The evaluation of uterine cavity with saline infusion sonohysterography and hysteroscopy in infertile patients

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Abstract

OBJECTIVES: The preliminary study was performed to evaluate the diagnostic accuracy of saline infusion sonohysterography (SIS) in the detection of intrauterine pathologies in infertile women The SIS findings were compared to the results of two widely used procedures: transvaginal sonograpy (TVS) and hysteroscopy (HS).

MATERIAL AND METHODS: 68 infertile women, aged 27–42 were enrolled in the study. TVS, SIS and diagnostic HS were consecutively performed in every patient. The results of each method were compared. Sensitivity, specificity, positive predictive value and negative predictive values for TVS and SIS were obtained.

RESULTS: Intrauterine pathologies were diagnosed in 25% of patients. TVS detected 6 (37.5%) and SIS revealed 11 (87.5%) of 13 intrauterine pathologies finally visualized at diagnostic hysteroscopy. TVS failed to visualize three submucous myomas, one endometrial polyp and two cases of septate uteri. All three cases of intrauterine synechiae were not detected with this method One submucous myoma and one endometrial polyp were not identified with SIS. The study group was, however, too limited to show statistically significant differences in diagnostic accuracy among TVS, SIS and HS.

CONCLUSIONS: Saline infusion sonohysterography is simple, sensitive and inexpensive diagnostic method. The procedure is not time-consuming, causes minimal discomfort to the patient and may be performed without anesthesia in office settings. The method may be recommended for the diagnosis of intrauterine pathologies in infertile women.

ORIGINAL ARTICLE

Abbreviations & Units:

SIS – saline infusion sonohysterography
TVS – transvaginal sonography
HS – hysteroscopy
IVF – in vitro fertilization
ART – assisted reproductive techniques
SD – standard deviation
n – number
MHz – megahertz

Introduction

Assessment of the uterine cavity is one of the necessary steps in the diagnostic procedure of infertile woman [2]. Intrauterine abnormalities are relatively common and may be associated with disturbed conception, recurrent pregnancy loss and poor pregnancy outcomes [14]. Almost one quarter of women with congenital or acquired structural defects of the uterine cavity has significant problems with conception and intrauterine pathologies are estimated to account for up to 10% of infertility cases [3]. Moreover distorted uterine cavity may contribute to implantation failure and problems with embryo transfer during in-vitro fertilization (IVF) procedure. There is the rapidly growing group of patients presenting for assisted reproductive techniques (ART) at an advanced age, when the risk of pregnancy complications and the prevalence of acquired uterine anomalies have already increased [15]

A number of diagnostic methods can be employed to evaluate the uterine cavity. The assessment may be performed either indirectly with transvaginal sonography or hysterosalpingography or directly with hysteroscopy. High frequency transvaginal transducers, being in use nowadays, give the possibility to observe the uterine cavity with a high degree of resolution. We still face, however, problems with differential diagnosis among submucous myomas, endometrial polyps and folded endometrium and with determination of actual fibroid extension into the uterine cavity. In these cases saline infusion sonohysterography (SIS) provides a more detailed picture, because the slowly injected saline solution distends the uterine cavity walls and acts as a negative contrast agent (Fig. 1). That simple modification of transvaginal sonography may more precisely estimate congenital anomalies of the Mullerian tract as for instance septated uteri. Proper diagnosis enables the surgical correction of structural abnormalities and consequently contributes to the improved pregnancy rates in that group of patients.

Hysteroscopy is the "gold standard" in the diagnosis of intrauterine pathologies [10] (Fig. 2). The 4 mm rigid hysteroscope is the most often used equipment, that may, however, damage uterine wall and cervical canal, especially in inexperienced hands. It therefore seems reasonable to seek for less invasive methods of uterine evaluation in infertile women. Noninvasive and relatively simple sonohysterography made with the thin and flexible insemination catheter seems to face these expectations [1,2]. We have performed a preliminary prospective study to estimate the diagnostic accuracy of saline infusion sonohysterography (SIS) by comparing it with transvaginal sonography (TVS) and diagnostic hysteroscopy (HS).

Materials and methods

68 infertile women diagnosed in the 1st Department of Obstetrics and Gynecology, Medical University of Warsaw between May 2004 and October 2005 were enrolled in the study. There were 43 cases of primary and 25 cases of secondary infertility in the group. The mean age of patients was 33.0 years (range 27–42) and the mean BMI reached 24 kg/m^2 (range 15–48). The time of infertility ranged from 1 to 9 years (mean 2.5 years). All women were provided with wide information about the aim and characteristics of the study and written consents to participate were obtained. Diagnostic procedures were carried out most likely in the proliferative phase of menstrual cycle, mean on 7th day of the cycle (range 1–28). The exclusion criteria were symptoms of active pelvic or vaginal infection and the suspicion of early pregnancy. Four women from the study group did not complete the diagnosis. SIS was not completed in two patients because of problems with insemination catheter insertion into the uterine cavity (tight nulliparous internal os of the cervix). Two patients were excluded for massive mucopurulent vaginal discharge.

The first procedure was TVS with the use of vaginal 9.0 MHz transducer (BK Medical, Denmark). Ultrasound images of the uterus, ovaries and any adnexal pathologies were obtained from longitudinal and transverse dimensions.

SIS was performed afterwards with patient in the dorsal lithotomy position. No analgesics were used. After insertion of the bivalve speculum the vagina and cervix were cleansed with povidone solution. Anterior cervical lip was grasped with a tenaculum and the thin 2 mm insemination catheter (Biomed, Poland) was slowly inserted into the cervical canal and uterine cavity until it reached the fundus. The speculum was carefully removed so as not to misplace the catheter. The vaginal transducer covered by sterile condom was then inserted in the vaginal vault and the catheter was drawn back in order to place it's top 0.5–1.0 cm above the internal os of the cervix. The uterine cavity was distended with sterile saline isotonic solution injected through the catheter from 20 ml standard syringes. In most cases the volume of 20–40 ml was sufficient for satisfactory uterine cavity visualization. A particular attention was paid to infuse the saline slowly. Too rapid injection of the saline introduced highly echogenic air into the cavity and disturbed the interpretation of the obtained images. All TVS and SIS images were recorded on standard video VHS tape. No prophylactic antibiotics were used.

Fig.1. SIS imaging of submucous myoma in the fundus of the uterus.

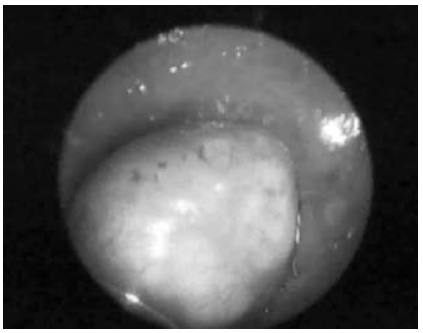

Fig. 2 (above). The same submucous myoma (see: Fig.1) visualized with hysteroscopy.

Table.1. Hysteroscopic findings in the study group and subgroups of infertile patients.

Hysteroscopic findings	n	Primary infertility (n)	Secondary infertility(n)
Submucous myoma	6	1	5
Endometrial polyp	4	2	2
Uterine anomaly	3	3	0
Uterine synechiae	3	1	2
Normal cavity	48	33	15
Total	64	40	24

As the next step, diagnostic hysteroscopy with 4 mm metal hysteroscope (Olympus Optical, Germany) was performed by an endoscopist who was not informed about the results of the previous investigations. If the lesion identified at SIS or HS was suspected to be relevant to the patient's infertility (submucous myomas, endometrial polyps), the operative hysteroscopy was carried out during the same analgesia. In 12 cases of congenital uterine anomalies laparoscopic correction was subsequently performed.

Results of transvaginal ultrasonography and saline infusion sonohysterography were compared with the results of hysteroscopy – the gold standard for uterine cavity imaging. Sensitivity, specificity, positive predictive value and negative predictive values for TVS and SIS were obtained.

Results

The final results of diagnostic hysteroscopy were gathered in Table 1. Intrauterine pathologies were diagnosed in 25% of cases, seven of the primary (11%) and nine of the secondary (14%) infertility. Normal uterine cavity was described in 48 infertile women (75%). The distribution of intrauterine lesions detected with the assessed diagnostic methods was showed in Table 2. The findings of TVS and SIS were compared with the results of diagnostic hysteroscopy believed to be the gold standard in uterine cavity imaging. TVS detected 6 (37.5%) and SIS revealed 11 (87.5%) of 13 intrauterine pathologies finally visualized at diagnostic hysteroscopy. TVS failed to detect three submucous myomas, one endometrial polyp and two cases of septate uteri. All three cases of intrauterine synechiae were

Table.2.Intrauterine lesions detected with SIS (saline infusion sonohysterography) and TVS (transvaginal sonography) in comparison to hysteroscopy - the gold standard for uterine cavity imaging.

Method	Submucous myoma (n)	Endometrial polyp (n)	Intrauterine synechiae (n)	Uterine anomaly (n)	Total (%)
TVS	3	2	0	1	6 (37,5)
SIS	5	3	3	3	14 (81,5)
HS	6	4	3	3	16 (100)

Table.3. Comparison of diagnostic value of SIS (saline infusion sonohysterography) and TVS (transvaginal sonography) in evaluation of intrauterine lesions.

Method	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	*p* value
TVS	37,5	100	100	82,7	ns
SIS	87,5	100	100	96,0	ns

not detected with TVS as well. SIS alone misdiagnosed one submucous myoma which was located close to the internal os of the cervix and one endometrial polyp which was described as endometrial folding.

The three cases of congenital uterine anomalies were confirmed to be septate uteri (2 cases) and bicornuate uterus (one case) at hysteroscopy under laparoscopic supervision. The septum was visualized as an echogenic structure separating the uterine cavity into two parts. One septum was found to be complete (reached the internal os) and one to be partial (reached the isthmus). In both cases surgical correction with resectoscope was successfully performed.

The intrauterine adhesions were suspected at SIS in case of echogenic area or structure observed between the two walls of the uterus filled with saline solution. The adhesions were classified as stage I and II according to the American Fertility Society classification system. One woman with mild intrauterine adhesions detected with SIS got pregnant during the cycle following the procedure. May SIS be suspected to have some therapeutic potential?

The study group was, however, too limited to show statistically significant differences in diagnostic accuracy among TVS, SIS and HS. Final conclusions regarding the ability to detect different kinds of uterine pathologies could not have been drawn from the limited number of cases. The comparison of diagnostic value of SIS and TVS was shown in Table 3.

Discussion

Infertility related to uterine abnormalities has been estimated to account for up to 10–15% of infertility cases [3]. Those abnormalities may be acquired or congenital in origin. Acquired lesions include submucous myomas, endometrial polyps and uterine adhesions. Among congenital defects there are septate, bicornuate, didelphic or unicornuate uteri. Acquired uterine abnormalities may contribute to implantation failure and impaired embryo growth, moreover are observed to predispose to habitual abortion and preterm labor. Congenital abnormalities occur in one in every 700 women and are also believed to increase the risk of habitual abortions and later pregnancy complications.

It is widely accepted that the initial diagnostic method in patients with infertility should be hysterosalpingography (HSG). Diagnostic hysteroscopy or laparoscopy is usually performed when HSG discloses any pathology. However these methods are invasive and may cause complications making implantation process even more difficult and impaired. Hysteroscopy with the use of flexible, 3mm diameter devices is not so commonly introduced. Transvaginal sonography is utilized worldwide for the assessment of the uterine cavity, however used alone may fail to establish the specific and correct diagnosis in some cases of irregular and abnormally thick endometrial lining [8]. So one may consider that there is the

need for simple, inexpensive, possibly noninvasive and reproducible method for evaluating intrauterine pathologies.

Bonilla-Musoles et al. first described transvaginal saline infusion sonohystereography in 1992 [2]. The visualization of specific lesions of the uterine cavity depends directly on the phase of menstrual cycle when making a scan. Endometrial polyps are best seen in proliferative phase and submucous myomas or intrauterine adhesions are better visualized during the secretory phase. Intracavitary saline instillation introduces an anechoic background and makes it possible to examine the cavity during any stage of menstrual cycle and enhances diagnostic possibilities (sensitivity and specificity) of transvaginal ultrasound alone. Hamilton et al. in the study of 500 consecutive, unselected, infertile women, suggested that SIS appeared to be an acceptable first-line screening procedure for uterine structure [7]. According to authors SIS improved the predictive power of TVS alone for uterine anomalies and provided additional information, potentially of value when planning operative hysteroscopy [11]. In another study of 104 patients, the authors suggested that sonohysterography was fully capable of replacing HSG for evaluating the uterine cavity [12]. Many authors reported the high value of SIS for the differentiation of intracavitary, endometrial and submucosal abnormalities [4,5,6,9]. According to literature, as with hysteroscopy, SIS had sensitivity, specificity and predictive values of 100% or very close to 100% in the evaluation of polypoid lesions and submucous myomas. In our study we described endometrial polyps and submucous myomas as protrusions into the intrauterine cavity with walls separated by saline solution. Polyps were described as sessile structures with homogeneous echogenicity without damage of the endometrial-myometrial junction. We estimated integrity of the uterine wall and the relationship of the lesion to the endometrial basement (sessile or pedunculated). Such details are reported to be very useful during electroresectoscopic procedures.

In cases of the Muellerian anomalies sonohysterography has the advantage of simultaneous observing both the interior and exterior surfaces of the uterus. That gives the possibility to distinguish between bicornuate and septate uteri. The thickness of the septum at the fundal insertion can be measured what is useful when hysteroscopic metroplasty is planned. In cases of intrauterine synechiae SIS imaging can also contribute to correct diagnosis and helps to schedule the hysteroscopic adhesiolysis [12]. In one of our patients mild intrauterine adhesions were supposed to be released during SIS because conception occurred in the cycle following the procedure. When the diagnosic accuracy of the three methods were analyzed, no statistically significant differences were found (Table 3). SIS seemed to be, however, more sensitive when compared with TVS. Although the specificity and positive predictive values were the same for the three methods, the negative predictive value was higher for SIS. Moreover SIS appeared to be almost as predictive as hysteroscopy. The procedure was well tolerated and practically painless for all patients. There were no infectious complications in the follow-up period.

Conclusions

Saline infusion sonohysterography is simple, sensitive and inexpensive diagnostic method. The procedure is not time-consuming, causes minimal discomfort to the patient and may be performed without anesthesia in office settings. The method may be recommended for the diagnosis of intrauterine pathologies in infertile women. A one-step type of diagnostic algorithm with the use of SIS could be elaborated to complete the assessment of uterine cavity during one visit in medical centre.

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