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Comparing the Diagnostic Value of Hysterosalpingography with Hysteroscopy in Diagnosis of Uterine abnormalities in Infertile Women

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ABSTRACT

Background & aim: Despite the identification of hysteroscopy as the most accurate method for the diagnosis of uterine cavity disorders, the patients are initially subjected to hysterosalpingography (HSG). In this regard, the present study aimed to compare the diagnostic value of HSG and hysteroscopy in the detection of uterine cavity abnormalities in infertile women.

Methods: This cross-sectional study was conducted on 91 infertile women who needed to undergo hysteroscopy in the Gynecology Ward of Imam Reza Hospital in Mashhad, Iran, due to the detection of a uterine abnormality in their HSG or failure of intrauterine insemination and in vitro fertilization during 2013 to 2014. The results of HSG and hysteroscopy to detect uterine cavity changes were compared. Data analysis was performed in SPSS software (version 16) using McNemar's test. P-value less than 0.05 was considered statistically significant.

Results: Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of HSG were 38.78%, 78.57%, 67.86%, 52.38%, and 57.14%, respectively, in comparison to those of hysteroscopy. The results of the McNemar's test revealed a significant difference between the results of HSG and hysteroscopy in the diagnosis of uterine cavity abnormalities (P=0.001).

Conclusion: As the findings indicated, HSG had lower sensitivity, specificity, as well as positive and negative predictive values. Consequently, this method can be concluded as insufficient for the diagnosis of endometrial cavity disorders and incapable of diagnosing many factors affecting the outcome of infertility treatments. Therefore, all infertile women who are candidate for laparoscopy or those who need expensive infertility treatments are suggested to undergo hysteroscopy before the onset of treatment.

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Introduction

Nearly 15% of couples are infertile and are faced with important physical, psychological, and economic consequences (1, 2). There are different reasons accounting for infertility among which the uterine causes are not really common (15%). Endometrial cavity disorders that can affect the therapeutic outcomes or future pregnancy are present in about 50% of infertile women. Therefore, uterine cavity evaluation is routinely performed on infertile women (3, 4).

Hysterosalpingography (HSG) is one of the primary evaluations in infertile cases and the first step for the assessment of the fallopian tubes, giving reliable information about their patency and morphology. The HSG is an indirect method for the observation of intrauterine cavity. In the HSG, endometrial disorders are distinguished as filling disorders or uterine wall irregularity (5).

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On the other hand, hysteroscopy is a technique facilitating the direct observation of the uterine cavity and biopsy. Hysteroscopy is used as an auxiliary method for suspected uterine cavity disorders in HSG. The combined use of HSG and hysteroscopy can help treat some of the endometrial cavity disorders, such as septum, polyp, submucous myoma, and uterine adhesions.

Although some uterine cavity disorders are not directly responsible for infertility, they can affect the infertility treatment outcomes or future pregnancy (e.g., polyp, submucous myoma, and endometrial adhesions). However, such disorders may not be diagnosed by HSG. Moreover, some cases reported as endometrial disorders in HSG may originate from technical problems or air bubble, and be mistakenly considered as an abnormal finding, thereby affecting the therapeutic process (3).

Previous studies have reported a low sensitivity for HSG as an evaluation method for the diagnosis of the uterine cavity disorders and suggested it to be only used as a screening method. Regarding this, there is a need for the adoption of a better method for definitive diagnosis and prevention of unnecessary interventions in infertile women (5). Overall, most of the infertile women are not really infertile, and their infertility decreases over time; accordingly, many of them will be pregnant without undergoing any therapeutic intervention (6). The women who do not get pregnant after a year or more of intercourse without protection should be evaluated for infertility. However, we should not always assume one year of infertility as a perquisite for evaluation.

Regardless of age and duration of infertility, evaluation should start promptly in a number of cases. The only functional uterine disorder which needs extra attention in the evaluation of infertility is chronic endometritis (7). The HSG accurately evaluates the size and shape of the uterine cavity. This method renders clear images of most of the uterine developmental disorders (e.g., unicorn uterus, septate uterus, bicornuate uterus, and didelphic uterus). In addition, with some exceptions, it facilities the recognition of the majority of submucous myomas and intrauterine adhesions, which may affect the reproduction process (8).

Hysteroscopy is a definitive method for the diagnosis and treatment of intrauterine pathologic disorders, which may exert adverse effects on fertility. This technique allows for the direct observation of the size, shape, and site of intrauterine pathologic disorders and endoscopic surgery (9, 10). Many studies have compared the diagnostic values of HSG and hysteroscopy in the detection of uterine cavity disorders (11). In this regard, Barati et al. reported an incompatibility between the findings of hysteroscopy and those of the HSG and ultrasound findings in 75% of the cases (11, 12).

In another study, HSG was concluded as a proper method for screening; however, it was suggested to use this technique, together with hysteroscopy, for the diagnosis of intrauterine disorders (5, 13). In a study performed by Kumar et al., HSG was reported to have a very low sensitivity. The cases that are mostly difficult to be diagnosed by HSG are reported as uterine septum, endometrial polyp, submucous myoma, and Asherman syndrome (14).

Some authors believe that hysteroscopy is essential to diagnose the uterine cavity disorders that cannot be distinguished through the utilization of HSG (15-18). However, given the invasiveness of hysteroscopy as a diagnostic method, it is needed to further investigate this domain to reach a definitive conclusion in this regard. With this background in mind, the present study was conducted to evaluate the validity and diagnostic value of HSG in comparison with those of hysteroscopy in the detection of uterine cavity disorders among infertile women.

Materials and Methods

This prospective cross-sectional study was conducted in the Gynecology Ward of Imam Reza Hospital affiliated to Mashhad University of Medical Sciences, Mashhad, Iran, within 2013-2014. Considering the similar studies, sample size was estimated as 88 cases using the following formula (d=0.1, p=0.35):

$$\frac{0/35 \times 0/65 \times 1/96^2}{0/1^2} = 88$$

The study population corresponded to a group of infertile women referred to the Gynecology Ward for undergoing hysteroscopy or laparoscopy. These women had already undergone HSG as part of the infertility evaluations. The study protocol was approved by the Institutional Review Board and the Ethics Committee of Mashhad University of Medical Sciences. An informed written consent was obtained from all participants prior to the study enrollment.

The inclusion criteria were: 1) age range of 20-45 years, 2) infertility, 3) implementation of HSG before the operation in the past 6 months, and 4) candidacy for laparoscopy or hysteroscopy. On the other hand, the exclusion criteria included: 1) electrolyte disorder, 2) cervicitis or pelvic inflammatory disease, and 3) pelvic pain. The patients' demographic information was collected using a questionnaire.

All patients underwent hysteroscopy in the operation room under general anesthesia. In case of severe cervical stenosis or impossibility of performing hysteroscopy for any reason, the patient was excluded from the study. Hysteroscopy was performed by the Olympus operative hysteroscope (Olympus Co., Germany). The hysteroscopic expense was paid from the plan's budget for the patients who had been reported to have normal endometrial cavity in HSG and admitted only for laparoscopy. In case of the curability of endometrial cavity pathology by hysteroscopy, surgical treatment was concomitantly performed.

Finally, the study was conducted on 91 patients. The comparison of the hysteroscopic findings with the HSG results was accomplished using SPSS software (version 16). The quantitative variables were analyzed through McNemar's test. P-value less than 0.05 was considered statistically significant.

Results

According to the results, the mean age and mean marriage duration of the participants were 31.456.±6.90 and 9.07.±5.57 years, respectively. Nearly 61.5%, 26.4%, and 12.1% of the women had primary infertility, secondary infertility, and both primary and secondary infertility, respectively. Furthermore, 82.42% of the participants had no pregnancy at all, while 12.1%, 3.3%, and 2.2% of them had one, two, and three children, respectively.

Regarding the history of abortion, 74.7% of the females had no such an experience, while 14.3%, 6.6%, 3.3%, and 1.1% of them had a history of one, two, three, and six abortions, respectively. In addition, 93.4% of the patients had no history of fetal mortality; however, 5.5% and 1.1% of them had one and two cases of fetal death, respectively. In terms of the menstruation period, 22% of the participants had irregular menses, whereas the rest of them had regular periods.

As the data indicated, HSG results were normal in 69.2% of the cases (Table 1). Given the importance of septate uterus among the other investigated disorders, it was reported separately. Among the reported congenital anomalies in HSG, there were 7 (43.75%), 5 (31.25%), and 4 (25%) cases of arcuate, bicornuate, and monocornuate uterus, respectively. Hysteroscopy was normal in 46.2% of the patients (Table 1). Among congenital anomalies observed in hysteroscopy, 1 (16.66%) and 5 cases (83.33%) were detected with arcuate and monocornuate uterus, respectively.

At first, the results of hysteroscopy and HSG were compared in terms of normality or abnormality. (Table 2). Generally, HSG results corresponded with hysteroscopic results in 57.14% of the cases, both of which were normal and abnormal in 36.27% and 20.88% of the cases, respectively. Out of the 91 participants, 30 women had normal HSG, while the hysteroscopic results were reported as abnormal. The most frequent abnormality in

Table 1. Frequency distribution of uterine cavity disorders diagnosed by hysteroscopy and hysterosalpingography

Reported disorder	Hysteroscopy frequency (percentage)	HSG frequency (percentage)
Normal	41 (45.1%)	63 (69.2%)
Polyp	19 (20.9%)	1 (1.1%)
Myoma	0 (0%)	6 (6.6%)
Congenital anomaly (except septum)	5 (5.5%)	15 (16.5%)

Asherman syndrome	13 (14.3%)	4 (4.4%)
Septum	7 (7.7%)	1 (1.1%)
Polyp+Congenital anomaly (except septum)	1 (1.1%)	0 (0%)
Polyp+Asherman	1 (1.1%)	0 (0%)
Polyp+Septum	3 (3.3%)	0 (0%)
Asherman+Septum	1 (1.1%)	0 (0%)
Myoma+Congenital anomaly	0 (0%)	1 (1.1%)
	91 (100%)	91 (100%)

Table 2. Comparison of normal and abnormal cases of hysteroscopy and hysterosalpingography

Hysteroscopy hysterosalpingography	**Normal**	**Abnormal**
Normal	33	30
Abnormal	9	19

Table 3. Frequency distribution of uterine cavity disorders in patients with normal hysterosalpingography and abnormal hysteroscopy (a) and patients with normal hysteroscopy and abnormal hysterosalpingography (b)

Reported disorder in hysteroscopy	**(a) normal HSG and abnormal hysteroscopy**	**(b) abnormal HSG and normal hysteroscopy**
Polyp	13	1
Congenital anomaly	4	6
Asherman	7	0
Septum	3	0
Polyp+Congenital anomaly	1	0
Polyp+Asherman	1	0
Polyp+Septum	1	0
Myoma	0	1
Myoma+Congenital anomaly	0	1
	30	9

HSG: hysterosalpingography

these patients was endometrial polyp (Table 3).

Table 3 presents the patients with abnormal HSG, but normal hysteroscopic results. Congenital abnormality cases in HSG mostly showed normal hysteroscopy. There were 1 case (11.11%) of polyp, 1 case (11.11%) of myoma, and 6 cases (66.66%) of congenital anomalies in HSG reports. According to the obtained results, in the diagnosis of uterine cavity disorders in infertile women, HSG had a sensitivity of 38.78% as compared to hysteroscopy:

$$\frac{19}{49} \times 100 = 38.78\%$$

In addition, this method had the specificity of 78.57% in the diagnosis of uterine cavity disorders in infertile women in comparison with hysteroscopy:

$$\frac{33}{42} \times 100 = 78.57\%$$

The positive predictive value of HSG in comparison with that of hysteroscopy in the diagnosis of uterine cavity disorders in infertile women was obtained as 67.86%:

$$\frac{19}{28} \times 100 = 67.86\%$$

Table 4. Distribution of uterine cavity disorders diagnosed abnormal in both hysterosalpingography and hysteroscopy

HSG	**Hysteroscopy**			
	Septum	**Polyp and Septum**	**Polyp**	**Asherman syndrome**

Septum	-	-	1 (5.27%)	-
Myoma	-	-	2 (10.53%)	2 (10.53%)
Myoma+Congenital anomalies	-	-	1 (5.27%)	-
Congenital anomalies	4 (21%)	2 (10.53%)	2 (10.53%)	1 (5.27%)
Asherman syndrome	-	-	-	4 (21%)

Among 19 cases which were diagnosed abnormal in both methods, HSG diagnosed septum instead of congenital anomaly in 21%; both methods diagnosed Asherman's in 21% of cases.

Additionally, the negative predictive value of HSG in comparison with that of hysteroscopy was estimated as 52.38%:

$$\frac{33}{63} \times 100 = 52.38\%$$

The HSG had the accuracy of 57.14%, in comparison with that of hysteroscopy, in the diagnosis of uterine cavity disorders in infertile women:

$$\frac{52}{91} \times 100 = 57.14\%$$

Besides the matter of normality or abnormality of these two methods, in some cases in which both HSG and hysteroscopic results were abnormal, different disorders were presented (Table 4). Therefore, hysteroscopic results were compared with HSG findings in terms of similarity to fulfill the main purpose of this study.

According to the results, these two methods had an agreement rate of 68.9%. The HSG indicated intrauterine adhesions in one patient and cervical dilatation in another patient. These diagnoses were approved by hysteroscopy. The agreement rates of hysteroscopy with HSG in the diagnosis of Müllerian anomalies, uterine septum/subseptum, endometrial polyps, uterine cavity hypoplasia, and submucous myomas were 40%, 33.3%, 28.5%, 25.0%, and 0%, respectively.

In 50 patients (14.9%), HSG was interpreted to be normal. The comparison of the HSG and hysteroscopic findings in this study showed several differences in abnormal cases, especially in IUA, endometrial polyps, and submucous myomas cases. Furthermore, in 21% of the cases confirmed as abnormal by both methods, HSG diagnosed septum for congenital abnormality. Additionally, in 21% of the cases, both methods detected Asherman syndrome. Based on the results of the McNemar's test, HSG had a significant difference with hysteroscopy in the diagnosis of endometrial cavity disorders (P=0.001).

Discussion

In this study, HSG results were normal in 69.2% of the infertile women, and abnormal in the rest of them. In a study conducted by Barati (2007), 50.4% of the cases had normal HSG results (11). In another study performed in India, HSG results were normal in 73.4% of the cases (13). In a study carried out in Turkey, 78% of the cases had normal HSG results (14). In addition, in a study carried out in Tehran, Iran, HSG results were normal in 53% of the cases (5). In another study conducted in China, HSG results were reported as normal in 36.9 of the cases (19).

In the present study, 30.8% of the cases had abnormal HSG results. In this regard, 16.5%, 6.6%, 4.4% of the patients had congenital uterine anomalies (except for septum), myoma, and Asherman syndrome, respectively. In addition, 1.1% of them had polyp, septum, or myoma concomitant with congenital anomalies. Among the congenital anomalies, which were the most common disorders found in HSG, 43.75%, 31.25%, and 25% of the cases were arcuate, bicornuate, and monocornuate uterus, respectively.

In an Indian study, abnormal cases in HSG included uterine myoma (1.66%), endometrial polyp (1.66%), arcuate uterus (10%), and monocornuate uterus (3.33%) (9). Similar to our study, the most common disorders detected by HSG were congenital anomalies, the most common of which was arcuate uterus. In our study, hysteroscopic results in infertile women were abnormal in most of the cases (54.9%). In line with our findings, in the study of Barati, hysteroscopic results were mostly abnormal (62.63%) [8]. In a study carried out in Tunisia, 75% of the cases had abnormal hysteroscopic

results (20).

On the other hand, in some other studies, hysteroscopic results were normal in the majority of cases. For instance, in the studies conducted in India (9), Ankara (in Turkey; 14), Tehran (15), Spain (5), China (19), and France (21), 66.7%, 66.2%, 61%, 59%, 64%, and in 88% of the hysteroscopic results were normal, respectively (21). The difference between our study and the others may be due to the fact that many of our subjects had been referred for hysteroscopy because of some problems in HSG.

In our study, the disorders in cases with abnormal hysteroscopic results included (in a decreasing order) polyp, Asherman syndrome, septum, and congenital anomalies (except for septum), as well as concomitant polyp and septum, uterine anomaly, and Asherman syndrome. The majority of the reported congenital anomalies (except for septum) were arcuate uterus (83.33%), and the rest of them were monocornuate uterus.

In a study performed in Ahwaz, Iran, hysteroscopic findings were similar to our study from the viewpoint of incidence. In this regard, in the mentioned study, the hysteroscopic findings revealed polyp (61.9%), Asherman syndrome (14.1%), septum (9.4%), small uterine cavity (4.7%), and cervical stenosis (21%) (11).

In the Indian study, hysteroscopic findings were reported as uterine fibroma (6.66%), arcuate uterus (8.33%), and bicornuate uterus (1.66%) (9). In the study carried out in France, the disorders included small adhesions and arcuate uterus (15%), endometrial polyp (23%), and endometrial hyperplasia (30%) (21). In a study performed in Thailand, the hysteroscopic findings included intrauterine adhesions, endometrial polyps, and submucous myoma detected in 23%, 19%, and 9% of the cases, respectively (22).

In our study, HSG results corresponded to hysteroscopic results in the majority of cases (57.14%) in terms of normality or abnormality. Accordingly, both of these methods revealed normal and abnormal results in 37.27% and 20.88% of the cases, respectively. This consistency was also found in a study conducted in Spain in 73% of the cases (5).

In the Indian study, a correspondence of 57.7% was obtained between the HSG and hysteroscopic findings (9), which is close to the rate observed in our study. In the study conducted in China, this rate was reported as 77.2% (19). In Greece, both results were normal and abnormal in 54.7% and 20.1% of the cases, respectively (2). In the study carried out in Turkey, a general correspondence of 68.9% was obtained (11). Furthermore, in another study performed in China, the correspondence rate was reported as 80.2% (23).

In our study, the results among 30 cases with normal HSG but abnormal hysteroscopic results were as follows (in a decreasing order): polyp, uterine congenital anomalies (except for septum), Asherman's syndrome, uterine septum, and accompaniment of polyp with septum, Asherman syndrome, and congenital anomaly. It indicates that in most of the cases, HSG was incapable of diagnosing polyp and Asherman syndrome (14).

In the Spanish study, uterine cavity disorders were reported in 16% of the cases in the group with normal HSG results, and these disorders included disorder in the shape of the uterine cavity (16.31%), polyp (8.10%), endometrial hyperplasia (5.4%), and submucous myoma (2.7%) (5). In our study, HSG revealed uterine congenital anomaly (66.66%), polyp (11.11%), and myoma (11.11%) in women with abnormal HSG and normal hysteroscopy findings. In the Indian study, these cases were uterine fibroma (1.66%) and polyp (1.66%) (9).

In the present study, sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of HSG in the diagnosis of uterine cavity disorders in infertile women were 38.78%, 78.57%, 67.86%, 52.38%, and 57.14%, respectively, in comparison with those of hysteroscopy.

Except for some differences, the results of the important studies investigated this issue are similar to findings (Table 5). In the study carried out in Ahwaz, the results for sensitivity, specificity, and positive predictive value were

Table 5. Diagnostic values of hysterosalpingography and hysteroscopy in important national and international studies

Study [Ref No]	Sensitivity	Specificity	Positive predictive value	Negative predictive value

Current study	38.78%	78.57%	67.86%	52.38%
Ahwaz study (11)	48.9%	87.2%	51.1%	12.8%
Tehran study (15)	55%	68%	41%	60%
Ankara study (14)	21.56%	83.76%	55.26%	70.75%
Indian study (13)	60%	90%	20%	40%
Spanish study (5)	81.2%	80.4%	63.4%	83.7%
Thai study (22)	98%	34.9%	69.9%	72%
Scandinavia (18)	98%	15%	45%	95%

similar; however, the reported negative predictive value (12.8%) was much lower than our result (11). Nonetheless, this value (70.75%) was higher in the study conducted in Ankara, (14).

Regarding the Indian study, the factor that was different from our result was positive predictive value, and the other three factors were similar to our data (13). In the study carried out in Tehran, sensitivity, specificity, positive predictive value, and negative predictive value were 55%, 68%, 41%, and 60% (15), respectively, which are almost similar to our study in all factors, except for sensitivity. In a study performed in Babol, north of Iran, sensitivity and specificity were reported as 71.4% and 92.3% (16), respectively. The specificity reported in the mentioned study was similar to the value obtained in the present study.

The limitation of this study was that some patients only had their HSGs' reports; therefore, they were excluded. The strength of the research was that it was performed in a referral hospital, which is a gynecology laparoscopy center in Mashhad and also the infertility center.

Conclusion

As the findings of the current study indicated, HSG had low sensitivity and specificity, as well as positive and negative predictive values. Consequently, this technique is not accurate for the diagnosis of endometrial cavity disorders and is incapable of diagnosing many uterine cavity disorders affecting infertility treatment outcomes or future pregnancy, such as polyp or Asherman syndrome.

As a result, it is suggested to perform hysteroscopy for infertile women with the diagnosis of uterine intra cavity disorders, especially for those requiring expensive infertility treatments, in order to diagnose and treat the uterine disorders affecting infertility treatment results or future pregnancy with minimum expenses and complications. It is also recommended to perform similar studies using more data.

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Conflicts of interest

The authors declare no conflicts of interest

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