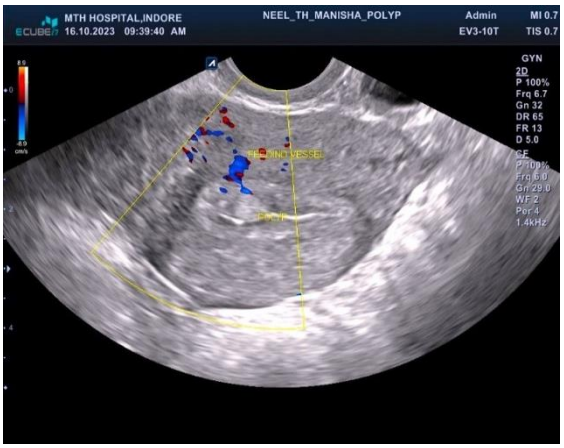
Females were explained about the procedure and demographic data was recorded. BMI was calculated as weight in kilograms divided by height in meter squared, all subjects were studied in their phase of complaint of not conceiving.

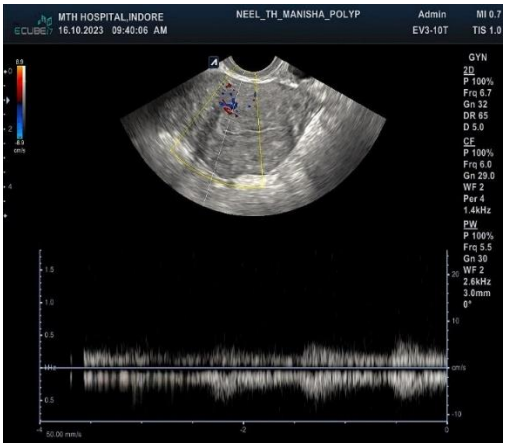
Case 1- A 27 year old patient with complaints of irregular menstrual bleeding and taking infertility treatment since 6 months.



A)

B)



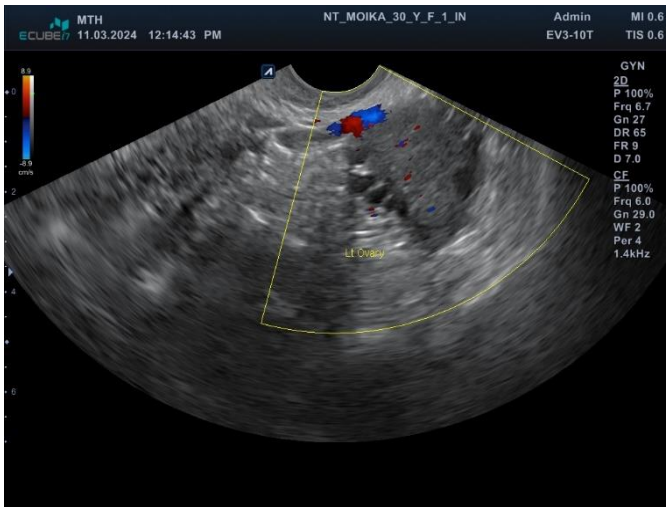


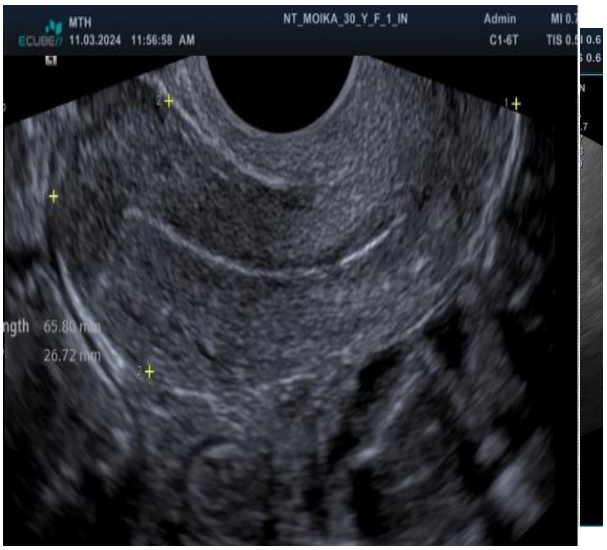
C)

D)

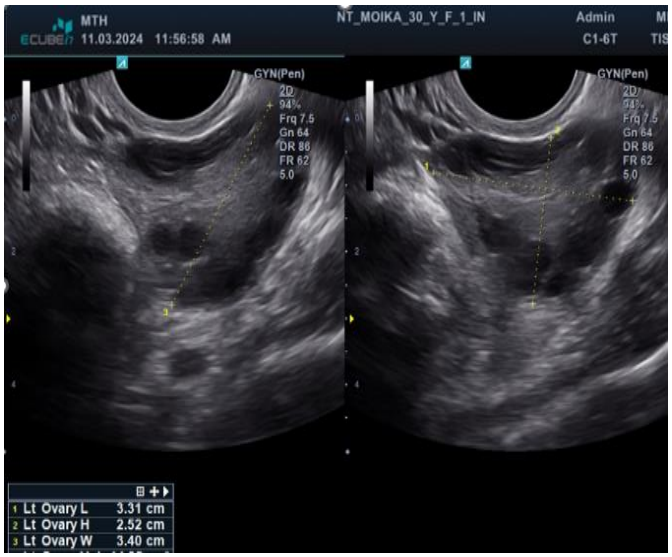
A) and B) images on the TVS grey scale show, an endometrial polyp appearing as a well-defined hyperechoic mass protruding into the endometrial cavity.
C) and D) On color Doppler imaging a vascular pedicle is seen. Spectral analysis reveals low-flow characteristics, which further support the diagnosis of an endometrial polyp.

Case 2: A 25 year old female with complaints of irregular menstrual cycles and infertility.





A)



C)
D)

On the B-mode scan, bilateral ovaries are bulky, with volume measuring 17.38 ml & 15.70 ml for right and left ovaries respectively, with multiple small follicles (2-9mm) arranged peripherally. The Final diagnosis is PCO morphology.

RESULTS

In this study, the spectrum of patients was in the range of 18-45 years,maximum infertile females were in the age group of 31-35 years (40%), mean age of the patients in our study was 29 yrs.(Table /Figure 2)

Age (years)	Number of patients	Percentage (%)
18-20	17	8.5
21-25	30	15
26-30	45	22.5
31-35	80	40
36-40	18	09
41-45	10	05
Total	200	100

Table/figure2 : Distribution of patients according to age

In this study the majority of the group falls within the overweight category 84 (42%), followed by those in the normal weight range 76(38%). A smallerportion of the group was either underweight 18(9%) or obese 22(11%).(Table/Figure3)

Table 2: distribution of infertile females based on BMI

BMI ($kg/m^{2)}$	Number of patients	Percentage
<18.5 (underweight)	18	09
18.5-24.9(normal)	76	38
25-29.9(overweight)	84	42
>30(obese)	22	11
Total	200	100

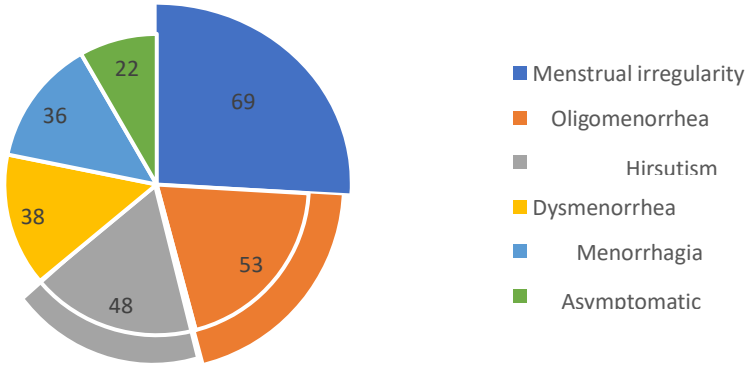
Among the total 200 of infertile females, the majority of the infertile females were of primary infertility 112 (56.5%). Table/figure3

Infertility	Number of patients	Percentage (%)
Primary	112	56.5
Secondary	88	43.5
Total	200	100

Table/figure 3: Distribution of patients according to type of infertility

Menstrual irregularity was the most common presenting complaint, affecting 69 patients (34.5%). This is followed by oligomenorrhea, which affects 53 patients (26.5%). Hirsutism affected 48 patients (24%), while dysmenorrhea and menorrhagia affected 38 patients (19%) and 36 patients (18%), respectively (Graph/Figure4)

(Graph/figure 4) Distribution of infertile patients according to Clinical Features



The majority of patients 89(44.5%) had normal pelvic findings, followed by ovarian pathologies at 67(31%). Uterine and tubal pathologies were less common, affecting 37(18.5%) and 12(6%) of patients, respectively. **(Table/figure4)**

Pelvic pathologies	No of patients (n)	Percentage (%)
Uterine	37	18.5
Ovary	62	31.0
Tubal	12	6.0
Normal	89	44.5
Total	200	100

Table /figure04: Distribution of patients of infertility on the basis of various pelvicpathologies

Uterine Finding	No of Patients (n)	Percentage (%)
Leiomyoma	13	35.1
Adenomyosis	12	32.4
Endometrial Polyp	07	18.9
Mullerian ductanomaly	05	13.5
Total	37	100

Table 06: Distribution of patients with infertility on the basis of uterine causes

Ultrasound finding	No of patients (n)	Percentage (%)
PCO morphology	58	27.5
Uterine leiomyoma	13	6.5
Endometrial polyp	07	3.5
Adenomyosis	12	06
Ovarian endometrioma	03	1.5
Hydrosalpinx	04	02
Pyosalpinx	03	1.5
Tubo-ovarian complex abscess	02	01
Adnexal mass	03	1.5
Ovarian tumors	01	0.5
MDA	05	2.5
Normal	89	44.5
Total	200	100

Table 07: Distribution of spectrum of pelvic ultrasound findings in infertile females

DISCUSSION :

Infertility affects a significant portion of the population, with up to 15%of couples experiencing difficulties conceiving. Within this group, female infertility is often linked to pelvic abnormalities such as polycystic ovary syndrome (PCOS), endometriosis, fibroids, and congenital uterine anomalies. Ultrasound in evaluating pelvic causes of female infertility is vital for advancing medical knowledge, improving clinical practice, and enhancing patient outcomes, making it a highly relevant and impactfularea of research.

The patients in this study ranged from 18 to 45 years old. Most patients 40% were between 31-35 years, followed by 22.5% aged 26 to 30. Most patients 40% are between 31 and 35 years , as this is a common age range for women actively trying to conceive, leading to the detection of fertility issues. This age distribution of patients in this study is in accordance with a study conducted by Jannat Ara Ferdows et al (2017),[4] In their study, most patients (41%) were between 31 and 35 years followed by age group 25 to 30 years old (27.5%).

In our study , The largest group, 42%, were overweight with a BMI between 25-29.9, while 38% had a normal BMI of 18.5-24.9. 11% of the patients were obese with a BMI over 30 and lastly , 9% of patients had a BMI below 18.5, indicating they were underweight. This distribution reveals that the majority of infertile patients are eith overweight or within the normal BMI range. The higher prevalence of infertility among overweight (42%) and obese (11%) patients is likely due to the negative impact of excess body fat on hormonal balance and ovulation ,the results of our study align with those of Hichem Abdessalem Maï et al. (2015),[05] which found a high percentage of

overweight (41.79%) and obese (9.76%) women in the infertile group. Similarly, Shivani Bhadkaria et al. (2023,[18] reported that 56.66% of infertile women were overweight, 32% had a normal weight, and 10.4% were obese.

The patients in this study ranged from 18 to 45 years old. Most patients 40% were between 31-35 years, followed by 22.5% aged 26 to 30. Most patients 40% are between 31 and 35 years .In this study the majority of the group falls within the overweight category 84 (42%), followed by those in the normal weight range 76(38%). A smaller portion of the group was either underweight 18(9%) or obese 22(11%).

In this study primary infertility, affects 112 patients, making up 56.5% of the total. Secondary infertility, affects 88 patients, accounting for 43.5%. Overall, primary infertility is more common among the patients,this pattern could be because, it includes a wide range of initial reproductive challenges, such as ovulatory disorders, tubal blockages, and male factor infertility. Secondary infertility, though also significant, is often due to factors like age-related decline in fertility, postpartum complications, or previous surgeries affecting reproductive organs. The results are similar to a study done by Nagla Hussein Mohamed Khalid et al. (2018),[06] which concluded that most infertile females have primary infertility (65%), with the remainder having secondary infertility (35%). Similarly, Tehrani et al. (2011) found that the majority of patients had primary infertility.

Among the infertile patients, 34.5% reported menstrual irregularity, with 26.5%experiencing oligomenorrhea and 24% hirsutism. Dysmenorrhea affected 19% of patients, while 18% had menorrhagia. Additionally, 11% of the patients were asymptomatic. Similar findings were seen in the study done by Mittal A et al. (2015),[07] found that 34.1% of infertility cases had menstrual disorders.

In our study, The distribution of infertility patients based on pelvic pathologies shows that ovarian pathologies are the second most common pathology affecting 31.0% of patients, with most of the infertile women having normal pelvic ultrasound finding 44.5%. Uterine pathologies account for 18.5% of cases, while tubal pathologies are the least common, present in 6.0% of patients. This data highlights the significant impact of ovarian issues on infertility compared to otherpelvic pathologies.The study has similarity with multiple studies most significant among them was study done by Nagla Hussein Mohamed Khalid et al. (2020),[08] which concluded that most infertile females have primary infertility (65%), with the remainder having secondary infertility (35%). Similarly, Tehrani et al. (2011) found that the majority of patients had primary infertility.

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Out of 12 patients diagnosed with adenomyosis in our study , focaladenomyosis was more common observation (66.6%) as compared to diffuse adenomyosis. Similar finding was seen in the A single-centre, cross- sectional study done by Mathilde Bourdon et al (2018)[11] where he highlighted that, in a population of late reproductive aged women, the focal adenomyosis of the outer myometrium phenotype was significantly associated with primary infertility.

The distribution of patients with endometrial polyps is as follows: 42.8% had polyps on the posterior uterine wall, 28.5% on the anterior uterine wall, and 28.5% in multiple locations. The majority of patients had polyps on the posterior uterine wall. The findings were comparable with a retrospective study done by Atsushi Yanaihara et al[2001][12]. He found posterior uterine wall (32.0%), anterior uterine wall (15.4%) and multiple (35.4%) similar to our study.

In our study, the most frequent mullerian duct anomaly is the bicorporeal uterus, with 40% cases. Septate, hemi-uterus, and aplastic uterus are equally less common, each with 20% case. The higher prevalence of bicorporeal uterus may be due to its earlier and more noticeable presentation of symptoms, leading to more frequent diagnosis. Additionally, the development of bicorporeal uterus might be influenced by genetic and environmental factors that are more prevalent in the studied population. A study with similar results is by Mark D. Sugi (2023)[13], which also found a high prevalence of bicorporeal uterus in their cohort of infertile women, indicating a possible pattern in the occurrence of uterine anomalies contributing toinfertility.

In this study, the distribution of ovarian causes of infertility among patients was analyzed. The majority of patients, 58 out of 62 (93.5%), exhibited polycystic ovary (PCO) morphology. A study with similar results was doneby Azziz et al. (2004),[13]Also Nguyen Sa Viet Le ,Minh Tam Le ,et al (2021),[14] also found a high prevalence of PCO morphology in their cohort of women with infertility issues. This study also reported asignificant occurrence of PCOS, reinforcing the commonality of this condition as a primary ovarian cause of infertility.

In our study, the distribution of adnexal pathologies among infertility patients was analyzed. Hydrosalpinx was the most common, affecting 33.3%. Pyosalpinx and adnexal mass each affected 25.0%, while tubo-ovarian complex abscess was found in 16.6%. This data indicates a significant presence of tubal abnormalities among the patients. The above findings are similar to the study by Shaidul Islam Borah et al. (2023),[15] which found PID and hydrosalpinx as significant causes offemale infertility. Additionally, Nagla Hussein Mohamed Khalid et al.(08) found hydrosalpinx to be responsible for around 4% of female infertility cases in their descriptive study.

A diagnostic evaluation for infertility in women should be conducted systematically, quickly, and cost-effectively to identify all relevant factors. The initial focus should be on the least invasive methods to detect the most common causes of infertility. Hormonal, biochemical, and congenital factors are significant contributors to infertility. An initial ultrasound evaluation is an efficient way to rule out a wide range of pathologies, including uterine, ovarian, tubal, and intrauterine causes.

Conclusion

Female infertility is a complex and emotionally challenging condition affecting millions of women worldwide, defined as the inability to conceive after one year of regular, unprotected intercourse, or six months for women over 35. Addressing female infertility necessitates a comprehensive approach involving thorough medical history reviews, physical examinations, and advanced diagnostic techniques. Among these, ultrasound evaluation stands out as a cornerstone in assessing female reproductive health. This non-invasive imaging technique provides detailed visualization of the ovaries, uterus, and fallopian tubes, allowing clinicians to identify anomalies like PCOS, uterine fibroids, and tubal blockages. Ultrasound's reliability in diagnosing anatomical causes of infertility makes it comparable to gold-standard investigations, and it should be recommended as a primary diagnostic modality. When necessary, it can be complemented by other tools such as MRI, HSG, and laparoscopy.

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Ethical approval: approved by Institutional Ethics and Scientific Review Committee

References

1. World Health Organization (WHO) (2020) Infertility. WHO, Geneva. https://www.who.int/fr/news-room/fact-sheets/detail/infertility
2. Le Goff, S., Lédée, N. and Bader, G. (2008) Obesity and Reproduction: Review of the Literature. Gynécologie Obstétrique & Fertilité, 36, 543- 550.
3. Meng, Q., Ren, A., Zhang, L., et al. (2015) Incidence of Infertility and RiskFactors for Impaired Fertility in Newly Married Couples in a Chinese Population. Repro ductive BioMedicine Online, 30, 92-100.
4. Ferdows JA, Jahan I, Joty FS, Jahan R, Susan ZS, Ghani A. Role ofTransvaginal Ultrasound in Infertility: Experience at a Tertiary Care
5. BOUDIA F, DEMMOUCHE A, MAÏ HA. THE IMPACT OF FEMALE BODY WEIGHT ON INFERTILITY. Journal of Disease andGlobal Health. 2015 May 16;3(1):34-8.

6. Khalid NH, Ahmed IA, Ahmed SA. Evaluation of causes of female infertility using ultrasonography in Najran, Saudi Arabia. African Journalof Reproductive Health. 2022 Aug 14;26(5):90-5.
7. Ambala H. An epidemiological study of infertility among urbanpopulation of Ambala, Haryana.
8. Khalid NH, Ahmed IA, Ahmed SA. Evaluation of causes of female infertility using ultrasonography in Najran, Saudi Arabia. African Journalof Reproductive Health. 2022 Aug 14;26(5):90-5.
9. Ambala H. An epidemiological study of infertility among urbanpopulation of Ambala, Haryana.
10. Ukwenya V, Maduemezia N, Afolayan O, Alese O, Thomas W. Prevalence of uterine fibroid in a South-Western Nigerian population: Asonographic study. Journal of Experimental and Clinical Anatomy. 2015Jan 1;14(1):24-9.
11. Bordonne C, Millisher AE, Plu-Bureau G, Cormier J, Chapron C. Focal adenomyosis is associated with primary infertility. Fertility and Sterility.2020 Dec 1;114(6):1271-7.
12. Sugi MD, Penna R, Jha P, Põder L, Behr SC, Courtier J, Mok-Lin E, Rabban JT, Choi HH. Müllerian duct anomalies: role in fertility andpregnancy. Radiographics. 2021 Oct;41(6):1857-
13. Azziz R. Polycystic ovary syndrome. Obstetrics & Gynecology.2018 Aug 1;132(2):321-36.
14. Le NS, Le MT, Nguyen ND, Tran NQ, Nguyen QH, Cao TN. A cross-sectional study on potential ovarian volume and related factors in women
15. 15. Borah SI, Sarma HK, Deka T, Chaliha B, Das S. Hysteroscopic evaluation of uterine pathology in women with infertility in a tertiary care.