

HYSTEROSALPINGOGRAPHY

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Abstract

To emphasize the role and value of hysterosalpingography (HSG) as a radiological procedure for investigation of the uterine cavity and the patency of the fallopian tubes.

This is a retrospective study of a group of 43 patients with infertility examined at the University institute of radiology in Skopje, Republic of North Macedonia during a two months period in 2025. The HSG was part of the infertility examination, evaluation and treatment at the University clinic of gynecology and obstetrics in Skopje, Republic of North Macedonia.

The mean age of the 43 patients included in the study was 34.02 years with a range of 20 to 47 years. Most of the participants, 27 (62.8%) had primary infertility. The period of infertility duration was under 5 years in 31 (72.1%) of the women. Hysterosalpingograms showed normal uterine morphology in 31(72.1%) of the included patients, tubal morphology was normal in 35 (81.4%) of the patients, while 42 (97.7%) of the 43 participants had normal cervical findings.

The most prevalent uterine anomaly was the arcuate uterus present in 6 (13.9%) of the patients, while the rarest findings were the hypoplastic and the unicornuate uterus, each presenting in only 1 (2.3%) of the patients. Cervical insufficiency was detected in 15 (34.9%) of the patients.

Patent tubal dilatation and hydrosalpinx were the most common tubal abnormalities, each finding appearing in 3 (7%) of the patients. Normal tubal patency was present in 36 (83.7%) of the included women, while 3 (7%) of the patients had bilateral tubal occlusion.

HSG is a method of choice for demonstration of the uterine endometrial contour, filling of the fallopian tubes and intraperitoneal spillage of contrast with the purpose of establishing tubal patency.

Key words: Hysterosalpingography, female infertility, Fallopian tubes.

Introduction

Infertility, defined as failure to achieve pregnancy within 12 months of unprotected intercourse or therapeutic donor insemination in women younger than 35 years or within 6 months in women older than 35 years affects up to 15% of couples. Common causes of infertility include male factor (45%), ovulation disorders (37%) and tubal damage (18%). A combination of several factors is found in approximately 20 % of all couples [9].

It is common for an infertile woman initially to seek care from her obstetrician–gynecologist. Essential components of an initial workup of female infertility include a review of the medical history, physical examination, and additional tests as indicated. These tests will focus on ovarian reserve, ovulatory function, and structural abnormalities. Imaging of the reproductive organs provides valuable information on conditions that affect fertility, and can detect tubal patency and pelvic pathology and assess ovarian reserve.

One of these imaging modalities is hysterosalpingography (HSG). HSG is a fluoroscopic method in which x-ray images are taken at various stages of the procedure to assess filling, uterine shape, tubal patency, and peritoneal spillage to evaluate the structure of the endometrial cavity and patency of the fallopian tubes. The ability to specifically evaluate fallopian tube patency and endometrial cavity structure is unique to HSG, which is often utilized as a complementary procedure with other imaging modalities (e.g. pelvic ultrasonography, hysteroscopy, or magnetic resonance imaging) to assess anatomic infertility etiologies.

The procedure should be performed in the late follicular phase of the menstrual cycle to ensure that the patient is not pregnant and to prevent false-positive intrauterine filling defects and proximal tubal occlusion due to endometrial thickening. The absolute contraindications for HSG are pregnancy, known contrast allergy, active pelvic infection, recent tubal or uterine surgery, and active vaginal or uterine bleeding.

The pathologies detected on HSG may be classified as tubal, peritubal, uterine/intracavitary, and cervical pathologies. Uterine pathologies can manifest as filling defects or irregular outlines of the uterine cavity. A well-defined filling defect suggests submucosal leiomyoma or endometrial polyp, while ill-defined

filling defect suggests intrauterine adhesion or synechiae.

The procedure also depicts congenital defects, both on the uterus and the tubes. HSG is a first-line diagnostic tool in evaluating tubal patency, with a sensitivity of 76-96%. Tubal occlusion is diagnosed by failure of the contrast dye to traverse the tube and freely spill into the pelvis, which may be due to spasm, infection or congenital anomalies. It manifests as non-opacification of the entire fallopian tube or opacification of the proximal fallopian tube and an abrupt cutoff of contrast medium with non-opacification of the distal fallopian tubes and can be unilateral (left or right) or bilateral. A dilated and fluid-filled tube most commonly represents a hydrosalpinx and is usually the result of peritubal adhesions due to prior pelvic inflammatory disease or pelvic surgery.

HSG also allows evaluation of cervical abnormalities, including both morphological changes, such as stenosis and dilatation and functional issues, such as impaired contrast flow or cervical incompetence [2,6,8,10].

The aim of this study was to emphasize the role and value of HSG as a radiological procedure for investigation of the uterine cavity and the patency of the fallopian tubes and its clinical importance in diagnosing and properly categorizing each uterine and tubal abnormality.

Materials and methods

This is a retrospective study of the HSG findings in a group of 43 patients with infertility examined at the University Institute of Radiology in Skopje, Republic of North Macedonia during a two months period in 2025. All of the patients were referred to our institute by the University Clinic of Gynecology and Obstetrics in Skopje as part of the infertility examination, evaluation and treatment at the clinic.

Before performing the HSG several key gynecological assessments were conducted to ensure the patients were suitable for the procedure and to gather essential information about their reproductive health. These evaluations helped identify any underlying conditions that might affect the procedure's outcome or interpretation. First, a detailed medical and gynecological history was taken.

This included information about the patient's menstrual cycle, previous pregnancies, surgeries, any history of sexually transmitted infections (STIs), and symptoms like pelvic pain or abnormal bleeding. Hormonal profiles were also assessed, including tests for FSH, LH, AMH, estradiol, and progesterone, to evaluate ovarian function and reserve.

Additionally, thyroid and prolactin levels were checked to rule out any endocrine imbalances. Transvaginal ultrasound was done to check for uterine anomalies, fibroids, polyps, ovarian cysts, and to assess markers of ovarian reserve, like the antral follicle count. Cervical exams and Pap smears were also carried out to rule out any cervical infections or abnormalities.

STI (sexually transmitted infections) screening was done for all patients to ensure no infections were present. Furthermore, all of the patients were carefully screened for any contraindications to HSG, such as active infections or a positive pregnancy test.

The patients were informed about the procedure's purpose, potential risks, and what to expect, and they provided written consent on the day of the procedure. They were scheduled in the second week of their menstrual cycles due to the earlier stated reasons. The procedure itself is relatively quick, typically lasting about 15 to 30 minutes.

After preparing and positioning each patient on the exam table similar to a routine pelvic, gynecologic examination, a catheter was carefully inserted through the cervix inside the uterine cavity under sterile conditions to minimize the risk of infection.

Then, a water-soluble iodine contrast medium was applied under fluoroscopic control. We used 10-20 ml of contrast medium in each of the patients.

Three radiographs were taken during and after contrast administration in every patient, with the purpose of evaluating the uterine filling and morphology, the tubal outlining and the spillage of contrast medium in the abdominal cavity.

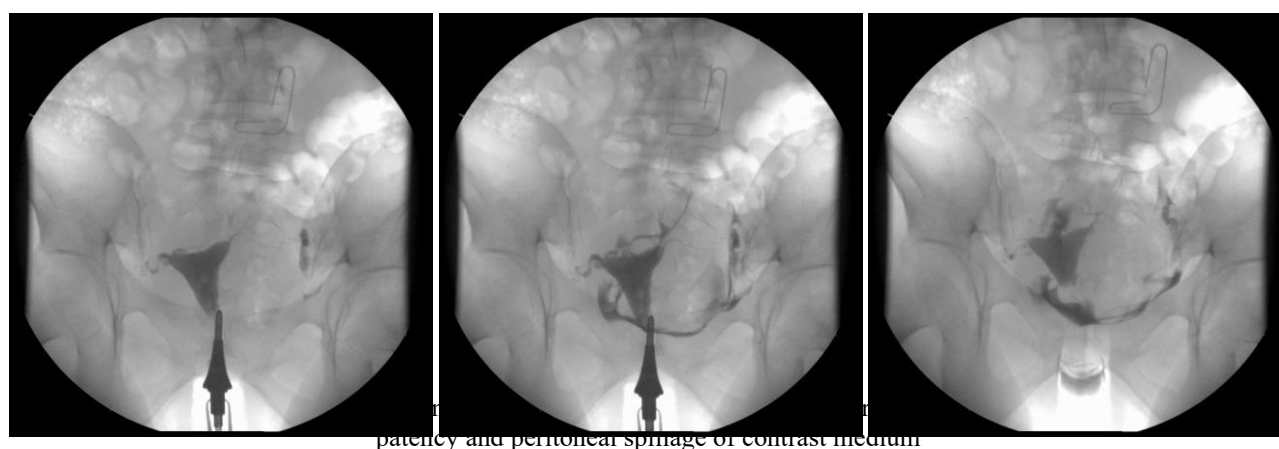
After finishing the procedure the patients were hospitalized for 24 hours for observation, allowing the medical team to monitor for any potential complications or reactions, ensuring patient safety and addressing any issues that may arise post-procedure.

Results

The mean age of the 43 patients included in the study was 34.02 years with a range of 20 to 47 years. A total of 14 patients (32.6%) belonged to the 25-30 age-group, making it the most prevalent. Most of the participants, 27 (62.8%) had primary infertility. The period of infertility duration was under 5 years in 31 (72.1%) of the women, while the other 12 (27.9%) patients presented with a history of infertility lasting over 5 years. This HSG was the first for 40 (93%) of the patients, with the other 3 (7%) had undergone the procedure before.

Table 1. Age distribution in groups

Patient's age	≤ 25 yo	26-30 yo	31-35 yo	36-40 yo	41-45 yo	≥ 45 yo
Number of patients	4	14	9	9	6	1



Hysterosalpingograms showed normal uterine morphology in 31 (72.1%) of the included patients, tubal morphology was normal in 35 (81.4%) of the patients, while 42 (97.7%) of the 43 participants had normal cervical findings. The most prevalent uterine anomaly was the arcuate uterus present in 6 (13.9 %) of the patients, followed by the bicornuate uterus – 4 (9.3%), while the rarest findings were the hypoplastic and the unicornuate uterus, each presenting in only 1 (2.3%) of the patients.

Cervical insufficiency was detected in 15 (34.9%) of the patients, with cervical dilatation observed in only 1 of them (2.3%).

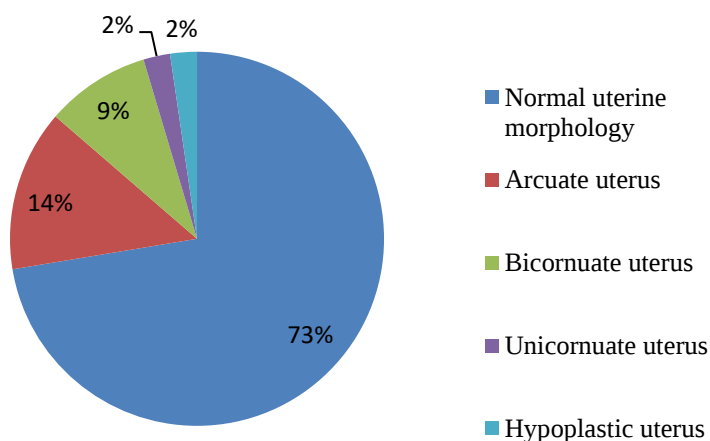


Fig. 2. Distribution of uterine anomalies among the patients.



Fig. 3 Arcuate uterus



Fig. 4 Bicornuate uterus



Fig. 5 Unicornuate uterus

Most of the included patients, 35 (81.4%) had normal morphology of both Fallopian tubes. Patent tubal dilatation and hydrosalpinx were the most common tubal abnormalities, each finding appearing in 3(7%) of the patients. 1 (2.3%) patient had a normal tube morphology as part of the unicornuate uterus. Salpingectomy was registered in 2 (4.7%) of the patients, with one having normal morphology of the remaining tube, and the other presenting with hydrosalpinx on the second tube.

Normal tubal patency was present in 36 (83.7%) of the included women, 4 (9.3%) patients had one patent tube, while 3 (7%) of the patients had bilateral tubal occlusion.

Intravasation of contrast medium was detected in the uterine wall in only 1 (2.3%) of the included patients.



Fig. 6 Bilateral tubal occlusion

Table 2. Distribution of Fallopian tubes findings among patients

Tubal morphology	Normal tubal morphology	Hydrosalpinx	Dilated patent tubes	Normal tubal morphology correlated with unicornuate uterus	St. post sal-pingetomiam
Number of patients	35 (81.4%)	3 (7%)	3 (7%)	1 (2.3%)	2 (4.7%)

Table 2. Distribution of Fallopian tubes findings among patients

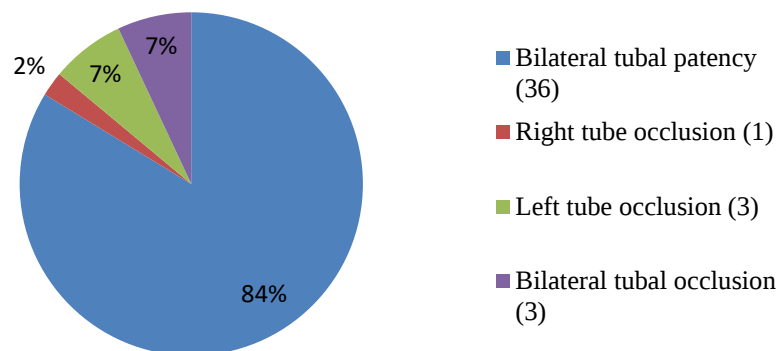


Fig. 7. Distribution of Fallopian tubes' patency among the patients

The majority of the patients, 25 (58.1%) had no prior medical intervention in the pelvic region. A total of 7 (16.3%) patients had a history of Cesarean section, surgical intervention due to an ovarian tumor was registered in 5 (11.6%) of the included patients, 2 (4.7%) had previously undergone unilateral salpingectomy due to an ovarian tumor and ectopic pregnancy, while myomectomy was present in 1 (2.3%) patients. Intrauterine-related medical procedures were present in 7 (16.3%) of the patients, with fractional endometrial curettage (FEC) registered in 5 (11.6%) and surgical abortion in 2 (4.7%) of the patients.

Table 3. Distribution of prior medical interventions in the pelvic region

Type of intervention	No prior history	Cesarean section	Ovarian tumor surgery	Unilateral salpin- gectomy	Myo- mectomy	FEC	Surgical abortion
Number of patients	25 (58.1%)	7 (16.3%)	5 (11.6%)	2 (4.7%)	1 (2.3%)	5 (11.6%)	2 (4.7%)

Table 3. Distribution of prior medical interventions in the pelvic region

Discussion

Infertility is a significant issue that can have profound emotional, financial, and at times, traumatic impacts on patients. HSG is one of the first line imaging modalities used for infertility evaluation, being mainly used to outline the uterine cavity and to assess tubal patency. In the present study, HSG findings indicated that 72.1% of participants had normal uterine morphology, 81.4% had normal tubal morphology, and 97.7% exhibited normal cervical findings.

A study conducted by Panda and Calpana showed that 76.4% of patients had a normal uterine cavity on HSG, a figure closely aligned with the 72.1% observed in our study [7].

Ibinaiye et al. also found similar results, with normal uterine cavity present on HSG in 75.9% of the patients [3]. This reinforces the reliability of HSG as a non-invasive first-line investigation in identifying gross uterine anomalies and suggests comparable diagnostic yield across studies conducted in different settings.

When comparing the types and frequencies of uterine anomalies identified on HSG, our results show both similarities and differences with those reported by Panda and Kalpana. In their study, the bicornuate uterus was seen in 5.73% of cases, the hypoplastic uterus in 2.54%, and the arcuate uterus in just 1.27% of patients [7].

In contrast, we observed a slightly higher incidence of bicornuate uterus at 9.3%, a comparable rate of hypoplastic uterus at 2.3%, and a markedly higher frequency of arcuate uterus, which was the most common anomaly in our series at 13.9%. This notably higher detection of arcuate uterus may be due to increased sensitivity in identifying subtle anatomical variants, possibly influenced by improved imaging quality or a higher index of suspicion among radiologists.

Alternatively, it could reflect a genuine variation in prevalence within our population, potentially related to genetic or regional factors. On the other hand, the arcuate uterus was similarly the most common anomaly in the Makwe et al. study, with a higher rate of appearance in the patients of 18.5% [4].

This finding, alongside the similar rates of bicornuate and hypoplastic uteri in our study, which are relatively consistent with those of Panda and Kalpana may suggest that some congenital anomalies may have a stable baseline occurrence across different populations.

Regarding tubal patency, we observed that 83.7% of women had normal bilateral tubal patency, 9.3 % off all patients had one patent tube, and 7% experienced bilateral tubal occlusion. Of the 7 patients with tubal occlusion present (16.3%), 4 (57.1%) had only one blocked tube, while bilateral tubal occlusion was detected in 3 (42.9%) of the subjects.

The results of our study show a higher rate of bilateral tubal patency (83.7%) compared to Choudhury et al. (69.4%) and Muhammad et al. (60.4%). Regarding unilateral tubal patency, our study found a lower rate of 9%, which is significantly less than Choudhury et al. (14.5%) and Muhammad et al. (22.9%). Additionally, the prevalence of bilateral tubal occlusion in our study was only 7%, which is much lower than the 16.1% reported by Choudhury et al. and 16.7% by Muhammad et al. Overall, the differences in findings between the studies could be attributed to the distinct characteristics of the populations studied, including factors such as age, health history, and geographical variations.

These results highlight the importance of considering local epidemiological factors when assessing tubal infertility and the utility of hysterosalpingography as a diagnostic tool. Other possible factors for this may be the procedure technic (e.g. the use spasmolytic agents) and the level of patient relaxation, considering that Fallopian tube spasms can significantly influence tubal patency [1,5].

Understanding the role of prior medical interventions is crucial, as such procedures can influence reproductive health outcomes.

For instance, Cesarean sections, ovarian surgeries, salpingectomies, and uterine procedures like curettage can have varying impacts on fertility. These interventions may affect uterine integrity, tubal patency, and ovarian function, thereby influencing infertility assessments and treatment outcomes.

In our study 18 (41.9%) of the patients had a history of medical intervention in the pelvic region, presented in table no. 3.

We have correlated the interventions history with tubal patency finding in each patient, and found no tubal occlusion in the patients that had undergone an intrauterine-related procedure (FEC, surgical (vacuum-assisted) abortion). Out of the 7 patients with a prior history of Cesarean Section, 1(14.3%) had bilateral tubal occlusion. 1 of 5 patients (20%) who had previously had laparoscopic ovarian tumor surgery had unilateral tubal occlusion, and the only patient that had undergone open myomectomy had also unilateral tubal occlusion. The other 15 patients (83.3%) of the group that had a history of medical interventions in the pelvic region had normal, bilateral tubal patency.

Our data indicate that a history of pelvic surgeries, such as Cesarean section and laparoscopic ovarian tumor surgery or intrauterine procedures, does not significantly impair tubal patency in the majority of patients. We cannot comment on the effect of open myomectomy, since only one patient in the study had such prior surgery. However, further research with larger sample sizes is necessary to confirm these findings and refine clinical guidelines.

Conclusion

In this study, hysterosalpingography (HSG) was utilized as a primary imaging modality to evaluate uterine and tubal factors in women undergoing infertility assessment. The procedure was performed using standard fluoroscopic techniques with contrast media to assess the contour of the uterine cavity and the patency of the fallopian tubes.

Our findings revealed a range of abnormalities, including unilateral and bilateral tubal occlusion, hydrosalpinx, and uterine congenital malformations.

A significant proportion of patients exhibited normal bilateral tubal patency, underscoring the importance of HSG in differentiating between structural and non-structural causes of infertility.

HSG remains a valuable, minimally invasive, and cost-effective diagnostic tool in the initial evaluation of female infertility. It provides essential information about uterine and tubal anatomy, which directly impacts clinical decision-making and the selection of appropriate fertility treatments.

Early identification of abnormalities through HSG can facilitate timely intervention and improve reproductive outcomes.

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