A new evaluation score that uses salpingoscopy to reflect fallopian tube function in infertile women

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Objective: To build an evaluation scoring system using the results of salpingoscopy, and to evaluate the relationship between this scoring system and the outcome of pregnancy.
Design: Retrospective study.
Setting: Sugiyama Clinic.
Intervention(s): Using salpingoscopy, we observed the tubal lumen, paying attention to the following six results: adhesions, loss of mucosal folds, rounded edges of mucosal folds, debris, foreign bodies, and abnormal vessels.
Patient(s): From April 2008 through June 2009, 104 women in whom unexplained infertility had been diagnosed underwent salpingoscopy. The F scores were evaluated related with various clinical results or pregnancy rates.
Main Outcome Measure(s): The F score expressed the sum of the abnormal results, and one abnormal result was given a 1-point F score.
Results: Approximately 60% of the patients showed an F score of 0, and the percentages of patients who showed 1, 2, 3, and $\geq$4 points were 19.2%, 11.5%, 4.5%, and 4.5%, respectively. After evaluation, 23 patients achieved pregnancy within a year. The pregnancy rates for patients with F scores of 0 and 1 point were 30.6% and 20.0%, respectively, and the rate of patients with an F score of 0 was significantly higher than the rate of patients with high F scores (F score $\geq$2; 9.1%).
Conclusion(s): The patients showing a lower F score (0 or 1) showed higher fecundity than those showing an F score of $\geq$2. (Fertil Steril® 2010;94:2753–7. ©2010 by American Society for Reproductive Medicine.)

Key Words: Fallopian tube, laparoscopy, pregnancy, salpingoscopy, unexplained infertility

The fallopian tube is more than a passive conduit for gametes and early embryos; it also plays an important role in many reproductive functions such as sperm transport and capacitation, oocyte retrieval and transport, fertilization, and embryo storage. On the other hand, the fallopian tube is easily damaged by an ascending vaginal infection and by a uterine infection such as chlamydia. These types of damage result in impaired function of fallopian tubes and subsequently cause female mechanical factors of subfertility (1). For fallopian tube evaluation, hysterosalpingography (HSG) is the most common test because of its safety and low cost. Papaioannou et al. (2) mentioned that HSG is a reliable test for the diagnosis of proximal and distal obstruction, hydrosalpinx, and peritubal adhesions. However, a recent report indicated that laparoscopy was mandatory after abnormal HSG findings in the workup before the start of the infertility treatment (3). Laparoscopy remains the gold standard for the evaluation of mechanical factors affecting fallopian tubes, but it cannot be used to directly observe the inner cavity of the fallopian tube.

Salpingoscopy originally was performed during laparotomy for reconstructive tubal surgery to assess the mucosa of the infundibulum and ampulla. A flexible bronchoscope was used initially to improve the images obtained before the introduction of a dedicated rigid salpingoscope (2). Marchino et al. (4) reported that prediction of infertility outcomes by laparoscopy could be improved by the concomitant performance of salpingoscopy. However, there is no information concerning its accuracy, reliability, prognosis, or effectiveness. Several reports have shown pregnancy rates after laparoscopy for patients with unexplained infertility etiology (5, 6). However, there are no reports to indicate the pregnancy outcomes related with the findings from inside the fallopian tube. Indeed, it is believed strongly that the fertilization between oocyte and sperm occurs at the ampulla of the fallopian tube, and that conditions inside of the ampulla are quite important as this is the location for fertilization. From this point of view, observation inside the ampulla could be used to predict the pregnancy potential.

For evaluation of the pelvic cavity and fallopian tube, we performed salpingoscopy concomitant with the performance of laparoscopy for patients in whom unexplained infertility had been diagnosed to glean more information about the fallopian tube. In the present study, we tried to build an evaluation scoring system using the results of salpingoscopy and to evaluate the relationship between this scoring system and the outcome of pregnancy.

MATERIALS AND METHODS

Criteria of Unexplained Infertility and Patients

In the present study unexplained infertility was diagnosed with use of the following criteria: [1] the patient's infertility period was >1 year; [2] the patient's normal menstrual cycle and ovulation

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were investigated by transvaginal ultrasonography by estimation of serum P concentrations in the midluteal phase; [3] the patient showed normal findings for genital organs by ultrasonography, and the patency of at least one fallopian tube was confirmed by HSG; [4] the patient who showed unilateral or bilateral hydrosalpinges or tubal obstruction was excluded; [5] the patient showed normal values in several hormone analyses (LH, FSH, PRL, E_2, P); [6] the patient's male partner had normal sperm findings (7), and results of the postcoital test were normal; and [7] the patient did not achieve pregnancy after more than six courses of timing intercourse or IUI. The patients who showed unilateral or bilateral hydrosalpinges or tubal obstruction were excluded, as were patients who had ovarian endometrioma in either ovary. All patients were checked for antichlamydial antibodies in their sera before laparoscopy. From April 2008 through November 2009, a total of 104 infertile women who had had a diagnosis of unexplained infertility and underwent both laparoscopy and salpingoscopy at our clinic were recruited for this study.

Procedure for Laparoscopy and Salpingoscopy

Laparoscopy was performed with the patient under general anesthesia. A three-port laparoscopy was used with an umbilical 3-mm port for the scope and two additional 3-mm operating ports. A 3-mm laparoscope was inserted through an umbilical port and connected to a video monitor (Karl Storz, Tuttlingen, Germany). A pneumoperitoneum was achieved (8–10 mm Hg).

Observation in the pelvic cavity and complete adhesiolysis and mobilization of the tubes and ovaries were performed if necessary. Tubal patency was checked with indigo carmine. In addition to patency testing, with this procedure the gross external appearance of the fallopian tube and fimbrial mucosa can be assessed. We also checked for the presence of peritubal adhesions, pelvic adhesions, or lesions of endometriosis such as bluish spots or red spots. With abnormal findings, adhesiolysis or either electroablation or resection of endometriotic implants was undertaken to the extent possible. Periadnexal adhesion was one of the main causes of tubal infertility and had a negative impact on the ability to achieve pregnancy. In the present study, to evaluate the correlation between salpingoscopic results and their relationship to reproductive outcomes, adhesiolysis and mobilization of the tubes and ovaries were performed if necessary, which eliminated effects such as peritubal or salpingo-ovario adhesion.

After the patency of bilateral tubes was checked, a 2.9-mm salpingoscope (Karl Storz) was inserted through the right port under observing laparoscopy through the umbilical port, and the inner cavity of the fallopian tube was checked. An atraumatic grasping forceps was applied just behind the fimbriae to hold the tubal wall against the salpingoscope, while an infusion of distending saline water was instilled to open up the potential space of the tubal lumen (2).

Assessment of Salpingoscopy and the F score

With the salpingoscope, we always observe both the right and left tubal lumen paying particular attention to the following six findings: [1] adhesions, [2] loss of mucosal folds, [3] rounded edges of mucosal folds, [4] debris, [5] foreign bodies, and [6] abnormal vessels. The salpingoscopic results were our original classifications, but they were based on the classification of Puttemans et al. (8). The mucosa of the ampullary segment in normal cases consisted of three to five major folds with secondary folds arising from them and several minor folds interspaced among them. "Adhesions" indicated adhesions and/or agglutinations between folds. "Loss of mucosal folds" indicated disseminated fold flat areas or a loss of the fold pattern of flattening folds. "Rounded edges of mucosal folds" indicated the disappearance of the secondary folds. "Debris" indicated mucus plugs, which were found to consist of a cast of debris containing aggregates of histiocytic-like cells of an endometrial stromal or mesothelial origin by the previous histologic examination (9). "Foreign bodies" consisted of oily contrast agents that were used on HSG. "Abnormal vessels" indicated irregularities of blood vessel diameters.

Examples of normal mucosa and abnormal findings are shown in Figure 1. We calculated the F scores after salpingoscopy, which was our original score to evaluate tubal lumen expressing the sum of the abnormal findings. One abnormal finding was given a 1-point F score, and the maximum was 12 points.

Infertility Outcomes and Statistical Analysis

After receiving laparoscopy and salpingoscopy, the patients started infertility treatment as soon as possible using timing intercourse or IUI. The patients who were in need of assisted reproductive technologies (ART) treatment due to tubal damage were excluded in this evaluation. The patients recruited in the present study had a diagnosis of unexplained infertility, and their tubal patency was confirmed by HSG before operation. The patients who showed unilateral or bilateral hydrosalpinges or tubal obstruction and were in need of ART treatment were excluded in this evaluation, to focus on evaluating the correlation between the salpingoscopic results and the relationship to reproductive outcomes. Clinical pregnancy was defined as the development of a gestational sac, as determined by transvaginal ultrasonography after ovulation. We analyzed the relationship between the F scores and various clinical findings or pregnancy rates.

Data were recorded as the mean ± SEM, and data were analyzed statistically with use of χ^2 tests. A P value $< .05$ was considered to be statistically significant.

RESULTS

The backgrounds of patients who underwent both laparoscopy and salpingostomy because of unexplained infertility are summarized in Table 1. The average age of the patients was 34.2 ± 0.3 years, and mean duration of infertility was 24.7 ± 0.9 months. The percentage of nulliparous women was 68.8%, and the percentage of patients who showed positive chlamydial antibodies and abnormal HSG findings such as peritubal adhesion were 27.8% and 29.1%, respectively.

The average F score was 0.9 ± 0.1, and range for F scores was from 0 to 7. The distribution of the F scores is shown in Figure 2. Slightly more than half (59.7%) of the patients showed an F score of 0, and the percentages of patients who showed 1, 2, 3, and ≥4 points were 19.2%, 11.5%, 4.5%, and 4.5%, respectively. The average F score of nulliparous patients was 1.0 ± 0.2. This trend was higher than for patients who had a history of pregnancy (0.5 ± 0.2), but the difference was not statistically significant (Table 2). The average F score of patients with an abnormal result on HSG was similar to that of the patients with a normal result on HSG (1.2 ± 0.4 and 0.8 ± 0.2, respectively). However, the average F score for patients who tested positive for chlamydial antibodies was 1.7 ± 0.4, which was significantly higher than that of patients who tested negative (0.6 ± 0.1, P=.0003).

After evaluation, all patients (N = 104) began infertility treatment, and none were in need of ART treatment because of tubal damage after salpingoscopic evaluation. Twenty-five patients