Transvaginal salpingosonography for assessing tubal patency in women previously treated for pelvic inflammatory disease and benign ovarian tumors

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ABSTRACT

Objective The aim of this study was to evaluate the role of transvaginal salpingosonography in the assessment of tubal patency among women previously treated conservatively for pelvic inflammatory disease and surgically for a benign ovarian tumor.

Design Twenty-two women were recruited for this study at the University Hospital of Oulu. Transvaginal salpingosonography was scheduled to be performed twice within a 3-month interval. X-ray hysterosalpingography was chosen as a reference method and was performed within 2 days of the second salpingosonography examination during the same menstrual cycle. Altogether, 31 Fallopian tubes were assessed with the second salpingosonography examination and X-ray hysterosalpingography.

Results Twenty-nine Fallopian tubes were observed by both methods to be patent (i.e. 29 tubes by each method, but not necessarily the same tubes). An occlusion was diagnosed by each method in two tubes only, of which one appeared occluded by both methods, while one tube from each method appearing to be occluded was demonstrated to be patent using the other method. The agreement of transvaginal salpingosonography compared with X-ray hysterosalpingography was 94%, the sensitivity 50%, the specificity 97%, the positive predictive value 50% and the negative predictive value 97%. Two successive transvaginal salpingosonography examinations were performed in 18 patients with 27 Fallopian tubes. Disagreement was observed for only one tube. The agreement between these two examinations was 96%, the sensitivity 100%, the specificity 96%, the positive predictive value 67% and the negative predictive value 100%. The kappa coefficient was 0.78 (95% confidence interval 0.75–0.81).

Conclusions In conclusion, transvaginal salpingosonography can be used in patients with previous pelvic inflammatory disease and adnexal surgery due to its ease of use, reliability and low costs on an out-patient basis. Among these patients, tubal patency was a common finding.

INTRODUCTION

Acute salpingitis is one of the most common gynecological conditions in women of childbearing age. Fifteen per cent of women develop adnexitis by the age of 30. Inflammation recurs, or patients are reinfected, in about 20% of cases, and 10–20% of patients complain of chronic low abdominal pain. The risk of tubal pregnancy is increased and the sterility rate is approximately 10–20%1. The occurrence of tubal stenosis, salpingitis and peritubal adhesions associated with tubal infertility is strongly linked to infection by Chlamydia trachomatis2.

Previous gynecological surgery may also cause peritubal adhesions and even tubal occlusions. According to salpingoscopic findings, however, intraluminal changes in Fallopian tubes after previous surgery are milder than those observed after pelvic inflammatory disease (PID) or severe endometriosis. Adhesions are observed at similar frequencies (50–59%) after both PID and pelvic surgery. Changes in tubal patency by salpingoscopy were found in 41–43% of cases after PID and endometriosis and in 33% after surgery. According to these results, surgery causes significant adhesions, but does not have as much effect on tubal patency as does PID1.

Besides using laparoscopic chromoperturbation, tubal patency can be assessed reliably using either
Transvaginal salpingosonography (or hysterosalpingo-contrast sonography, HyCoSy) or X-ray hysterosalpingography which at present can be used as primary-phase examination modalities in infertility. However, if tubal occlusion is suspected with transvaginal salpingosonography or X-ray hysterosalpingography, these patients should be referred for laparoscopic chromoperturbation, which is still considered to be the second and final method for observing tubal patency, peritubal and periovarian adhesions.

The aims of this study were to evaluate the repeatability of transvaginal salpingosonography and its value compared with X-ray hysterosalpingography in the evaluation of tubal patency among women previously treated for PID or benign ovarian tumors.

MATERIALS AND METHODS

Twenty-two women with a history of PID and/or an operation for benign ovarian tumors, such as functional cysts, endometriomas or teratomas, were recruited for this study. Inclusion criteria for the PID group included acute salpingitis with hospitalization and clear clinical findings (abdominal pain, fever, elevated C-reactive protein, treatment with antibiotics). Six patients fulfilled the criteria of PID. No chlamydial infections were observed as an etiological factor for this disease among these women. Sixteen women had been operated upon for a benign ovarian tumor. Of these, five had earlier had PID, including two chlamydial infections. Fourteen patients had previously undergone laparoscopy and two patients laparotomy. A cyst operation had been performed unilaterally in 14 cases (salpingo-oophorectomy in three cases and extirpation of a cyst in 11 cases, including one patient with a previous contralateral salpingo-oophorectomy). Bilateral extirpation of a cyst had been performed in two cases. Two patients had previously been treated for a tubal pregnancy by salpingostomy. Endometriosis had been diagnosed in five cases. Only seven of the 22 patients in this study had the desire to become pregnant at the time of transvaginal salpingosonography. Twelve patients were using oral contraceptives, one patient had an intrauterine device, one couple was using condom protection and one patient did not need any protection because she had no sexual partner.

Transvaginal salpingosonography using air and saline as contrast media was performed twice in these patients with a 3-month interval. It was performed during the follicular phase of the menstrual cycle, as described in detail in our earlier reports. After the examination patients received 2 g of metronidazole (Tricidol, Orion, Oulu, Finland) orally. A Foley silicone catheter (Sewoon med. Co., Ltd., Seoul, Korea) was inserted into the uterus. Transvaginal ultrasound scanning was performed using a Toshiba 6-MHz probe (Toshiba SSA-270A, PVF-651 VT, Toshiba Co., Tokyo, Japan).

X-ray hysterosalpingography was performed as a reference method by a radiologist during the same day or a day subsequent to the second transvaginal salpingosonography. A Cook’s catheter with a Scollof balloon was used in all X-ray examinations and a water-soluble Omnipague® containing iodine was used as an X-ray-positive contrast medium (Omnipaque®; iohexol 240 mg/ml, Nycomed Imaging AS, Helsinki, Finland). Patients routinely received an oral spasmyotic analgesic, Litalgin® (Metamizol. natri. 550 mg, Pitofenon. hydrochlorid. 5 mg, 2-dimethylamino-ethylbenzilat. hydrochlorid. 0.2 mg, Leiras, Finland) 30 min before the procedure. If the pelvic ultrasound findings at the first transvaginal salpingosonography examination were abnormal, such as a large endometrioma, the patient was referred for laparoscopy in which chromoper- tubation was also performed.

All transvaginal salpingosonography was performed by the same author (H.S.). The study protocol was approved by the Ethical Committee of the Medical Faculty of Oulu University.

Statistical analysis

The results were calculated by using test performance characteristics including agreement, sensitivity for the detection of tubal occlusion, specificity for the detection of tubal patency, and positive and negative predictive values. Additionally, the Cohen’s kappa coefficient was calculated. Kappa is a chance-adjusted measure of agreement between two observations. When agreement is perfect, the kappa coefficient has a theoretical maximum value of 1. If the kappa coefficient is 0.6–0.8, the agreement can be regarded as good. If the value is 0.4–0.6, it is moderate. When the kappa coefficient is more than 0.8, the agreement is excellent.

RESULTS

Altogether, 22 patients were included in the final analysis. The mean age of the patients was 27 years (SD, 5). Fifteen patients who had been treated earlier for a benign ovarian tumor were examined with the first transvaginal salpingosonography within 7 months of the operation. Two women in the PID group had been treated within 6 months of the first transvaginal salpingosonography. The others had had older genital infections. Two patients became pregnant after the first transvaginal salpingosonography and a further two were directed to laparoscopic treatment owing to the finding of a large endometrioma after the first transvaginal salpingosonography.

Transvaginal ultrasound in connection with the first transvaginal salpingosonography revealed normal genital findings in 11 cases and abnormal findings in 11 cases. Two patients had an ovarian cyst. Two patients were shown to have polycystic ovaries and one patient had both a myoma and a suspicion of a small teratoma. Five patients were suspected of having an endometrioma and one patient a small teratoma.

In the first transvaginal salpingosonography (n = 22), bilateral tubal patency was observed in 12, unilateral tubal patency in nine and bilateral tubal occlusion in one case. In the second transvaginal salpingosonography, bilateral tubal
Transvaginal salpingosonography

patency was again diagnosed in 12, unilateral tubal patency in five and a bilateral tubal occlusion in one case (total of 18 cases). According to the X-ray hysterosalpingography \( (n = 18) \) and a laparoscopic chromopertubation \( (n = 2) \), bilateral tubal patency was present in 14, unilateral flow in five and a bilateral tubal occlusion in one case (total of 20 cases) (Table 1).

In the benign ovarian tumor group, the Fallopian tubes were observed to be patent according to the second transvaginal salpingosonography and X-ray hysterosalpingography in the treated side in all cases, except in one case in which only unilateral tubal patency was observed. This patient had been treated earlier for bilateral endometriomas. One patient with a previous salpingooophorectomy had a saccosalpinx formation in the contralateral tube after a saline injection. All patients with only previous PID had patent Fallopian tubes on examinations by both transvaginal salpingosonography and X-ray hysterosalpingography.

The findings between the two successive transvaginal salpingosonography examinations were similar in all 18 cases, except in the one case with the non-patency result in the first examination. Transvaginal salpingosonography was technically difficult to perform in three cases, owing to poor visualization, and the results of those Fallopian tubes were therefore excluded. Two patients did not have the second examination because they were referred directly for laparoscopy owing to the finding of a large endometrioma after the first transvaginal salpingosonography. The kappa coefficient between the two transvaginal salpingosonography examinations was good (0.78, 95% confidence interval (CI) 0.75–0.81). The results are presented in detail in Table 2.

### Table 1

<table>
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<tr>
<th>Findings</th>
<th>First TSSG</th>
<th>Second TSSG</th>
<th>X-ray HSG/ laparoscopy</th>
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<td>Bilateral patency</td>
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<td>12</td>
<td>14</td>
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<tr>
<td>Unilateral patency</td>
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<td>5</td>
</tr>
<tr>
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<td>1</td>
<td>1</td>
</tr>
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<td>Total</td>
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<td>20</td>
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### Table 2

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<tbody>
<tr>
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</tr>
<tr>
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<td>3</td>
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<tr>
<td>0</td>
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<tr>
<td>Total</td>
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Agreement 96%; kappa coefficient 0.78 (95% CI 0.75–0.81); sensitivity 100%; specificity 96%; positive predictive value 67%; negative predictive value 100%.

### Table 3

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<th>Patent</th>
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<tr>
<td>Total</td>
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Agreement 94%; kappa coefficient 0.47 (95% CI 0.44–0.50); sensitivity 50%; specificity 97%; positive predictive value 50%; negative predictive value 97%.

X-ray hysterosalpingography results were available from 18 patients with 31 Fallopian tubes. Total agreement with transvaginal salpingosonography was observed in 29 and disagreement in two Fallopian tubes. The results obtained from the second transvaginal salpingosonography and X-ray hysterosalpingography examinations are shown in Table 3.

### DISCUSSION

The observed agreement between the second transvaginal salpingosonography and X-ray hysterosalpingography in this study was 94%, which was better than in our previous studies67. We earlier reported agreements between transvaginal salpingosonography and X-ray hysterosalpingography or laparoscopic chromoperturbation in infertile women varying between 84% and 93%. The agreement was lower among women previously treated for tubal pregnancy (86%) or reversal of sterilization (84%) than among infertile women generally (90–93%)67. It has been reported that it is usually easy to demonstrate tubal patency; in this series, the rate of tubal occlusion was minimal. This may partly explain the high agreement.

According to our results, previous PID or pelvic surgery for a benign ovarian tumor did not impair tubal function, as has also been observed in other reports1. Thirty-three of the 35 Fallopian tubes assessed were shown to be patent with both transvaginal salpingosonography and X-ray hysterosalpingography or laparoscopy. In one case, the patient had earlier been treated by salpingooophorectomy and there was a saccosalpinx formation in the contralateral tube. The number of tubal occlusions was nevertheless minimal compared to the other groups that we have tested with transvaginal salpingosonography67. The diagnosis of tubal patency with transvaginal salpingosonography is generally easy, but the demonstration of a real occlusion, not a cornual spasm, is difficult. Technical difficulties occurred in only one case. This was probably caused by a spasm. It must also be remembered that, when only unilateral tubal patency is observed and the patient does not feel any pain on the contralateral side, the apparent tubal blockage may be due to the fact that the air bubbles are flowing into the tube with the least resistance. In these cases, the contralateral tube may still be open. This type of difficulty is common to all methods used for the evaluation of tubal patency.

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The sensitivity in the detection of a tubal occlusion with transvaginal salpingosonography was rather low in our sample (50%). According to the reference method, only two Fallopian tubes out of 35 were observed to be occluded. In one case there was a large cystic lesion in the left ovary, possibly making it technically difficult to assess tubal patency with transvaginal salpingosonography on that side. The tube was regarded as patent in the transvaginal salpingosonography assessment, but no flow was observed in X-ray hysterosalpingography. In another case, there was a clear tubal patency with transvaginal salpingosonography, but an occlusion with X-ray hysterosalpingography. This could have been due to either a spasm caused by X-ray hysterosalpingography or asymmetrical flow. These two cases demonstrate that both of these methods have some limitations in connection with the evaluation of tubal patency. The same holds for laparoscopic chromoper- turbation. The moderate kappa coefficient (0.47) between transvaginal salpingosonography and X-ray hystero- salpingography observed in this study can partly be explained by these limitations. On the other hand, it must be remembered that a good kappa coefficient (0.78) between the two successive transvaginal salpingosonography examinations reflects the repeatability of this new ultrasound method in the evaluation of tubal patency.

There are several reports in which X-ray hysterosalpingography has been evaluated for assessing tubal patency among women with pelvic surgery. In a meta-analysis by Swart and co-workers, there were reports on the sensitivity of hysterosalpingography compared to laparoscopy which varied from 7 to 58%, with specificity from 30 to 99%. Laparoscopy can be regarded as the best method for reliably diagnosing pelvic adhesions. On the other hand, it cannot be used alone for assessing the uterine cavity (submucous polyps/fibroids, septae, etc.), which is also important in diagnosing the causes of infertility. Apart from tubal patency, transvaginal salpingosonography and X-ray hysterosalpingography provide important information on the morphology of the uterine cavity. According to some reports, salpingoscopy might also be of great importance in evaluating the intraluminal changes in Fallopian tubes caused by PID, especially chlamydial infections, endometriosis and pelvic surgery. This method cannot be used, however, for the primary and routine evaluation of tubal patency.

According to this and many earlier reports, transvaginal salpingosonography using air or Echovist® has been shown to be a reliable method and can thus be used as a primary-phase examination modality in infertile women. All patients can be primarily evaluated with transvaginal salpingosonography, and, if tubal patency is observed and no other fertility-decreasing factors exist, the patients can be followed expectantly for 6 months, for example. If no pregnancies occur during this time, the patient might then be referred for laparoscopy or for a repeat transvaginal salpingosonography examination. Using transvaginal salpingosonography, it is possible to determine which patients will benefit most from laparoscopy. If a patient has a history of many episodes of PID or severe endometriosis, for example, she should also be evaluated with laparoscopy. Therefore, it is important that the operator performing transvaginal salpingosonography should be aware of the patient's medical history.

By performing transvaginal salpingosonography as a first-phase examination in all infertile women, it is possible to save costs and time, as the patients do not have to wait for laparoscopy. The investigation and especially the treatment of infertility are expensive. The more we can save in investigation, the more we can invest in the treatment of infertility, for example in in vitro fertilization. The number of infertile couples is increasing, and, therefore, by minimizing the costs of investigation, more patients can be treated.

We can therefore conclude that transvaginal salpingosonography is an easily repeatable and reliable method with low cost for the primary out-patient assessment of tubal patency also among women previously treated for pelvic inflammatory disease and benign ovarian tumors. According to our results, 94% of Fallopian tubes were patent after these diseases, examined either with transvaginal salpingosonography or with X-ray hysterosalpingography and laparoscopic chromoper- turbation.

REFERENCES