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Hysterosalpingography, Laparoscopy or Both in the Diagnosis of Tubal Disease in Infertility

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Abstract

Objectives: To evaluate and compare the diagnostic value of hysterosalpingography (HSG) with laparoscopy in the assessment of fallopian tube patency in infertile women.

Design: A comparative prospective cross-sectional study.

Setting: Department of Obstetrics and Gynaecology in Goztepe Education and Research Hospital, Istanbul, Turkey.

Materials and Method: Laparoscopy was performed in 100 infertile patients with either unexplained infertility or tubal factors indicated by hysterosalpingography. Regarding laparoscopy as the reference standard, tubal patency findings in histerosalpingography were compared with laparoscopic findings.

Results: The sensitivity, specificity, positive predictive value, negative predictive value of HSG in detecting tubal patency were 0.80, 0.75, 0.91 (95 % CI 0.82-0.96), and 0.55 (95 % CI 0.38-0.70), respectively. The false- negative and false-positive rates of HSG in detecting tubal patency were 15 % and 6 %, respectively. Adnexial adhesions, ovarian cysts and pelvic endometriosis were detected in 27% of cases with normal HSG's. Of the twelve cases of bilaterally occluded tubes detected by HSG, only 3 (25%) were confirmed to have bilateral occlusion during laparoscopy.

Conclusion: Because HSG has a limited value for accurately identifying tubal patency, laparoscopy is necessary to rule out the existence of peritubal adhesions and mild and moderate endometriosis.

INTRODUCTION

Hysterosalpingography (HSG), laparoscopy or both can be applied to demonstrate tubal patency. Owing to its noninvasive nature and low cost, hysterosalpingography (HSG) is widely used as a first-line approach to assess the patency of the Fallopian tubes and uterine anomalies in the routine fertility workup.[1] However, even when tubal patency is demonstrated by HSG, laparoscopy has been suggested as a mandatory step to rule out the existence of peritubal adhesions as well as endometriosis and peritubal adhesions.[2] Some authors have suggested laparoscopy after hysterosalpingography for pelvic pathologies which could be missed with HSG.[3,4]

Since morphological abnormalities of the Fallopian tubes can be visualized directly under laparoscopy, it is generally accepted as the gold standard in diagnosing tubal pathology and other intra-abdominal causes of infertility. Diagnostic laparoscopy has become the standard procedure in the infertility work up in many clinics as the final test to be performed before the couple is referred to infertility treatment. This diagnostic scenario concerns couples eligible for intrauterine insemination (IUI), i.e. unexplained infertility, male subfertility and cervical hostility. Laparoscopy is not usually performed in patients who are already planned for assisted reproductive technology. In such patients, assessment of the tubes and other intra-abdominal pathologies is of less concern except in the presence of hydrosalphinges which can be diagnosed by ultrasonography.[5] Meta-analyses of 20 studies on basic infertility investigations carried out in 4000 infertile women were reviewed to determine the accuracy of hysterosalpingography (HSG) in the demonstration of tubal patency, with the idea that tubal obstruction is a reliable finding of HSG that does not have to be confirmed by laparoscopy; however, normal hysterosalpingographic findings are not sufficient enough to exclude tubal pathologies with peritoneal factors.[6] Nevertheless, Fatum et al stated that couples with unexplained infertility should be treated with IUI without preceding diagnostic laparoscopy, and if unsuccessful, they should be referred directly to IVF.[7]

The relative merits of HSG and laparoscopy in the screening for tubal pathologies have been a matter of discussion for more than 30 years. We designed a study to compare the diagnostic value of hysterosalpingography (HSG) with laparoscopy in the assessment of fallopian tube patency in infertile women.

Materials and Methods

Hundred patients admitted to the Infertility Department of Goztepe Education and Research Hospital between March 2008 and July 2008 were included in this cross-sectional study. The informed consents of all the patients were obtained and the

study was approved by the Human Research Review Committee. Patients with subfertility complaints lasting less than a year, women older than 40 years at the time of their first visit, anovulation despite clomiphene citrate or bromocriptine use, partners with abnormal semen analyses according to the WHO criteria, previous histories of oophorectomy, salpingectomy or pelvic inflammatory disease and surgical or medical treatment for endometriosis were excluded from the study. The past medical histories, semen analyses, day 3 hormone levels and investigations for ovulation were obtained from all the study participants and a physical examination was carried out. Hysterosalpigography and laparoscopy was performed for the assessment of tubal patency in all the participants except for those with recent HSGs performed within the last two years, in whom only laparoscopy was performed and the available HSG was evaluated. All hysterosalpingographies were performed in the outpatient clinic of the department of radiology, between the 7th to the 10th day of the menstrual period. A water soluble contrast medium was used. Photographs were taken at the instant when the uterine cavity and tubes were filled with opaque material and when an overflow was seen at both sides of the tubes or when maximal filling of the tubes was observed without any overflow. After 30 minutes, a late film was made to detect contrast depots. HSG findings were classified as having no tubal occlusions, one-sided tubal occlusion or two–sided tubal occlusions (partial or total occlusion). Additional abnormalities of the uterine cavity were recorded as well. The laparoscopic examination was performed under general anesthesia, in the follicular phase of the menstrual cycle. After making a pneumoperitoneum, a thorough inspection of the pelvis, internal genitalia, and liver region was performed, followed by testing for Fallopian tube patency using Methylene Blue. A dilute solution of Methylene Blue was injected through the cervix via a Rubin cannula. The presence of adhesions, structural abnormalities of the uterus, endometriosis and Fallopian tube occlusion were sought for. Tubal occlusions detected with laparoscopy were classified as no tubal occlusions, one-sided tubal occlusion or two–sided tubal occlusion. During laparoscopy, therapeutic reproductive surgery such as coagulation of grade I or II endometriosis, adhesiolysis or cystectomy were performed when required.

Statistics

Tubal occlusions detected at HSG were compared with occlusions detected at laparoscopy. Tubal pathology was defined as any form of tubal occlusion, be it one-sided or two-sided . Sensitivity, specificity, positive predictive value, negative predictive value and likelihood ratio of HSG in the diagnosis of tubal occlusions were calculated, regarding laparoscopy as the reference standard. Confidence intervals (95% CI) were reported.

Results

Hundred cases with unexplained infertility or infertility due to tubal factors were included in this study. Mean female age of the study was 31.1 ± 5.5 (range 20-40). 69 Patients had primary and 31 had secondary infertility. The average infertility duration of patients with primary infertility was 2.6 years. The average duration of patients with secondary infertility was 4.3 years. 63 of the laparoscopic procedures conducted were diagnostic, while 37 were operative. Table 1 shows tubal status detected at HSG as compared to tubal status detected at laparoscopy. The sensitivity and specificity of HSG were 0.80 and 0.75, respectively, with a positive predictive value of 0.91 (95 % CI 0.82-0.96) and a negative predictive value of 0.55 (95 % CI 0.38-0.70), when tubal pathology was defined as any form of tubal occlusion detected at laparoscopy be it one-sided or two-sided. The false- negative and false-positive rates of HSG in detecting tubal patency were 15 % and 6 %, respectively. The likelihood ratio of HSG for a positive test result was 3.21 and the likelihood ratio for a negative test result was 0.26 (Table 1).

In laparoscopy, 21 patients were found to have intraabdominal adhesions disturbing the tuboovarian anatomy. 8 patients were diagnosed with stage 1 or 2 endometriosis. Ovarian cysts were detected in three patients and hydrosalpinx detected in 5 patients. Laparoscopic surgery was performed in cases with intraabdominal pathologic findings. A summary of tubal patency findings in HSG and laparoscopy can be found in Table 2.

TABLE 1: Comparison of tubal status between HSG and laparoscopy

	Laparoscopy			
HSG	*No occlusion*	*One-sided occlusion*	*Two-sided occlusion*	*Total*
No occlusion	61	5	1	67
One-sided occlusion	9	11	1	21
Two-sided occlusion	6	3	3	12
Total	76	19	5	100

Disease defined as any abnormality: sensitivity 0.80, specificity 0.75

TABLE 2: Detection of tubal status at HSG and laparoscopy

Tubal status at HSG and laparoscopy	*n*
HSG patent, Laparoscopy patent	61
HSG one-sided occluded, Laparoscopy patent	9
HSG two-sided occluded, Laparoscopy patent	6
HSG patent, Laparoscopy one-sided occluded	5
HSG one-sided occluded, Laparoscopy one-sided occluded	11
HSG two-sided occluded, Laparoscopy one-sided occluded	3
HSG patent, Laparoscopy two-sided occluded	1
HSG one-sided occluded, Laparoscopy two-sided occluded	1
HSG two-sided occluded, Laparoscopy two-sided occluded	3
Total	100

Of the 67 patients with normal HSG findings, 12 were found to have adnexial adhesions, 3 were diagnosed with pelvic endometriosis and 3 patients had ovarian cysts. Of the twelve cases of bilaterally occluded tubes detected by HSG, only 3 (25%) were confirmed to have bilateral occlusion during laparoscopy.

Discussion

Histerosalpingography (HSG) is a frequently utilized diagnostic method in the assessment of tubal status and detection of intrauterine anatomical defects in the infertility diagnostic workup. However, the inadequacy of HSG in determining the state of tubal patency, emphasizes the need for laparoscopy. Laparoscopy provides both a panoramic view of the pelvic reproductive anatomy and a magnified view of pelvic organs and peritoneal surfaces. It is generally accepted that, diagnostic laparoscopy is the gold standard in diagnosing tubal pathology and other intraabdominal causes of infertility.[8] Compared with laparoscopy, HSG has only moderate sensitivity but relatively high specificity. If an occlusion is detected in HSG, there is a 60% possibility of the tubes to be actually patent, however, when patency is demonstrated in HSG, there is little chance the tube to be actually occluded.[9,10] In our study, the likelihood ratio of HSG for tube patency was found to be 3.21, and the likelihood ratio for tubal occlusion was 0.26. Consequently, similar to the studies mentioned previously, we concluded that HSG is more accurate in detecting patent tubes rather than occluded ones. Both false negative and false positive results can be seen with HSG. In accordance with literature, the false-negative results were much more common than the false-positive results in our study.[11] Injection of contrast material during HSG can lead to the misdiagnosis of tubal occlusion following cornual spasm.[12] In HSG, while one tube can be observed to be patent, the other one can be occluded. Whereas this observation may indicate an actual one sided proximal tubal occlusion, most commonly it is due to the tendency of the contrast material to enter the tube with the least resistance. Therefore, the occluded appearing tube is in fact most likely to be normal.[13] Another scenario resulting in false-negative diagnosis of tubal occlusion is when inadequate wedging of the cervical cannula allows leakage of contrast material into the vagina, thus interfering with generation of sufficient intracavitary pressure and often leading to the misdiagnosis of tubal occlusion.[14] In our study, we found 15 false negative cases. Although often venous and lymphatic channels can be identified by their anatomy, contrast intravasation into uterine and ovarian veins can sometimes be mistaken for tubal filling.[15] False- positive HSG results may be due to the contrast material entering through the dilated tube with hydrosalphinx. In the presence of peritubal adhesions, even though the tubes may actually be patent, focal contrast deposits can lead to the misinterpretation as distal occlusions.[16] In our study we found 6 false- positive cases.

Both HSG and laparoscopy have advantages and disadvantages. HSG is quite accurate in defining the uterine cavity. Laparoscopy on the other hand, although not able to give information on the uterine cavity, is superior to histerosalpingography in the assessment of tubal patency and allows detection and, most importantly, treatment of intraabdominal pathologies as endometriosis and peritubal adhesions. The disadvantages of histerosalpingography are the possibility of allergic reactions to iodine, pelvic infections, endometriosis secondary to carriage of endometrial tissue onto extrauterine sites, and tubal rupture due to contrast material given under pressure in patients with hydrosalphinges. Also the ovaries are said to be exposed to 500-1000 mRads of radiation during HSG. The disadvantages of laparoscopy are its invasiveness, cost, and related risks of surgical complications.[17] During our HSGs, a water soluble contrast medium was used, and no complications were encountered. During laparoscopy, the only complication encountered was hemorrhage from the 5 mm trocar insertion site that was managed by cauterization.

A diagnosis of unexplained infertility is usually made only after it has been demonstrated that the female partner ovulates regularly, has patent fallopian tubes, shows no evidence of peritubal adhesions, fibroids or endometriosis and has a partner with normal sperm production and function.[2] Fatum et al suggested that couples with unexplained infertility should be treated by 3-6 cycles of combined gonadotrophins and IUI without preceding diagnostic laparoscopy, and if unsuccessful, they should be referred directly to IVF. In their opinion, this approach would prove to be the most cost effective and efficient treatment protocol.[7] In Drake et al's series of 24 cases with unexplained infertility, 18 were found to have abnormal findings in laparoscopy. It was proposed that the usage of laparoscopy as a standard test of tubal function would reduce the apparent incidence of unexplained infertility. They concluded that laparoscopy is an essential final step in an otherwise negative work-up for infertility.[18] Laparoscopy has been shown to reveal abnormal findings in 21-68 % of infertile patients with a normal hysterosalpingogram.[4,8,19] Hening et al have detected adnexial adhesions and pelvic endometriosis during surgery in 21% of patients with normal HSG findings.[20] The superiority of laparoscopy over HSG in assessing extratubuler pathology is shown in our study as has been demonstrated in other studies.[6] Tanahatoe et al stated that laparoscopy revealed abnormalities that resulted in altered treatment decisions in 25% of the patients who would normally have been scheduled for IUI if laparoscopy had not been performed. The altered treatments mainly concerned surgery for minimal/mild endometriosis and periadnexial adhesions, both performed during diagnostic laparoscopy.[8] In our study, 27 % of cases with normal HSGs were found to have adnexial adhesions, ovarian cysts and pelvic

endometriosis. Of the twelve cases of bilaterally occluded tubes detected by HSG, only 3 (25%) were confirmed to have bilateral occlusion during laparoscopy.

These findings are in accordance with the aforementioned studies. Contrary to Farum et al's suggestions[7] though, we are of the thought that proceeding to IUI without a prior diagnostic laparoscopy will lead to low pregnancy rates, a prolonged period of time until a pregnancy is achieved, or to the unnecessary referral of the patient to IVF, a very costly treatment.

Speroff et al state that laparoscopy has been suggested traditionally to be an integral diagnostic procedure of most infertility investigatory protocols. Also, according to Speroff et al, following a normal HSG and laparoscopy, the couple is diagnosed as suffering from unexplained infertility and should be referred to the next line of treatment.[11] Moreover, the study of Perquin et al showed that routine use of HSG at an early stage in the fertility workup prior to laparoscopy and dye does not influence the cumulative pregnancy rate.[21]

CONCLUSION

HSG demonstrated reduced positive predictive value especially for bilateral proximal tubal occlusion. Moreover, HSG has a limited value for accurately identifying tubal patency. Therefore, we suggest that laparoscopy is necessary to rule out the existence of peritubal adhesions and mild and moderate endometriosis as causes of infertility in patients with abnormal HSG findings.

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