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Hysterosalpingographic Findings Among Ghanaian Women with Infertility: A Five-year Trend Analysis

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ABSTRACT

Objectives: To understand the pattern of hysterosalpingographic (HSG) findings and annual trends among Ghanaian women with infertility over a five-year period. ***Methods***: We retrospectively evaluated the hospital medical records of women with infertility who underwent HSG at a major tertiary center in Ghana between January 2018 and December 2022. The data was statistically analyzed. ***Results:*** The subjects comprised of 2324 Ghanaian women diagnosed with clinical infertility. HSG identified 1685 (72.5%) with primary infertility and they were also younger women with a mean age of 32.2±4.5 years. The remaining 639 (27.5%) women had secondary infertility and were older (34.2±5.3 years; $p < 0.001$). Primary infertility rate decreased with increasing age ($p < 0.001$). Bilateral tubal blockage was seen in 701 (41.6%) women with primary infertility and 365 (57.1%) women with secondary infertility. Hydrosalpinx was present in 236 (10.2%) women, fimbrial adhesions in 444 (19.1%), Asherman's syndrome in four (0.2%), and bilateral beaded tubes/tubercular salpingitis in five (0.2%). HSG was unable to detect infertility-related abnormalities in 513 (22.1%) women despite their clinical infertility. The majority of patients (1502; 64.6%) had tubal blockage: bilateral in 1066 (45.9%) and unilateral in 436 (18.8%). ***Conclusions:*** Infertility rates among Ghanaian women increased at an accelerating rate over the years. Primary infertility was significantly more prevalent among younger women. Tubal and cervical abnormalities were the most prevalent HSG findings.

One of the most common health conditions affecting modern young men and women is infertility, defined as the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse.[1] Primary infertility is the inability to conceive despite attempts at conception for more than one year, whereas secondary infertility is the inability to become pregnant following a previous successful conception.[1] In the past, sexually transmitted infections used to be the leading causes of infertility, but today, stress and lifestyle factors dominate.[2]

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Infertility prevalence has been reported to have been increasing since 1998. According to the World Health Organization, about 186 million individuals and 48 million couples experience fertility problems worldwide with associated medical, economic, and psychological implications including stress and trauma, particularly in Africa, where there is a strong emphasis on childbearing.[3] Worldwide, about 11% of women are reported to experience fertility problems against 9% of men, and the impact of advancing age is much greater in women.[4,5]

The global age-standardized prevalence of female infertility increased from 1367 per 100 000 (1.4%) in 1990 to 1571 per 100 000 (1.6%) in 2017, representing a rise of 14.9% over 18 years. The prevalence of infertility is high in Sub-Saharan Africa, South Asia, the Middle East and North Africa, Central Asia, and Central Europe.[6,7] Female infertility can result from a variety of conditions that affect the ovaries, uterus, fallopian tubes, and endocrine system, among others. Recently, oxidative stress has been recognized as a major mediator, especially in polycystic ovary syndrome, endometriosis, and unexplained infertility.[7]

Fertility assessment methods include ovulation test, ovarian reserve tests, other hormone tests, genetic tests, imaging tests such as hysterosalpingography (HSG), pelvic ultrasound, sonohysterography, and hysteroscopy. Sometimes laparoscopy is used to identify irregularities or blockages of the fallopian tubes, scarring, endometriosis, and problems with the ovaries and uterus. HSG is still the first-line technique to diagnose tubal and intrauterine problems associated with infertility.[8]

HSG is a non-invasive and simple procedure where a dye that is opaque to X-rays is introduced vaginally into the uterus, which then spreads to the fallopian tubes. An X-ray is taken to visualize the uterine cavity contour and lesions, revealing anomalies in the uterus and the fallopian tubes.[9] Despite potential side effects of HSG—such as nausea, fever, pelvic infection, pelvic cramps/pain, lymphogranuloma formation, vasovagal symptoms, radiation exposure, and high probability of false positives—it remains a popular diagnostic tool in the developed and developing regions of the world.[9,10]

Studies elsewhere have reported the common HSG findings related to infertility to be fibroids, tubal blockages, capacious uterine cavities, and hydrosalpinx.[10–12] There is a dearth of similar data in Ghana. Therefore, we aimed to assess the patterns of HSG findings and the sociodemographic and clinical variables among Ghanaian women with infertility over a period of five years.

METHODS

We undertook a retrospective review of all radiological reports of 2324 women with infertility who underwent HSG during their infertility work-up at the Department of Radiology, Cape Coast Teaching Hospital (CCTH), who met the inclusion criteria between January 2018 and December 2022. The CCTH is one of Ghana's top medical research and referral institutions and receives patients referred from all over the country.

The Ethical Review Committee of CCTH cleared the study as per the 1975 Helsinki Declaration (Ref. CCTHERC/EC/2018/30). Although informed consent was not required for this retrospective study, patient anonymity and confidentiality were ensured.

The demographic and imaging data of all patients who underwent HSG during the selected period were retrieved from the hospital's electronic patient database. The type of infertility of each patient was assessed using her gravidity, parity, and medical history. All the HSG reports were reviewed by three radiologists with over 10 years of experience in fluoroscopic examinations including HSG.

The inclusion criteria were cases of women who underwent HSG within the study period, and whose complete medical records including comprehensive HSG reports were available. The cases that did not meet these conditions were excluded.

All HSG procedures we reviewed were conducted as per our institutional protocol: HSG was performed during the patient's proliferative phase (days six to 11) when there is no menstrual flow. A negative urine pregnancy test was required. The patient was administered a rectal diclofenac suppository (100 mg) and oral hyoscine butyl bromide tablets (60–80 mg), 30–50 minutes before the examination to help relieve pain and reduce the likelihood of tubal spasms. With the patient in the lithotomy position, a control image of the pelvis was taken. A vaginal speculum was inserted to assess the external cervical os, followed by cervical cannulation. About 10–30 mL of contrast medium (iopamidol) was administered under fluoroscopic guidance after expelling air bubbles. Once the uterine cavity was

filled with the contrast medium, a radiographic image was taken using Shimadzu Flexavision (2012 model) digital fluoroscopy system (Shimadzu Corporation, Kyoto, Japan). HSG was reported to be normal when both tubes were visualized, normal in caliber and with free spillage of contrast medium into the peritoneum, with a normal outline of the uterine cavity and cervical canal. An abnormal HSG was reported when there was evidence of unilateral or bilateral tubal obstruction/dilatation, and/or uterine or cervical abnormality.

The uterine abnormalities (acquired or congenital) reviewed in this study comprised of irregular uterine outline, filling defects in the uterine cavity, Asherman's syndrome, elongated uterine cavity, arcuate uterus, and bicornuate uterus. Cervical abnormalities included elongated cervical canal, irregular cervical outline, edematous cervix, and patulous cervix. Tubal abnormalities considered were beaded tube(s) indicative of tubercular salpingitis, salpingitis isthmica nodosa (bilateral or unilateral), hydrosalpinx(es) (bilateral or unilateral), terminal tubal contrast collection suggestive of fimbrial adhesion(s), and tubal blockage (bilateral or unilateral) indicated by the non-spillage of contrast medium to the affected side(s).

From the records, we classified all the patients into two infertility categories: primary and secondary. During the study period, a total of 2337 patients underwent HSG examination of whom 13 were excluded because of incomplete reports. The records of the remaining 2324 women who met the inclusion criteria were consecutively retrieved for analysis. The patients were categorized into the following age groups: ≤ 30 years, 31–35 years, 36–40 years, and > 40 years.

The collected data was analyzed and presented as tables and charts using GNU PSPP statistical analysis software version 1.2.0-3 (Free Software Foundation, Boston, Massachusetts, USA) and LibreOffice Calc version 6.1.5.2 (The Document Foundation, Berlin, Germany). The associations between the HSG findings and other variables—patient age, year of HSG, and type of infertility—were assessed using the chi-square goodness-of-fit test. After the assumption for normality check was satisfied, a two-tailed independent sampled students *t*-test was employed to determine whether the mean ages of patients with primary and secondary infertility were statistically the same in our setting. Statistical significance was set at $p \leq 0.05$.

RESULTS

The subjects of the study comprised of 2324 women with infertility who underwent HSG. The mean age of patients with primary infertility was 32.2±4.5 years while that of patients with secondary infertility was 34.2±5.3 years ($p < 0.001$). The percentage of the youngest women (≤ 30 years) undergoing HSG was the highest in 2022 (27.1%; $p < 0.001$) and the lowest in 2018 (13.2%; $p < 0.001$). A similar chronological trend was seen in the 31–35-year age group [Table 1]. The percentage of the oldest women (> 40 years) undergoing HSG was the highest in 2021 (33.9%) and the lowest in 2019 (6.6%). Women who presented with primary infertility constituted the majority of the patients with an accelerating yearly rate except in 2022. However, there was a fluctuating trend in the annual numbers of women with secondary infertility. These yearly changes were statistically significant ($p < 0.001$).

HSG was unable to identify any signs of infertility in respect of 513 (22.1%) participants despite their known clinical infertility [Table 1]. Thus, the net number of women with fertility abnormalities as found by HSG was 1811.

Primary infertility cases exceeded secondary infertility cases in all age groups with an inverse relationship with age [Figure 1].

The most common abnormal HSG finding was bilateral tubal blockage (58.9%), followed by elongated cervical canal (25.1%) and irregular uterine outline (1.4%). The least recorded findings were Asherman's syndrome, bilateral beaded tubes/tubercular salpingitis, and bicornuate uterus. Apart from left hydrosalpinx, the positive HSG findings were more prevalent in primary infertility cases. All the cases of right tubal blockage, right fimbrial adhesions, edematous cervix, patulous cervix [Figure 2], arcuate uterus, bicornuate uterus, Asherman's syndrome, and bilateral beaded tubes/tubercular salpingitis were found in women with primary infertility [Table 2]. Hydrosalpinx was recorded in 72.9% of primary and 27.1% of secondary infertility cases and was predominantly on the left side. Fimbrial adhesions were seen in 21.5% of primary and 12.8% of secondary infertility cases and were more common on the right side [Table 2].

Irregular uterine outline, bilateral tubal blockage [Figure 2], left tubal blockage, elongated cervical canal, elongated uterine cavity, irregular cervical outline, and edematous cervix were significantly

Table 1: Distribution of age, hysterosalpingographic (HSG) findings, and infertility types over a five-year period among Ghanaian women with infertility (N = 2324).

Variables	No. of patients, n (%)						*p*-value
	2018	2019	2020	2021	2022	Total	
Age group, years							
≤ 30	116 (13.2)	165 (18.8)	163 (18.5)	198 (22.5)	238 (27.0)	880 (100)	< 0.001*
31–35	122 (14.9)	131 (16.0)	158 (19.3)	192 (23.4)	216 (26.4)	819 (100)	
36–40	78 (15.5)	72 (14.3)	72 (14.3)	90 (17.9)	192 (38.1)	504 (100)	
> 40	21 (17.4)	8 (6.6)	33 (27.3)	41 (33.9)	18 (14.9)	121 (100)	
Total	337 (14.5)	376 (16.2)	426 (18.3)	521 (22.4)	664 (28.6)	2324 (100)	
Infertility type							
Primary	266 (15.8)	308 (18.3)	326 (19.3)	440 (26.1)	345 (20.5)	1685 (100)	< 0.001*
Secondary	71 (11.1)	68 (10.6)	100 (15.6)	81 (12.7)	319 (49.9)	639 (100)	
Overall HSG findings							
Normal	72 (14.0)	60 (11.7)	72 (14.0)	135 (26.3)	174 (33.9)	513 (100)	< 0.001*
Abnormal	265 (14.6)	316 (17.4)	354 (19.5)	386 (21.3)	490 (27.1)	1811 (100)	

	Minimum	Maximum	Mean (SD)	SE
Age, years	21	48	32.7 (4.8)	0.100
	Mean (SD) years	**Mean diff (CI)**	**t-score**	***p*-value**
Primary	32.2 (4.5)	-1.99 (-2.42–1.56)	-9.02	< 0.001*
Secondary	34.2 (5.3)			

**Significance. Diff: difference. N: total number of women who underwent HSG.*

associated with the youngest (≤ 30 years) age group. Filling defects/fibroids, bicornuate uterus, and bilateral beaded tubes/tubercular salpingitis were more prevalent among 36–40-year age group. Right tubal blockage, bilateral hydrosalpinxes, [Figure 3], left hydrosalpinx, right fimbrial adhesions, left fimbrial adhesions, patulous cervix, arcuate uterus, and Asherman's syndrome were more likely among 31–35-year-olds [Table 3].

Figure 4 shows an increasing trend of infertility among Ghanaian women over five years at an accelerating rate.

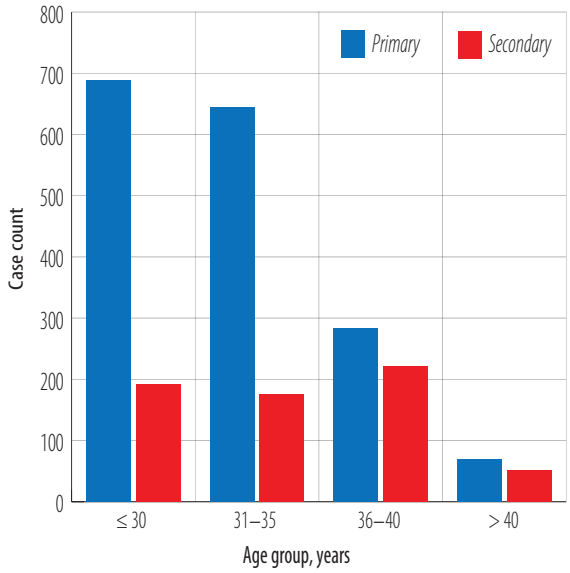

Figure 1: Prevalence of primary and secondary infertility in Ghanaian women stratified by age group.

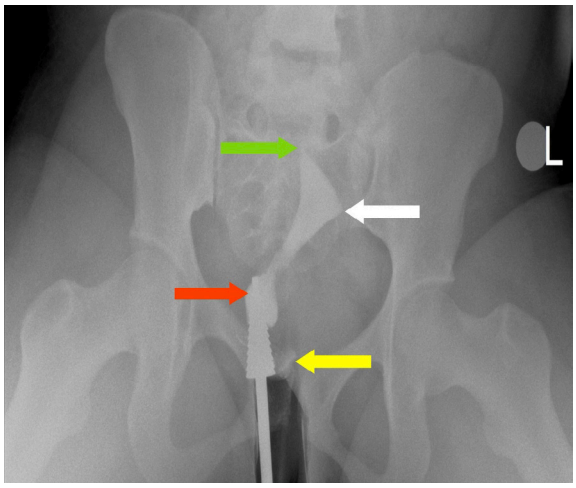

Figure 2: A frontal hysterosalpingography image showing pooling of contrast medium around the cervical cannula suggestive of a patulous cervix as indicated by the red arrow, backflow of contrast (yellow arrow), right tubal blockage (green arrow), and left tubal blockage (white arrow).

Table 2: Abnormal hysterosalpingographic (HSG) findings in Ghanaian women with primary versus secondary infertility (n = 1811).

HSG finding	No. of women with infertility, n (%)		Total	*p*-value
	Primary	Secondary		
Tubal findings				
Bilateral tubal blockage	701 (65.8)	365 (34.2)	1066	< 0.001*
Right tubal blockage	275 (100)	0 (0.0)	275	< 0.001*
Left tubal blockage	157 (97.5)	4 (2.5)	161	< 0.001*
Bilateral hydrosalpinxes	78 (72.9)	29 (27.1)	107	0.926
Left hydrosalpinx	51 (39.53)	78 (60.5)	129	< 0.001*
Right fimbrial adhesions	172 (100)	0 (0.0)	172	< 0.001*
Left fimbrial adhesions	190 (69.9)	82 (30.1)	272	0.297
Bilateral beaded tubes/ tubercular salpingitis	5 (100)	0 (0.0)	5	0.168
Bilateral tubal patency	446 (63.5)	256 (36.5)	702	< 0.001*
Uterine findings				
Elongated uterine cavity	39 (76.5)	12 (23.5)	51	0.521
Irregular uterine outline	229 (78.7)	62 (21.3)	291	0.011*
Filling defect/fibroid	98 (61.3)	62 (38.8)	160	0.001*
Arcuate uterus	16 (100)	0 (0.0)	16	0.013*
Bicornuate uterus	7 (100)	0 (0.0)	7	0.103
Asherman's syndrome	4 (100)	0 (0.0)	4	0.218
Cervical findings				
Elongated cervical canal	298 (65.6)	156 (34.4)	454	< 0.001*
Irregular cervical outline	22 (84.6)	4 (15.4)	26	0.164
Edematous cervix	135 (100)	0 (0.0)	135	< 0.001*
Patulous cervix	12 (100)	0 (0.0)	12	0.032*

**Significance. n: total number of patients with abnormal HSG findings.*

The year 2021 saw the highest rates of irregular uterine outline (29.9%), bilateral tubal blockage (23.6%), irregular cervical outline (38.5%), edematous cervix (37.0%), and bilateral beaded tubes/tubercular salpingitis. Meanwhile, right tubal blockage (44.0%), left tubal blockage (54.0%), elongated uterine cavity (33.3%), and bilateral tubal patency (27.2%) [Figure 5] were the most common in 2022. All findings of bicornuate uterus, Asherman's syndrome, and bilateral beaded tubes/ tubercular salpingitis features occurred in 2018, 2019, and 2021, respectively [Table 4].

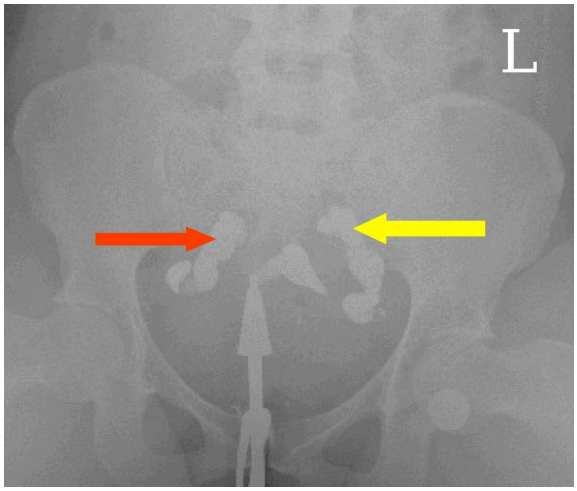

Figure 3: A hysterosalpingography image showing bilateral tubal dilatation with no spillage of contrast medium bilaterally into the peritoneal cavity as depicted by the left and right arrows suggestive of bilateral hydrosalpinxes.

DISCUSSION

According to the literature, secondary infertility is the most prevalent type of female infertility worldwide.[13] However, a large majority (72.5%) of the women in this study had primary infertility, mainly resulting from bilateral tubal blockage (41.6%). Bilateral tubal blockage also accounted for 57.1% of secondary infertility and 45.9% of all infertility cases. Ambildhuke et al,[14] reported bilateral tubal obstruction as responsible for up to 40% of female infertility which supports our

Table 3: Prevalence of abnormal hysterosalpingographic (HSG) findings in various age groups (n = 1811).

HSG findings	No. of women by age group (in years), n (%)				Total	*p*-value
	≤ 30	31–35	36–40	> 40		
Tubal findings						
Bilateral tubal blockage	428 (40.2)	341 (32.0)	232 (21.8)	65 (6.10)	1066	0.009*
Right tubal blockage	98 (35.6)	138 (50.2)	39 (14.2)	0 (0.0)	275	< 0.001*
Left tubal blockage	56 (34.8)	38 (23.6)	47 (29.2)	20 (12.4)	161	< 0.001*
Bilateral hydrosalpinxes	23 (21.5)	38 (35.5)	14 (13.1)	32 (29.9)	107	< 0.001*
Left hydrosalpinx	15 (11.6)	53 (41.1)	50 (38.8)	11 (8.5)	129	< 0.001*
Right fimbrial adhesions	69 (40.1)	92 (53.5)	4 (2.3)	7 (4.1)	172	< 0.001*
Left fimbrial adhesions	72 (26.5)	112 (41.2)	84 (30.9)	4 (1.5)	272	< 0.001*
Bilateral beaded tubes/ tubercular salpingitis	0 (0.0)	0 (0.0)	5 (100)	0 (0.0)	5	< 0.001*
Bilateral tubal patency	264 (37.6)	250 (35.6)	174 (24.8)	14 (2.0)	702	< 0.001*
Uterine findings						
Elongated uterine cavity	33 (64.7)	18 (35.3)	0 (0.0)	0 (0.0)	51	< 0.001*
Irregular uterine outline	118 (40.5)	68 (23.37)	95 (32.6)	10 (3.4)	291	< 0.001*
Filling defect/fibroid	42 (26.3)	32 (20.0)	76 (47.5)	10 (6.3)	160	< 0.001*
Arcuate uterus	0 (0.0)	12 (75.0)	4 (25.0)	0 (0.0)	16	0.003*
Bicornuate uterus	0 (0.0)	0 (0.0)	7 (100)	0 (0.0)	7	< 0.001*
Asherman's syndrome	1 (25.0)	3 (75.0)	0 (0.0)	0 (0.0)	4	0.384
Cervical findings						
Elongated cervical canal	163 (35.9)	121 (26.7)	149 (32.8)	21 (4.6)	454	< 0.001*
Irregular cervical outline	14 (53.8)	7 (26.9)	5 (19.2)	0 (0.0)	26	0.292
Edematous cervix	76 (56.3)	40 (29.6)	19 (14.1)	0 (0.0)	135	< 0.001*
Patulous cervix	0 (0.0)	12 (100)	0 (0.0)	0 (0.0)	12	< 0.001*

Significance. n: total number of patients with abnormal HSG findings.

finding. In another study, bilateral tubal blockage constituted the majority, however, unlike our findings, only 22.0% of their participants had primary infertility.[15]

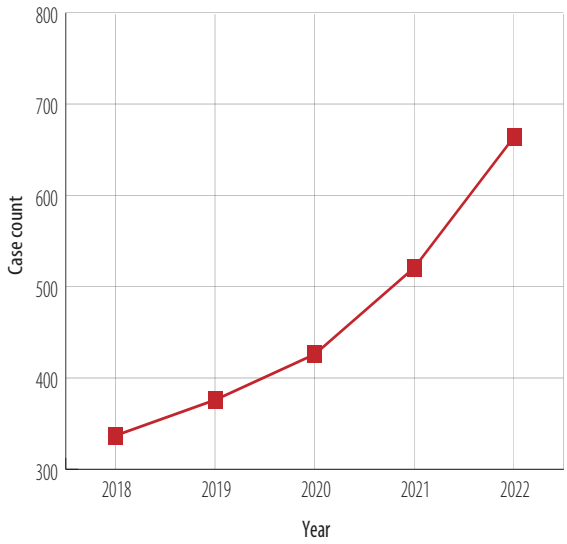

Figure 4: Yearly trend of infertility from 2018–2022 among Ghanaian women.

A Nigerian study reported that nearly half (44.8%) of their patients had primary infertility, which was higher than the international prevalence and thus closer to ours.[16] We found that primary infertility was more common in younger women (≤ 30 years) and had a decreasing trend with age.

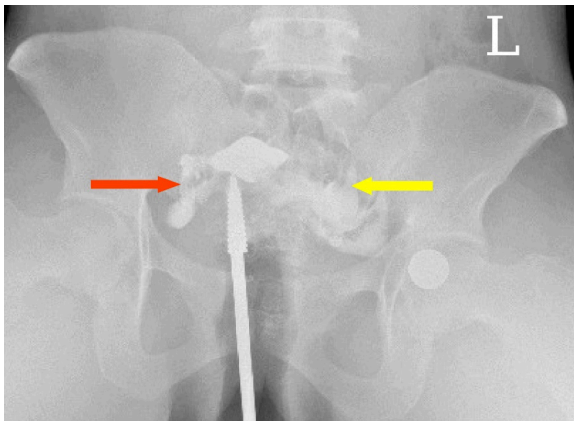

Figure 5: A frontal hysterosalpingography radiograph showing free intraperitoneal bilateral spillage (right spillage: red arrow and left spillage: yellow arrow) suggestive of bilateral tubal patency.

Table 4: Annual trend of the hysterosalpingographic (HSG) findings among Ghanaian women with infertility (N = 2324).

HSG findings	Cases per year, n (%)					Total	*p*-value
	2018	2019	2020	2021	2022		
Tubal findings							
Bilateral tubal blockage	158 (14.8)	188 (17.6)	220 (20.6)	252 (23.6)	248 (23.3)	1066	< 0.001*
Right tubal blockage	21 (7.6)	48 (17.5)	34 (12.4)	51 (18.5)	121 (44.0)	275	< 0.001*
Left tubal blockage	22 (13.7)	8 (5.0)	13 (8.1)	31 (19.3)	87 (54.0)	161	< 0.001*
Bilateral hydrosalpinxes	7 (6.5)	20 (18.7)	33 (30.8)	30 (28.0)	17 (15.9)	107	< 0.001*
Left hydrosalpinx	28 (21.7)	28 (21.7)	36 (27.9)	20 (15.5)	17 (13.2)	127	< 0.001*
Right fimbrial adhesions	43 (25.0)	32 (18.6)	43 (25.0)	20 (11.6)	34 (19.8)	172	< 0.001*
Left fimbrial adhesions	35 (12.9)	72 (26.5)	52 (19.1)	45 (16.5)	68 (25.0)	272	< 0.001*
Beaded tubes/tubercular salpingitis	0 (0.0)	0 (0.0)	0 (0.0)	5 (100)	0 (0.0)	5	0.002*
Bilateral tubal patency	107 (15.2)	108 (15.4)	124 (17.7)	172 (24.5)	191 (27.2)	702	0.460
Uterine findings							
Elongated uterine cavity	8 (15.7)	12 (23.5)	9 (17.6)	5 (9.8)	17 (33.3)	51	0.205
Irregular uterine outline	35 (12.0)	80 (27.5)	71 (24.4)	87 (29.9)	18 (6.2)	291	< 0.001*
Filling defect/fibroid	28 (17.5)	36 (22.5)	41 (25.6)	37 (23.1)	18 (11.3)	160	< 0.001*
Arcuate uterus	8 (50.0)	0 (0.0)	8 (50.0)	0 (0.0)	0 (0.0)	16	< 0.001*
Bicornuate uterus	7 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	7	< 0.001*
Asherman's syndrome	0 (0.0)	4 (100)	0 (0.0)	0 (0.0)	0 (0.0)	4	< 0.001*
Cervical findings							
Elongated cervical canal	64 (14.1)	120 (26.4)	111 (24.4)	107 (23.6)	52 (11.5)	454	< 0.001*
Irregular cervical outline	7 (26.92)	4 (15.38)	5 (19.23)	10 (38.46)	0 (0.0)	26	0.010*
Edematous cervix	7 (5.2)	44 (32.6)	34 (25.2)	50 (37.0)	0 (0.0)	135	< 0.001*
Patulous cervix	8 (66.7)	4 (33.3)	0 (0.0)	0 (0.0)	0 (0.0)	12	< 0.001*

**Significance. N: total number of participants.*

On the other hand, secondary infertility was more prevalent in the 36–40 years age group, with a fluctuating pattern with increasing age [Figure 1]. The Nigerian study also reported a high prevalence of primary infertility among younger women (< 30 years) with a similar pattern as ours, while secondary infertility was common among those aged 35–39 years.[16] A study from Sudan found a similar pattern for primary infertility, but the secondary infertility increased with increasing age against our fluctuating trend.[17] A large long-term study in the UK reported that the causes of infertility in older women differed from those in younger women.[18]

Our participants with primary infertility were significantly younger than those with secondary infertility [Table 1], which was corroborated by other studies.[17,19] All our patients with right tubal blockage, right fimbrial adhesions, and edematous cervix among others had primary infertility [Table 2] and only a small minority (0.17–0.69%) had these abnormal findings, similar to findings in other studies.[10,20]

Past research suggested that myomas, intrauterine adhesions, polyps, and gas bubbles (iatrogenic) may show up as filling defects on HSG. Filling defects were recorded in 6.9% of all our patients. A study in Nigeria reported a much higher proportion of filling defects (26.9%).[21]

The outline of the uterus was irregular in 13.4% of our patients and the cervical outline was irregular in 1.6%, against 20.6% and 12.1%, respectively in the Nigerian study.[21] Uterine abnormalities were seen in 22.8% of our patients, attributable to genetic, acquired, and environmental factors.[22] Genes such as *Pax*, *Wnt9b*, *Wnt4*, *Emx2*, and *Lim1* have been reported to influence the development of Mullerian ducts. Among environmental triggers is exposure to diethylstilbestrol and thalidomide during pregnancy, which may cause malformations such as T-shaped uterus in the fetus.[22,23] A study in Oman found a much higher prevalence of uterine abnormalities than among our participants (3% versus 1%).[24] The possible reason for their higher proportion is due to the inclusion of only congenital uterine abnormalities.

Cervical abnormalities were observed in 27.0% of all our patients against 10% reported in the literature.[25] The comparatively high prevalence of cervical abnormalities in women with infertility could be caused by uterine prolapse and irregular and edematous cervix due to chronic cervicitis. Studies have associated uterine prolapse with elongation of the supravaginal part of the cervix while the vaginal part has been linked with chronic cervicitis leading to cervical hypertrophy.[26,27]

Asherman's syndrome was found in 0.2% of our patients against a much higher prevalence reported in the literature. A systematic review conducted in Denmark reported a prevalence range of 2.8–45.5%, while 1.5% was reported in the USA.[28,29] The extremely low prevalence of Asherman's syndrome in our study is positive for Ghanaian women, due to its association with menstrual disturbances, recurrent pregnancy losses, and infertility.[28,30] Asherman's syndrome is generally associated with secondary infertility,[30,31] while the opposite was recorded in our study.

Hydrosalpinx was found in 10.2% of our participants. A European survey recorded a 30% prevalence. The majority of our cases of hydrosalpinx were on the left side with decreasing patterns as the years progressed [Table 4]. However, a Nigerian study reported a higher incidence of hydrosalpinx on the right side, probably due to the presence of the appendix.[32]

In addition, 19.1% of our patients had fimbrial adhesions and 0.2% had bilateral beaded tubes/tubercular salpingitis. About 22.1% of the infertility cases in this study were not identifiable on HSG, possibly due to factors beyond the scope of HSG such as ovulation problems, poor sperm, or egg quality, etc.[2]

Generally, we observed an increasing trend in the annual cases of infertility at an accelerating rate as the years progressed [Figure 2]. There was no clear pattern seen in the annual proportions of HSG findings apart from tubal blockage which appeared to be increasing with progressing years. Our finding has been corroborated by Sun et al,[33]'s massive long-term study covering 195 countries and territories worldwide, which found that the international prevalence rate of infertility has been growing by 0.29% for men and 0.37% for women.

Our study has limitations. Firstly, the causal relationship between primary and secondary infertility could not be evaluated in this study. Secondly, the sample size was slightly reduced due to the exclusion of patients whose files lacked comprehensive medical records and HSG reports. Finally, the largely homogenous characteristics of our study population may impact the generalization of our findings.

As 22.1% of infertility cases could not be identified on HSG, practitioners should explore other causal factors such as ovulation problems and poor sperm/egg quality. The rising trend in the annual number of patients undergoing HSG is an evolving public health concern. This calls for policy measures to manage this serious long-term problem, along with its associated medical, economic, and psychosocial fallouts, particularly in Africa where there is a strong emphasis on childbearing.

CONCLUSION

Most Ghanaian women in this study had primary infertility with a progressively accelerating rate over the study period. The prevalence of secondary infertility fluctuated during the same period. Women with primary infertility were significantly younger than those with secondary infertility. Tubal blockage and cervical abnormalities were the most prevalent HSG findings while Asherman's syndrome and bilateral beaded tubes/tubercular salpingitis were the least prevalent. There was no clear pattern seen in the annual proportions of HSG findings apart from tubal blockage which appeared to be increasing with progressing years. These increases are part of the global rise in female infertility, in addition to the associated socio-psychological sequelae.

Disclosure

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