

Short communication

Sonographic hydrotubation using agitated saline: a new technique for improving fallopian tube visualization

¹F CHENIA, FCOG(SA), ¹G J HOFMEYR, MRCOG, ²S MOOLLA and ²P ORATIS, ARDMS

Departments of ¹Obstetrics and Gynaecology and ²Ultrasonography, Coronation Hospital and the University of the Witwatersrand, Johannesburg, South Africa

Abstract. Vaginal sonographic hydrotubation (SHT) was assessed in the evaluation of uterine configuration and tubal patency in 71 women undergoing investigation for infertility. In addition, a new technique using “agitated” saline during transvaginal sonography was evaluated in 50 of the patients. Ultrasound was more sensitive in detecting uterine abnormalities (89% compared with 6% for hysterosalpingography (HSG)). Of 142 individual fallopian tubes studied, the diagnosis on SHT and HSG were the same in 120 (85%). Laparoscopic results were available on 15 patients. The findings on all 19 tubes in which the SHT and HSG diagnosis had concurred were confirmed. Of 11 tubes in which the diagnoses had differed, the laparoscopic finding agreed with the diagnosis made with SHT in seven, HSG in three, and neither in one. As shown in previous studies, sonographic hydrotubation is a simple technique with a high degree of accuracy. The use of “agitated” saline improved the ease with which the fallopian tubes were visualized.

Introduction

Infertility is a common problem in the developing world, affecting 10–15% of couples. Tubal pathology is one of the commonest causes of infertility in South Africa, and in Africa in general.

Hysterosalpingography (HSG) is often the primary investigation of tubal patency. The value of HSG in infertile women is limited to the demonstration of intrauterine and intratubal abnormalities.

The role of ultrasound in infertility investigations and management is well established. A previous study in infertile women found that sonographic findings were similar to HSG findings in 82% with respect to uterine assessment and 72% with respect to tubal findings [1]. Difficulty in demonstrating healthy fallopian tubes, especially the cornual region, was the limiting feature. The present study is, to our knowledge, the first to report the use of agitated saline for enhancing tubal demonstration by transvaginal ultrasound.

Subjects and methods

A comparative study of SHT and HSG was conducted in order to assess the value of vaginal sonographic hydrotubation. The study, carried out at Coronation Hospital, Johannesburg, was approved by the Committee for Research on

Human Subjects of the University of the Witwatersrand. Women referred for routine HSG were invited to participate in this study; 71 patients agreed to take part and nine patients did not wish to participate in the study. SHT was performed prior to HSG, on the same day.

A bimanual pelvic examination was performed before the procedure in order to detect obvious clinical abnormalities and to exclude pelvic inflammatory disease. After routine transabdominal pelvic ultrasound examination, a size 8 Foley catheter with a semi-rigid introducer was inserted into the endocervical canal and the balloon inflated with 2 ml sterile water. A 5 MHz transvaginal ultrasound probe was introduced into the vagina. 10–20 ml saline were injected through the Foley catheter during the examination. The shape of the uterus and its cavity, the flow of saline through the tubes, and the presence of hydrosalpinx before and after injection of saline were noted. Figure 1 shows some of the typical findings on transvaginal SHT. Plain saline was used in the first 21 cases. Thereafter agitation of the saline, a technique commonly used in echocardiography, was introduced. A 20 ml syringe containing 10 ml saline and 10 ml air was vigorously shaken immediately prior to injection of the fluid, taking care to tilt the syringe downwards and to avoid injection of air. The micro-bubbles produced bright scintillating echoes on ultrasound which were easily visible as they passed through the fallopian tube. Figure 2 compares agitated saline and normal saline in two different patients with hydrosalpinx.

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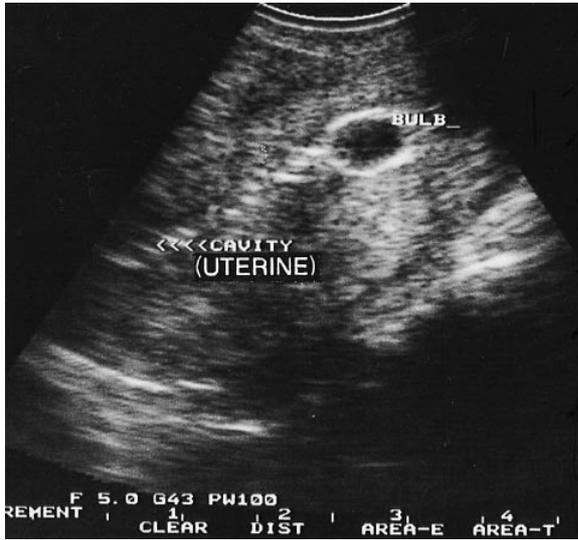


Figure 1. Uterine cavity after agitated saline.

HSG was performed routinely, using an intra-cervical Foley catheter for the injection of contrast medium. The HSGs were all reported by a consultant radiologist with particular expertise and interest in this field.

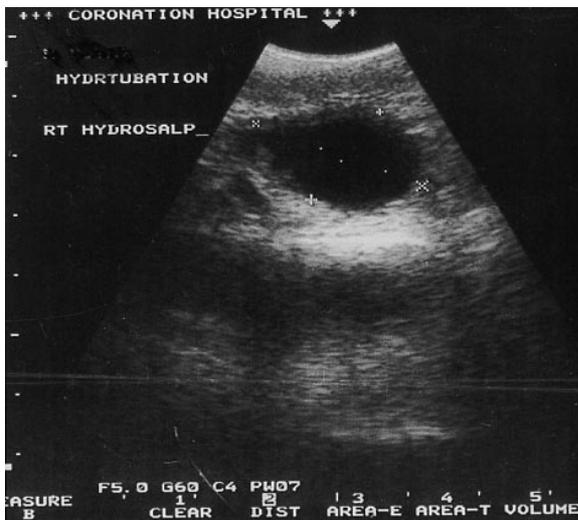
The SHT and HSG were each reported without knowledge of the findings in the other procedure. The findings in both studies were collated once all the data for the study had been collected.

Results

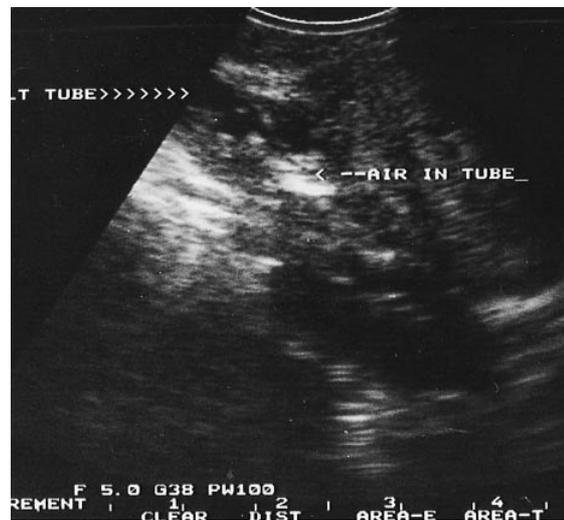
The uterine findings are shown in Table 1. Leiomyomata were detected in 13 cases with SHT. Three of these, which were submucosal *in situ*, were also detected with HSG. One additional case of leiomyoma was detected by HSG. One case of bicornuate uterus was detected with SHT but not with HSG, the diagnosis being confirmed by hysteroscopy.

The SHT and HSG findings were compared for each individual fallopian tube studied (Table 2). The findings corresponded for 120 out of 142 tubes (85%). Laparoscopic information was available on 15 patients. The findings on SHT and HSG were in agreement with respect to 19 of the tubes studied laparoscopically, and the diagnosis was confirmed in all cases. The laparoscopic results for 11 tubes for which the SHT and HSG diagnoses had differed are shown in Table 3. Laparoscopy confirmed the SHT diagnosis in seven tubes, the HSG diagnosis for three tubes and neither modality for one tube.

Use of agitated saline made demonstration of the fallopian tubes much easier because of the bright echogenic scintillation produced by the micro-bubbles in the agitated saline. The rate of agreement of SHT findings with HSG or laparoscopy between agitated saline and plain saline were not statistically significant (86% vs 81%).



(a)



(b)

Figure 2. Comparing (a) saline and (b) agitated saline infusion in two different patients with hydrosalpinx.

Table 1. Comparison of sonographic hydrotubation (SHT) and hysterosalpingography (HSG) in the detection of uterine abnormalities

HSG	Sonographic hydrotubation			Total
	Normal uterus	Fibroids	Bicornuate uterus	
Normal uterus	53	13	1	67
Fibroids	1	3	—	4
Total	54	16	1	71

Table 2. Comparison of findings with sonographic hydrotubation (SHT) and hysterosalpingography in 142 fallopian tubes

HSG	Sonographic hydrotubation			Total
	Normal	Hydrosalpinx	Cornual block	
Normal	28	6	4	38
Hydrosalpinx	4	71	5	80
Cornual block	0	3	21	24
Total	32	80	30	142

Table 3. Laparoscopic findings in 11 tubes for which the SHT and HSG diagnosis differed

Number	SHT	HSG	Laparoscopy
3	Hydrosalpinx	Cornual block	3 Hydrosalpinx
2	Hydrosalpinx	Normal	2 Hydrosalpinx
2	Normal	Cornual block	2 Normal
1	Normal	Hydrosalpinx	1 Hydrosalpinx ^a
3	Cornual block	Hydrosalpinx	1 Normal 1 + 1 Hydrosalpinx ^a

^a Non-agitated saline used.

However, this comparison should be treated with caution as laparoscopic confirmation was not available in all cases. Although quantitative improvement in diagnosis was not proven in this study, there was unequivocal qualitative improvement in visualization of fallopian tubes.

Discussion

Tubal pathology is one of the major causes of infertility in South Africa. There is a high incidence of sexually transmitted diseases in Southern Africa [2]. Salpingitis carries a significant risk of infertility with the probability of doubling the risk after each inflammatory episode [3]. Significant tubal pathology was present in 57 of the 71 patients in our study. 48 of these had bilateral tubal disease.

HSG is still the primary investigation of tubal patency in most centres in South Africa. It is, however, time-consuming, labour intensive, carries the risk of reaction to contrast media and involves radiation exposure. Laparoscopy is required if tubal surgery is contemplated or other causes of infertility need to be excluded. Although laparoscopy is considered to provide the most reliable method of assessing tubal patency before surgery, it does not provide information about the cavity of the uterus and fallopian tubes.

Ultrasound examination of the fallopian tubes is well established in gynaecological practice, particularly when gross pathology such as ectopic pregnancy, hydrosalpinx or tubo-ovarian abscess is present. Evaluation of healthy fallopian tubes is difficult, as the normal tube is a poor sonic reflector devoid of the tissue/fluid interfaces that would produce a clear organ outline [4]. To overcome these limitations, we have used the transvaginal

probe with a high frequency transducer to assess the tubes while filling them with normal saline via an endocervical catheter. Heikkinen et al compared transvaginal salpingography and laparoscopic chromotubation and found concordance in 85% of cases [5].

More uterine abnormalities were detected in the present study with SHT than with HSG (14 vs 4). Regarding tubal assessment, an important limitation of this study is that laparoscopic information was available in only 15 women. HSG assessment of tubal pathology is not infallible and cannot be regarded as a gold standard. It is therefore not possible to comment on the absolute accuracy of SHT. However, the information obtained with SHT is similar to that of HSG in the majority of tubes studied (85%). In cases in which the tubal diagnosis differed between SHT and HSG and where laparoscopic information was available, laparoscopy confirmed the SHT findings in neither of the two cases in which SHT was performed with plain saline and in seven of nine cases in which SHT was performed with agitated saline. Laparoscopy confirmed the HSG finding in three cases.

SHT proved to be a rapid and convenient procedure which avoids the use of contrast medium and X-ray exposure. Other pelvic conditions, as well as unsuspected pregnancy, are excluded at the same time. Because of its simplicity, the procedure can be repeated, for example after tubal surgery.

The disadvantages of sonographic hydrotubation are that the interpretation requires considerable operator expertise in vaginal ultrasound examination, and the difficulty in demonstrating healthy fallopian tubes. It was found that the demonstration of healthy fallopian tubes became considerably easier when agitated saline was used.

Balen et al [6], using transvaginal ultrasound, concluded that on ultrasound contrast medium (Echovist, Schering) was insufficiently accurate in the determination of tubal patency and felt that it could not replace conventional HSG. Although a direct comparison was not carried out between Echovist and saline in the present study, the use of agitated saline was at least as accurate as HSG.

It is recommended that, in units in which skilled vaginal ultrasonography is available, SHT should be considered as the primary method of assessment of the uterus and fallopian tubes in women with infertility, using agitated saline to identify the fallopian tubes.

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