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Hysterosalpingography in Women with Infertility in Ondo, what are the Recent Findings?



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ABSTRACT

Background: Infertility is a common gynecological condition in Africa with terrible societal, psychological and psychosocial implications, especially among women. Hysterosalpingography, however is a gold standard investigative modality used to establish female causes of infertility. It is widely preferred to other available investigative modalities because of its cost effectiveness, accessibility and reliable diagnostic results. **Aim:** This study aimed to identify and describe the pattern of recent imaging findings in HSG of participants and compare the findings with previous studies done within the country and around the world.

Methods: This study is a retrospective evaluation of the HSG and reports of 680 patients done at the Radiology department of a tertiary health institution over a 3-year period between January 2019 and December 2022.

Results: A total of 705 patients were referred for HSG within the period of study, however 680 were involved in the study. The age range of the participant was 20 – 55 years with mean age of 35 years. Secondary infertility was the commonest cause of infertility accounting for 76% among the participant. Tubal abnormality was the commonest abnormality found accounting for 32.9% of study population with distal tubal obstruction being the commonest pattern. High incidence of hydrosalpinx was noted in this study which was majorly traced to previous surgical intervention mainly myomectomy as a risk factor. However, 143 (21%) of the participants showed completely normal hysterosalpingogram findings and hormonal disorder and/or male factors of infertility were inferred to be the cause of infertility in this group.

Conclusion: Like other previous researchers, tubal abnormalities was the commonest abnormality seen among the participants. However, the recent finding seen in our study is the increased incidence of hydrosalpinx among the patients which could be traced to previous surgical interventions being the major risk factor responsible for this. Hence, further studies on the effect of previous surgical procedures on Hysterosalpingographic findings and infertility as a whole should be considered.

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Introduction

Hysterosalpingography (HSG) is a generally accepted radiologic investigation in the assessment of infertility. It is reasonably safe and affordable. The cervical canal, uterine cavity, fallopian tubes, and the existence of adhesions can all be seen during a quick radiographic test called an HSG, which is widely accessible and used in the management of female infertility [1,2]. It is a crucial diagnostic technique for identifying the origin and precise location of structural abnormalities in the cervicouterine and tubal regions in infertile women [3]. In most African cultures, including Nigeria, women are mostly held responsible for the issue of infertility. They experience frustration, stigmatization, and marital discord or divorce as a

result [4]. Rindfleisch is credited with performing the first HSG using Bismuth solution in 1910, and it is regarded as the first radiologic operation [5,6].

Infertility is defined as the inability to conceive following twelve months of adequate, consistent, unprotected sexual activity [7]. For infertile couples, it is a major concern, especially in Africa where having children and having a large family is highly valued. Millions of couples struggle to conceive or maintain pregnancies on a global scale. This places a variety of pressures on the affected family, including financial, psychological, and emotional ones. Female factor infertility can result from anatomical or functional abnormalities affecting one or more of the reproductive system's components, including the cervix, uterus, fallopian tubes, and ovary, as well as endocrine system issues [7,8].

The percentage of women of reproductive age (15 to 55 years) who after adequate, consistent unprotected sexual activity are unable to conceive is known as the prevalence of infertility [9, 10]. Infertility

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affects between 60 and 80 million couples globally, and the number is rising [11,12]. Infertility can be primary or secondary, female factor, male factor or both [13]. Primary infertility affects 6.6% - 26.4% of couples in wealthy nations and 5% - 25.7% of couples in poor nations, respectively [14]. In addition, Cong and associates observed that the prevalence of primary infertility was 9% in China, 10% to 15% in the United States, 16% in Siberia, and 78.4% in Iran [13,14]. Infertility rates worldwide are estimated to be between 10% to 15% [15]. The infertility rate could surpass 30% in Nigeria and other countries in Sub-Saharan Africa (SSA), including Cameroon [16,17]. As a result, this issue affects the public health significantly. However, compared to the worldwide picture, secondary infertility is more common, with 52% in Sub-Saharan Africa and 40% in Latin America, compared to only 23% in Asia and 16% in North Africa [17,18]. Sexually transmitted infections (STIs) account for more than half of cases of secondary infertility and can result from genital infections [19]. According to estimates, 10% and 6%, respectively, of couples in the US and UK are infertile [20].

However, the incidence of couples in Africa is higher, ranging from 20% to 60% [21], and this has been linked to puerperal pelvic infections, an increase in STD rates, and problems from unsafe abortions [19]. In addition to STDs, TB, the Herpes Simplex virus, and HSV-2 seropositivity are other causes of pelvic infections [22]. According to statistics, 15% of women may eventually experience primary or secondary infertility during their reproductive lives [23].

Normal human fertility requires patent fallopian tubes. The organs of the fallopian tubes are extremely specialized. They play a crucial part in collecting eggs and moving eggs, sperm, and embryos. Additionally required for sperm activation and egg fertilization are the fallopian tubes. The fragile fimbriae or highly specialized endosalpinx of the fallopian tubes are susceptible to infections and surgical injury, which may compromise function. In comparison to other ways of evaluating these structures, hysterosalpingogram is the easiest, safest, and least expensive way to check fallopian tube patency, uterine morphology, and cervix. It can identify tubal obstruction with a sensitivity of 65% and a specificity of 83%. Additionally, it has been proposed that hysterosalpingography can improve subfertility through treatment [24].

Tubal, peritubal, uterine/intracavitary, and cervical abnormalities can all be identified on an HSG [25]. Tubal occlusion/blockage, which may be caused by spasm, infection, or congenital defects, is one of the tubal abnormalities/pathologies found on HSG. A tubal occlusion is characterized by non-opacification of the whole fallopian tube or non-opacification of the distal fallopian tubes with abrupt contrast media cutoff. The proximal, mid, or distal portions of the fallopian tube might therefore be affected by tubal diseases, and the tubal blockage can be unilateral (left or right) or bilateral [26].

Contrast medium cannot freely disperse and spill into the peritoneal cavity due to peritubal adhesions. Uterine diseases might show up as uterine cavity irregularities or filling deficiencies. In contrast to poorly defined filling defects, which may indicate intrauterine adhesion or synechiae, well-defined filling defects may indicate sub mucosal leiomyoma or endometrial polyp.

The following are the indications for HSG: evaluation of infertility, assisted reproduction, evaluation of women who have had spontaneous abortions, evaluation of the effectiveness of tubal sterilization, reversal of tubal surgery, evaluation of secondary amenorrhea, identification of congenital anomalies of the female genital tract, suspected uterovesical fistula, other uterine fistulae that may affect conception, abnormal uterine bleeding, and evaluation of the uterus [28].

Pregnancy, an active pelvic infection, recent uterine or tubal surgery, and ongoing vaginal or uterine hemorrhage are the only absolute contraindications to HSG. HSG is not recommended in cases of pelvic inflammatory disease, pregnancy risk, and contrast medium hypersensitivity [28]. HSG is a procedure that is generally safe, but it can be complicated by pelvic pain or cramps, pelvic infection, fever, nausea, vaso-vagal symptoms, or even lymphogranuloma formation [27].

It appears that there is increased demand due to recent advances in reproductive techniques. This study aimed to identify the current most common radiological abnormality to achieve the best possible diagnostic information and in future offer a solution to women with infertility in Ondo State, South West Nigeria.

MATERIALS AND METHODS

This is a retrospective study carried out at the of the Department of Radiology, University of Medical Sciences Teaching Hospital Complex, Ondo City Ondo State between January 2019 and December 2022 which involved 705 patients. The patients were women seeking care for infertility referred from Obstetrics and Gynecology unit of the above named hospital complex, General hospitals, Private hospitals and some Fertility centers within the state.

Following the referral of patients to our facility, each patient recruited was adequately clerked by radiologists to get their detailed gynecological and obstetrics as well as past surgical information, especially the patients from places other than the teaching hospital complex whose case notes could not be assessed.

Verbal informed consent was obtained from patients after due explanations of the procedure and possible complications with reassurance and confidentiality of their identity ensured.

The procedure was performed between days 8 and 12 of the menstrual cycle (day 1 being the first day of menstrual bleeding). This is due to the fact that the endometrium was thin during this proliferative phase, which also made it easier to interpret images and ensure there was no pregnancy already present. Pregnancy tests were performed in cases of uncertainty. Pregnancy, active pelvic inflammatory disease, hemorrhage, and history of severe allergy to iodine-based contrast agents were all contraindications to the procedure.

Hysterosalpingography Technique

GE OEC 9600 C-arm (1999) Fluoroscopy Machine was used for the procedure. The patient was positioned on the fluoroscopy table in supine position, and a preliminary film was done to ascertain the technical factors and radiopaque pelvic lesions. The patient was positioned in lithotomy. A speculum was used to visualize the cervix under aseptic approach, and a Volsellum forceps was used to hold the anterior lip in place. After sounding the uterus with a uterine sound, an appropriate sized Everard Williams or Leech-Wilkinson uterine cannula was placed into the endocervical canal. Contrast medium which contains urografin 76% (sodium amidotrizoate + meglumine amidotrizoate) was injected slowly into the uterine cavity and non-ionic contrast 350mg iohexol (Tromethamine, Calcium, Disodium EDTA, HCl and Iodine) was used for patients with history of prior reaction to ionic contrast or severe atopy. By using direct image intensification, the uterine cavity's appearance and the fallopian tubes' patency were evaluated. Spot films were taken throughout the peritoneal spill, early uterine filling, and tubal filling periods.

Delayed film was obtained to verify the clearance of the contrast from the pelvic cavity and also to confirm cases of hydrosalpinx. It was crucial to get radiographs of the uterus in the proper antero-posterior projection in order to detect small uterine cavity anomalies, and this was accomplished via cervical tension and, when necessary, taking oblique views. The report of the HSG images were done by competent radiologists using uniform criteria for interpretation to avoid bias. The reporting criteria include; Patterns of the cervical canal, uterine size and contour, tubal patency and pattern of spillage.

The data obtained was entered using Microsoft excel and analyzed using the SPSS for windows version 23 program. The frequency of the pathologies seen was calculated. Correlations between the variables was carried out using the Chi square test. Ethical approval was obtained from the Health Research and Ethics committee of the University of Medical Sciences Teaching Hospital, Ondo state.

RESULTS

A total of 705 patients were referred for HSG at our facilities within the period under review. However 25 of them were not involved in

this study due to inadequate clinical information making the sample size to be 680.

The youngest age of participant was 20 years and the oldest participant was 55 years with mean age of 35 years. The most prevalent age range was 30-39 years constituting 51.2% of study population, whereas the least prevalent age range was 50-55 years accounting for 3.8% as shown in Table 1.

There were 163 cases of Primary infertility accounting for 24% and 517 cases of Secondary infertility amounting to 76% of the study population as shown in Table 2. Both types of infertility were most prevalent in the 30-39 age group accounting for 55.2% and 50% of primary and secondary infertility respectively as shown in Table 2.

143 (21%) of the participants had completely normal HSG findings i.e. no abnormality was noted in neither of the fallopian tubes, uterine and the cervical cavity. Also, 549 (80.7%) had normal uterine cavity, while 101 (14.8%) had uterine fibroids predominantly the sub-mucosal type. Uterine synechiae was seen in 16 (2.4%) cases, Arcuate uterus was demonstrated in 4 (0.6%), retroverted uterus was seen in 6 (0.9%) and 4 (0.6%) had IUCD in situ as shown in Table 3.

A total of 615 (90.4%) patients had normal cervical findings whereas 65 (9.6%) patients had cervical abnormalities, 42 (6.2%) had tight cervical synechiae and 23 (3.4%) had partial cervical stenosis which were relieved during the procedure, this is shown on Table 4.

456 (67.1%) of patients had fully opacified bilateral fallopian tubes with normal calibre and elicited free bilateral spillage. However, 224 (32.9%) patients had one form of tubal abnormality or the other making tubal factors the commonest cause of infertility in this study. 108 (48%) patients had unilateral tubal blockage, 60 (55%) and 48 (45%) right and left respectively.

Bilateral tubal blockage was demonstrated in 116 (52%) of patients, cornual obstruction accounts for 52 (23.2%) of cases of tubal obstruction having 5.3% and 8.5% on the right and left respectively. However, distal tubal obstruction both bilateral and unilateral totaling 114 (51%) of the total tubal abnormalities was the commonest pattern of obstruction among the patients. Hydrosalpinx was seen in 58 (26%) of cases of tubal obstruction with 36 (16.1%) of cases being bilateral while 12 (5.4%) and 10 (4.5%) were unilateral, right and left respectively (Table 5). It was noted that majority of the patients with hydrosalpinx in this study belong to the category of participants who have had gynecological operation especially myomectomy prior to the HSG.

Age	Number of patients	Percentage
20-29 years	154	22.6%
30-39 years	348	51.2%
40-49 years	152	22.4%
50-55 years	26	3.8%

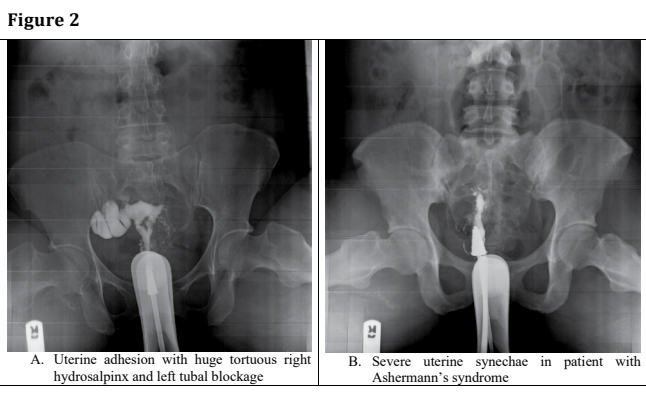
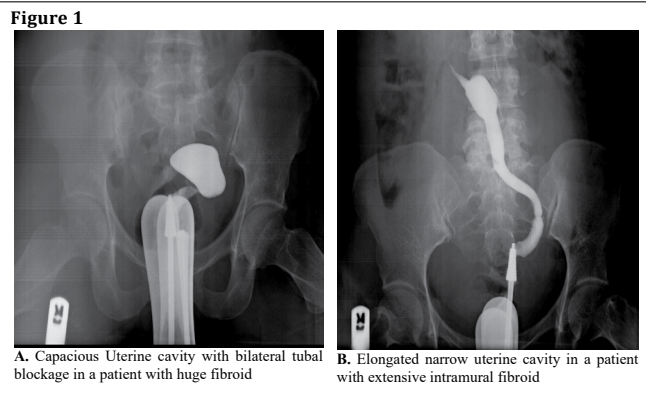
Table 1: Age Distribution.

Age group	Primary infertility	Secondary infertility
20-29 years	25	129
30-39 years	90	258
40-49 years	40	112
50-55 years	8	18
Total	163	517

Table 2: Age Distribution and Types of Infertility.

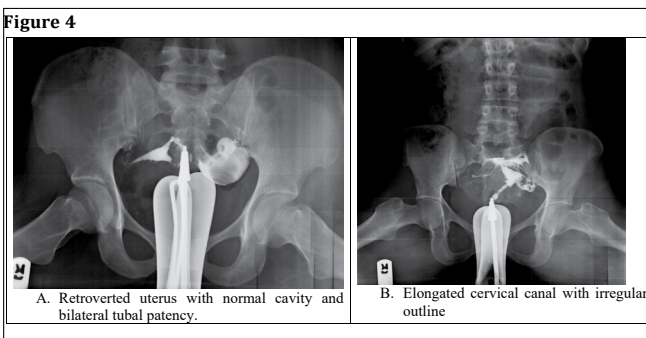
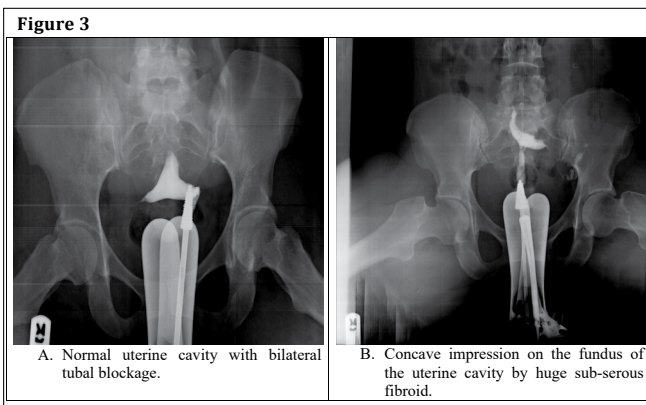
Uterine findings	Number	Percentage
Normal cavity	549	80.7%
Uterine Fibroid	101	14.8%
Adhesions/Synechia	16	2.4%
Arcuate uterus	4	0.6%
Retroverted uterus	6	0.9%
IUCD in situ	4	0.6%
Total	680	100%

Table 3: Pattern of Uterine findings.



Cervical findings	Number	Percentage
Normal cervical canal	615	90.4%
Cervical synechiae	42	6.2%
Partial cervical stenosis (pinhole)	23	3.4%

Table 4: Pattern of Cervical Findings.



Tubal patterns	Number
Bilateral tubal patency	456 (67.1%)
Tubal blockage	224(32.9%)

Table 5b

Types of blockage	Number	Right fallopian tube	Left fallopian tube
Bilateral tubal blockage	116 (52%)	116 (52%)	116 (52%)
Unilateral tubal blockage	108 (48%)	60 (55%)	48 (45%)

Table 5c

Location of Obstruction	Number	Right fallopian tube	Left fallopian tube	Bilateral
Cornual obstruction	52 (23.2%)	12 (5.3%)	19 (8.5%)	21 (9.4%)
Distal tubal Obstruction	114 (51%)	33 (14.7%)	22 (9.8%)	59 (26.3%)
Hydrosalpinx	58 (26%)	12 (5.4%)	10 (4.5%)	36 (16.1%)
Total	224 (100%)	57 (25.4%)	51 (22.8%)	116 (51.8%)

Figure 5

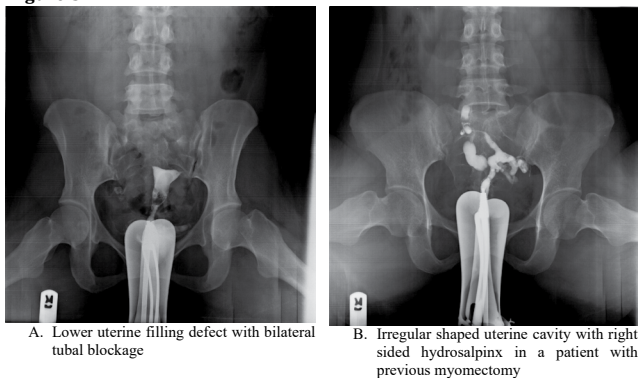


Figure 6

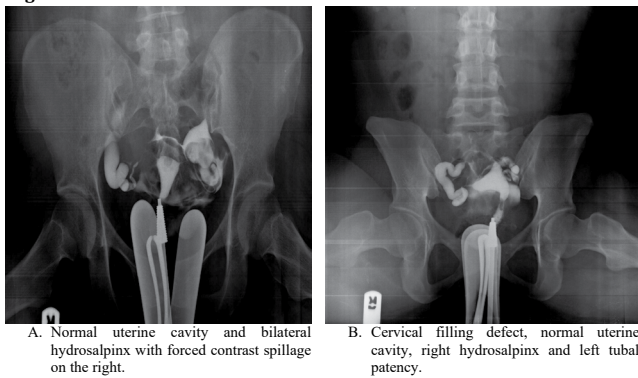


Figure 7

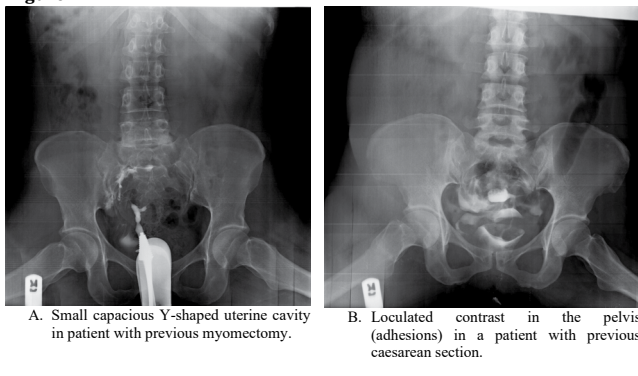
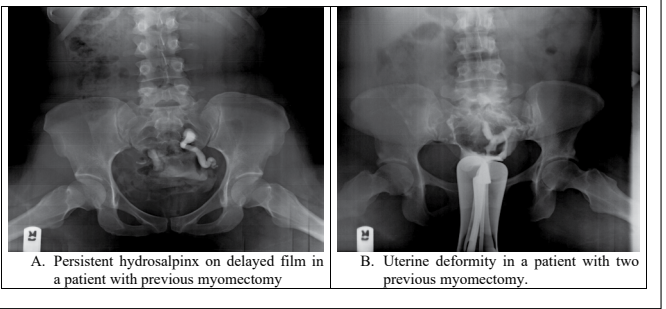
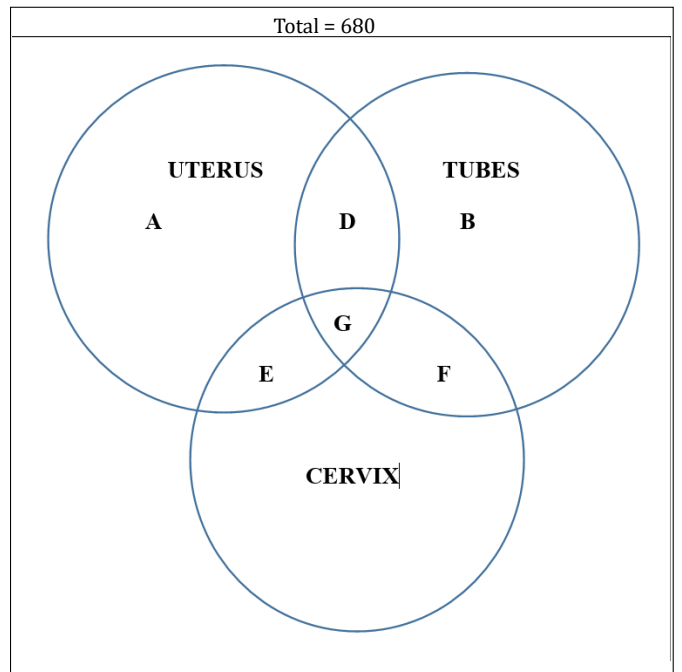


Figure 8



Surgical procedure (Number of patients)	Uterine findings (%)	Tubal findings (%)	Pelvic findings (%)
Caesarean section (67)	Normal - 47 (70%) Abnormal - 20 (30%)	Normal - 57 (85%) Abnormal - 10 (15%)	Normal - 35 (52%) Abnormal - 32 (48%)
Myomectomy (82)	Normal - 34 (42%) Abnormal - 48 (58%)	Normal - 16 (19%) Abnormal - 66 (81%)	Normal - 57 (69%) Abnormal - 25 (31%)
Salpingectomy (22)	Normal - 19 (88%) Abnormal - 3 (12%)	Normal - 0 (0%) Abnormal - 22 (100%)	Normal - 18 (80%) Abnormal - 4 (20%)
Appendectomy (16)	Normal - 14 (86%) Abnormal - 2 (14%)	Normal - 13 (82%) Abnormal - 3 (18%)	Normal - 13 (79%) Abnormal - 3 (21%)

Table 6: Findings in Patients with Previous Surgical Interventions.



- A. Uterine abn only = 131
- B. Tubal abn only = 224
- C. Cervical abn only = 65
- D. Uterine + Tubal abn = 36
- E. Uterine + cervical abn = 28
- F. Tubal + cervical abn = 32
- G. Tubal + Uterine + Cervical abn = 21
- N. Normal HSG findings = 143

Figure 9: Venn diagram representing the HSG abnormalities and their anatomical location.

DISCUSSION

Infertility is a common gynecological condition in Africa with terrible societal, psychological and psychosocial implications, especially among women. Hysterosalpingography, however because of its less invasiveness, reliable diagnostic result and cost effectiveness, it is used as a first line investigative modality in reproductive medicine to establish the cause of female infertility in a low resource economy like Nigeria.

The Age range in this study was 20-55 years of age and the mean age was 35 years. The most prevalent age range was 30-39 years constituting 51.2% of study population, this is in correlation with the findings of previous researchers [28-30], this is because the peak of female reproduction is reached in this age category whereas the least prevalent age range was 50-55 years accounting for 3.8%. The higher mean age in this study is largely due to lateness in marriage due to pursuance of education, dedication to religious activities and prayers and seeking alternative methods (Herbalists and spiritualists) before presenting to the hospital [30].

The 30-39 age group had the highest incidence of both types of infertility compared to other age groups. However, this study shows that the prevalence of secondary infertility (76%) is higher than that of primary infertility (24%) and thus correlates with findings of previous Nigerian studies done by Adetiloye [31], and Nwankwo et al [33]. The high incidence of Secondary infertility recorded in this study is due to poorly managed pelvic infections, STIs, Post-abortal sepsis, Post-operative infections amongst others. However, some studies conducted in other parts of Nigeria and India have contradicting findings, because they show a higher incidence of primary infertility [29].

This study shows that the most common cause of infertility in the studied population was Tubal pathology accounting for 224 (32.9%) of the participants. Unilateral tubal blockage was found in 108 (48%) and bilateral tubal blockage in 116 (52%). Cornual obstruction 52 (23.2%) and distal tubal obstruction 114 (51%) was seen in patients with tubal blockage. These findings reveal a similar incidence of tubal pathology in 33.6%, 40% and 43.55% recorded in previous studies across Nigeria [28,29,38]. Pelvic inflammatory disease and post abortal sepsis in unwanted pregnancy are the major factors implicated for the higher incidence of tubal pathology in this study. Hydrosalpinx accounts for 26% of patients who presented with cases of unilateral and bilateral tubal blockage respectively. This is similar to what was reported by previous research findings [3,39].

Cornual obstruction had a higher incidence on the left (8.5%) compared to the right (5.3%). In this study, distal fallopian tubal obstruction happens to be the highest pattern of tubal obstruction recorded and this is due to previous poorly managed pelvic infections, STIs, post-operative infections and adhesions. This finding agrees with the study conducted by Chinwe et al in Enugu [11]. The uterine HSG patterns of this study shows that 80.7% of this study population have normal uterine cavity, a value that is higher than what was recorded in previous studies conducted by other researchers [11,29,33]. Uterine fibroid had a high frequency in this study accounting for 14.8% of study population, a finding that shows a similar range of value with research conducted in Enugu [11], although less than the finding of a similar study conducted by Ait Benkaddour et al [30]. 0.9% of study participants have retroverted uterus, 0.6% have arcuate uterus and 0.6% have IUCD in situ. 2.4% had uterine synechiae, a value lower in comparison to the finding of other studies [1].

This study shows that 615 cases had normal cervical canal. Cervical synechiae was the most frequent abnormality occurring in 6.2% of the cases and 3.4% had partial cervical stenosis. The frequency of cervical synechiae in this study is consistent with findings of the study conducted by Danfulani et al [28] and it is attributed to Post abortal sepsis, pelvic infections and treatment by unqualified medical personnel.

In this study, it was recorded that some patients had already done one or more surgical procedure in the past ranging from caesarean section, myomectomy, salpingectomy and appendectomy.

67 patients were recorded to have had previous caesarean section. However, there is a relatively higher percentage of normalcy on their uterine, tubal and pelvic findings with 70% having normal uterine findings, 85% have normal tubal findings and 52% have normal pelvic findings.

82 patients have had myomectomy with a higher pattern of abnormality, 58% with abnormal uterine findings and 81% with abnormal tubal findings. However, pelvic findings appear to have a higher frequency of normalcy at 69%.

Salpingectomy and appendectomy accounted for the lowest number of patients with previous surgical procedures done, 22 and 16 respectively. Post-Salpingectomy shows a higher incidence of normal findings with 88% of normal uterine findings and 80% of normal pelvic findings however, 100% of them had abnormal tubal findings (unilateral tube).

In appendectomy, 86% had normal uterine findings, 82% had normal tubal findings and 79% had normal pelvic findings. Cases of hydrosalpinx in this study can be traced to patients with previous surgical cases especially myomectomy. This is similar to the findings of the study conducted by Makwe et al. [40]

CONCLUSION & RECOMMENDATION

While having a lower prevalence compared to earlier and older researches, tubal factors are still the most prevalent abnormality found in the hysterosalpingograms of infertile women in this study. The majority of participants exhibited normal utero-cervical cavity and bilateral tubal patency, hence hormonal imbalance and male causes of infertility should be paid more attention to. The recent finding seen in our study is the increased incidence of hydrosalpinx among the patients which could be traced to previous surgical interventions being the major risk factor responsible for this. Hence, further studies on the effect of previous surgical interventions on Hysterosalpingography and infertility as a whole should be considered.

According to the study, tubal pathology is still the most frequently seen in the patients; however, it is advised to test for and treat pelvic inflammatory disease before HSG. Furthermore, continued campaign for safe sex and the abolition of harmful behaviors is necessary.

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Conflict of Interest: None.

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