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Evaluation and perspectives on hysterosalpingography (HSG) procedure in infertility: a comprehensive study

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Abstract. – OBJECTIVE: Infertility continues to be a common medical problem with significant societal repercussions and psychological and economic effects on families' lives. Hysterosalpingography (HSG) is the preferred method in clinical practice for evaluating the uterine cavity and tubal patency. Our study aims to present a comprehensive perspective on the importance of the HSG procedure in the evaluation of infertile patients, starting with the recommendation of the HSG procedure to the patient, the application of the procedure, and the evaluation of the patient's post-procedure process.

PATIENTS AND METHODS: This is a prospective evaluation of 323 women who underwent HSG at Kafkas University between 2021-2022. The type and duration of infertility in patients, the source from which the patient received the recommendation for HSG, visual pain score for evaluating pain during the HSG procedure, HSG results, patients' perspectives on the procedure's contribution to the treatment processes, their immediate post-procedure pain, and their pregnancy status within 6 months after the procedure were evaluated.

RESULTS: 72.1% of patients had primary, and 27.8% had secondary infertility. 82% of HSG results were reported as normal. Among primary infertility, uterine pathologies were detected in 62.5%. In secondary infertile patients, tubal pathology was detected in 88.4%. There is a statistically significant difference between the infertility types of patients with normal HSG results and those without (p=0.001). There was also a difference between the results of HSG and follow-up types (p<0.001). A statistical difference was also found between the HSG result and the patients' conception status within 6 months after the procedure (p<0.001).

CONCLUSIONS: When it comes to the cost of the HSG procedure for infertility, as well as potential pain, radiation exposure, and rare allergic reactions to the contrast material, it is important to choose the appropriate circumstances for this procedure. In order to avoid unnecessary interventional procedures, it would be beneficial to discuss the recommendation of HSG for primary infertile patients under 28.5 years of age. Further research is required in this regard. Since tubal factors are most common among secondary infertile women, this group of patients is more likely to benefit from HSG in the evaluation.

Key Words:
Infertility, Hysterosalpingography, Pregnancy, Assisted reproductive techniques, VAS, Reproductive health assessment.

Introduction

Approximately 200 million people worldwide have infertility, mostly in developing countries[1,2]. The strongest factors negatively affecting fertility are increasing female age, lifestyle, and environmental factors. While the prevalence of infertility is 15% in reproductive-age couples, it ranges from 9% to 18% in the general population. Only 35% of patients diagnosed as infertile can get medical help[3,4].

Infertility continues to be a common medical problem with significant societal repercussions and psychological, social, and economic effects on families' lives[5]. Infertility is the inability to conceive despite regular unprotected intercourse for 12 months in a woman under 35 years old and 6 months in a woman over 35. It has subtypes such as primary infertility, secondary infertility, and subfertility[3,6].

Primary infertile women do not have a history of pregnancy. In contrast, secondary infertile women cannot conceive again after a previous pregnancy/pregnancy, regardless of whether they resulted in a live birth. Subfertility, on the other hand, describes decreased fertility with prolonged unwanted delay in conception[7].

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Among the factors that cause female infertility, obesity, increasing age, infection, stress, immunological, endocrine, or genetic causes, anovulatory processes, genital system pathologies, and iatrogenic causes such as previous surgical interventions can be counted. The most common tubal factors (25-30%) and uterine factors (10-15%) are held responsible among the genital system pathologies responsible for the etiopathogenesis of female infertility[8]. Infertility due to tubal occlusion is the most common cause of female infertility, which can make up 30-50% of the cases[9]. Tubal factor-related infertility can have several causes. These include tubal obstruction or blockage at any level, tuberculosis, endosalpingeal destruction, peritubular adhesion resulting from inflammation, pelvic inflammatory disease (PID), endometriosis, ectopic pregnancy, and abdominopelvic surgery. Another factor contributing to tubal factor-related infertility is an infection that occurs after an intrauterine device (IUD) is inserted when asepsis conditions are not properly followed[4]. Endometrial fibroids, polyps, intrauterine adhesions or synechia, and congenital Müllerian anomalies are among the causes of subfertility related to the uterine cavity[10]. Assisted reproductive techniques (ART) are widely used to treat infertility. However, the last alternative, *In Vitro* Fertilization (IVF) and intrauterine insemination (IUI) techniques, are still expensive and have low availability for many families[11]. A detailed evaluation of the patients is important in selecting ART for the treatment planning or treatment of patients with infertility. The necessity of evaluating the female genital system anatomy with a detailed pelvic ultrasound scan in evaluating the patient is indisputable in terms of prognosis and treatment decisions. However, instead of the hysteroscopic laparoscopic chromopertubation procedure, recommended as the gold standard in evaluating the uterine cavity and tubal patency, daily, simple, inexpensive hysterosalpingography (HSG) is the preferred method in clinical practice[10]. HSG is a radiological imaging method to evaluate fallopian tube patency and uterus and cervix morphology[5]. The procedure has 94% sensitivity and 92% specificity[12] in detecting tubal blockade, 90% specificity, and 78% sensitivity in detecting congenital uterine anomalies[13]. The opaque material used during the procedure can also have a therapeutic effect by opening the obstruction in the proximal tuba[14]. Filling defects in HSG may reveal pathologies such as synechia, polyps, submucosal myoma, uterine septum, or endometrial hyperplasia[15,16]. HSG has high sensitivity and specificity in detecting anomalies in the uterine cavity[17]. HSG allows simultaneous visualization of the myometrium and tuba. Despite the risk of ionizing radiation and iodine allergy[18], it remains one of the most frequently used tools to investigate the etiological causes of female infertility in developing countries[19].

In our study, we evaluate the infertility type and infertility duration of patients with infertility, the evaluation of HSG results, as well as the recommendations for the HSG procedure and the patient's perspectives on the procedure, pain scores during the procedure, the ART method preferred in the follow-up of the patients, and pregnancy outcomes. Our study aimed to evaluate the position of the frequently applied HSG procedure in the infertility approach in detail.

Patients and Methods

Selection of the Patient's Group

Our study was carried out with the prospective evaluation of 323 women who underwent HSG in the Department of Obstetrics and Gynecology of Kafkas University between 2021-2022. Ethics approval was obtained for our study from the Ethics Committee of Kafkas University Faculty of Medicine (80576354-050-99/239). All study participants were given detailed information about our study, and their consent was obtained. All our patients signed the informed consent form. HSG procedure was not applied to women with active vaginal bleeding, active cervical and vaginal infection, allergic reaction to the opaque substance used in HSG shots, women with known PID, and pregnancies before the procedure.

Hysterosalpingography

HSG was performed under aseptic conditions and after written consent was obtained. The routine procedure recommended by ACOG[16] was used for HSG, and the same specialist physician performed all procedures. HSG shots were performed in the first 10 days after the last menstrual cycle (between the 4th and 13th days of the menstrual cycle). In this way, the possibility of unintentional irradiation of the developing fetus in an undetected early pregnancy and the possibility of ectopic pregnancy were tried to be prevented. The cervix was visualized by placing the patient supine position on the radiology table where the X-ray was to be taken, disinfection of the perineum and

vagina, and then inserting a sterile Cusco speculum into the vagina. The cervix was stabilized by holding the anterior wall with a tenaculum. Then, a Leech-Wilkinson cannula was placed in the cervical canal, and 10-15 cc of iohexol was injected into the uterus to visualize the cervical canal, uterine cavity, and fallopian tubes. A water-soluble, non-ionic contrast agent (Opaxol) containing three iodines in its structure was used. Six images were taken of the patients who underwent the procedure, the first of which was after the complete injection of the contrast agent; when we assumed that the opaque material had reached the peritoneum, the time taken to complete the procedure with contrast agent injection ranged from 3-30 minutes.

The ages of the patients participating in the study were recorded. We examined women in two groups, below 35 years of age and above, because the period in which natural reproduction is at its maximum level in women is 20-35 years, and the fertility capacity of women over 35 years of age decreases due to decreased ovarian reserve.

Infertility type was questioned as primary and secondary, and the patients' infertility duration was recorded. HSG draws attention as a frequently preferred examination in the approach to infertility. The source of the patients' requests for HSG is an important factor in directing the patients with the correct indication. When the patient was asked about the source of the HSG recommendation, the answers were: health professional, social environment, and social media. The indications for HSG imaging are influenced by social media and environmental cues. Due to these influences, the HSG procedure has become an indispensable step in the evaluation algorithm for infertility, leading to the performance of unnecessary procedures and creating a social problem.

It is known that if HSG is not performed under anesthesia, it can be a painful procedure. The visual analog (VAS) scoring results were evaluated to assess the comfort of the procedure. Immediately after the procedure, VAS was given to the patients so that they could evaluate the pain they felt. The rating on the scale ranged from 1 (minimum, tolerable) to 10 (maximum, intolerable). The patient's HSG results were recorded. For HSG results to be considered normal, all criteria, including normal uterine cavity, normal tubal contour, pouring of bilateral contrast material into the pelvic cavity, and exclusion of tubal blockade, had to be met. While evaluating the HSG results, the results were grouped as normal, unilateral obstruction, t-shape uterus, y-shaped uterus, septum, bilateral obstruction, and submucous myoma. After completing the procedure, the possible contribution of HSG to the infertility process was asked to ensure the active participation of the patients and to reveal their perspectives. They were asked to answer the following statement "I think it contributed to my infertility process" with "I think so", "I am not sure", and "I do not think so". It was thought that revealing the patient's point of view on the procedure performed during the infertility process would provide a perspective on the patient's active contribution to a difficult process such as infertility. The patients were called for control 6 months after the HSG procedure. During this period, it was questioned whether they had applied assisted reproductive techniques such as IVF, IUI and, if so, which one was preferred. If the patients did not use assisted reproductive techniques, it was recorded as a spontaneous follow-up. The pregnancy results of the patients were recorded. Patients who did not come to the controls and could not be reached or refused to be interviewed six months after the procedure were excluded from the study.

Statistical Analysis

Statistical analyses were performed with IBM SPSS 20 statistical analysis program (IBM Corp., Armonk, NY, USA). Data were presented as mean, standard deviation (std), median, minimum (min), maximum (max), percentage, and number. The normal distribution of continuous variables was evaluated with the Shapiro Wilk-W test, Kolmogorov-Smirnov test, Q-Q plot, skewness, and kurtosis. In comparing two independent groups, the Independent Samples *t*-test was used when the normal distribution condition was met, and the Mann-Whitney U test was used if it was not. The Chi-square test was used to compare the two ratios. In 2×2 comparisons between categorical variables, the expected value (>5) was calculated using the Pearson's Chi-square test; if the expected value is between (3-5), the Chi-square Yates was used test and the expected value (<3) was made using the Fisher's Exact test. For comparisons greater than 2×2 between categorical variables, the Pearson's Chi-square test was used when the expected value was >5, and the Fisher-Freeman-Halton test was used when the expected value was <5. Receiver operating characteristic (ROC) analysis was used to determine whether the continuous variable could be used in the diagnosis. Sensitivity and specificity values

Table I. Comparison of the categorical variables with the HSG results.

		HSG			
		Normal n (%)	Anormal n (%)	Chi-square	p
Infertility	Primary	201 (0.758)	32 (0.552)	10.121	0.001
	Secondary	64 (0.242)	26 (0.448)		
The HSG procedure contributes to the treatment process	I believe	223 (0.842)	48 (0.828)	0.353	0.904
	I do not believe	11 (0.042)	3 (0.052)		
	I am not sure	31 (0.117)	7 (0.121)		
IVF/IUI/Spontaneous follow-up	IVF	141 (0.532)	48 (0.828)	19.778	< 0.001
	IUI	51 (0.192)	8 (0.138)		
	Spontaneous follow-up	73 (0.275)	2 (0.034)		
Recommendation source	Health professional	178 (0.672)	38 (0.655)	1.047	0.608
	Social environment	69 (0.26)	14 (0.241)		
	Social media	18 (0.068)	6 (0.103)		
Pregnancy within 6 months of follow-up	Yes	17 (0.064)	13 (0.224)	14.456	< 0.001
	No	248 (0.936)	45 (0.776)		

were calculated for the validity of the diagnostic test results. In addition, Youden-Index was used to determine the cut-off. The statistical significance level was taken as $p<0.05$.

Results

HSG was performed on 323 women in our clinic. Of these women, 72.1% had primary, and 27.8% had secondary infertility. The mean age of our patients was 29.29±6.12 (max: 47, min: 20, median: 28). While 81.4% of these patients were under the age of 35, 18.5% were over the age of 35.

Table I compares the categorical variables with those who had HSG results. These results found a statistically significant difference between the infertility types of patients with normal HSG results and those without ($p=0.001$). More pathological findings were found in the HSG results of patients with secondary infertility. There was also a difference between the results of HSG and IVF/IUI/Spontaneous follow-up ($p<0.001$). Spontaneous follow-up was recommended for 27.5% of people with normal HSG results and 3.4% with abnormal HSG results. A statistical difference was also found between the HSG result and the patients' conception status within 6 months after the procedure ($p<0.001$). There was no difference between the HSG results, the answer to the statement "I think the HSG procedure contributes to the treatment process", and the "recommendation source" variables. The p-values were found to be 0.904 and 0.608, respectively.

The results of 82% of patients who underwent HSG procedures were reported as normal. While the most common pathological finding was a tubal obstruction in 10.9%, uterine anomalies were found in 7.2% (Table II).

Considering the abnormal HSG results, tubal pathology was detected in 37.5% of patients with primary infertility complaints, and uterine pathology was detected in 62.5%. In secondary infertility patients, the rates were tubal pathology at 88.4%, while the uterine pathology rate was 11.6% (Table III).

There was no difference between the results of people with HSG and VAS scores ($p=0.360$). However, a statistically significant result was obtained with the duration of infertility ($p=0.002$).

When we look at the comparison table between HSG results and duration of infertility separately in people with primary and secondary infertility, a statistical difference was found between HSG results and age and duration in individuals with primary infertility ($p=0.003$; $p=0.019$). There was no statistical difference between HSG results and age, VAS, and duration in individuals with secondary infertility ($p=0.975$; $p=0.070$; $p=0.171$) (Table IV).

Table II. Distribution of HSG results.

	N	%
Normal	265	82.0
Unilateral obstruction	27	8.4
T shaped uterus	5	1.5
Y shaped uterus	4	1.2
Septate uterus	12	3.7
Bilateral obstruction	8	2.5
Subserosal myoma	2	0.6
Total	323	100.0

Table III. The relationship of tubal and uterine pathologies with infertility type.

	Primary infertile patient		Secondary infertile patient		Total
	N	%	N	%	n
Tubal pathology	12	37.5	23	88.4	35
Uterine pathology	20	62.5	3	11.6	23
Total	32	100	26	100	58

Table IV. Relationship between HSG results and duration of infertility, age, and VAS results according to infertility type.

	HSG					
	Normal		Anormal			
	Mean ± std	Median (min-max)	Mean ± std	Median (min-max)	*t, z*	*p*
VAS results	5.65 ± 2.13	6 (1-10)	5.16 ± 2.55	6 (1-9)	-0.915	0.36
Infertility duration	2.95 ± 1.53	3 (1-9)	3.43 ± 1.31	3 (1-8)	-3.124	0.002
Primary infertility						
Age	27 ± 4	26 (20-42)	30 ± 5	30 (21-43)	-2.961	0.003
VAS	6 ± 2	6 (1-10)	6 ± 2	7 (1-9)	-0.357	0.721
Duration	2 ± 1	2 (1-7)	3 ± 1	3 (1-5)	-2.353	0.019
Secondary infertility						
Age	35 ± 6	34 (23-45)	35 ± 7	34 (23-47)	-0.031	0.975
VAS	6 ± 2	6 (1-8)	5 ± 3	5 (1-8)	-1.812	0.07
Duration	4 ± 2	5 (1-9)	4 ± 1	4 (3-8)	-1.37	0.171

A statistically significant difference was found between HSG results and age groups (p=0.002). While 32.8% of people with pathological findings from HSG were over 35 years old, 15.5% of people with normal HSG results were over 35 years old (Table V).

In IVF/IUI/Spontaneous follow-up groups, a statistically significant difference was found between IVF and HSG results of patients under 35 years of age and their conception status within six months after the procedure (p<0.001). Similarly, a statistically significant difference was found between the HSG result and the state of being pregnant within six months after the procedure in the IUI group and individuals under 35 years of age (p=0.031) (Table VI).

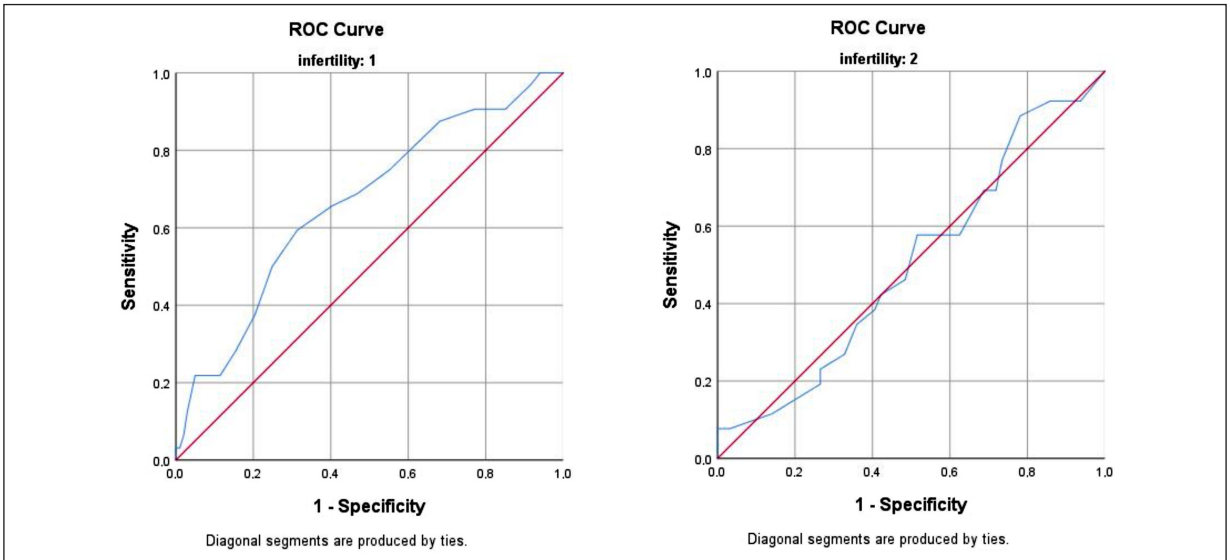
According to the evaluation of the relationship between HSG results and age in individuals with primary and secondary infertility by ROC analysis, it has been observed that there is a significant relationship between HSG results of people with primary infertility and age. However, there is no significant relationship between HSG results and the age of people with secondary infertility. This result means that the necessity of HSG requests in the young (under 28.5 years old) selected group who applied to the physician for primary infertility investigation may be controversial (Figure 1).

Table V. Association of HSG results with age.

		HSG					
		Normal		Anormal			
		N	%	N	%	Chi-square	*p*
Age	< 35	224	84.5%	39	67.2%	9.402	0.002
	> 35	41	15.5%	19	32.8%		

Table VI. Assisted reproductive techniques, age, and pregnancy relationships.

						HSG		
						Normal n (%)	Anormal n (%)	p
IVF/IUI/Spontaneous follow-up	IVF	Age	< 35	Pregnancy within 6 months of follow-up	Yes No	3 (0.029) 99 (0.971)	8 (0.276) 21 (0.724)	< 0.001
			> 35	Pregnancy within 6 months of follow-up	Yes No	0 (0) 39 (1)	1 (0.053) 18 (0.947)	0.328
	IUI	Age	< 35	Pregnancy within 6 months of follow-up	Yes No	3 (0.061) 46 (0.939)	3 (0.375) 5 (0.625)	0.031
			> 35	Pregnancy within 6 months of follow-up	Yes No	0 (0) 2 (1)	0 (0) 0 (0)	NA
	Spontaneous follow-up	Age	< 35	Pregnancy within 6 months of follow-up	Yes No	11 (0.151) 62 (0.849)	1 (0.5) 1 (0.5)	0.296
			> 35	Pregnancy within 6 months of follow-up	Yes No	0 (0) 0 (0)	0 (0) 0 (0)	NA



Infertility	Area Under the Curve (ROC)					
	Area ± Std. Error	95% CI for Area Lower-Upper	p	Cut-off	Sensitivity	Specificity
Primary	0.663 ± 0.052	0.561-0.764	0.003	28.5	0.59	0.69
Secondary	0.502 ± 0.066	0.372-0.632	0.975			

Figure 1. Relationship between HSG results and age in individuals with primary and secondary infertility by ROC analysis.

Discussion

Considering that infertility affects one out of every seven couples, it is clear that it poses a significant burden of health problems on the general population[20]. Infertility due to uterine and tubal obstruction is responsible for more than 30% of all infertility cases[20]. Although laparoscopy combined with chromopertubation accompanying hysteroscopy is the gold standard for evaluating the patency of the uterine cavity and fallopian tubes, HSG, which is an outpatient evaluation, is still more widely used[21].

Primary and secondary infertility incidence differs in different parts of the world. In our study, it was observed that the incidence of primary infertility was higher than secondary infertility. Similarly, Deshpande and Gupta[22] found the incidence of primary infertility higher than that of secondary infertility. While Toufig et al[4] found the incidence of primary and secondary infertility to be equal, Aziz et al[23] and Al-Turki et al[24] found a higher incidence of secondary infertility in their studies.

In their study, Toufig et al[4] and Ibekwe et al[25] divided the women presenting with primary infertility complaints into 3 age groups: 15-25/26/35/36-45. In their study, the authors found the highest rate of infertility among women in the 26-36 age group. They associated this result with the peak of the reproductive period in this age range. We examined women in two groups, below 35 years of age and above, because the period in which natural reproduction is at its maximum level in women is 20-35 years, and the fertility capacity of women over 35 years of age decreases due to decreased ovarian reserve. In our study, it was observed that the rate of admissions with complaints of infertility was 81.4% in the young group under the age of 35.

In their research, Toufig et al[4] and Benksim et al[26] found a significant relationship between age and infertility type. In their studies, primary infertility affected patients younger than 25, while secondary infertility was commonly observed in patients aged 37 years and older. Similarly, in our study, the mean age of women who presented with the complaint of primary infertility and had no HSG finding was 27 (min: 20, max: 42), while the mean age of primary infertile women with pathological findings on HSG was 30 (min: 21, max:

43). The mean age of women who applied with secondary infertility and no pathological findings on HSG was 35 (min: 34, max: 45), while the mean age of women with pathological HSG was 34 (min: 23, max: 47). According to these results, statistical significance was found between infertility, age and duration of infertility of women who were primary infertile and had pathological findings in their HSG. According to the evaluation of the relationship between HSG results and age in individuals with primary and secondary infertility by ROC analysis, it was observed that there was a significant relationship between HSG results of individuals with primary and secondary infertility and age. However, there was no significant relationship between the HSG results of individuals with secondary infertility and age. With our results, we claim that the need for HSG requests in the young age (under 28.5 years) selected group who applied to the physician for primary infertility research is open to discussion. Our HSG results revealed 82% of normal uterine anatomy and normal tubal passage. 201 (75.8%) of patients were primary infertile, and 64 (24.2%) were secondary infertile. The high rate of HSG results of primary infertile women reported as normal anatomy suggests that the application is used excessively and out of indication.

There were 58 patients for whom the HSG result was reported as pathological; 32 (55.2%) were primary, and 26 (44.8%) were admitted with complaints of secondary infertility. While 60.3% of the pathologies detected in HSG were tubal, 39.7% were uterine pathologies. Uterine anomalies were detected in 20 (62.5%) of 32 patients with complaints of primary infertility and whose HSG results were reported pathologically. It can be argued that primary infertile patients with uterine pathologies can be diagnosed with expert ultrasonography (USG) examination and, if necessary, with auxiliary techniques such as saline infusion sonography without needing HSG imaging.

In our study, tubal pathology was the most common pathology. Although the gross pathology in infertile women is related to the deterioration in tubal motility, and therefore it is thought that the HSG procedure will essentially be a more effective diagnostic tool in this group, it is also noteworthy that showing tubal transit does not mean that tubal motility is intact.

Similarly, Okafor et al[27] and Al-Turki et al[24] found the most common tubal pathologies in their studies. On the other hand, Onwuchekwa and Oriji[5] observed more uterine anomalies in their study. Similar to our results, Toufig et al[4] and Aziz et al[23] observed unilateral tubal blockades more than bilateral ones in their studies. While Kitilla[28] reported that distal tubal blockade was observed more frequently than proximal blockade, Adedigba et al[16] reported detecting cornual blockage more frequently. The fact that the location of a tubal blockade in our study needed to be detailed in our HSG reports can be considered a limitation of our study.

HSG is an invasive, uncomfortable, and painful procedure. Considering its high specificity and sensitivity in imaging the uterus and fallopian tubes, the discomfort that HSG will cause due to the pain caused by the patient is often overlooked in terms of physicians and patients. Considering our results, it was revealed that the procedure was painful. However, unlike the study of Stacey et al[29], none of our patients developed vagal symptoms or required hospitalization due to severe pain. The fact that HSG could not be performed on the same day as women's menstrual cycle suggests the possibility that women who underwent the procedure earlier in the cycle may have experienced more pain due to increased uterine activity. The participants stated that the pain was gone in the first hour after the HSG procedure. After the procedure, all patients were prescribed antibiotics and nonsteroidal anti-inflammatories (flurbiprofen). None of the participants reported to the physician for pain complaints for more than 24 hours. All participants were given 10-15 cc of contrast material, and the practicing physician stated that none had any difficulty during catheter passage. Considering the high pain score in our study, performing the procedure under anesthesia could have been considered an option. However, it should not be forgotten that imaging HSG under anesthesia will increase the cost of the procedure and the risks of possible complications.

Our study examined some parameters yet to be evaluated in the literature. Effective evaluation and management of the infertility process can enhance active family participation and promote successful outcomes. This process, which necessitates motivation, relies on accurately assessing each step to ensure optimal results. As a result of our evaluation, 83.9% of the infertility patients who participated in the study believe that the procedure will contribute to the treatment.

When the results are taken into consideration, it is seen that the HSG procedure has a definitive role in infertility assessment tests. For this reason,

ensuring the proper orientation of patients becomes an increasingly significant responsibility. This responsibility led to the need to question the source to which the participants were directed. Patients reported receiving guidance from healthcare professionals at a high rate of 66.8%. According to our results, 34.5% of HSGs recommended by healthcare professionals were reported as normal. This result suggested that healthcare professionals may have an overly positive perception and expectation about the benefits of the HSG procedure or that HSG may be unnecessarily preferred in some patients to evaluate infertility. In addition, 75.9% and 89.7% of the patients who had an HSG with recommendations from the social environment and social media were normal in their results, emphasizing the importance of the physician's recommendation. It also reveals the need for a more careful evaluation of the patients who want an HSG due to other factors besides the physician's recommendation.

In our study, the results of the patients and their applications to ART were also taken into account. Our study referred all patients over 35 with abnormal HSG results to ART. The fact that 102 of the 131 patients under the age of 35 who continue their treatment with the IVF method have normal HSG results questions the importance of HSG as a necessary test in the IVF process. When these rates are evaluated over the age of 35, the HSG results of 39 of 58 IVF patients were found to be normal. Considering that abnormal HSG results are often tubal pathologies in this age group, the necessity of HSG is open to discussion when considering the IVF technique. Considering IUI, 49 of 57 patients under 35 were compatible with a normal HSG result. Although the normal HSG in the IUI technique supports the successful process of IUI, the importance of choosing the right patient comes to the fore in the ART approach rather than having HSG for each patient. In our study, the pregnancy status of the patients was also followed up within 6 months. Pregnancy was detected in 6 patients who underwent IUI, all under the age of 35 and 3 of whom had abnormal HSG results. Pregnancy results were obtained in 12 infertile patients under 35, and 1 had abnormal HSG results. It can be suggested that the therapeutic effect of HSG can be considered an advantage of the possibility of eliminating possible tubal pathologies with the effect of HSG in patients who have not applied IUI and any ART. Our study brings a different perspective to the HSG procedure by evaluating these parameters not available in the literature. HSG is widely used in the evaluation of infertility. HSG is a costly operation. Because this procedure can be painful, it can be an uncomfortable examination. There is also radiation exposure, and allergic reactions may occur due to the contrast material. Taking into consideration the findings of our study in light of these factors, the contribution of HSG to the assessment of reproductive health in patients with primary infertility under the age of 28.5 should be subject to further discussion.

Conclusions

Our study provides a unique perspective on evaluating the HSG process, including patients' application to ART, pregnancy rates, patients' perspectives on the procedure, and reference sources for the procedure, contrary to the common literature.

Despite its limitations, HSG will continue to be utilized by physicians due to its cost-effectiveness, accessibility, short application time, and rapid results. Additionally, there is an exaggerated positive perception of HSG among women influenced by sources such as social media and the immediate environment, leading patients to request the procedure. Since hydrosalpinx and tubal occlusion are the most common risk factors in women with secondary infertility, they are more likely to benefit from the HSG procedure. The effective use of the HSG procedure in infertility evaluation can be possible by directing the patient correctly and avoiding unnecessary procedures.

Conflict of Interest

The authors declare no conflict of interest concerning this article's authorship and/or publication.

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Ethics Approval

Ethics approval was obtained for our study from the Ethics Committee of Kafkas University Faculty of Medicine (Approval date and number; 26/10/2021 and 80576354-050-99/239).

Availability of Data and Materials

The data generated and analyzed during the study are available from the corresponding author. They are not available publicly.

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Authors' Contribution

Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; drafting or revising it critically for important intellectual content. MC raised the presented idea and designed the study. SK, MC and AY collected the data. AY did data analyses. MC and AY wrote a paper. All authors have read and approved the final manuscript.

Informed Consent

Written informed consent was obtained from all patients before inclusion in the study.

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