

COUNTERCURRENT



Hysterosalpingography is obsolete: hysterosalpingo-contrast foam sonography should be the alternative

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ABSTRACT

Current evidence suggests that the hysterosalpingo-foam sonography test (HyFoSy) has emerged as a new option to make Fallopian tube assessment easier. Several published studies have compared the different types of tubal patency test available with the accepted gold standard, laparoscopy and dye, endorsing the advantages of HyFoSy over the other techniques. However, the authors wonder why professionals nowadays do not indicate HyFoSy as a first-choice diagnostic tool, with X-ray hysterosalpingography as still the most recommended procedure in outpatients. The aim of this article is to highlight the latest updates on this topic in order to raise awareness of the benefits of hysterosalpingo-contrast sonography as well as provide some tips for performing HyFoSy to obtain the maximum information in a single consultation.

INTRODUCTION

An accurate diagnosis for an infertile couple is mandatory to propose a precise therapeutic treatment. An assessment of Fallopian tube patency is an essential part of the routine infertility workup as tubal obstruction is estimated to play a role in about 12–33% of these patients. Reliable evaluation of the Fallopian tubes is crucial because an incorrect diagnosis may result in unnecessary tubal reconstructive surgery or IVF. Various tests are recommended for this purpose, including laparoscopy and dye as a gold standard, hysterosalpingography (HSG) and hysterosalpingo-contrast sonography (HyCoSy). Many of these tests are complementary to each other, rather than alternatives.

While for decades HSG has traditionally been the first option to investigate Fallopian tube patency it has certain limitations, which have prompted us to query its current role when newer modalities are clearly available. In 2007 a new contrast non-embryotoxic medium to perform HyCoSy was developed by Emanuel and Exalto: ExEm Foam (IQ Medical Ventures BV, Rotterdam, The Netherlands) (Emanuel *et al.*, 2012). This foam is a hyperechogenic medium, which enhances contrast visualization and enables a clearer delineation of the tubal anatomy; in addition it lasts longer than other contrast media such as air and saline. It is important to take into account that it is currently the only registered commercial contrast medium for tubal patency testing in ultrasonography. HyCoSy performed with

ExEm Foam medium has been named the hysterosalpingo-foam sonography (HyFoSy) test (Emanuel *et al.*, 2012). HyFoSy is meant to unseat HSG as a first diagnostic option for several remarkable reasons, which are presented in this article.

FEASIBILITY AND REPRODUCIBILITY

HyFoSy enables gynaecologists to complete a fertility workup in the clinic in the most minimally invasive way, achieving a global assessment of the uterus, ovaries and Fallopian tubes in a time-efficient manner. The ability to perform most infertility diagnosis by ultrasonography in the ambulatory setting is attractive and beneficial not only to patients, but also to the healthcare

KEY WORDS

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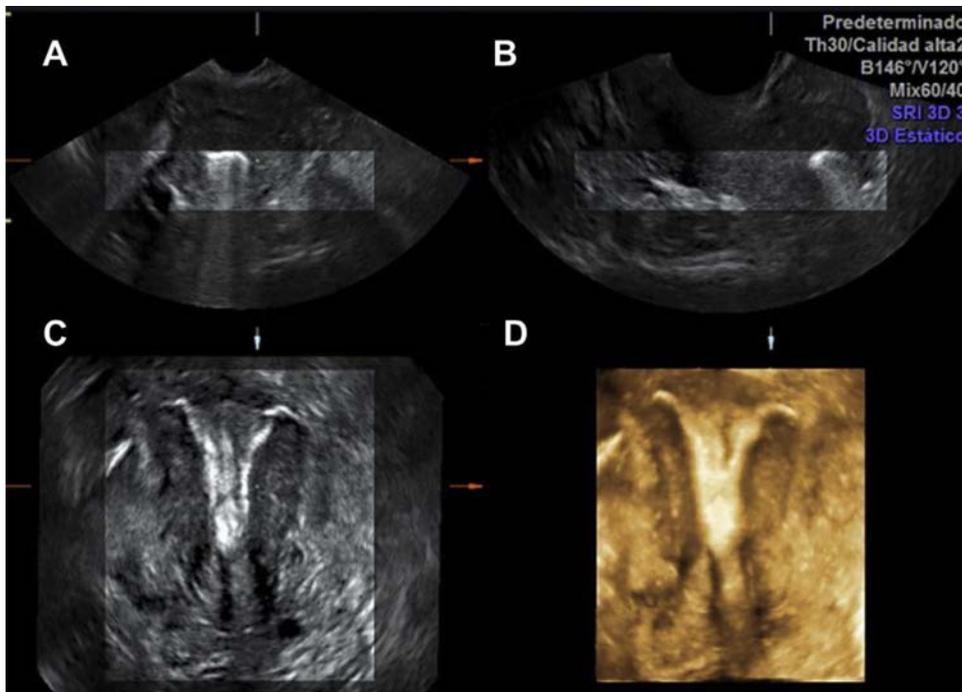


FIGURE 1 Multiplanar and three-dimensional transvaginal ultrasound images from hysterosalpingo-foam sonography (HyFoSy) in the (A) transverse, (B) sagittal and (C) coronal planes. (D) Reconstructed image in the coronal plane of a uterus demonstrating a normal uterine fundal contour and tubes filled with foam. Hyperechogenic foam (ExEm Foam) has filled the endometrial cavity and passed through the Fallopian tubes.

system. Conversely, HSG must be performed with radiological equipment, cannot detect abnormal ovaries or myometrium, implies an exposure to ionizing radiation and is associated with a small risk of iodine allergy.

A novel concept has recently arisen for the exploration of female infertility: the Fertiliscan, a unique investigation based on the realization of a high-quality 3D ultrasound scan that identifies the presence of any congenital uterine malformations or intracavitary abnormalities and involves HyFoSy to assess tubal patency. It enables a quick clinical judgement to be made in a patient seeking fertility treatment, which particularly benefits older women (Levaillant *et al.*, 2019). Thanks to HyFoSy, it is not necessary to make a referral to another specialist to carry out further investigations, unless doubts about the diagnostic results may lead to difficulties in indicating the therapeutic route to follow (Rajesh *et al.*, 2017).

In the authors' experience, having worked with ExEm-foam Kit for several years, a methodologically simple study can be suggested to perform a global assessment for each woman. To start this we recommend carrying out saline infusion sonography (SIS). The aim of SIS

is to identify abnormalities of the uterine cavity that could affect pregnancy. SIS has been shown to be very accurate in detecting polyps and fibroids. The procedure is performed by inserting a soft catheter inside the uterine cavity and instilling sterile saline solution to distend and assess the cavity.

Following that and leaving the same catheter in the uterus, foam should be flushed in to visualize the Fallopian tubes. The slow introduction of 5 ml of foam in one bolus into the endometrial cavity is enough to achieve a correct visualization. It is recommended that a longitudinal uterine ultrasound analysis is performed to evaluate whether foam is passing through it and is not returning to the vagina. Next, the vaginal probe should be switched to a transverse section of the uterus to locate the tubes. Finally, foam dispersion around the ovaries and inside the peritoneal cavity should be checked (FIGURE 1). The gel usually maintains its echogenicity long enough, between 5 and 12 min, to allow image acquisition. We have defined tubal patency as gel foam spillage from the fimbrial endings, seen as fluid flow surrounding the ovary and its collection in the pelvis. Distal tubal blockage is defined as an absence of spillage. In the event of apparent cornual blockage, it is acceptable to add

more foam, which may correct the tubal spasms.

Finally, it is advisable to check the ovaries and to establish the antral follicle count.

EFFICACY

As stated above, tubal disease is an important cause of infertility, and tubal patency testing is essential in the investigation of infertility. Nowadays there are plenty of well-designed studies that have demonstrated the validity of new emerging techniques such as HyFoSy by comparing its accuracy with traditional techniques. In such a study, Van Schoubroeck and colleagues compared HyFoSy with the gold standard, finding 100% agreement between HyFoSy and the laparoscopy and dye technique. They concluded that HyFoSy is both feasible and accurate in the diagnosis of tubal patency (Van Schoubroeck *et al.*, 2013).

In addition, two recently published articles have compared the diagnostic accuracy of HyFoSy and HSG, performing both techniques in all the women they enrolled; they established that both techniques were in concordance in 73% of women regarding the accuracy of tubal patency but HyFoSy was better tolerated and had

the previously mentioned benefits over HSG. Considering that unilateral tubal pathology does not necessarily reduce the chance of pregnancy in comparison to an absence of tubal pathology (*van Welie et al., 2022*), the aim of both studies was to detect bilateral tubal pathology and to assess the percentage of women who would need a second, complementary test. In this sense, 5.7% of the women would have needed a second test in Ramos and co-workers' study and 13.9% in the study by van Welie and collaborators. This is less than was seen in previous studies, such as Emanuel and colleagues' report, in which HSG had to be performed in about 21.9% of cases. This is probably due to the implementation of an appropriate learning curve. What is more, in the study of van Welie and collaborators, where the primary outcome for the comparison of the two strategies was ongoing pregnancy leading to live birth within 12 months after inclusion, the estimated live birth rate was 46% in the HyFoSy group versus 47% in the HSG group, confirming non-inferiority between the two techniques (*Emanuel et al., 2012; Ramos et al., 2021; van Welie et al., 2022*).

HyFoSy has also been compared with HyCoSy in a randomized controlled trial using saline medium to assess the diagnostic yield and efficacy of ExEm Foam as a contrast agent. A higher proportion of tubes were classified as patent with HyFoSy when compared with HyCoSy (*Rajesh et al., 2017*) and, likewise, HyFoSy provided a more accurate diagnosis compared with HyCoSy with saline solution when both techniques were compared against the laparoscopy and dye approach (*Piccioni et al., 2017*).

The meta-analysis of Maheux-Lacroix and colleagues shows that, like HyCoSy, HyFoSy appears to be as accurate in diagnosing tubal patency as HSG. The accuracy of use of both sono-HSG and HSG in all participants compared with laparoscopy gave a sensitivity and specificity of 0.95 (95% confidence interval [CI] 0.78–0.99) and 0.93 (95% CI 0.89–0.96) for sono-HSG, and 0.94 (95% CI 0.74–0.99) and 0.92 (95% CI 0.87–0.95) for HSG, respectively (*Maheux-Lacroix et al., 2014*).

The efficacy of HyFoSy has also been proven in women where the diagnosis

of tubal occlusion after a surgical procedure relating to hydrosalpinx or as a contraceptive method was evaluated using HyFoSy and HSG; a 100% concordance in the results was seen between the two techniques (*Rajesh et al., 2017*).

TOLERABILITY AND SAFETY

HyFoSy offers the additional advantage of less pain being experienced by the woman during the procedure and a shorter procedural time. While HyFoSy can be performed in about 5 min, HSG requires an average time of 12.5 min (showing a significant difference, $P < 0.01$) (*Dreyer et al., 2014*).

Based on a visual analogue scale (VAS) score for the perception of pain, several studies have shown that the number of patients who experienced less pain is higher with HyFoSy than HSG. The multicentre study of Van Welie and colleagues, which included 1026 participants, pointed out that the average VAS pain score for HyFoSy was 3.1 whereas the mean VAS pain score for HSG was 5.4 (*van Welie et al., 2022*). Therefore HSG can result in an overdiagnosis of tubal occlusion possibly due to tubal spasms caused by pain during the procedure (*Dreyer et al., 2014; Ramos et al., 2021*).

Considering the safety and side-effects of HyFoSy, the foam used to perform the test is a safe product; it contains hydroxyethylcellulose, purified water and glycerol, all ingredients that comply with international pharmacopoeiae (US, British and European Pharmacopoeiae). This contrast medium is authorized for intrauterine application and tubal patency testing, indicating an optimal risk–benefit ratio in clinical use. The safest strategy, however, is to restrict clinical examinations with gel and foam to the pre-ovulatory phase of the menstrual cycle. The side-effects of HyFoSy encountered in daily practice include pain, vasovagal reactions, fluid loss and spotting, but these do not differ from other comparable diagnostic procedures.

We propose some tips that may be useful when performing HyFoSy. It is preferable to perform the technique with the patient having a comfortably full bladder for two reasons; first, access to the interior of the uterus is facilitated in cases of anteverted uterus, and second,

if there are doubts about the correct position of the catheter, abdominal ultrasonography can be performed to ensure that the foam is passing correctly. A suitable catheter must be selected for the procedure, such as a Gynetics (#4219 Emtrac Delphin embryo transfer catheter) (Gynetics, Belgium), Kitazato (4.7 Fr 230 mm Trial EC-PRO Catheter and outer guide) (Kitazato, Japan) or HunterCath (Hunter Urology, United Kingdom). It is preferable to use a thin balloon-free-catheter, which can be easily inserted inside the uterine cavity. There is no need to use a tenaculum because hardly any pressure is necessary to fill the uterine cavity and the subsequent filling of the Fallopian tubes is remarkably quick. It is advisable to introduce the foam slowly to avoid the sensation of cramps and discomfort (*Exalto et al., 2014*).

CONCLUSIONS

HyFoSy is a suitable technique to assess tubal patency, being as accurate as HSG. Nevertheless, it is more patient friendly, uses a non-embryotoxic contrast, is more cost-effective and allows a fast track pathway to a fertility treatment. It can be performed in an examination room equipped only with an ultrasound scanner. Based on these statements, HyFoSy should be the first-line diagnostic procedure to assess tubal patency, especially in women who have a low risk of tubal disease. It must be considered that, in order to achieve adequate precision, the gynaecologist who performs the test must be well trained and must rely on good ultrasound equipment. As a natural conception requires at least one functional and patent Fallopian tube, only cases of bilateral tubal obstruction diagnosed by HyFoSy would require further investigation. In summary, it is vital for gynaecologists to implement modern non-invasive ultrasound modalities in daily clinical practice, and we encourage all professionals to be open to new changes that will benefit our patients.

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