Original Article

Radiological Evaluation of Uterine Tubes in Infertile Women with Previous Pelvic Surgery

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Abstract

Background: Infertility is a disease that affects 8%–12% of couples at their reproductive age. Tubal factors account for 20%–30% of infertility cases. Tubal infertility can be caused by infections, endometriosis, and complications from previous abdominopelvic surgery. **Objectives:** The objective of the study is to determine the impact of pelvic surgery on future fertility by examining the fallopian tubes for any potential damage using a hysterosalpingography (HSG) examination. **Materials and Methods:** A cross-sectional study was conducted at Nineveh Governorate, Iraq, in two clinics from March 2022 to September 2022 by examining 317 infertile females using HSG. The exam was done as part of an infertility workup. **Results:** The results revealed that the study included 317 infertile women patients with a mean age of 28.82 ± 6.9 years (range 17–49 years), of these, 184 patients (58.04%) with primary infertility, and 133 patients (41.95%) with secondary infertility. The years of infertility ranged between 1 and 20 years and a median of 4 years. The history of one or more previous pelvic interventions was recorded in 39 cases (12.3%). The prevalence of tubal abnormalities was noted in 23.1% of cases with previous pelvic intervention and 13.3% in other patients, with an odds ratio of 1.95 at a 95% confidence interval. Tubal abnormalities do not differ significantly according to the type of infertility, and the mean age of infertile women with tubal abnormalities is not statistically different from those with normal tubes. **Conclusion:** This study concludes that pelvic surgeries, particularly cesarean operations increase the risk of developing subsequent fallopian tube abnormalities and pelvic adhesions, which can lead to infertility.

Keywords: Hysterosalpingography, infertility, pelvic surgeries, tubal factor, tubal obstruction

Introduction

Infertility is a disease that is, described as the failure of a couple to achieve a clinical pregnancy after 12 months of unprotected regular sexual intercourse.[1] It may be primary if no previous clinical pregnancy has been diagnosed, or otherwise called secondary infertility and estimated from the last pregnancy.[1] Worldwide, infertility affects between 8% and 12% of couples of reproductive age,[2] a prevalence rate as high as 30% documented in some regions, such as the Middle East, South Asia, Central Asia, sub-Saharan Africa, and Central and Eastern Europe.[2-4]

An identifiable cause of infertility is present in about 85% of cases, whereas the rest is classified as unexplained infertility. The most common causes are related to ovulation, male infertility, or tubal diseases.[5]

The tubal factor was reported by previous literature to account for 20%–30% of causes of infertility.[6] Tubal infertility may be attributed to many causes, the most common of which are infections caused mainly by sexually transmitted diseases, the presence of endometriosis, as well as the complications from previous abdominopelvic surgery, may also contribute.[7]

As the rates of interventional pelvic procedures in females at their reproductive ages increase, the complications of surgeries also increase. Many studies have discussed the effects of these interventions, the complications of

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cesarean scars, and their effects on infertility, which are attributed to the scar or pelvic adhesions.[8-11] However, the effects on the tubes needed to be further investigated. Our study aims to determine the effect of pelvic surgery on future fertility by examining any possible harm to the ovarian tubes using hysterosalpingography (HSG).

Materials and Methods

A cross-sectional study was conducted in Nineveh governorate, Iraq, in two clinics, from March 2022 to September 2022 using HSG.

The study included adult females seeking new pregnancies, referred by the gynecologist to the radiology department to do HSG as a part of the workup for infertility. The exclusion criteria are contraindications to HSG as pregnancy, recent tubal or uterine surgery, previous allergic reaction to a contrast media, severe systemic diseases, such as renal or cardiac impairment, refusal of participation, present active pelvic inflammatory disease (PID) or history of recurrent PID, and suboptimal technique of the HSG.

Data collected, included patient age, duration and type of infertility, parity, number and types of previous unsuccessful pregnancies, any history of pelvic interventions, their types indications, and any significant recorded post-interventional complications.

Ethical approval

The ethical approval was obtained from the Ethics Committee/Nineveh University. The procedure, possible complications, and the aim of the study were discussed in detail with the patients, and informed consent was obtained from all participants.

Checking the patient's fitness and the timing of the exam

For patients fit for the HSG procedure (those who did not have any contraindications to HSG), appointments were arranged to handle the exam after the end of their menstruation periods to ensure easy cannulation of the cervical Oss, which is expected to be maximally open at this phase of the cycle. Examinations during the first half of the cycle are preferred to avoid the risk of irradiating the fetus during early pregnancy if unexpectedly present[12] and to avoid the risk of contrast intravasation, which is higher within the secretory phase endometrium.[13]

Those with irregular cycles or amenorrhea for a long period are examined after getting a negative blood test for pregnancy.[12,14] The patients were also asked to avoid any unprotected sex from the first day of the cycle to the time of the HSG exam.[12]

Preprocedural preparation

Antibiotics

Doxycyclin 200 mg tablet was given once 20 min before the procedure as a prophylactic to PID in high-risk patients, as decided by the gynecologist. No routine antibiotics were used for the rest of the patients.

Analgesics

We used non-steroidal anti-inflammatory drugs to ease the pain during and after the procedure. The analgesics were given for 1 h before handling HSG.[15]

Positioning, procedure, and contrast media

The procedure was performed by a trained radiologist. The patient was placed in a dorsal recumbent position on the X-ray table, and the vagina was sterilized with an antiseptic solution and dilated by a sterilized metallic dilator. To straighten the cervix, we used surgical forceps placed at 3 and 9 o'clock positions. For most of the cases examined, metallic cannulas of the external cervical were done by using metallic cannulas of different sizes, in a minority of the cases where the cervical ostium was patulous. Thus, the contrast can flow out in the reversed direction during injection or when the metallic cannula is too small to contain it. Next, we insert a plastic urinary catheter into the canal of the cervix. Next, 2–3 mL of normal saline to inflate the balloon of the catheter to fix its tip inside the uterine cavity. The catheter was gently pulled down to ensure a stable position and to prevent retrograde flow of the injectable contrast to the vagina.[12,14,15]

A syringe filled with contrast media should be connected to either the cannula or the catheter, and the contrast should be pushed gently through the cannulation device before application to the cervix, thereby getting all the air and preventing air bubbles from causing filling defects in the endometrial cavities or tubes during the exam.[15] The contrast used should be an iodinated, water-soluble contrast medium.[12]

Replacement of the previously used oil contrast medium with the water-soluble contrast was due to factors like the oil-soluble contrast medium serious adverse reactions, such as PID, granulomatous reactions, and as well as retinal and pulmonary emboli.[16-18] The fact that the water-soluble contrast medium carries a better delineation of the uterus and uterine tubes and lesser rates of venous contrast intravasation, are other factors.[13,18] The claim of higher rates of subsequent pregnancy after the use of oil contrast media is a matter of debate and argument between studies.[18,19]

The HSG exam begins with a plain pelvic radiograph in supine anteroposterior projection. The aim of this is to exclude the presence of any pelvic radiopacities calcifications or radio-opaque foreign body, which can be misinterpreted in the subsequent films (a series of subsequent films should be obtained then. A film for uterine filling, tubal filling, and free uterine cavity contrast spillage films. Additional films, however, are sometimes

required as indicated by the case. A small indicator is placed in the right lower border of the film to indicate the right side.[12,20]

The diagnosis of tubal obstruction is made in cases where there is a failure of opacification of the fallopian tube totally, and if there is prolonged retention of contrast in the tube with no spillage to the peritoneal cavity.

Statistical analysis

The data was analyzed using Statistical Package for the Social Sciences (SPSS) version 23.0 (SPSS, IBM Company, Chicago, IL, USA). The continuous variables were expressed by measures of central tendency (mean) and measures of dispersion [range and standard deviation (SD)] when normally distributed, or otherwise by range and median. The frequency and percentile were used to describe categorical variables. For the normally distributed continuous variables, we used the Student *t* test to compare means. Non-parametric tests were used for the continuous variables that failed to follow the normal distribution, and for the categorical variable analysis. We considered a *P* value of <0.05 to be statistically significant. The odds ratio of getting tubal abnormality after pelvic intervention was calculated at a confidence interval of 95%.

Results

The study included 317 infertile women, with an age range between 17 and 49 years. The mean age was 28.82 years, and SD was 6.9 years. The sample included 184 women (58.04%) with primary infertility and 133 (41.95%) women with secondary infertility, including 45 cases (17.03%). The years of infertility range between 1 and 20 years and a median of 4 years. Table 1 shows the age, years of infertility, and history of previous pelvic interventional procedures according to whether primary or secondary infertility with their statistical differences.

Regarding the past obstetrical history of women with secondary infertility, the parity ranged between 0 and 7, the median was 0.00, the frequency of abortion was in the range of 0–4, mean of 0.21, and SD of 0.68, whereas the neonatal or childhood deaths were in the range of 0–2, mean of 0.01, and SD of 0.137.

Of the studied sample, pelvic interventional surgical procedures were conducted in 39 cases (12.30%), and number of the interventions was 57 interventions for various indications, as shown in Table 2.

For the patients who had previous pelvic interventions (39 cases; 12.3%), tubal abnormalities were evident in 9 cases (23.1%), whereas for the patients who had no history of previous pelvic surgery (278 cases), tubal abnormalities

Table 1: The age, years of infertility, and history of previous pelvic interventions according to the type of infertility

Factor	Type of infertility	*N*	Minimum	Maximum	Mean	SD	*P* value
Age	Primary infertility	184	17	49	27.04	6.795	0.549
	Secondary infertility	133	18	48	31.29	6.316	
Years of infertility	Primary infertility	184	1	20	4.89	3.835	0.000
	Secondary infertility	133	1	15	4.22	2.714	
History of previous pelvic interventions	Primary infertility	184	0	1	0.03	0.163	0.000
	Secondary infertility	133	0	4	0.39	0.806	

Table 2: Indications of surgical interventions among infertile women

Indications		Range	Mean	Median	SD
Previous pelvic interventions	For all patients	0–4	0.18	0	0.57
	For patients with previous intervention	1–4	1.4615	1	0.85
Types of previous pelvic interventions		**Frequency**	**Percentage (%)**		
Cesarean sections		45	78.95	%	
Unilateral salpingectomy		4	7.02	%	
Salpingostomy		2	3.51	%	
Unilateral oophorectomy		1	1.75	%	
Cystectomy		1	1.75	%	
Partial oophorectomy for dermoid		1	1.75	%	
Hysteroscopic removal of polyps		1	1.75	%	
Dermoid removal		1	1.75	%	
Myomectomy for fibroid		1	1.75	%	
Total		57	100	%	

Table 3: The HSG appearance of the ovarian tubes in the studied sample

Appearance of ovarian tubes by HSG	Frequency	Percentage (%)
Normal both tubes	271	85.5
Unilateral tubal obstruction	19	6.0
Bilateral tubal obstruction	16	5.0
Unilateral hydrosalpinx	6	1.9
Unilateral salpingectomy	2	.6
Salpingectomy + contralateral tubal obstruction	2	.6
Salpingitis isthimica nodosa	1	.3
Total	317	100.0

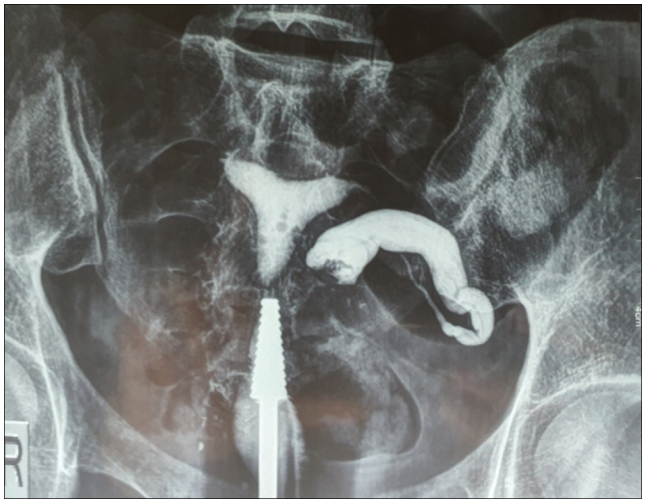

Figure 1: HSG of 25 years infertile woman shows evidence of left hydrosalpinx

were seen in 37 cases (13.3%). The odds ratio is 1.954 at a 95% confidence interval. Table 3 shows the appearance of fallopian tubes in HSG.

The women with primary infertility in the studied group showed tubal abnormalities in 23 cases, whereas 23 cases of secondary infertility showed abnormal uterine tubes. There was no significant statistical difference between the two groups. Regarding the age of patients with positive tubal abnormalities, the mean age is 30.65±7.4 years, and this mean does not show a significant difference from the mean age of the women with no detectable tubal abnormality (mean age is 28.5±6.7 years). The detected uterine tube abnormalities are listed in Table 3, which shows the HSG appearance of the uterine tubes in the studied sample. Figures 1 and 2 show examples of abnormal uterine tubes in HSG.

The pelvic adhesion was diagnosed in the HSG of 3.5% (11 cases, including 3 out of 39 cases with previous one or more pelvic surgery and 8 out of 278 cases with no previous pelvic surgery). The odds of having pelvic adhesions in a woman with previous pelvic surgery is

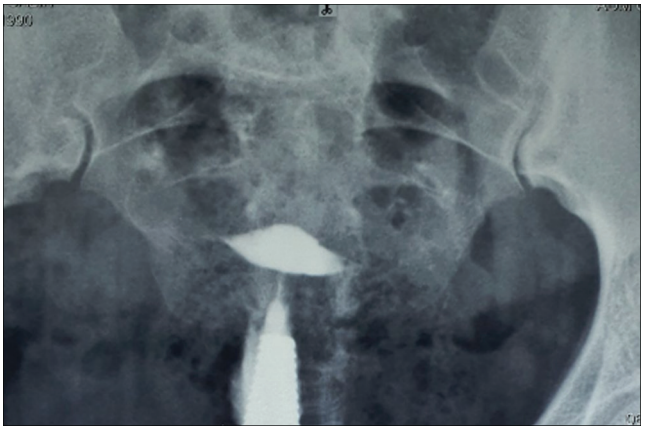

Figure 2: HSG of a 23-year-old infertile woman, HSG exam shows evidence of bilateral tubal occlusion [the tubes are not visible, and there is no free spillage of contrast in the endometrial cavity, even in the delayed films (not shown)]

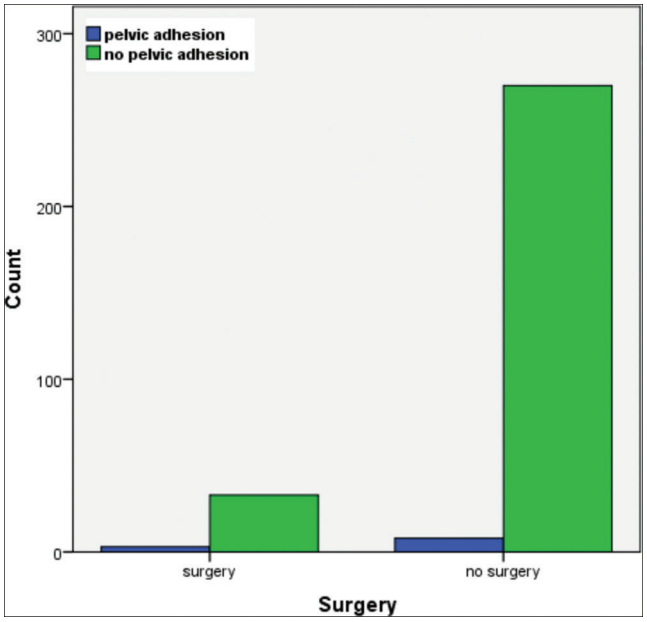

Figure 3: Distribution of pelvic adhesion according to the history of pelvic surgery

Table 4: Summary of uterine HSG findings

Uterine findings in HSG	Frequency	Percentage (%)
Normal	271	85.5
Bicornuate	12	3.8
Arcuate	11	3.5
Irregular endometrial cavity outlines	6	1.9
Small endometrial cavity	7	2.2
Irregular filling defects (adhesions/ evident scar of previous CS).	5	2.2
T shaped uterus	2	0.6
Fibroid filling defect	3	0.3
Total	317	100.0

thus estimated to be 2.67 at a 95% confidence interval [Figure 3].

Uterine abnormalities were detected in the HSG of 14.5% of the cases (46 cases). The HSG findings of uterine abnormality are summarized in Table 4.

Discussion

Fallopian tube abnormality is an important cause of infertility.[21] The HSG is a safe and simple primary method for examining the tubes.[12,22] In some regions of the world, tubal abnormalities are the most common cause of infertility and the most common abnormal finding in HSG of infertile women.[6,23] In our study, tubal and uterine abnormalities were equally prevalent.

Studies on the relationship between tubal infertility and a history of previous pelvic surgery have shown controversy.[23-26] Famurewa *et al.*[23] reported a significant association between occlusion of the fallopian tubes and a history of previous pelvic surgery, regardless of the number of surgeries done before and the type of infertility, the same was found in our study. The tubal abnormalities in our sample, mainly in the form of unilateral or bilateral obstruction were found at a significantly higher rate in women with a history of previous pelvic interventions regardless of their age, frequency of surgeries, and type of infertility, with an odd ratio of 1.95 at a 95% confidences interval. Furthermore, investigation into the mechanism of this relationship is necessary.

In this study, cesarean sections were found to be the most common operation performed among the infertile females studied, which is consistent with the global trend of increased pelvic surgery frequency in women, particularly cesareans. Previous studies have reported an increase in deliveries by cesarean section from 10% in 1990 to 55%in 2012, with rates attributed to the frequency of non-indicated cesareans, which led to an increase in short- and long-term post-operative complications, including infertility.[8-11,27]

The pelvic adhesions, in the form of contrast loculation, are found to be significantly higher in infertile women with previous pelvic interventions in the current study. This finding is consistent with previous literature, which may be attributed to post-operative fibrosis or infection.[8-11]

Conclusion

Pelvic surgeries, especially cesarean operations, are associated with an increased risk of subsequent fallopian tube abnormalities and pelvic adhesions, which are attributed to infertility. The pelvic surgeries in females at the childbearing age should be well justified.

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Nil.

Conflicts of interest
There are no conflicts of interest.

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