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COMPARISON BETWEEN TRANSVAGINAL ULTRASONOGRAPHY AND LAPAROSCOPIC FINDINGS OF PELVIC PATHOLOGY IN SUBFERTILE PATIENT

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ABSTRACT

Background: Subfertility, a growing global issue, arises from diverse gynecological factors including pelvic pathologies. While laparoscopy is the diagnostic gold standard, it is invasive and costly. Transvaginal ultrasonography (TVS) offers a less invasive, affordable alternative, yet its diagnostic accuracy for pelvic pathology in subfertile women requires validation. **Aim:** To assess and compare the detection of gross pelvic pathology in subfertile women by TVS and laparoscopy. **Materials and Method:** This cross-sectional study enrolled 100 subfertile women aged 20–40 years at Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) General Hospital, Dhaka, from January to December 2015. All underwent TVS followed by diagnostic laparoscopy. Data collection included clinical examination, sonography, and surgical findings. **Results:** The study included women aged 20–40 years, predominantly between 26 and 35 years. Among them, 61% had primary and 39% had secondary subfertility. TVS identified a normal uterus in 66% and fibroids in 14% of cases, comparable to laparoscopy findings (76% normal uterus, 14% fibroids). TVS detected normal ovaries in 56% and polycystic changes in 32%, while laparoscopy detected 40% and 38%, respectively. Fallopian tubes were visualized in 96% by TVS and 84% by laparoscopy. However, TVS failed to detect peritubular adhesions visible in 14% by laparoscopy. Hydrosalpinx was observed in 4% by TVS and 2% by laparoscopy. Pouch of Douglas abnormalities and endometriosis were underdiagnosed by TVS compared to laparoscopy. Overall, TVS demonstrated a sensitivity of 62.87%, specificity of 81%, positive predictive value of 89%, and negative predictive value of 49% in detecting pelvic pathology. **Conclusion:** TVS is a valuable, noninvasive tool for detecting uterine and some ovarian pathologies in sub-fertile women. Yet, it has limitations in detecting tubal and peritoneal disease, emphasizing that laparoscopy remains necessary for definitive diagnosis in complex cases.

Keywords: Sub-fertility, Transvaginal Ultrasonography, Laparoscopy, Pelvic Pathology, Diagnostic Accuracy.

INTRODUCTION:

A clear and uniform definition of subfertility is essential for guiding appropriate management strategies in reproductive medicine.

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The term subfertility generally refers to any state of diminished fertility marked by an extended duration of unsuccessful attempts to conceive. Typically, most conceptions occur within the first six menstrual cycles when intercourse coincides with the fertile window, accounting for about 80% of pregnancies. Beyond this period, a significant degree of subfertility must be considered in approximately 10% of couples. However, even among these couples, nearly 55% may still achieve a live birth naturally within the following three years, despite ongoing difficulties. After four years without conception, around 5% of partners are classified as permanently infertile, with virtually no likelihood of conceiving spontaneously. Increasing age further diminishes the overall probability of conception, largely due to greater variation in natural fecundity and a higher fraction of couples affected by infertility. While some with favorable prognoses, such as unexplained infertility, may continue attempting naturally, others may require earlier intervention with assisted reproductive technologies[1].

Infertility represents a major public health concern, affecting nearly 10%–15% of couples globally. The condition arises from multiple causes, among which tubo-peritoneal disorders constitute the leading contributor, accounting for roughly 25%–30% of female-related infertility[2]. Data show that about 84% of women achieve conception within one year of regular unprotected intercourse (4–5 times weekly), with cumulative chances increasing to 92% after two years and about 93% after three years[3]. Approximately 60–80 million couples worldwide can be labeled as suffering from subfertility. Successful conception relies on the reproductive capacity of both partners. Male factors contribute to nearly 30%–40% of cases, while female factors account for about 40%–55%. In roughly 10% of couples, both partners are affected, and another 10% remain unexplained. Notably, around 40% of couples with unexplained infertility conceive spontaneously within three years without targeted therapy[4].

The prevalence of infertility in developing countries like Bangladesh is difficult to assess due to inadequate research and poor record keeping. In a study of rural populations in Bangladesh, 3.2% of married women of reproductive age were found to have primary subfertility, and 3% had secondary infertility[5].

According to the FIGO (International Federation of Gynecology and Obstetrics) manual (1990), the causes of female infertility are: factors related to peritonium and fallopian tubes (25%–35%), ovulatory factors (30%–40%), and endometriosis (1%–10%). Major causes according to the World Health Organization (WHO) on a global basis include malnutrition, pelvic tuberculosis, and puerperal infections leading to tubal blockage[6].

Pelvic pathology includes ovarian disorders such as polycystic ovary, cysts, endometrioma, and endometriosis. Peritubal adhesion is an important cause of subfertility. Endometriosis is found in 22% of women with subfertility or chronic pelvic pain, and it is the second most common gynecological condition[4-6].

Pelvic inflammatory disease (PID) is the most common cause of tubal disease, representing more than 50% of cases. It may affect the fallopian tube at multiple sites. After one episode of PID, the rate of infertility is estimated to be 11%, increasing to 23% after two episodes and 54% after three episodes. Tubo-peritoneal disease results from both proximal and distal tubular diseases[7,8].

The extent and degree of investigation will, of course, depend on the sophistication of the laboratories and the skill of the gynecologist. Investigation should begin within one year for female partners under 35 years of age and within six months for those over 35 years of age [9]. The most important key point is a detailed history

and physical examination of the couple. Following this, basic investigations are required in all cases. Routine hemoglobin percentage, total and differential white blood cell count, erythrocyte sedimentation rate, blood sugar, venereal disease research laboratory (VDRL) test, urine examination, chest X-ray, and ultrasonogram are performed. VDRL and semen analysis of husbands are also done routinely. Prolactin levels are estimated if needed. Evaluation of the subfertile patient also includes hysterosalpingography and laparoscopy[10].

A diagnostic laparoscopy is also carried out as a first-line invasive investigation based on the view that it will expedite management and give the patient a better idea of prognosis. However, laparoscopy is not readily available everywhere in the country, and it is expensive, invasive, and requires anesthesia, which may cause anxiety for the patient. Therefore, it is impractical to undergo an invasive procedure at the initial subfertility workup. In this case, a noninvasive diagnostic method can be used to exclude these abnormalities, and TVS may serve this purpose[11].

MATERIALS AND METHOD

This study was a cross sectional study which recruited 100 sub-fertile women in the department of Obstetrics and Gynecology, BIRDEM General Hospital - 2, Dhaka from January 2015 to December 2015.

Inclusion Criteria

Both primary and secondary sub-fertile patients within 20-40 years of age.

Exclusion Criteria

- Patients whose husband has semen abnormalities (Azospermia)
- Primary infertility due to Mullerian agenesis
- Patients with medical disorders like severe heart disease, schizophrenia
- Patients who are not fit for anesthesia as well as laparoscopy.

Variables studied

Imaging findings:
Transvaginal ultrasonography findings.

Surgical Findings:
Laparoscopic findings.

Ethical implication

Clearance from institutional ethical committee was taken.

Study Procedure

This study was a cross sectional study which recruited 100 sub-fertile women.Patients were selected purposively according to the selection criteria to assess and compare the gross pelvic pathology in the sub-fertile patients by TVS and laparoscopy. For each and every subject separate data collection sheets were prepared. The purpose and procedure of the study was discussed with the patient. Written consent was taken from those who agreed to participate in the study.

Statistical Analysis

Data was compiled in predesigned record forms and this was analyzed by using window based SPSS 18.0 software (SPSS live Chicago. IL.USA).

RESULTS

This study was a cross sectional observational study which recruited 100 sub-fertile women. The tables and figures were plotted according to age, pathological characteristics and their comparison of findings between TVS and laparoscopy.

The study enrolled women aged 20–40 years, with a predominant age group of 26–35 years and a mean age of 29.34 ± 4.96 years, as illustrated in Figure 1..

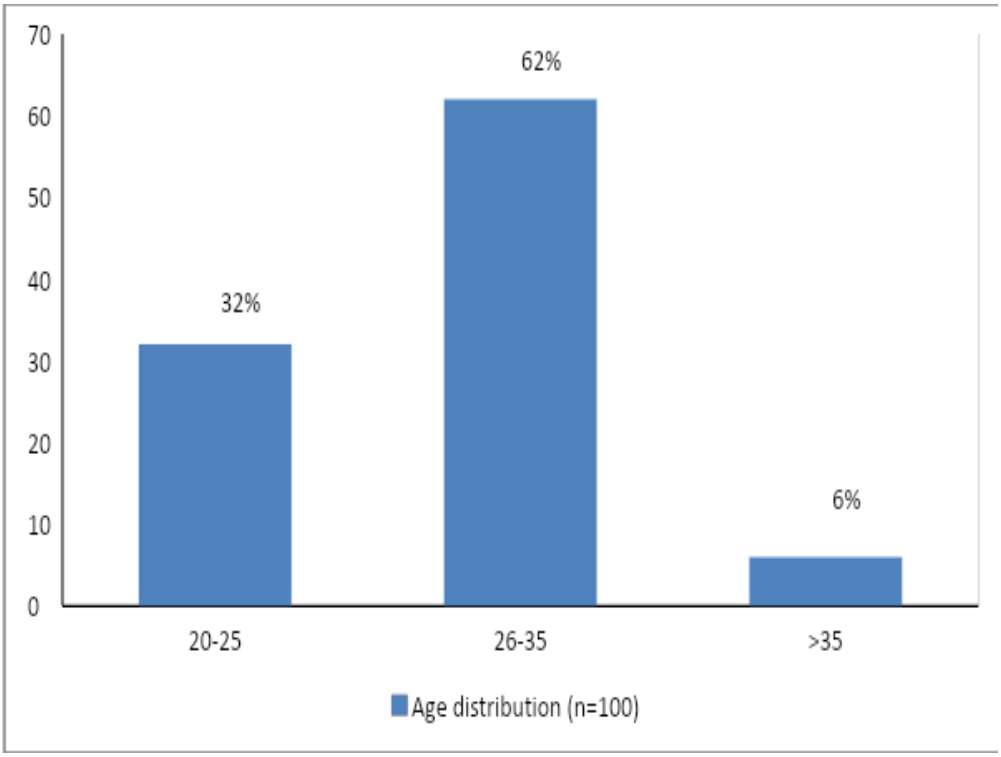

Figure 1: Displays the age distribution. n=Number of subjects. Maximum respondents were in the age group 26-35 years.The mean age of the 100 study subjects was 29.34±4.96 years.

The majority had a subfertility duration of 2–5 years (76%), with an overall mean duration of 4.31 ± 3.33 years (Table 1). Menstrual history analysis revealed that 88% experienced periods within the normal range (<7 days), while 46% had irregular cycles and 70% reported dysmenorrhea (Table 2). Comparison of pelvic pathology between TVS and laparoscopy showed that a normal uterus size was more often detected by laparoscopy (76%) than TVS (66%), while uterine fibroids were found consistently in 14% of cases by both modalities (Table 3). TVS demonstrated high sensitivity (82.39%) and specificity (81.78%) for uterine abnormalities (Table 4). For ovarian findings, TVS identified normal ovaries in 56% and by laparoscopy: 40%, polycystic changes in 32% and by laparoscopy: 38%, and chocolate cysts in 8% and laparoscopy: 12%, with sensitivity and specificity for ovarian abnormalities at 66.8% and 89.95%, respectively (Tables 5,6). Concerning fallopian tubes, TVS detected normal tubes in 96% of cases, markedly more than laparoscopy (84%), but was inferior for identifying peritubular adhesions and hydrosalpinx (Table 7), reflected by a sensitivity of only 20% for tubo-ovarian abnormalities (Table 8). Assessment of the pouch of Douglas highlighted higher rates of normal findings by TVS (96%) compared to laparoscopy (66%), with TVS unable to reliably detect adhesions or endometriosis (Table 9), showing a sensitivity of just 3.16% (Table 10). Overall diagnostic accuracy for TVS in pelvic pathology was moderate, with a sensitivity of 62.87%, specificity of 81%, a high positive predictive value of 89%, but a lower negative predictive value of 49% (Table 11). These results demonstrate that TVS is effective for detecting uterine and some ovarian pathologies, but is limited in identifying tubal adhesions, endometriosis, and pouch of Douglas abnormalities as compared to laparoscopy.

TVS and laparoscopy findings of pelvic pathology compared

Table 1: Duration of subfertility of the respondents (n=100):

Duration of subfertility	Number of cases (%)
2 – 5 years	76
6 – 10 years	20
>10 years	4
Total	100
Mean±SD (in years)	4.31±3.33

n=Number of subjects

Table 2: Distribution of menstrual history (n=100):

Menstrual	Frequency (%)
Menstrual period	
a. Normal range (< 7 days)	88%
b. Beyond normal range (> 7 days)	12%
Menstrual regularity	
Regular	54%
Irregular	46%
Dysmenorrhea	
a. Present	70%
b. Absent	30%

n=Number of subjects

Table 3: TVS versus laparoscopic findings of uterus(n=100):

Uterus	TVS findings (n=100)	Laparoscopic findings (n=100)
Size		
a. Normal	66%	76%
b. Enlarged	34%	24%
Position		
a. Anteverted	82%	84%
b. Retroverted	18%	16%
Fibroid		
a. Present	14%	14%
b. Absent	86%	86%

n=Number of subjects; TVS= Transvaginal Ultrasonography

Table 4: Accuracy of TVS in uterine abnormality (n=100):

TVS	Percentage
Sensitivity	82.39%
Specificity	81.78%
Positive predictive value	57.87%
Negative predictive value	94.15%

n=Number of subjects; TVS=Transvaginal Ultrasonography

Table 5: TVS versus laparoscopic findings of ovaries (n=100):

Ovaries	TVS (n=100)	Laparoscopy (n=100)
Normal	56%	40%
PCOD	32%	38%
Chocolate cyst	8%	12%
Tubo-ovarian mass	10%	12%
Folliucular cyst	4%	12%

n=Number of subjects; TVS=Transvaginal Ultrasonography; PCOD=Polycystic Ovarian Disease

Table 6: Accuracy of TVS in ovarian abnormality (n=100):

TVS	Percentage
Sensitivity	66.8%
Specificity	89.95%
Positive predicative value	90.97%
Negative predictive value	64.98%

n=Number of subjects; TVS=Transvaginal Ultrasonography

Table 7: TVS versus laparoscopic findings of fallopian tube (n=100):

Fallopian tube	TVS (n=100)	Laparoscopic (n=100)
a. Normal	96%	84%
b. Abnormal	4%	16%
a. Peritubular adhesion	0%	14%
b. Hydrosalpinx	4%	2%

n=Number of subjects; TVS=Transvaginal Ultrasonography

Table 8: Accuracy of TVS in tubo- ovarian abnormality (n=100)

TVS	Percentage
Sensitivity	20%
Specificity	98.13%
Positive predictive value	51%
Negative predictive value	92.37%

n=Number of subjects; TVS=Transvaginal Ultrasonography

TVS and laparoscopy findings of pelvic pathology compared

Table 9: TVS versus laparoscopic findings of pouch of Douglus (n=100)

Pouch of douglus	TVS (n=100)	Laparoscopic (n=100)
Normal	96%	66%
Abnormal	4%	34%
Adhesion	0%	8%
Endometriosis	4%	20%
Adhesion with obliteration of P.O. D.	0%	4%

n=Number of subjects; TVS=Transvaginal Ultrasonography; P.O.D=Pouch of Douglas

Table 10: Accuracy of TVS in tubo- ovarian abnormality (n=100)

TVS	Percentage
Sensitivity	3.16%
Specificity	81.39%
Positive predictive value	26%
Negative predictive value	27.98%

n=Number of subjects;TVS=Transvaginal Ultrasonography

Table 11: Overall accuracy of pelvic pathology (n=100)

TVS	Percentage
Sensitivity	62.87%
Specificity	81%
Positive predictive value	89%
Negative predictive value	49%

DISCUSSION

Sub-fertility is a common problem worldwide. With the increase in population, the rising rate of sexually transmitted diseases, and the reduced availability of infants for adoption, this problem has been exacerbated. Among the causes of female subfertility, pelvic pathologies are often correctable. Pelvic pathologies include tubal factors, ovarian factors, peritoneal factors, and uterine factors[6]. Therefore, it is of prime importance to establish an accurate diagnosis and provide precise information to the couple as early as possible.

Currently, laparoscopy is the gold standard for diagnosing pelvic pathology. However, it is a time-consuming, expensive procedure that requires anesthesia. Various methods have been sought to diagnose pelvic pathologies, among which TVS shows great promise. TVS enables the identification of pelvic pathologies and uterine anomalies, monitoring the response to ovulation induction and confirmation of ovulation[12]. In this study, laparoscopy was used as the standard method for comparison with the diagnosis made by TVS.

The study showed that the majority of participants seeking medical help for infertility were between 26 and 35 years of age. A study conducted elsewhere showed that the dominant group seeking similar treatment was between 26 and 30 years[13]. Differences between our findings and previous study may be due to variations in treatment-seeking behavior, availability of health institutions offering such treatments, and knowledge differences about fertility among the populations studied. Women aged 26–35 years are expected to be within the childbearing age and therefore more likely to seek help if they experience symptoms suggesting infertility.

In the present study, the mean (± SD) age was 29.34 ± 4.96 years, with 62% in the 26–35 years age group. A previous study reported 62% of patients between 26–35 years, correlating with this finding[14]. Another study showed 57% of patients belonging to this age group[15]. The comparatively higher age in our study may be due to BIRDEM being a tertiary referral center where most patients received subfertility treatment for several years before referral.

The history of PID was almost equal among patients with primary and secondary infertility with no significant difference in clinical presentations (χ^2, p=0.91). Among patients with primary infertility, approximately 42% had obstructions in the distal section of the left fallopian tube compared to 25% of those with secondary infertility. A separate study reported PID prevalence of 3.1% in primary and 16.7% in secondary subfertility[16].

In this study, 100 patients attending the Obstetrics and Gynecology Out Patient Department of BIRDEM for the first time were evaluated for correlation between TVS and laparoscopy in detecting pelvic pathology. Among them, 61% presented with primary subfertility and 39% with secondary subfertility. The prevalence of primary subfertility was similar to previous reports (66.6%)[4]. Another study reported 70% primary and 30% secondary subfertility[15].

The mean duration of subfertility was 4.31 ± 3.33 years, which is less than the 9.5 ± 4.6 years reported previously[17], possibly due to increased awareness and better treatment availability. In this study, 76% of patients had subfertility for 2 to 5 years, 20% for 6 to 10 years, and 4% for more than 11 years.

Menstrual abnormalities are closely associated with subfertility etiology. A regular menstrual cycle indicates regular ovulation in about 90% of cases. In this study, 46% of patients reported irregular cycles and 54% regular cycles. Dysmenorrhea was present in 70%. Study performed by Kataria et al. reported among the infertile women,8% regular and 20.3% irregular cycles[18]. They also noted dysmenorrhea among 18.7% of infertile women as compared to 7.5% having no dysmenorrhea [18]. They indicated that the increased number of irregular cycles and dysmenorrheamay be related to a higher incidence of polycystic ovarian disease and endometriosis.

A study reported normal uterus size in 69%[19] of cases detected by laparoscopy, similar to this study's 76% normal and 24% bulky uterus findings. The normal adult uterus is anteverted, with retroversion in 15% of women, which may lower fertility by directing the cervix away from the seminal pool. Retroverted uterus was seen in 18% of cases compared to 82% anteverted, consistent with previous reports[20]. Fibroid uterus was found in 14% of cases.

Ovarian pathology causing anovulation is a common cause of subfertility. In this study, normal ovaries were observed in 40% of patients; polycystic ovary incidence was 38%, higher than the 4% reported previously[20], possibly because this was a referral hospital. Chocolate cysts were present in 12% of cases by laparoscopy.

Ovaries and the posterior leaf of the broad ligaments are the most frequent locations for endometriosis, more commonly on the left side[21]. Tubo-ovarian masses and follicular cysts were detected in 12% of cases each.

Normal tubal anatomy was present in 84% of cases. Tubal occlusion was found in 34% by laparoscopy but not detected by TVS, likely because TVS without contrast is not suitable for evaluating tubal patency. Tubo-peritoneal abnormalities such as fimbrial, peritubal, and periovarian adhesions significantly contribute to subfertility by impairing ovum pickup and transport. Pelvic inflammatory disease is the major cause of tubal infertility. Incidence of peritubal and periovarian adhesions was 5% in primary infertility and 20% in secondary infertility. Previous reports found these adhesions in 21.8% of cases[4]. In this study, peritubular adhesions were found in 14% and hydrosalpinx in 2% of cases.

Overall, 50% of patients were normal on TVS, with 24% of these also having normal laparoscopic findings. Pelvic abnormalities were confirmed in 70% by laparoscopy. The most common pathology detected was polycystic ovary disease (38%). Fibroids, adhesions, and chocolate cysts were diagnosed in 14%, 8%, and 12% of cases, respectively. Tubo-ovarian masses were found in 12%. TVS detected polycystic ovarian disease in 32%, fibroids in 14%, endometriosis in 4%, tubo-ovarian mass in 10%, and chocolate cyst in 8%.
Statistical analysis showed TVS has an overall sensitivity of 62.87%, specificity of 81%, positive predictive value of 89%, and negative predictive value of 49% for detecting pelvic pathology.

A previous study found endometriosis in 43.6% of 48 patients by laparoscopy but only 10.8% sonographically[22]. This study had a lower rate of endometriosis detection by TVS (4%) compared to laparoscopy (20%). Another study reported endometriosis in 12.5% with primary and 11.1% with secondary subfertility[16].

The sensitivity and specificity of TVS for diagnosing pelvic pathologies in sub-fertile women are not encouraging for detecting endometriosis, adhesions, tubo-ovarian masses, and pouch of Douglas abnormalities. Thus, TVS is sensitive for fibroids and polycystic ovaries but not for endometrial deposits or flimbrial adhesions.

CONCLUSION

Laparoscopy remains the gold standard for diagnosing anatomical and pathological abnormalities of internal genital organs, playing a major role in infertility management. However, transvaginal ultrasonography also plays an important role in the initial workup of pelvic pathology in sub-fertile women. TVS is reliable for detecting uterine fibroids and polycystic ovarian changes, but it has limited sensitivity for identifying endometriosis, adhesions, tubo-ovarian masses, and abnormalities of the pouch of Douglas. Therefore, while TVS can complement laparoscopy, it cannot replace it. In cases where TVS findings are inconclusive or suggest complex pathology, further evaluation with laparoscopy remains necessary for accurate diagnosis and appropriate subfertility treatment.

CONFLICT OF INTEREST

There is no conflict of interest.

REFERENCES

1. Gnoth C, Godehardt E, Frank-Herrmann P, Friol K, Tigges J, Freundl G. Definition and prevalence of subfertility and infertility. Hum Reprod. 2005;20(5):1144-7. doi: 10.1093/humrep/deh870.
2. Khanum S, Ahmed JU, Rahim MA, Sultana N, Begum R.Evidence Based Diagnostic Approach to Tubal Factor Infertility. BIRDEM Med J.2014; 4(1): 33-7.https://doi.org/10.3329/birdem.v4i1.18551

3. te Velde ER, Eijkemans R, Habbema HD. Variation in couple fecundity and time to pregnancy, an essential concept in human reproduction. Lancet. 2000;355(9219):1928-9. doi: 10.1016/s0140-6736(00)02320-5.

4. Haider G, Rani S, Talpur S, Zehra N, Munir A. Laparoscopic evaluation of female infertility. J Ayub Med Coll Abbottabad. 2010;22(1):136-8.

5. Chowdhury TA, Mahmud N . Infertility: A Global Problem. The Orion.2001; 9: 6-8.

6. Sohail CM. An Audit of Diagnostic Laparoscopies for Infertility. J Surg Pak.2003;8 (3):8-10.

7. Sumi MA, Ghani T, Rahman F, Paul R, Annur BM, Mahmuda UK, et al. Evaluation of Pelvic Pathology of Subfertile Women by Transvaginal Sonography and Correlation with Laparoscopic Findings. Mymensingh Med J. 2025 ;34(1):65-73.

8. Tsamantioti ES, Mahdy H. Endometriosis. [Updated 2023 Jan 23]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK567777/

9. National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Population Health and Public Health Practice; Committee on a Framework for the Consideration of Chronic Debilitating Conditions in Women; Batulan Z, Bhimla A, Higginbotham EJ, editors. Advancing Research on Chronic Conditions in Women. Washington (DC): National Academies Press (US); 2024 Sep 25. 5, Female-Specific and Gynecologic Conditions. Available from: https://www.ncbi.nlm.nih.gov/books/NBK607731/

10. Ferlin A, Foresta C. Infertility: Practical Clinical Issues for Routine Investigation of the Male Partner. J Clin Med. 2020 May 30;9(6):1644. doi: 10.3390/jcm9061644.

11. Shalev J, Meizner I, Bar-Hava I, Dicker D, Mashiach R, Ben-Rafael Z. Predictive value of transvaginal sonography performed before routine diagnostic hysteroscopy for evaluation of infertility. Fertil Steril. 2000;73(2):412-7. doi: 10.1016/s0015-0282(99)00533-6.

12. Thaker N, Dhande R, Parihar P. Role of Transvaginal Sonography in the Diagnosis of Female Infertility: A Comprehensive Review. Cureus. 2023 ;15(12):e50048. doi: 10.7759/cureus.50048.

13. Blacker J, Opiyo C, Jasseh M, Sloggett A, Ssekamatte-Ssebuliba J. Fertility in Kenya and Uganda: a comparative study of trends and determinants. Popul Stud (Camb). 2005;59(3):355-73. doi: 10.1080/00324720500281672.

14. Begum N, Chowdhury SB, Hussain MA . Laparoscopic evaluation of tubal factors in infertility: Explain with 50 cases .BJMS.2002; 08:20-4.

15. Khan MI, Jerin J, Jesmin S, Chowdhury TA . Laparoscopic Evaluation of the Tuboperitoneal Factors in Infertility. BIRDEM MedJ.2014; 4(1):9-12

16. Aziz N. Laparoscopic evaluation of female factors in infertility. J Coll Physicians Surg Pak. 2010;20(10):649-52. doi: 10.2010/JCPSP.649652.

17. Naz T, Hassan L, Gulmeen, Nighat F, Sultan S. Laparoscopic evaluation in infertility. J Coll Physicians Surg Pak. 2009;19(11):704-7.

18. Kataria D, Rani B, Punia A, Jha SK, Narendran M, Singh J. Reproductive Risk Factors Associated with Female Infertility in Sonepat District of Haryana: A Community Based Cross-Sectional Study. J Hum Reprod Sci. 2023;16(3):204-211. doi: 10.4103/jhrs.jhrs_82_23.

19. Gulshan Ara. Laparoscopic findings among infertile woman attending at BSMMU : A study of 50 cases.Dissertation obsgynae BSMMU. 2001; 82-7.

20. Meherunnisa . Laparoscopic evaluation of pelvic organ in 100 cases of infertility. Dissertation, Obs & Gynae, BCPS, Dhaka.2002; 60-70.

21. Dogan MM, Ugur M, Soysal SK, Soysal ME, Ekici E, Gokmen O. Transvaginal sonographic diagnosis of ovarian endometrioma. Int J Gynaecol Obstet. 1996;52(2):145-9. doi: 10.1016/0020-7292(95)02522-7.

22. Friedman H, Vogelzang RL, Mendelson EB, Neiman HL, Cohen M. Endometriosis detection by US with laparoscopic correlation. Radiology. 1985;157(1):217-20. doi: 10.1148/radiology.157.1.2930866.