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Research Article

Diagnostic Value of Hysterosalpingography

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Abstract

Objective: Hysterosalpingography (HSG) is a contrast-enhanced, radiographic examination method of the internal female reproductive organs, which is used in the context of infertility diagnostics for the clarification of uterine malformations. The aim of this study was to investigate the significance of HSG as a diagnostic method in reproductive medicine.

Methods: The results of HSG examinations from the Clinic for Reproductive Medicine and Andrology of the University Hospital Halle (Saale) between 2006 and 2020 were retrospectively examined.

Results: Normal uterine findings were diagnosed by HSG in 151(51.01%) patients. The most common uterine malformation was uterus arcuatus, which was found in 46 patients (15.54%); 30(10.14%) patients had uterus bicornis unicollis. Uterus bicornis, unicornis, and subseptus were present in 5(1.69%) patients each. A duplex uterus was detected in 3(1.01%) patients, and malformations of a uterus arcuatum unicollis, uterus septus, bicornis subseptus, and uterus corpora in case of sectio bicornis were detected in 1(0.34%) patient each. A comparison of HSG findings with those from initial baseline diagnostics (gynecologic manual examination, sonography, etc.) revealed a correlation of findings in 105 cases (35.84%) and divergence of findings in 79 cases (26.96%). With the assistance of the HSG findings, further specification of the previously collected findings was achieved in 27 cases (9.22%). The diagnostic significance of HSG in reproductive medicine was demonstrated by the fact that findings were obtained and could not be detected in the preliminary examinations. In addition, basic diagnostic findings were confirmed by HSG, and conversely, previously collected findings could be further specified. HSG is a less invasive diagnostic imaging procedure

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with a short examination time. The fluoroscopy time is usually only a few seconds. Therefore, the radiation exposure is negligible.

Conclusion: HSG is a method of radiologic examination that can be used to diagnose and specify uterine malformations. The diagnosis by HSG often opens up new therapeutic options to correct uterine malformations.

Keywords: Uterine malformations; Infertility; Reproductive organs; Abortion; Hysterosalpingography; Radiation exposure; Contrast medium.

Introduction

Uterine malformations can cause infertility. Uterus subseptus is the most common malformation diagnosis [1]. In uterus subseptus, there is an outwardly, often normally shaped, usually somewhat wider protruding uterus with a sagittal septum that does not divide the entire length of the cavum uteri. This septum is longer than in uterus arcuatus but shorter than in uterus septus [2]. Uterus arcuatus is considered to be the mildest form of uterine malformation.

In uterus septus, the septum extends downward from the fundus into the vagina. It is not uncommon for this malformation to be combined with a vaginal septum [2]. Partial or complete absence of fusion of the lower part of the two paramesonephric ducts (Müller ducts) or incomplete development (atresia) of one of the two paramesonephric ducts is responsible for the formation of a uterus bicornis uni- or bicollis with or without duplication of the vagina. Uterus bicornis unicollis is the most common form [2]. In patients diagnosed with bicornis uteri, metroplasty can increase the chance of successful pregnancy and delivery and decrease the risk of miscarriage [2]. In unicornis uterus, the rudimentary horn must be surgically removed if it contains endometrium. If the rudimentary horn is absent, surgical correction is not necessary to allow a successful pregnancy with few complications and to reduce the abortion rate [2].

Hysterosalpingography (HSG) is an established procedure for the diagnosis of uterine malformations in the Clinic for Reproductive Medicine and Andrology at the University Hospital in Halle. In addition to visualizing uterine anomalies and testing for tubal patency in the context of obstructive diseases (e.g., inflammatory adhesions, tubal endometriosis), HSG also allows for monitoring of success after tubal sterilization. HSG is performed when a clear diagnosis cannot be made with the help of basic diagnostics (e.g., sonography, manual examination). Thus, it is part of a step-by-step diagnosis and is primarily used for additional diagnostics and for confirming the diagnosis. Patients who undergo HSG include particular women with infertility problems, suspected uterine anomalies, or tubal adhesions or blockages.

As compared with other diagnostic procedures, one special feature of HSG is the possibility of assessing the temporal dynamics of the outflow of contrast medium through the tubes. This provides HSG a high diagnostic value with regard to the assessment of patency and condition of the

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tubal lumen. Radiation exposure of the female reproductive organs is unavoidable in conventional HSG but is reduced to an acceptable minimum by short fluoroscopy times and specially adapted examination modes. Contrast agent allergy (premedication in advance, if necessary), shortly after a cesarean or tubal operation, represent a relative contraindication; pregnancy, fever, genital infection, and menstruation represent absolute contraindications to HSG. Alternatives to conventional HSG include HSG by magnetic resonance imaging (MR-HSG), endovaginal three-dimensional ultrasound (with contrast), and laparoscopy (invasive; better assessment of adhesions). An advantage of MR-HSG is the high informative value of the procedure, even without the need for radiation exposure. However, MR-HSG is a cost and time-intensive method and is performed only at a few centers. It is especially useful for patients with contraindications to magnetic resonance imaging, such as those with pacemakers, heart valves, and so forth.

Methods

A total of 293 patients underwent HSG between 2006 and 2020 at the Clinic for Reproductive Medicine and Andrology of the University Hospital in Halle (Saale). All patients were of childbearing age (20–42years) at the time of HSG. The study inclusion criterion was a complete baseline gynecologic diagnosis. Exclusion criteria for HSG were pregnancy occurring at short notice at the scheduled HSG date or patients in whom HSG was interrupted due to pain, bleeding, or circulatory complications. An experienced senior physician in gynecology and an experienced radiologic specialist performed the HSG examinations in each case in a standardized manner. Before the examination, a detailed explanation of the procedure and complications (slight bleeding, injuries caused by inserted instruments, infections) was provided. Patients, who were undressed, were fasted, and had empty urinary bladders, were positioned in the lithotomy position on the bucky table of the Siemens Axiom Luminos drf fluoroscopy unit. The gynecologist subsequently disinfected the portio and vagina and fixated the anterior and inferior cervical lips using ball forceps. After the gynecologist inserted the Schultze apparatus, approximately 10mL of Ultravist 300 was injected carefully into the uterus. The course of the contrast medium was observed by the radiologist under fluoroscopy on a monitor and documented digitally. A late image followed at 15 to 30minutes after contrast medium injection.

This image showed the distribution of the contrast medium in the peritoneum. The water-soluble KM normally leaks through both tubes into the peritoneal cavity, where it is then absorbed by the peritoneum. Excretion of the contrast agent is renal. The usual duration of the HSG examination is 5minutes or less, and the fluoroscopy time is short (<10 seconds); thus, the effective radiation exposure is low. The radiation doses during HSG were measured (including during constancy testing of the used fluoroscopy equipment) by chipstrate dosimeters (LPS-TLD-TD03) of the Landesanstalt für Personendosimetrie und Strahlenschutzausbildung (LPS Berlin, Germany) [3].

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The thermoluminescence dosimeters (TLDs) by the LPS was evaluated, using a HARSHAW 6600 CCD automatic TLD reader from Thermo Fisher Scientific (Waltham, MA, USA). Next, the TLDs were placed centrally in the beam path, on the lower abdomen of the patients. Lithium fluoride tablets XD-700 from Thermo Fisher Scientific were used as the thermoluminophore. Ionizing radiation traps electrons in excited states in the TLD. When the dosimeters are heated, the electrons recombine, and the LiF emits visible light. The amount of light is proportional to the absorbed energy over a wide range. The measurement range of the TLDs is from 0.05mSv to 1,000mSv. The uncertainty of the measurement is given as 5% [4]. The area dose product from the determined dose values (by multiplying the useful radiation area and the dose) was calculated. The area dose product was determined in the evaluation as a measure of individual radiation exposure for each patient. Excel version 2010 was used for the statistical analysis of collected data.

Results

No current studies exist examining the diagnostic value of hysterosalpingography, the advantages and disadvantages of the examination, or the gain in knowledge. This retrospective study shows the importance of HSG based on an extensive collection of patients from the Clinic for Reproductive Medicine and Andrology and the University and Polyclinic for Radiology, Halle (Saale), between 2006 and 2020.

Figure 1 summarizes the results of the frequency distribution in this study. The most common uterine normal finding diagnosed by HSG in the study collective was present in 151(51.01%) of patients.

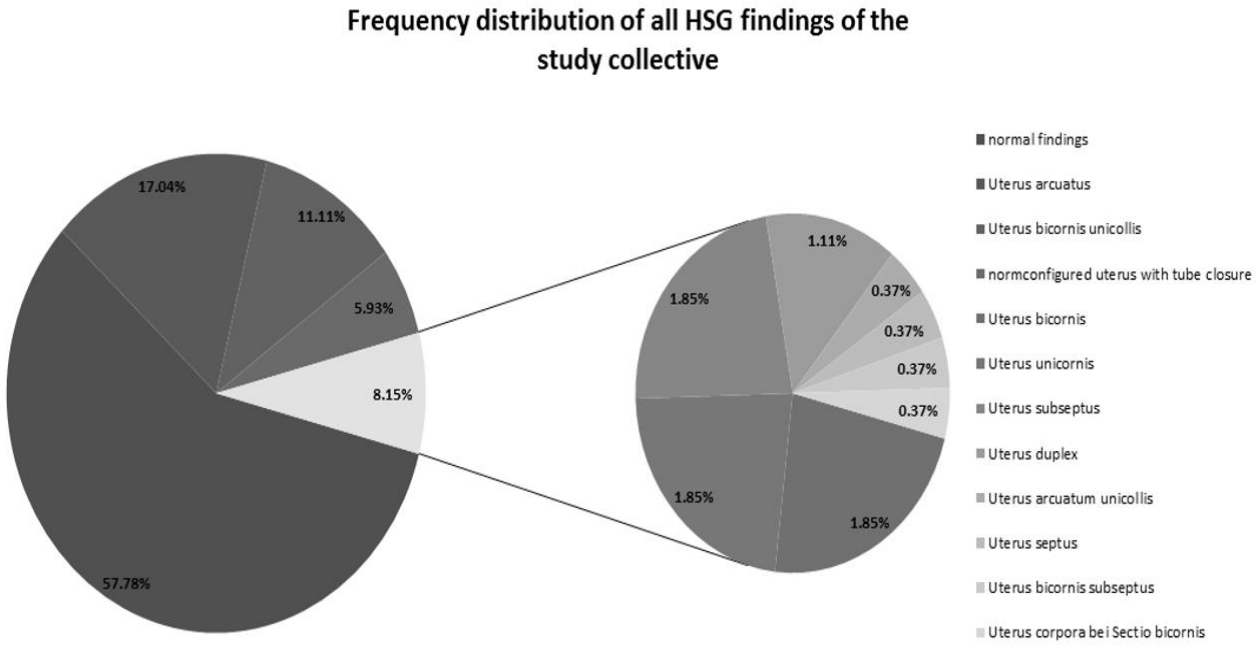

Figure 1: Frequency distribution of HSG findings.

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The most frequent uterine malformation was uterus arcuatus, found in 46 patients (15.54%); 30(10,14%) patients presented with uterus bicornis unicollis. Uterus bicornis, unicornis, and subseptus were present in 5(1.69%) patients each. A duplex uterus was detected in 3(1.01%) patients, and malformations of a uterus arcuatum unicollis, uterus septus, bicornis subseptus, and uterus corpora in case of sectio bicornis were detected in 1(0.34%) patient each. Preliminary examinations were performed before HSG. These included invasive diagnostic laparoscopies and hysteroscopies as well as noninvasive ultrasound examinations. When comparing the findings from the prebaseline diagnostics with those from HSG, a correlation in 105 cases was detected (35.84%). The most correlations were found in the diagnosis of a normal finding in 97 cases (35.40%). The most frequent malformation, which was most frequently detected in both the preliminary examinations and HSG, was a normoconfigured uterus with closure of the tubes in 3 cases (1.1%). A divergence in findings was noted in 79 cases (26.96%). Divergence between findings was most common in uterine malformation, namely, uterus arcuatus in 25 cases (9.1%). In 56 cases (19.11%), HSG was performed because the preliminary examinations revealed an unclear finding that could not be adequately clarified with the help of basic diagnostics. In 27 cases (9.22%), HSG was used to further specify the previously obtained findings. Table 1 provides an overview of the classification of the HSG findings in the study population.

Classification of all HSG findings of the study collective		
Number of patients	293	
Number of categories	5	
Number of findings on the 293 patients	293	100
Classification	**Frequency**	**(%)**
Correlation between HSG and preliminary examination most commonly: Normal findings Uterus with tubal occlusion	105	35.84
	97	35.40
	3	1.10
Divergence between HSG findings and preliminary examination	79	26.96
HSG due to unclear findings in preliminary examination	56	19.11
Further specification of the findings by the HSG	27	9.22
No clear diagnosis by the HSG	26	8.87

Table 1: Classification of the HSG findings.

Tubal occlusions naturally play a significant role in the impossibility of a successful pregnancy. In 16 patients of the current study, HSG revealed a normal configured uterus with unilateral or bilateral tubal occlusion, with 12 miscarriages (2.80%). Seven patients (2.39%) with tubal occlusion suffered from primary or secondary infertility. In general,

uterine malformations and tubal occlusions were diagnosed in invasive laparoscopic procedures. HSG, conversely, provides a noninvasive diagnosis of tubal occlusion with few complications. The presence of uterine malformations increases abortion rates. A total of 56 miscarriages occurred in patients with uterus arcuatus malformation (13.05%), the most commonly diagnosed anomaly in the study. Patients with uterus bicornis unicollis failed to conceive in 24 cases (5.59%). HSG, as a low-invasive diagnostic imaging procedure, is characterized by the short examination time and radiation exposure, as the fluoroscopy time is typically only a few seconds. Thus, the radiation exposure is negligible and justified in terms of diagnostic gain.

Discussion

Between 2006 and 2020, 293 patients from the Clinic for Reproductive Medicine and Andrology underwent HSG. Uterine malformations were detected in 142 patients during HSG. All patients suffered from primary or secondary infertility. Of the 293 patients, 101 had not yet achieved a successful pregnancy. In total, 429 miscarriages occurred in the 293 patients in the study cohort. HSG demonstrates the advantage of being a noninvasive method for quickly and safely diagnosis uterine malformations. In contrast to sonography, HSG allows an accurate estimation of the anatomy. Abnormalities in the female internal reproductive organs can be better detected. Because of the dynamics of the contrast medium, good accessibility of the tubes and a more precise specification of the diagnoses are made possible. Also, HSG can be used for therapeutic purposes. The removal of occluding mucus plugs from the tubal lumen by contrast medium perfusion is considered a positive side effect that can possibly enable contraception. Despite the short examination and fluoroscopy time of HSG, the radiation to which patients are exposed during the examination is a disadvantage. In a few cases, as shown in Table 1, inconclusive findings occurred in the present study population. This was due to the superimposition of surrounding structures, the uterus, and the tubes. HSG is a contrast-enhanced examination.

In the present study, a nonionic iodine-containing contrast agent was used (Ultravist). The use of contrast agent allows visualization of the reproductive organs and abnormalities of the uterus and tubes. In rare cases, side effects and complications may occur in the course of contrast agent application. Complications during HSG include pain and bleeding. Often, HSG has been terminated prematurely because of severe pain or nonstop bleeding. Before HSG can be performed, the examining physician must always consider whether the radiation exposure involved in using X-rays is justified. The dose area product was used to determine the risk of radiation exposure during an X-ray examination [5]. The “normal distribution” hypothesis using the Shapiro–Wilk significance test was tested [6], at the 5% level. In this study, the average examination duration with X-rays was 8.59seconds. This resulted in an average area dose product of 9.91 $\mu Gy^{*}m^{2}$, with a simple standard deviation of 5.54 $\mu Gy^{*}m^{2}$. Data from the work of the High Medical Faculty of the Ruhr University of Bochum (RUB) yielded a median area dose

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product of 6.95 ± 0.18cGy-cm² per second of exposure duration or 12.1 ± 0.1cGy-cm² per image. For an average 2-second examination with a mean of 25.5 images, the area dose product was 322.5 ± 2.6cGy-cm² [7]. The comparison of the two mean values and their standard deviations indicated that the radiation exposure of the present work was lower than in the study of the RUB.

In their 2007 recommendation, the International Commission on Radiological Protection used the linear no threshold model as a conservative estimate of the effect of small doses. This model assumes a linear relationship between the dose and risk of cancer incidence without a threshold even at small doses. Ionizing radiation is always considered harmful, and the sum of multiple small exposures is considered to pose the same risk as a single larger exposure [8]. However, at small doses, correlating radiation with any biological effects is virtually impossible [8].

In the studies discussed here, the radiation doses using HSG were determined to fall within this dose range. After the diagnosis of uterine malformation, surgical intervention can be used to increase the chance of a successful pregnancy and minimize the risk of miscarriage. In uterus subseptus and uterus septus, the septum can be removed surgically by septal dissection. In uterus bicornis unicollis, the existing rudimentary horn can be removed. In patients with uterus bicornis, a possibility of surgical therapy exists using abdominal metroplasty [9]. The number of women who were able to achieve a successful pregnancy after HSG was not clearly provable based on the records. After HSG, patients were recommended to undergo surgical intervention to correct the detected uterine malformation. As reported by Geibel and Rimbach, surgical correction results in a high percentage of successful pregnancies [9].

In contrast to basic diagnostic procedures, HSG often allows for an accurate assessment of anatomy and the detection of the possible presence of abnormalities in the female internal reproductive organs. In particular, the dynamics of the contrast medium, for example, in contrast to conventional ultrasound, allow for a good assessment of the tubes and, in some cases, accurate specification of diagnoses. Because of the overlap with other structures, the possibility exists that no definite diagnosis can be made. Some authors reported that the positive side effect of HSG with regard to improving the probability of conception is the removal of occluding mucus plugs from the tubal lumen by contrast perfusion. However, this effect was not observed in current study population. Similarly, typical side effects of HSG (such as tubal spasm and pain) occurred in only isolated cases in our own patient population.

Conclusion

In sum, the advantages of HSG clearly outweigh its disadvantages (e.g., radiation exposure). Hysterosalpingography can be used to clarify the anatomical changes in the area of the internal reproductive organs, which are often the cause of infertility in women, with a high degree of sensitivity and specificity. The diagnosis by HSG often opens up new therapeutic options (e.g., surgical revision of certain anomalies and adhesions) to fulfill the desire for a child.

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References

1. Thomas R, Frank N. Uterine Fehlbildungen, Reproduktionsmedizin, Springer Verlag, Springer Medizin Verlag, Heidelberg. 2019.
2. Deutsche Gesellschaft für Gynäkologie und Geburtshilfe, Ö. G. f. G. u. G, Schweizerische Gesellschaft für Gynäkologie und Geburtshilfe. Weibliche genitale Fehlbildungen. In Fehlbildungen des Uterus. 2020:115-28.
3. Engelhardt DJ. Technisches Datenblatt für das Chipstratedosimeter (LPS-TLD-TD 03). LPS-Berlin. 2015.
4. Schimka S. Persönliche Information, LPS Berlin. 2021.
5. Freyschmidt J, Schmidt T. Handbuch diagnostische Radiologie. Springer Verlag, Heidelberg. 2013.
6. Shapiro S, Wilk MB. An Analysis of Variance Test for Normality. 1965.
7. Bleil M. Hysterosalpingographie in Technik der digitalen Subtraktionsangiographie, Dissertation. Medizinische Fakultät der Ruhr-Universität Bochum. 1999.
8. Strahlenschutz, BF. 2007. Die Empfehlungen der Internationalen Strahlenschutzkommission (ICRP) ICRP-Veröffentlichung. 103:S55.
9. Geibel D, Rimbach S. Uterine Fehlbildungen. Frauenarzt. 2012:1054-62.

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