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Hysterosalpingograpy's Role in Evaluating Tubal Pathologies among Infertile Women Aged 20+ in Rawalpindi

Ayesha Azmat
Research Supervisor/ Lecturer At Zohra Institute of Health Sciences Rawalpindi, Radiology and Imaging Technology, Zohra Institute Of Health Sciences affiliated with GCUF. ayeshaazmat140@gmail.com

Aleena Tahreem
Department of Radiology and Imaging Technology, Zohra Institute Of Health Sciences affiliated with GCUF. aleena3965@gmail.com

Muqaddas
Department of Radiology and Imaging Technology, Zohra Institute Of Health Sciences affiliated with GCUF. muqddas.02@gamil.com

Zain Binte Afzal
Department of Radiology and Imaging Technology, Zohra Institute of Health Sciences affiliated with GCUF. ainbinteafzal4@gmail.com

Author Details

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Corresponding E-mail & Authors*:

Abstract

The frequency and kind of tubal diseases in infertile women using hysterosalpingography (HSG) are investigated in this study. 101 infertile women's data were examined based on their age, length of marriage, type of infertility, menstrual cycle, symptoms, and HSG results. 39.6% of the women had been married for less than ten years, and the majority were between the ages of 31 and 35. The prevalence of primary infertility (58.4%) was slightly higher than that of secondary infertility (41.6%). 41.6% of respondents reported irregular menstruation, compared to 58.4% who claimed normal cycles. The most common symptom was pelvic pain (43.6%), which was followed by discharge and pelvic surgical history. The most common anomalies were bilateral and left-sided tubal occlusion (15.8% each), followed by hydrosalpinx and right-sided occlusion (11.9%). Additionally, observed were peritubal adhesions and salpingitis isthmica nodosa. Positive HSG results were significantly correlated with irregular menstruation. Bilateral and left occlusions were more frequently linked to secondary infertility, maybe as a result of prior pelvic infections. This study highlights the usefulness of HSG in detecting uterine and tubal

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abnormalities as crucial elements in the treatment of female infertility through early diagnosis and targeted intervention, despite its limitations.

KEYWORDS: Hysterosalpingograhy, Pelvic inflammatory diseases, Tube-ovarian abscess, Salpingitis Isthmica Nodosa, In vitro fertilization, Water-soluble contrast medium

INTRODUCTION

The female reproductive system is a collection of structures consisting of both external and internal genitalia. The structure outside the actual pelvis, including the labia majora and minora, vestibule, clitoris, mons pubis, perineum, urethral meatus, and the area surrounding the urethra, is referred to as the external genitalia. The uterus, fallopian tubes, ovaries, cervix, vagina, and true pelvis are all considered internal genitalia. (1)

Located in the female pelvis directly behind the bladder and in front of the rectum, the uterus is a pear-shaped, hollow organ. The uterus is normally about 8 cm long, 5 cm wide, and 4 cm thick in an adult female. The average volume of the uterine cavity is typically thought to be between 80 and 200 milliliters. In a coronal section, its cavity appears as an inverted triangle. It is anatomically divided into four main segments, ranging from superior to inferior. The topmost part is the fundus, a broad, curved region where the uterus and fallopian tubes meet. The largest portion of the uterus is called the corpus, or body, which descends below the fundus from the level of the fallopian tubes. The isthmus, a small region that serves as a transitional space between the body and the cervix, is reached by the uterus as it continues to descend. The cervix, the lowest portion of the uterus, descends from the isthmus and opens into the vagina. The ligaments that support the uterus include the utero-ovarian, round, broad, cardinal, and uterosacral ligaments. Additionally, the pelvic diaphragm, urogenital diaphragm, and perineal body provide inadequate support. The uterus contains three layers of tissue, which include: The functional (superficial) and basal endometrium make up the endometrium, which is the inner lining. Reproductive hormones cause the functional layer to react. Menstrual bleeding occurs when this layer sheds. Fibrosis and adhesions may arise from damage to the basal endometrium (Asherman syndrome). Smooth muscle cells make up the myometrium, the muscle layer. The thin outer layer made up of epithelial cells is called the serosa or perimetrium. (2)

The fallopian tubes resemble hollow tubes. They run from the ovaries to the uterus and are 8–12 cm long and 0.5–1.2 cm in diameter. Their main function is to transport the oocyte and facilitate fertilization; they are found within the wide ligament. The broad ligaments currently act as storage spaces to keep them in place. Four functional segments make up the fallopian tubes: the interstitial or intramural portion, the isthmus, the ampulla, which is where most fertilizations occur, and the infundibulum,

which is the funnel-shaped distal end that is closest to the ovary (3).The fimbriae, which are finger-like projections that surround, gently grasp, and help guide the ovary to ensure that the ovum is appropriately directed into the fallopian tube during ovulation, are found at the fimbriated end of the infundibulum. The ampulla is the longest and widest segment of the fallopian tube. The fusion of spermatozoon and ovum, known as fertilization, is most frequently carried out near the ampulla-isthmus junction. The isthmus is the final segment of the fallopian tube outside the uterus and one of its narrowest sections. It plays a major role in controlling the movement of embryos into the uterus and the control of sperm entering the ampulla. Each fallopian tube has a muscular layer that developed as smooth muscle from the surrounding vascularized areolar issue, as well as a peritoneal covering and a serous coat. The single-layered columnar epithelium, which is composed of both ciliated and non-ciliated epithelial cells, is supported by a highly vascular connective tissue layer. It appears mucosal due to its longitudinal folds. Both longitudinal and circular (or spiral) layers of smooth muscle are arranged in the fallopian tubes muscularis in a manner that is somewhat interwoven. The mesothelium covers a thin layer of connective tissue that makes up the serosa. (4)

Located laterally to the uterus in the pelvis, the ovaries are bilateral, oval-shaped gonads that measure roughly 3 × 1.5 × 1 cm. They are located behind the external iliac vessels in the ovarian fossa, in front of the ureters. The vagina is a 6–8 cm long fibromuscular tube. It is located behind the urethra and bladder and anterior to the rectum. (1)

As the site of embryo implantation and the site of fetus development during pregnancy, the uterus plays a crucial role in the female reproductive process. Additionally, it serves as the main organ of menstruation, an endocrine cycle that prepares the lining of the uterus for potential fertilization every month. This lining is shed as menstrual bleeding if fertilization is unsuccessful. The uterine cycle has three phases. During the Menstrual Phase, the uterus's functional layer sheds due to a drop-in progesterone and estrogen levels. The proliferative phase is brought on by rising estrogen levels, which cause the endometrium to thicken and regenerate in anticipation of possible implantation. In the Secretory Phase, progesterone from the corpus luteum encourages the endometrium to continue developing in order to support an early pregnancy in the event of fertilization. In the event of implantation, the uterus undergoes amazing transformations and can expand up to 20 times in size in order to accommodate the growing fetus. To ensure gestation, its vascularity, elasticity, and muscular strength all significantly increase. Clinically, uterine growth measurements (fundal height) are used to assess gestational age. The myometrium, the uterus's

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muscular walls, contracts in unison during labor to help the baby be expelled. These contractions get stronger through feedback hormonal mechanisms mediated by prostaglandin and oxytocin. Continued uterine contractions after delivery aid in the placenta's expulsion and lessen postpartum hemorrhage (5)

Menstruation and reproduction are facilitated by the internal and external organs of the female reproductive system. It produces gametes (eggs or ova), regulates sex hormones, and supports the growth of fertilized eggs into full-term fetuses. The menarche, or the start of the first menstrual cycle, and the menopause, or the cessation of menstruation for 12 consecutive months, constitute a woman's reproductive cycle. Oocytes are transported from the ovaries to the uterine cavity via the fallopian tubes. Gametes are produced and sex hormones are secreted by the female gonads, or ovaries. Each ovary has an inner medulla that houses connective tissue and blood vessels, and an outer cortex where follicular development occurs. (6)

A range of gynaecological conditions, including structural, infectious, inflammatory, and benign and malignant neoplasms, are referred to as uterine diseases. These illnesses typically require medical or surgical care, with surgery being the second most common procedure. Polyps, fibroids, endometrial hyperplasia, adenomyosis, endometriosis, and endometritis are among the most prevalent uterine disorders that can lead to infertility in families. A distinct overgrowth of endometrial tissue that extends into the uterus and may contain smooth muscle cells is called an endometrial polyp. Although small, asymptomatic polyps can resolve on their own, surgical excision is typically necessary for definitive management. It is typically asymptomatic but can cause painless abnormal uterine bleeding. The most common benign tumor in women is called leiomyoma, or fibroid, and it is composed of smooth muscle tissue. Most frequently seen in African-American women, it frequently manifests as multiple, distinct masses in the uterus. Due to its sensitivity to estrogen, it may enlarge during pregnancy or shrink following menopause. In addition to iron deficiency anemia from excessive bleeding, it can result in abnormal bleeding, miscarriage, or pressure-related symptoms like constipation. The overgrowth of endometrial glands brought on by excessive estrogen stimulation is known as endometrial hyperplasia, and it has the potential to progress to endometrial cancer. Hysterectomy is the only treatment for adenomyosis, which is the invasion of endometrial glands into the uterine myometrium and is typically linked to menorrhagia and dysmenorrhea. It results in a symmetrically enlarged, globular uterus. Endometritis is an inflammation of the endometrium, usually brought on by foreign bodies or retained products of conception that cause bacterial infections from intestinal or vaginal flora. The ovaries, pelvis, or peritoneum are frequently affected

by endometriosis, a disorder in which endometrial glands or stroma form outside the uterine cavity. It is thought to be the result of retrograde menstruation and can cause "chocolate cysts" or endometriomas in the ovaries. Although there are medical treatments for it, surgery to remove lesions may improve fertility. It can also be painful and result in infertility or unusual bleeding. (2) A wide range of acquired and structural conditions are referred to as tubal pathologies, and they can significantly impact female fertility and overall reproductive health. Congenital abnormalities such as diverticula, duplication, or partial or total absence of the fallopian tube can impair ovum transport and increase the risk of ectopic pregnancy or infertility. Usually benign, Para ovarian and paratubal cysts can occasionally cause torsion or hinder ovum pickup. Inflammation, scarring, and adhesions that interfere with the tube's ability to function can result from acquired conditions like pelvic inflammatory disease (PID) and its sequelae, tube-ovarian abscess (TOA). Anatomical distortion brought on by hydrosalpinx and salpingitis isthmica nodosa (SIN) results in a loss of fertility and patency, which has a significant impact on the success of assisted reproductive technologies like IVF. While ectopic pregnancies, which usually occur in incompetent tubes, pose serious health risks and typically require surgery, endometriosis of the tubes results in infertility through inflammatory and fibrotic processes. (7)

A complicated issue, infertility presents serious health, psychological, and financial challenges. It is commonly defined as a couple's inability to conceive following a year of regular, unprotected sexual activity. While secondary infertility refers to the inability to conceive after an earlier pregnancy, whether it ended in a live birth or was terminated, primary infertility refers to couples who have never become pregnant. Infertility in women can be caused by anomalies in the ovaries, uterus, fallopian tubes, or cervix. About 35–40% of cases of infertility are caused by disorders affecting the fallopian tubes (8). Infertility affects about 80 million people worldwide. Delays in marriage, childbearing, and primary infertility are all contributing factors to declining fertility in developed countries. However, early marriage and childbearing are common in developing nations, but secondary infertility rates are high because of STIs and infections brought on by inadequate healthcare (9). The most frequent causes of infertility are tubal pathologies. Both the proximal and distal portions of the fallopian tubes may be affected, and it may be acquired or congenital (10). Infertility is frequently caused by blockage of the fallopian tubes. Tubal obstruction accounts for between 30 and 40 percent of female infertility. Congenital defects, endometriosis, acute or chronic inflammation, and other pathologic conditions are among the causes, which can result in partial or total blockage of the fallopian tubes. Tubal disease affects about 30% of

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infertile women, and in 10% to 25% of cases, the obstruction is at the proximal tube level (11).

A radiologic diagnostic procedure called fluoroscopic hysterosalpingography (HSG) is used to investigate the underlying cause of subfertility. In order to visualize the uterus and fallopian tubes using fluoroscopy, a water-soluble contrast medium (WSCM) is injected into the uterine cavity. HSG is primarily used to check for fallopian tube patency, which is indicated by the spillage of contrast material into the peritoneal cavity if the tubes are patent. Additionally, HSG enables the evaluation of uterine cavity morphology and the detection of intracavitary abnormalities. Numerous uterine pathologies, including polyps, submucosal or intracavitary fibroids, uterine synechiae, and Müllerian duct anomalies, can now be detected by it. With 13.6% of examinations revealing conditions like Müllerian duct anomalies, hydrosalpinx, fibroids, adenomyosis, or other uterine pathology, hysterosalpingography is a safe, affordable, and practical diagnostic tool for detecting reproductive abnormalities. Unlike ultrasound, HSG can assess uterine cavity pathology and tubal patency, but its resolution is low, especially when it comes to detecting subtle ovarian and uterine diseases. In addition to using low doses of ionizing radiation, HSG carries the risk of contrast-related allergic reactions. Notwithstanding these drawbacks, it is still essential for determining tubal patency and for diagnosing uterine and tubal abnormalities. (12)

Fluoroscopic guidance is used to carry out the procedure. To ensure correct positioning, acceptable technical parameters, and to look for any radiopaque pelvic pathology, the patient was first placed supine on the fluoroscopy table. A pelvic scout film was then taken. After that, the patient was placed in the lithotomy position. After aseptic preparation, a Vulsellum forceps was used to hold the anterior lip while a speculum was used to examine the cervix. After determining the uterine depth using a uterine sound, a suitable-sized Everard Williams or Leech-Wilkinson uterine cannula was gradually inserted into the endocervical canal. By gently pulling on the Vulsellum and applying pressure to the cannula, the seal between the cannula and the cervical canal was firmly formed. After that, 15–20 ml of a water-soluble contrast agent (Urografin 76%, sodium amidotrizoate, and meglumine amidotrizoate) was slowly injected into the uterus. Real-time image intensification was used to evaluate the uterine cavity's appearance and the fallopian tube's patency. During the stages of peritoneal spillage, tubal opacification, and early uterine filling, spot radiographs were obtained. To assess the removal of contrast from the pelvic cavity, particularly in cases of suspected hydrosalpinx, a terminal "release" film was then taken. Cervical traction and, if required, oblique patient rotation was used to obtain true anteroposterior films of the uterus for

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minimal uterine abnormalities. Direct analysis of hard copy films was used to interpret all HSG exams. Particular attention was paid to unilateral or bilateral tube spills as well as any irregularities in the morphology of the cervical or uterine cavity that might indicate congenital or acquired abnormalities. (8)

OBJECTIVES OF THE STUDY:

This study investigates the prevalence and types of tubal abnormalities in infertile women using HSG and examines their association with infertility type, menstrual patterns, and symptoms. It highlights HSG's role in diagnosing tubal causes of infertility.

LITERATURE REVIEW

1. Grégory A, et al[2020] performed the research on the function of HSG in infertile women with bilateral tubal factors revealed that HSG is a widely accessible, low-cost outpatient fluoroscopy that assesses the patency of the fallopian tube and uterus in infertile women. Despite being primarily a diagnostic tool, it occasionally has therapeutic benefits and can even result in pregnancy (13)
2. Makwe CC ,et al[2021] analyzed hysterosalpingography (HSG) results among 266 female patients who presented for infertility at Lagos University Teaching Hospital (LUTH), according to a study on the findings of female partners of infertile couples. The average age of the patients was 38.4 yea rs, and 65.4% were nulliparous and the majority (80.5%) had secondary infertility. Bilateral tubal obstruction was detected in 30.8% of cases, while tubal disease was the most common abnormality at 54.9%. The right had slightly more tubal occlusion (43.2%) than the left (41.7%). (14)
3. Antonisamy N, et al[2021] concluded that even though the accuracy of HSG in identifying bilateral tubal block is debatable, research on the role of HSG in diagnosing tubal blockage revealed that women with abnormal hysterosalpingography (HSG) findings often worry about tubal pathology, especially as assisted reproductive technologies reduce the need for invasive procedures like laparoscopy. The study found that the positive predictive value (PPV) of HSG was 50% for bilateral hydrosalpinx and 20.9% for bilateral tubal block. The agreement between laparoscopy and HSG was moderate (PABAK = 0.42). Additionally, 12.3% of females on HSG had at least one patent tube(15)
4. Toufig H, et al[2020] conducted hysterosalpingography (HSG) results among infertile patients and reported that hysterosalpingography (HSG) is widely used in the diagnosis of infertility, a global health concern. HSG findings in women with primary and secondary infertility were assessed in the current study by comparing them to data from other countries and establishing a correlation with clinical history. Primary and secondary infertility rates were similar in the age group that was most prevalent, which

was 26–36 years old. 52.7% of cases had unusual HSG results, with tubal pathology accounting for the majority (42.7%). Tubal abnormalities were strongly associated with a history of pelvic inflammatory disease (PID) or abdominopelvic surgery.(16)

5. Zafarani F, et al[2021] conducted a research. According to research on the evaluation of proximal tubal pathologies, one of the main causes of infertility is tubal and peritoneal pathology. Tubal disease can be unilateral or bilateral, proximal or distal, congenital or acquired. Although laparoscopy is the preferred method for assessing pelvic anatomy and tubal patency, hysterosalpingography (HSG) is the first, less expensive, and low-risk diagnostic procedure. HSG is the gold standard for evaluating tubal lumen pathology and provides an accurate assessment of the size, shape, and inner anatomy of the fallopian tube. The radiographic indicators and causes of proximal tubal pathology on HSG are highlighted in the review.(10)

6. Sharma S et al[2023] concluded that Hysterosalpingography (HSG) is a low-cost method of diagnosing fallopian tube obstruction in infertile women, while laparoscopy is used to confirm the results of HSG and to treat tubal obstruction, according to a study on diagnosed follapian tube blockage in infertile females. Of the 48 patients in the study, 46% had unilateral obstructions and 54% had bilateral. Forty percent of bilateral obstructions and twenty-seven percent of unilateral obstructions were successfully treated with laparoscopy; 33.3% of obstructions remained. On HSG, two false-positive results were found.(17)

7. Canday M ,et al[2023] performed a study. According to a study on opinions regarding HSG procedures in infertility, infertility is a prevalent condition that has a big social and emotional impact. This study highlighted the value of hysterosalpingography (HSG) in determining infertility. Of the patients, 72.1% reported primary infertility, while 27.8% reported secondary infertility. The HSG results for 82% of the patients were normal. Uterine and tubal abnormalities were found in 62.5% of patients with primary infertility and 88.4% of patients with secondary infertility, respectively. The diagnostic and predictive value of HSG in the treatment of infertility issues was demonstrated by the significant differences between types of infertility, HSG findings, follow-up results, and conception levels six months after the procedure ($p<0.001$). (18)

8. Bobmanuel EF et al[2023] performed a research on uterine and tubal findings in infertile women, concluded that infertility affects approximately 10% of the world's population and is the fifth most disabling condition according to the WHO (2018). It is described as the inability to conceive following a year of consistent sexual activity. As women age, their fertility decreases. Ultrasound is a more effective method of detecting uterine abnormalities than hysterosalpingography (HSG), which is the gold standard for

evaluating fallopian tube patency. According to this study, the most common tubal pathology was bilateral tubal occlusion (27.8%), and the most common uterine abnormality was uterine myoma (24.1%). The age group most affected was 32–37 years old, and there was a positive correlation between age and the type of infertility.(19)

9. İsrafilova G et al[2024] carried out studies on tubal factor infertility with congenital abnormalities and concluded that TFI plays a major role in the global public health problem of infertility. This study looked at the prevalence of congenital tubal anomalies (CTAs) in women with TFI. Laparoscopy was used to diagnose 220 of the 895 women who had suspected TFI. Of the cases, 107 (49.7%) were normal and 113 (51.3%) had tubal pathology. Thirteen women (15%) had total or partial tubal agenesis, including sixteen who presented with other systemic anomalies and thirty-two who had congenital uterine anomalies. (20)

10. Barakat M, et al[2024] evaluated the therapeutic value of hysterosalpingography (HSG) and salpingostomy in patients with hydrosalpinx, with an emphasis on pregnancy outcomes, he said. Pregnancy timing and tubal improvement were strongly correlated ($p=0.007$). The improvement group experienced a significantly higher rate of spontaneous pregnancy (46.88%) compared to the non-improvement group (13.33%) ($p=0.028$). The improvement group had a shorter time to pregnancy (13 months) than the non-improvement group (16 months).(21)

11. Prathyusha P,et al[2024] performed a research. According to his research on the assessment of uterine factors in infertile women, 15–20% of cases of infertility are caused by uterine etiology, and 10–15% of couples experience infertility. The effectiveness of office hysteroscopy (OH) in identifying uterine pathology in infertile women was examined in this article. Compared to secondary infertility (36%), primary infertility was higher (64%). While adhesions (33.33%) were the most frequent finding in secondary infertility, intrauterine adhesions and submucosal fibroids each occurred in 25% of cases in primary infertility. Notably, all primary infertility cases displayed abnormalities, while 44.44% of secondary infertility cases had normal hysteroscopic results. (22)

12. Darwish A, et al[2025] evaluated the viability and efficacy of hysteroscopic fallopian tube (FT) functional tests, including the bubble test, flow test, and proximal tubal peristalsis test, in predicting FT status. Of the 141 cases, 98.6% had access to the uterine cavity, and 95% made it to the Darwish Triad (DT) for successful testing. Success rates were highest for the bubble test (88.1% right, 91% left), peristalsis test (79.1% both sides), and flow test (about 50% both sides). Test results did not significantly differ between patients who had previously had tubal patency confirmed by HSG or

laparoscopy.(23)

13. Bikuelo CJ et al [2024] conducted studies on infertile couples and found that, in Sub-Saharan Africa, where pro-natalist culture is common, infertility remains a major concern for couples. The most common cause of tubal factor infertility is still infection, post-abortion, or postpartum problems. This study found that the age of female patients increased by 36 days annually, while the age of male patients increased by 29 days. While obesity was present in 21.8% of patients and mean BMI increased by 0.04 kg/m^2 annually, cigarette smoking and sexual activity frequency decreased annually. The most common abnormality found by laparoscopy and hysterosalpingography was tubal occlusion. (24)

14. Abdullayeva LM, et al [2025] performed research on methods of infertility for inflammatory origin revealed that 80% of women with primary infertility and 65% with secondary infertility had a history of inflammatory disease or STIs; 75% and 60% of the former and the latter were found to be inflamed by bacterioscopy, respectively; PCR and bacteriological analysis revealed the presence of chlamydia, ureaplasma, and mycoplasma in 15–35% of primary and 40–50% of secondary infertility, respectively; and hysterosalpingography (HSG) revealed tubal obstruction in 40% of primary and 50% of secondary infertility. These differences were evident across clinical, laboratory, and imaging findings ($p < 0.05$). (25)

15. Yahya A, et al[2024] analyzed 215 hysterosalpingography (HSG) reports of 215 infertile women from Ahmadu Bello University Teaching Hospital, Zaria, Nigeria, as part of a retrospective cross-sectional study on female infertility, he said. 58.6% of cases were secondary infertility, and most participants were in the 35–44 age range. In 70.2% of cases, abnormal HSG findings were observed; the most common pathology was tuboperitoneal (46%), followed by uterine (38.1%) and cervical (15.3%) pathologies. Multiple abnormalities were present in more than half (53.9%). A history of induced abortion and secondary infertility were significantly correlated with abnormal HSG results. The study confirms that HSG is a useful tool for evaluating infertility in settings where tuboperitoneal causes are prevalent. (26)

16. Salma U, et al[2025] studied the function of hysterosalpingography and reported that From July 2019 to June 2020, 310 infertile women at the Maternity and Children Hospital in Sakaka, Aljouf, Saudi Arabia, had their hysterosalpingography (HSG) results evaluated in this retrospective analysis. Tubal occlusion and hydrosalpinx were the most common abnormalities, with higher rates on the left side. Uterine fibroids (14.5%), adhesions (4.5%), adenomyosis (4.8%), and a bicornuate uterus (7.4%) were other findings. In 27.7% of the cases, no abnormalities were found. The study found that

secondary infertility is more prevalent than primary infertility and that uterine and tubal factors are the main causes of infertility (27)

17. Gumaa S, et al[2024] examined the prevalence of frequent tubal aberrations that leads to infertility. He said, referring to research on hysterograms of tubal structures in infertile women from Sudan. Of the participants, 57% had tubal obstruction, and 50% had a history of pelvic inflammatory disease (PID). However, tubal obstruction was also noted in 12% of those without PID. Additionally, 20% of patients had a history of tubal blockage and either uterine or tubal surgery. Both a history of surgery and PID were strongly associated with increased rates of bilateral and unilateral tubal obstruction. (28)

18. ANYIOM O, et al[2024] concluded that according to a study on tubal patency with age in Nigerian women using hysterosalpingography, the country's cultural emphasis on childbearing has made infertility, a serious condition with social and emotional ramifications, highly stigmatised. This study looked into the relationship between age and tubal patency in women who came in for an infertility evaluation. It found a strong correlation, with women between the ages of 36 and 40 having the highest rate of tubal occlusion. (29)

19. Parvaiz M et al.[2024] conducted a study on the assessment of abnormalities in the female reproductive system, stating that the goal of the study was to determine how uterine and tubal defects affected female infertility using hysterosalpingography (HSG). The findings showed that tubal obstruction was the most common abnormality, typically resulting from abdominal surgeries and pelvic inflammatory disease (PID). Adhesions to the pelvis were also frequently observed. According to the study, HSG is a rapid, safe, and affordable way to evaluate the structural causes of infertility in women.(30)

METHODS & MATERIALS

Study design

- Cross sectional study

Study settings

- Health Ways

Time horizon

- April 2025 to August 2025

Sample size

- 101 (from Open EPI software)

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Sample Size for Frequency in a Population

Population size(for finite population correction factor or fpc)(*N*):	2000000
Hypothesized % frequency of outcome factor in the population (*p*):	7%+/-5
Confidence limits as % of 100(absolute +/- %)(*d*):	5%
Design effect (for cluster surveys-*DEFF*):	1

Sample Size(*n*) for Various Confidence Levels

ConfidenceLevel(%)	Sample Size
95%	101
80%	43
90%	71
97%	123
99%	173
99.9%	282
99.99%	395

Statistical Analysis

- SPSS Software used
- Used tables for presenting data

Research Tool

- Performa authorized by HOD

Study Duration

- Study took 04 months to complete, from May 2025 to August 2025

Sampling Technique

- Convenience sampling, non-probability sampling technique was used

Inclusion Criteria

- Woman above 20 years
- History of infertility

Exclusion Criteria

- Woman under 20 years
- All emergency and ward patients

Methods of Data Collection

Patients with clinical history of primary or secondary infertility above 20 years were included in this descriptive, cross-sectional study. The study was conducted over the time period of four months at a private diagnostic imaging facility at Citi Lab Rawalpindi. A convenient, non-probability sampling technique was used to determine the sample size. All participants underwent HSG examination in a standard manner.

The procedure was performed using GMI 1000 MAS (multi angle system). It produces high resolution images of uterus and fallopian tubes. It has high resolution digital sensors. It has fast processing that allows minimal motion blurring and minimal patient radiation dose. The patient was positioned in a lithotomy position on the

fluoroscopic table. After cleaning and draping, a speculum was inserted, and the cervix was cannulated using a sterile HSG cannula. A water- soluble contrast was gradually introduced into the uterine cavity under fluoroscopic guidance. Real time imaging was used to assess the contour of the uterus and patency of the fallopian tubes. Multiple views, including the anteroposterior and oblique projections, were obtained to visualize contrast flow. The appearance of contrast spillage into the peritoneal cavity was recorded to confirm tubal patency. Radiation exposure was minimized using pulsed fluoroscopy and protective measures. All the images were stored for evaluation and reporting.

Ethical consideration

A written consent was taken from each participant prior to filling perfoma. Study was conducted after approval from internal review board of study setting hospital.

RESULTS AND DISCUSSION

Table: 01 *Age Distribution of Patients*

Age ranges of patients	Frequency	Percent
21-25	9	8.9
26-30	38	37.6
31-35	40	39.6
36-40	14	13.9
Total	101	100.0

Table and figure 01: show the age distribution of 101 infertile females which are divided into four (4) different age groups. The 31-35 age group constitutes the highest number of patients represent at 40 individuals (39.6%). The 26-20 age group encompasses the second highest number of patients at 38 individuals (37.6%). The 36-40 age group constitutes 14 infertile females (13.9%). At the end, 21-25 age group has the fewest patients represented at 9 individuals (8.9%).

Figure: 01: Age Distribution of Patients

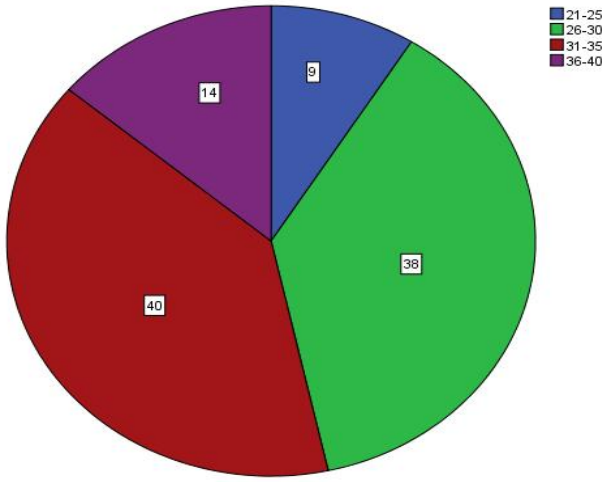

Table 02: Duration of marital status

Duration of Marital Status	Frequency	Percent
1-5 years	43	42.6
6-10 years	39	38.6
11-15 years	15	14.9
16-20 years	4	4.0
Total	101	100.0

Table and figure 02: display the range of marital duration for 101 infertile females. The majority of females, 43 (42.6%) were married 1-5 years, followed by 39 (38.6%) married 6-10 years. A lower percentage of 15 (14.9%) were married 11-15 years and 4 (4.0%0 of females marries 16-20 years). Overall results show that most females have been married for 10 years or less.

Figure 02: Duration of Marital Status

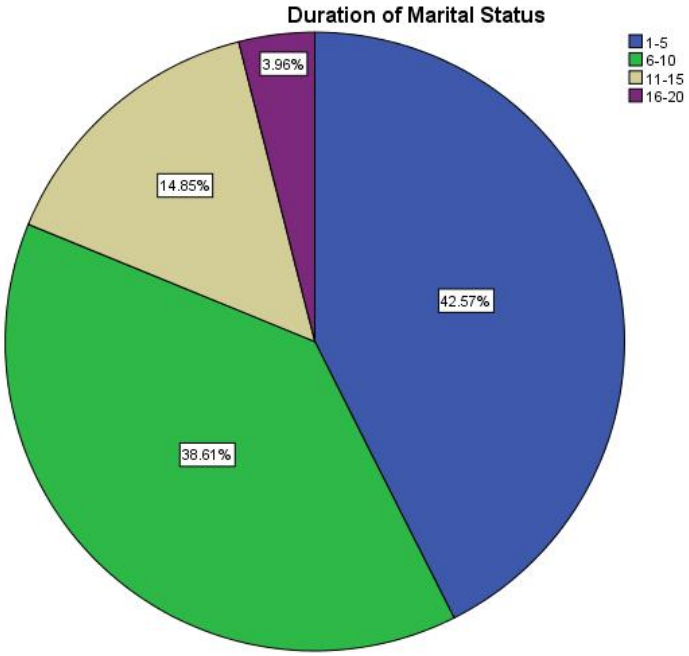

Table 03: Type of Infertility

Type of Infertility	Frequency	Percent
Primary Infertility	59	58.4
Secondary Infertility	42	41.6
Total	101	100.0

Table and figure 03: show the type of infertility present in 101 infertile females. Characteristics shows 59 females (58.4%) had primary fertility, while 42 females (41.6%) among the 101 females had secondary infertility. Thus, primary infertility was slightly more prevalent than secondary in these 101 infertile females.

Figure 03: Type of Infertility

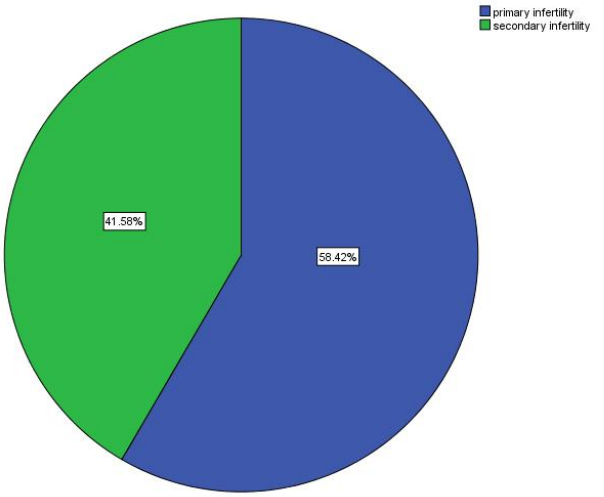

Table 04: *Frequency of Regular or Irregular Menstrual Cycle*

Regular Menstrual Cycle	Frequency	Percent
yes	59	58.4
No	42	41.6
Total	101	100.0

Table and figure 04: represent the frequency of regular and irregular menstrual cycle. It shows that out of 101 infertile females 59 individuals (58.4%) reported regular menstrual cycle, while 42 individuals (41.6%) had irregular menstrual cycles. This indicates that a slim majority had regular cycles.

Figure 04: Frequency of Regular or Irregular Menstrual Cycle

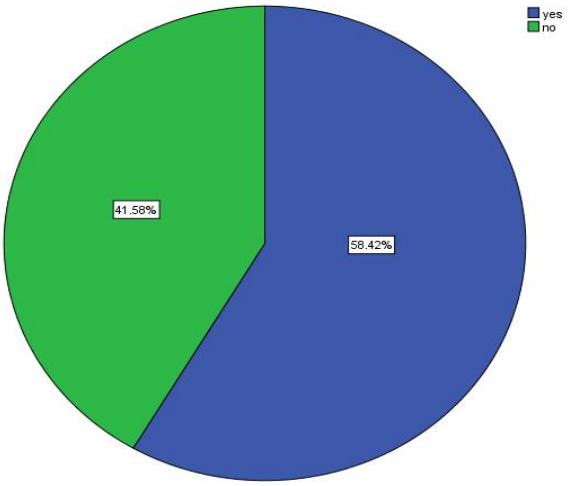

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Table 05: *Distribution Of Clinical Signs Present Among Infertile Patients*

Clinical signs	Frequency	Percent
pelvic pain	44	43.6
any previous pelvic surgery	13	12.9
Discharge	17	16.8
dysmenorrhea	6	5.9
Multiple symptoms	5	5.0
no sighs	16	15.8
Total	101	100.0

Table and figure 05: show the distribution of clinical signs present among the infertile females. It illustrates the number and percentages of clinical signs among the sample of 101 infertile females. The most common sign was pelvic pain which affected 44 individuals (43.6%). Next was discharge in 17 patients (16.8%) followed by the history of any previous pelvic surgery in 13 females (12.9%). Dysmenorrhea came from 6 patients (5.9%). Multiple signs were noted in 5 females (5.0%). Furthermore 16 females (15.8%) had no clinical signs. To encapsulate, the result, indicate the presence of pelvic pain being the most common clinical sign among infertile females

Figure 05: Distribution Of Clinical Signs Present Among Infertile Patients

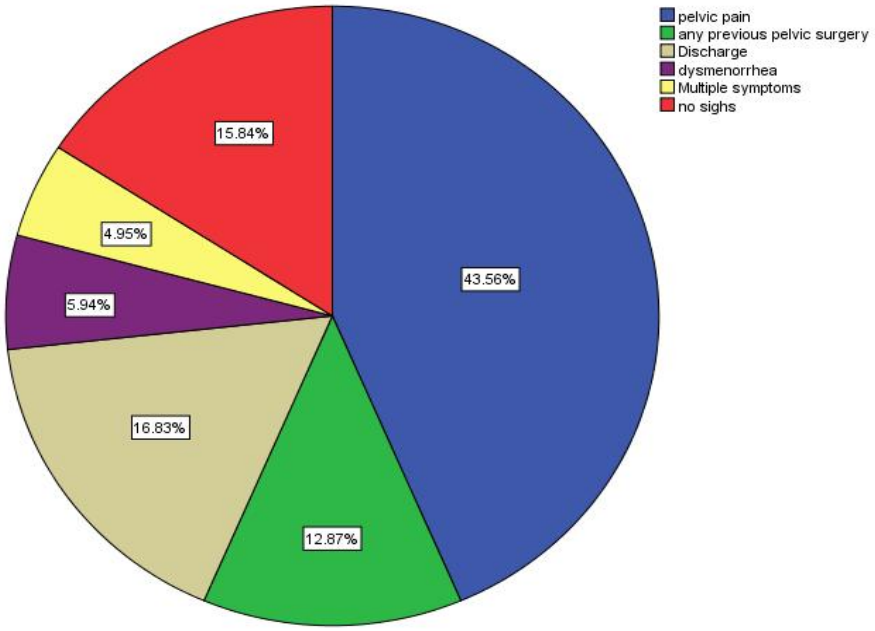

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Table: 06 Distribution of tubal pathologies among infertile patients

Tubal pathologies	Frequency	Percent
Right Tubal Blockage	12	11.9
Left Tubal Blockage	16	15.8
Bilateral Tubal Blockage	16	15.8
Right Hydrosalpinx	4	4.0
Left Hydrosalpinx	5	5.0
Bilateral Hydrosalpinx	6	5.9
Salphingitis Isthmica nodosa	11	10.9
Peritubal Adhesion	4	4.0
no tubal pathology	27	26.7
Total	101	100.0

Table and figure 06: outline the frequency and prevalence of a variety of tubal pathologies in 101 females. There were no tubal pathologies in 27 females (26.7%), indicating uterine abnormality or normal HSG. The prevalent tubal pathology was left tubal occlusion in 16 females (15.8%) and bilateral tubal occlusion in 16 females (15.8) followed by right tubal occlusion in 12 females (11.9%). Hydrosalpinx was observed unilaterally (right in 4 individuals making 4% of the total and left in 5 individuals making 5% of the total) and bilaterally seen in 6 females (5.9%). Additionally the presence of Salpingitis Isthmica Nodosa[SIN] was observed in 11 patients (10.9%) followed by peritubal adhesion in 4 females (4.0%). To encapsulate, tubal blockage and hydrosalpinx were the most prevalent tubal factors contributing to infertility.

Figure 06: Distribution of tubal pathologies among infertile patients

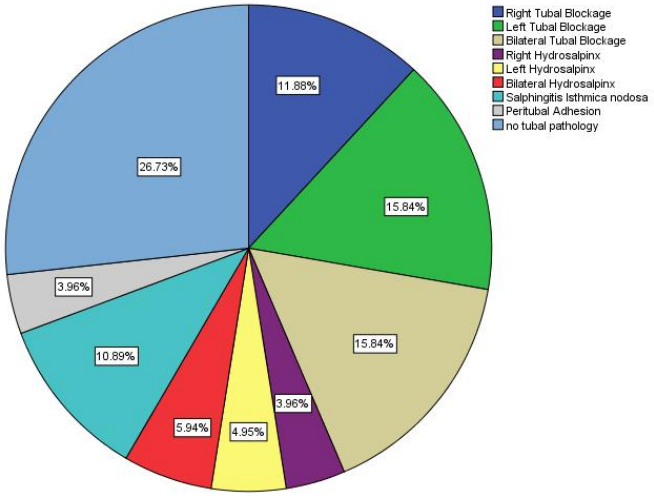


Table 07: HSG Findings among Infertile Females

HSG findings	Frequency	Percent
Positive	84	83.2
Negative	17	16.8
Total	101	100.0

Table and figure 07: show the findings of HSG either positive or negative among the 101 female patients with infertility. It shows that 84 females (83.4%) had positive HSG while 17 females (16.8%) had negative results. The large number of positive in HSG results reflects that HSG positively is clearly correlated with the infertility in this population.

Figure 07: HSG findings among infertile females

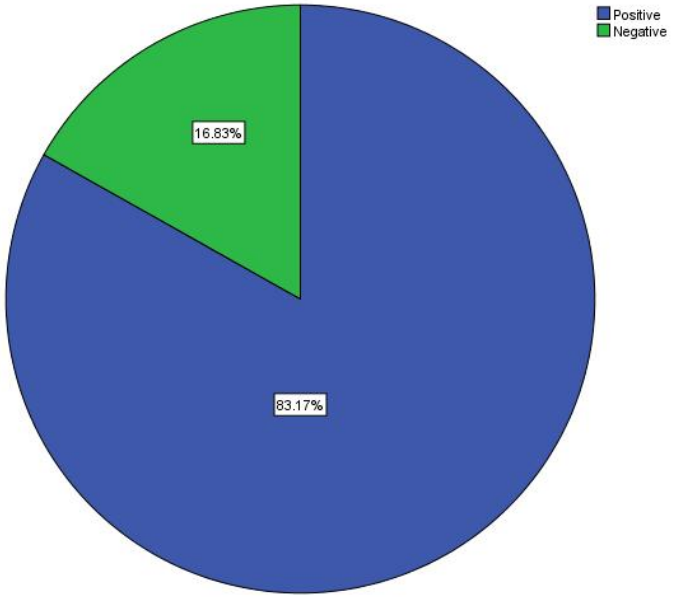


Table 08: *Shows the crosstab between Tubal Pathologies and Type of Fertility*

Tubal Pathologies	Type of Infertility		Total
	Primary Infertility	Secondary Infertility	
Right Tubal Blockage	9	3	12
Left Tubal Blockage	6	10	16
Bilateral Tubal Blockage	6	10	16
Right Hydrosalpinx	2	2	4

Left Hydrosalpinx	0	5	5
Bilateral Hydrosalpinx	0	6	6
Salphingitis Isthmica nodosa	9	2	11
Peritubal Adhesion	4	0	4
no tubal pathology	23	4	27
Total	59	42	101

Table and figure 08: illustrate the association between the tubal pathologies and type of infertility. It shows that 59 females have primary infertility and 42 females having secondary infertility, and the specific pattern of tubal abnormalities between these two groups. Right sided tubal obstruction had greater frequency in primary infertility (9) than in secondary infertility (3). Bilateral tubal obstruction and left sided tubal obstruction were more prevalent in secondary infertility (10 individuals each), than in primary infertility that includes 6 cases. For Hydrosalpinx it shows a distinct pattern, as sided and the bilateral cases were appeared only in secondary infertility (5 and 6 cases). While the right Hydrosalpinx was seen in 2 cases. Salpingitis Isthmica nodosa predominated in primary infertility (9 cases verses 2 in secondary infertility). There were 4 cases of peri tubal adhesion only noticed in primary infertility Notably, there were 27 women without tubal pathology with majority of 23 women belonging to the primary infertility. This suggests that left sided tubal abnormalities in secondary infertility could suggest cumulative effects of pelvic infections or PIDS.

Figure 08: Shows the crosstab between Tubal Pathologies and Type of Fertility

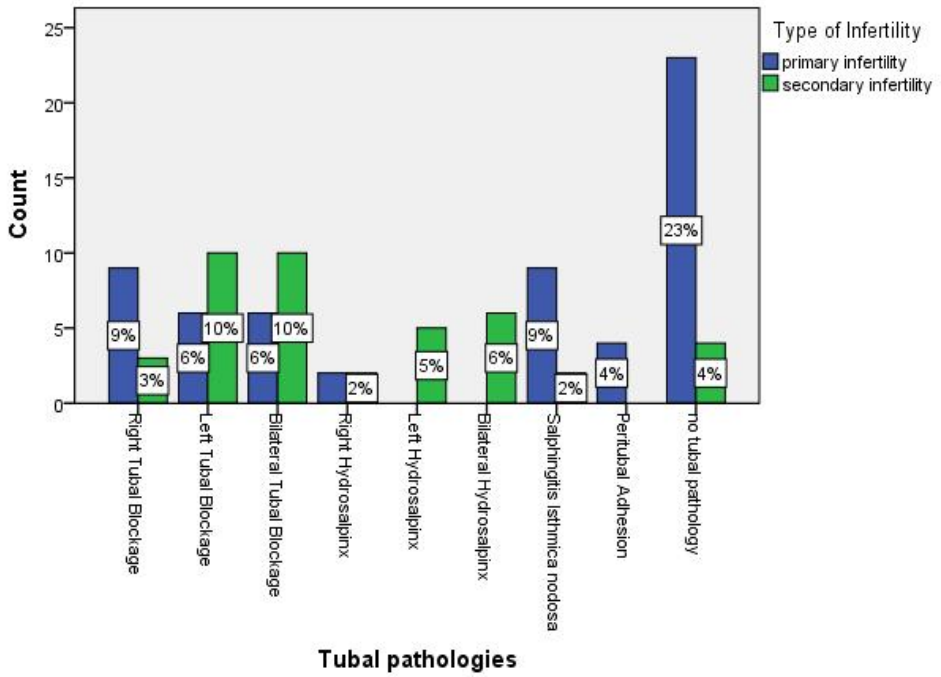
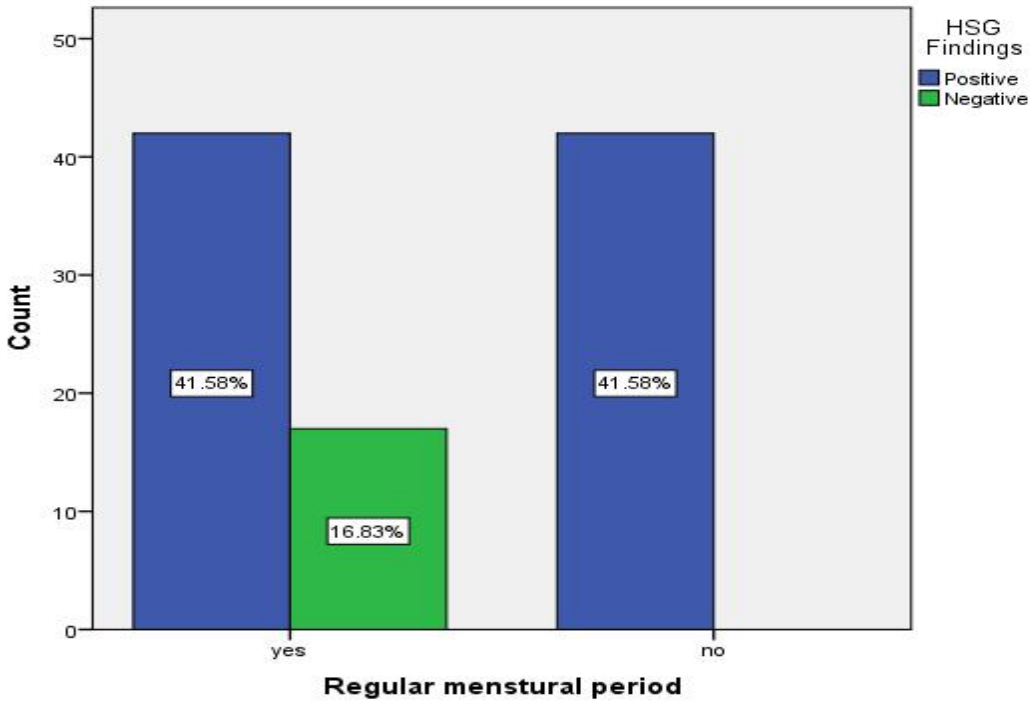


Table 9: *Regular menstrual period * HSG Findings Crosstabulation*

Crosstabulation between regular menstrual period and HSG findings		HSG Findings		Total
		Positive	Negative	
Regular menstrual period	yes	42	17	59
	no	42	0	42
Total		84	17	101

Table and figure 9: show the association between the menstrual regularity and HSG findings in 101 infertile females. The analysis shows that all 42% women (41.58%) with irregular menstrual cycle had 100% positive HSG findings, examining pathologies of tubes and uterus. Conversely, of the women who had regular cycles 71%(42 out of 59) had positive HSG and 29% (17 females) had negative findings. This shows a strong association that exists between menstrual irregularity and a detectable structural reproductive abnormality

*Figure 9: Regular menstrual period * HSG Findings Crosstabulation*



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DISCUSSION

The fallopian tubes and uterus play crucial roles in implantation and oocyte transfer, while the female reproductive system is composed of intricately connected internal and external organs involved in gamete generation, fertilization, and fetal growth. With tubal abnormalities accounting for over 30–40% of female cases, infertility—defined as the inability to conceive after a year of unprotected sexual activity—remains a significant clinical and psychosocial issue. Particularly in areas with limited resources, hysterosalpingography (HSG) is a practical, affordable, and less intrusive fluoroscopic technique for evaluating the anatomy of the uterine cavity and the patency of the fallopian tubes. In order to investigate age distribution, infertility causes, menstrual characteristics, clinical presentations, tube patency, and tubal disease, the study thoroughly assessed 101 infertile females using hysterosalpingography (HSG). The majority had been married for 10 years or fewer, and 39.6% of them were between the ages of 31 and 35. Of the patients, 58.4% had normal menstrual cycles, and the largest percentage of primary infertility was marginally greater (58.4%) than secondary (41.6%). 15.8% of them were asymptomatic, while the most common clinical presentation was pelvic pain (43.6%). Of the patients, 19.8% had no tube patency, indicating tube blockage, whereas 42.6% exhibited bilateral tube patency. Among tubal diseases, bilateral hydrosalpinx (5.9%) and Salpingitis Isthmica Nodosa (10.9%) were the most common findings, followed by left and bilateral tube obstruction (15.8% each). HSG's detection of abnormality in 83.2% of the cases supports its use as a diagnostic tool. Crosstab analysis revealed that while secondary infertility was linked to left and bilateral blockages and hydrosalpinx, primary infertility was more closely linked to right-sided blockage and SIN. This suggests that a history of pelvic inflammatory disease or cumulative pelvic infections may be the underlying causes. The association between menstrual dysfunction and the presence of coexisting tubal or uterine disease was further supported by the fact that menstrual abnormality was highly associated with favourable HSG results, with 100% of infertile women with irregular cycles presenting with reproductive tract pathologies. All things considered, the results highlight the usefulness of HSG in detecting uterine and tubal diseases in infertile women, particularly in those with secondary infertility and irregular menstruation.

CONCLUSION

The study highlights *tubal pathologies as a major cause of female infertility*, with **83.2%** of cases showing abnormalities on *hysterosalpingography (HSG)*. Common findings included **bilateral or left-sided tubal occlusion**, **hydrosalpinx**, and **salpingitis isthmica nodosa**, especially in women with **secondary infertility** and **irregular menstrual cycles**. A

strong link was observed between menstrual irregularities and abnormal HSG results. The findings support HSG as an **affordable, minimally invasive diagnostic tool**, particularly useful in **resource-limited settings** for early detection and treatment of uterine and tubal issues.

RECOMMENDATION

In light of the results, it is possible to advance several research interests in our understanding of tubal and uterine abnormalities in female infertility. Longitudinal studies are needed to assess the course and causes of entities such as bilateral hydrosalpinx and Salpingitis Isthmica Nodosa (SIN) for instance in the primary infertility cohort. Given the strong association between menstrual irregularities with tubal pathologies uncovered in this study, further study of menstrual disorders in relation to tubal abnormalities would be warranted. Comparative studies of the diagnostic value of hysterosalpingography (HSG) and other imaging modalities (e.g., sonohysterography, MRI) to increase diagnostic detection would be valuable. Furthermore, studies focused on the clinical relevance of clinically silent tubal disease involving asymptomatic women with abnormal HSG results would be useful. Another area to explore is the fertility results following HSG interventions to assess surgical treatments on non-tubal infertility (e.g., uterine endometrial polyp removal). And finally, further study with a large multi-institutional study could validate the patterns observed in relating primary and secondary infertility, menstrual abnormality and certain tubal diseases, perhaps providing greater clarity in managing female infertility analysis and treatment pathways

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