

Hysterosalpingography in infertility investigation protocol: is it still useful?

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Summary

Purpose of investigation: to assess the radiological findings of women undergoing hysterosalpingography (HSG) as initial infertility investigation protocol. **Materials and Methods:** A retrospective study on infertile women who underwent HSG at Institute of Radiology of Sassari University, Italy. **Results:** The present case series included 2,845 HSG, performed from January 1997 to March 2014. The age of the patients ranged from 20 to 48 years. The negative exams (tubal patency) were 2,039 out of 2,845 (71.67%). **Conclusion:** A technique of diagnostic imaging for the evaluation of infertility should be non-invasive, not expensive, rapid, of simple execution, and also be able to provide information on tubal patency and pelvic diseases. For these reasons, HSG today remains a useful diagnostic investigation tool in the diagnostic work-up of infertile patients.

Key words: Infertility investigation protocol; Hysterosalpingography (HSG); Saline-infusion sonography (SIS); Hysterosalpingo-contrast sonography (HyCoSy).

Introduction

Hysterosalpingography (HSG) is a radiological procedure, performed mainly in the diagnostic protocol of infertility, which allows, through the introduction of a radio-opaque contrast medium through the cervical canal, the accurate assessment of the uterine cavity and fallopian tubes [1].

Other procedures that are used for the evaluation of the uterus are saline-infusion sonography (SIS), optimal for viewing the uterine cavity, magnetic resonance imaging (MRI), especially useful for evaluating the myometrium and ovaries, and laparoscopy with the chromopertubation (or dye) test, accurate to diagnose the causes of tubal occlusion and to study pelvic peritoneum [1].

The introduction of hysterosalpingo-contrast sonography (HyCoSy) has become an increasingly popular alternative, combining the principles of SIS with those of HSG. In fact, HyCoSy has proven to be an acceptable, time efficient, and well-tolerated alternative to HSG with comparable accuracy in the assessment of the uterine cavity and tubal patency. HyCoSy is a simple, safe, and effective outpatient procedure that may add value to a streamlined initial infertility evaluation [2].

Despite the arrival of these newer imaging investigations, HSG still remains today the most used tool to study infertility, due to its ability to optimally evaluate the tubal occlusion which is present in 12-33% of infertile couples [3]. In recent years the number of HSG has increased consider-

ably, probably in relation to the progress of reproductive medicine, the successes of the results of medically assisted reproduction procedures, and the tendency of women to postpone pregnancy always later in their lives [1].

HSG is an examination that allows morphological study but not female genital tract functionality, because physiological integrity is evident only after a patient becomes pregnant. The main indications for HSG include uterine and tubal disease. Uterine pathology is represented by: uterine myoma, endometrial polyps, synechiae, and uterine malformations (uterus septum is the most frequent). Tubal pathology includes: proximal, distal occlusion, peritubal adhesions, and hydrosalpinx [4]. However, mild or moderate grade endometriosis is not visible with HSG. Conversely, laparoscopy allows to visualize the uterine anatomy, relationships between tube and ovary, pelvic adhesions, and any endometriosis lesions if present. On the other hand, HSG is less expensive and less invasive than laparoscopy. For the study of morphology of the uterus, and in particular of the uterine malformations, HSG must be combined with other imaging techniques such as transabdominal and transvaginal pelvic ultrasound, and/or MRI.

SIS is a simple, outpatient procedure, using ultrasonography: sterile saline solution (contrast medium) is injected into the uterine cavity through a catheter with balloon endocervical sampling of 5 French, so that the uterine cavity and fallopian tubes can be displayed [5, 6]. SIS can now be



Figure 1. — Bilateral tubal patency (normal findings).

considered how broadly validated survey in research of the causes of infertility, is able to increase the power of routine transvaginal ultrasound in evaluating uterine cavity diseases and congenital or acquired pathologies associated with infertility.

HyCoSy uses hyperechoic contrast medium (such as Echovist-200) or a mixture of saline and air for evaluating tubal patency [2].

The aim of this retrospective study was to analyze indications of HSG performed in a 17-year period at the Institute of Radiological Sciences at the University of Sassari, Italy.

Materials and Methods

The present case series included 2,845 HSG, performed from January 1997 to March 2014 at the Institute of Radiological Sciences at the University of Sassari, Italy. The age of the patients was between 20 and 48 years (mean age \pm SD = 34.5 ± 2.5).

HSG was performed with the patient supine on the fluoroscopy table in lithotomy position. After cervical preparation (commonly with povidone-iodine solution), a tenaculum was placed for cervical stabilization and uterine positioning. The HSG catheter (typically 5F) was inserted through the endocervix. The catheter balloon tip was inflated to aid in uterine traction, limit efflux of contrast, or spontaneous expulsion of the catheter. Iodinated hydrosoluble contrast media was instilled through the catheter into the uterine cavity. Radiograph images were obtained intermittently to document filling of the uterine cavity and fallopian tubes (Figure 1). The authors began the procedure at low pressure through a balloon catheter placed in the uterine cavity. Then, in case of failure or incomplete tubal opacification, other injections were performed, with higher pressure, while also varying the decubitus of the patient. In the presence of proximal tubal occlusion, mono or bilateral, the authors scheduled a second HSG after about a month [7]. Selective catheter-



Figure 2. — Monolateral right proximal tubal occlusion.

ization was performed during the execution of the second HSG in case of persistence of the tubal occlusion. The case series was divided for years and for ages to analyze the growth or decrease in the number and percentage of negative or pathological examinations.

Results

The negative exams were 2,039 out of 2,845 (71.67%) (Table 1). The negative results (normal findings and bilateral tubal patency) of examinations performed per year were as follows:

- 1997: 105/121 negative results (86.78%)
- 1998: 104/141 negative results (73.76%)
- 1999: 45/57 negative results (78.95%)
- 2000: 45/62 negative results (72.58%)
- 2001: 50/60 negative results (83.33%)
- 2002: 77/97 negative results (79.38%)
- 2003: 132/167 negative results (79.04%)
- 2004: 141/181 negative results (77.90%)
- 2005: 137/168 negative results (81.55%)
- 2006: 156/202 negative results (77.23%)
- 2007: 148/190 negative results (77.89%)
- 2008: 135/181 negative results (74.59%)
- 2009: 283/377 negative results (75.07%)
- 2010: 163/221 negative results (73.76%)
- 2011: 152/202 negative results (75.25%)
- 2012: 170/223 negative results (76.23%)
- 2013: 123/154 negative results (79.87%)
- 2014 (up to March 31): 32/41 negative results (78.05%)

Fifty-six out of 2,845 (1.97%) patients presenting with bilateral tubal occlusion to normal inflation pressure become patent tubes by injecting contrast medium at high-pressure. 133/2845 (4.67%) patients achieved opacification of a sin-

Table 1. — *Results of hysterosalpingographies.*

Negative: normal findings (bilateral tubal patency)	2,039
Bilateral occlusion	55
Monolateral occlusion	138
Proximal monolateral occlusion. Repeat after one month	15
Monolateral occlusion and hydrosalpinx	18
Bilateral hydrosalpinx	90
Monolateral hydrosalpinx	35
Cervical stenosis	1
Bilateral occlusion after ESSURE	2
Bilateral occlusion after tubal ligation	1
Negative for bilateral tubal patency at high pressure	56
Negative for monolateral tubal patency at high pressure	133
Negative after bilateral selective salpingography	8
Negative after monolateral selective salpingography	4
Tubal patency after a second HSG	2
Tubal patency after high pressure; endometrial polyp	1
Tubal monolateral patency after selective salpingography	6
Unicornuate uterus; tubal monolateral occlusion	11
Bicornuate uterus one cervix	39
Negative; arcuate uterus	2
Negative; septate uterus	5
Negative; uterus didelphys with double vagina	1
Negative; myoma	59
Negative; endometrial polyp	41
Myoma; monolateral tubal patency after high pressure	6
Myoma; hydrosalpinx	3
Myoma; monolateral occlusion	3
Myoma; bilateral occlusion	1
Multiple myomas; negative	18
	1,772

gle tube after high pressure injection. Twelve out of 2,845 (0.42%) patients underwent a second HSG after one month and, through selective salpingography, both tubes become patent.

The pathological changes observed are as follows: 141 mono (Figure 2) and 55 bilateral proximal occlusions: 12 resolved spontaneously to the next control and 12 resolved after selective salpingography; 35 unilateral and 90 bilateral hydrosalpinx; 58 congenital uterine anomalies; 72 fibromyomas and 41 endometrial polyps (confirmed with subsequent SIS and/or hysteroscopy). In all three patients undergoing bilateral tubal occlusion by hysteroscopic approach (ESSURE), the HSG confirmed the total closure of the tubes. During all diagnostic procedures, significant complications were not reported.

Discussion

The retrospective study carried out at the Institute of Radiological Sciences of Sassari University, showed that requests for the HSG underwent fluctuations over the years: 121 in 1997, 141 in 1998, to achieve a decrease in the years 1999, 2000, 2001, and 2002, respectively, with 57, 62, 60 and 97 requests. An increase once again was observed in recent

years: 167 requests in 2003, 181 in 2004, 168 in 2005 up to 211 in 2006, 190 in 2007, 181 in 2008, and a sharp increase in 2009 with 373 requests. This increase in exams noticed in the recent years, agrees with the observations reported by other authors [1] and is presumably linked to the progress of reproductive medicine, the successes of the results of medically assisted reproduction procedures, and the tendency of women to postpone pregnancy always later in their lives [1]. In fact, the age range in which HSG was a major request was that between 30-35 years with 617 procedures, followed by 464 procedures between 35-40 years. HSGs were still performed in women that are rather young of 20-25 years or older with an age of 45-50 years.

Another interesting fact is the high proportion about 70% of negative tests that deviates from the data reported in the literature by some authors [8-9] who mention in their cases a percentage of negativity of 64% and 67%. The present high percentage of HSG negatives could be linked to the fact that, in the present case, HSG did not represent the final diagnostic process investigation of infertility, but often was the first test for evaluating tubal patency.

With regard to the treatment of proximal tubal obstruction, the present authors [7] studied whether a second HSG done after one month compared to the previous one, could make it possible to clean the tube, reducing the use of selective salpingography in patients with proximal tubal obstruction due to deposits of mucus. For this purpose, a sample of 360 infertile women with proximal tubal occlusion uni- or bilateral were advised to have a second HSG after about a month from the previous, and of these, 40 patients were subjected to a second HSG after a month from the first HSG performed. In 24 patients out of 40 (60%), the execution of the second HSG obtained the patency of both tubes and only in the remaining patients selective salpingography was necessary. So in conclusion, in the infertile women with proximal tubal obstruction, is better to make a second HSG subjecting the patient to a very low dosage of radiation and also a smaller risk than the selective salpingography that must be carried out only in case of failure after the repetition of the second HSG.

Examination success is related to the choice of the catheter as well as SIS [5]: on the market, there are several catheters, with different features and different terms of use. Before coming to the choice of dedicated two-way balloon catheter, for a certain period of time, Foley catheters, two-way, were used normally: are soft, not stiff, and have the advantage of being inexpensive; variants to the balloon catheter are formed from the catheter by Goldstein (Cook), which does not possess the balloon at the top and is positioned in the uterus with a cup that is slid along the catheter and joins the external uterine orifice. Some authors [4] decided to proceed with the use of two-way balloon catheter to perform the HSG with the aim of ascertaining pain in patients who are subjected to the HSG using three different techniques. Always according to the above-mentioned complications, it is crucial to choose the contrast medium: in spite of the fact that in the present authors

practice they use just non-ionic water-soluble iodinated contrast media, some authors prefer to use lipid-soluble contrast media; the most used was the Lipiodol contrast media [4].

The present authors' choice falls on the water-soluble non-ionic iodinated contrast medium with key features such as: good radio-opacity, the absence of toxicity, good tolerability and easy application; also in this case the contrast medium must be radio-opaque enough to delimit precisely the uterus.

To exclude an active pelvic infection, the present authors used erythrocyte sedimentation rate (ESR) assessment; in fact, pelvic inflammatory disease (PID) causes an increase of the ESR, but patients with high ESR and with negative culture for Chlamydia and gonorrhea, are still subjected to examination [1]. The authors also gave a non-steroidal anti-inflammatory medication one hour before the procedure [1].

In the present authors' practice, they did not observe significant complications, although in the literature several complications have been described as inflammatory reactions resulting from the HSG, which represent a serious complication of the procedure. The presence of a tubal inflammatory reaction in patients with regular tubal patency is a major event and especially damages a woman's fertility. Antibiotic prophylaxis did not alter significantly the proportion of pelvic peritoneal inflammation [1]. Complications have also been reported in the literature due to perforation of the uterus and fallopian tubes. These are usually caused by improper use of an unsuitable tools, or the presence of uterine anomalies.

Luciano *et al.* [10] evaluated the benefits and accuracy of HyCoSy in studying the tubes, compared with HSG and laparoscopic chromopertubation. The sensitivity and specificity for HyCoSy in determining tubal patency compared with laparoscopic chromopertubation were 97% and 82%, respectively; the positive predictive value was 88% and the negative predictive value was 95%. The authors [10] concluded that HyCoSy had a similar sensitivity and specificity for tubal patency as HSG, without the inconvenience and potential hazards of HSG, such as possible iodine-based sensitivity to the radiopaque dye and exposure to radiation.

Considering that laparoscopic chromopertubation is the reference test (gold standard), HSG and HyCoSy are equally effective in the diagnosis of tubal patency. HyCoSy is a cheap technique, rapid, well-tolerated, and one of the most important advantages is the ability to obtain information on the status of tube and uterus in one survey time. HyCoSy allows to perform a continuous real-time survey, does not require the use of irritating contrast media as it uses as a mixture of air and a sterile saline solution and this makes it the simplest and most cheap method without affecting the outcome of tubal patency, it does not involve exposure to ionizing radiation (such as HSG) but is a simple ultrasound transvaginal examination and therefore is repeatable.

A technique of diagnostic imaging for the evaluation of infertility should be non-invasive, not expensive, rapid, and of simple execution, and should also be able to provide information regarding tubal patency and pelvic diseases.

HyCoSy should then precede HSG and patients with suspected tubal pathology should be selected [1]. It would therefore be desirable to perform before a HyCoSy as screening for selected patients with tubal pathology and HSG should be applied only in such cases. HyCoSy does not give an image of the whole tuba, while the HSG allows a more accurate location of tubal occlusion allowing opacification through selective catheterization. For all the aforementioned reasons, HSG today remains a useful diagnostic investigation tool in the diagnostic work-up of infertile patients.

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