

Original Research Article

# Role of Magnetic resonance hysterosalpingography in female infertility

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## Abstract

**Background:** Approximately 15 % of couples are affected by infertility, which is defined as the inability to conceive after 12 months of regular unprotected sexual intercourse. Magnetic resonance imaging (MRI) can be used to evaluate congenital Müllerian duct anomalies and to diagnose adenomyosis, leiomyoma and endometriosis. MRI-hysterosalpingography (MR-HSG) in addition to conventional MRI (with/without contrast) is effectively used in diagnosing the tubal and uterine cause of infertilities.

**Materials and methods:** The purpose of study was to evaluate the ability of magnetic resonance hysterosalpingography to evaluate fallopian tube patency and evaluate cause of infertility. Written informed consent was obtained from all subjects. Forty two women with infertility were recruited between 2017 and 2018. Eighteen out of 42 patients had already underwent conventional hysterosalpingography. MRI was performed on a 1.5-T System, using a phased array surface coil.

**Results:** About 32 patients showed bilateral tubal patency. Six patients showed bilateral tubal occlusion on MR HSG. 2 patients had unilateral tubal occlusion. 7 patients had ovarian endometriosis, 6 had leiomyomas, 2 patients had mullerian anomalies, 3 patients had features of polycystic ovarian disease and 5 patients had multifactorial etiology. No cause could be found in 9 patients.

**Conclusion:** MR-HSG is a feasible, useful, innovative and well tolerated tool for the assessment of the uterus, fallopian tubes, ovaries and extra-uterine structures. MR-HSG is a new promising imaging approach to female infertility. MR-HSG scanning can be helpful in demonstrating tubal patency even in patients with documented tubal blockage on conventional HSG.

## Key words

Hysterosalpingography, Tubal patency, Magnetic resonance, Female, Infertility.

## Introduction

Approximately 15 % of couples are affected by infertility, which is defined as the inability to conceive after 12 months of regular unprotected sexual intercourse [1]. Common causes of infertility include male factor (45 %), ovulation disorders (37 %) and tubal damage (18 %) [2]. A combination of several factors is found in approximately 20 % of all couples. The etiology of tubal damage can be intrinsic (ascending salpingitis, including salpingitis isthmica nodosa) or extrinsic (peritonitis, endometriosis and pelvic surgery). Women with infertility are often referred for MR for diagnosis of uterine or extrauterine abnormality, the ability to simultaneously assess tubal patency is always beneficial. MRI has high accuracy in detecting various pelvic, uterine and ovarian pathologies.

Magnetic resonance imaging (MRI) can be used to evaluate congenital Müllerian duct anomalies and to diagnose adenomyosis, leiomyoma and endometriosis. MRI-hysterosalpingography (MR-HSG) in addition to conventional MRI (with or without contrast) is effectively used in diagnosing the tubal and uterine cause of infertilities. MR-HSG was firstly used for a 32-year-old woman with a history of iodine-induced hypothyroidism, which contraindicated conventional HSG for her [3]. There are many benefits in MR-HSG, which stated in the previous reports; (1) Nonionizing radiation is used in scanning, it is so important considering that the target population of this workup is in fertility age, (2) it is not operator dependent versus sonography, (3) evaluating the other causes of infertility and assessing the adjacent organs, (4) selective tubal catheterization is possible during the procedure, (5) excellent resolution and multiplanar imaging, (6) evaluating distal tubal pathology and possible peritubal adhesions [4, 5]. However, there is some limitation for this modality; (1) An experienced reader and radiologist is needed for

interpreting the pictures, (2) there are some contraindications for MR-HSG including general MRI contraindication such as hepatic and renal insufficiency, intolerance to gadolinium-based contrast, severe claustrophobia, and metal device in body, e.g. cardiac pacemakers, cochlear implants. Furthermore, MR-HSG is an expensive and time lasting procedure which is other limitations. (3) Dislocating the catheter due to unavoidable motion and higher failure rate, (4) felling discomfort during the contrast injection up to 21% [6].

Thirty minutes is the maximum time, which take by MR-HSG that is acceptable for nonemergency patients such as infertile women [7]. Furthermore, MR-HSG can be hybrid with conventional radiography for more accurate diagnosis of the anatomical defects [8].

## Materials and methods

The purpose of study was to evaluate the ability of magnetic resonance hysterosalpingography to evaluate fallopian tube patency and evaluate cause of infertility. Written informed consent was obtained from all subjects. Forty two women with infertility were recruited between 2017 and 2018. Eighteen out of 42 patients had already underwent conventional hysterosalpingography and 8 out of 18 were diagnosed with bilateral tubal occlusion and three with unilateral occlusion. MRI was performed on a 1.5-T system (Siemens), using a phased array surface coil. T2-weighted axial, T2-weighted sagittal, T2-weighted coronal, T1 and T2 fat saturation and T1-weighted axial sequences were obtained to assess for intra- and extrauterine abnormalities. Then the patient was taken out of the MR scanner and brought to a procedure room where a 7 French balloon catheter was placed by female doctor or nurse to make the patient comfortable. After catheter placement, the patient was returned to the MR scanner for the remainder of the examination then flash 3D coronal scanning

by MR angiographic sequence (3D time-resolved imaging of contrast kinetics [TRICKS]) was performed with the uterine injection of a diluted mixture of gadolinium-based contrast (1:100), and data were reconstructed after digital subtraction scan. Patient comfort was evaluated using a specific score questionnaire (**Photo – 1 to 4**).

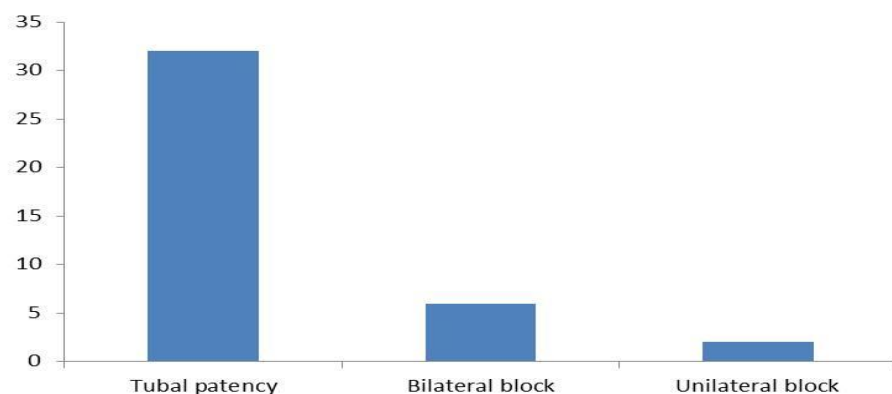
### Results and Discussion

Procedure was successfully completed in 40 patients. In one patient we couldn't insert the balloon catheter and patient was later diagnosed with cervical stenosis. One patient developed claustrophobia and failed to complete the study. About 32 patients showed bilateral tubal patency with symmetrical contrast leakage into peritoneum. Six out of eight patients who showed bilateral tubal occlusion on conventional HSG were diagnosed with bilateral tubal occlusion on MR HSG while as tubes were

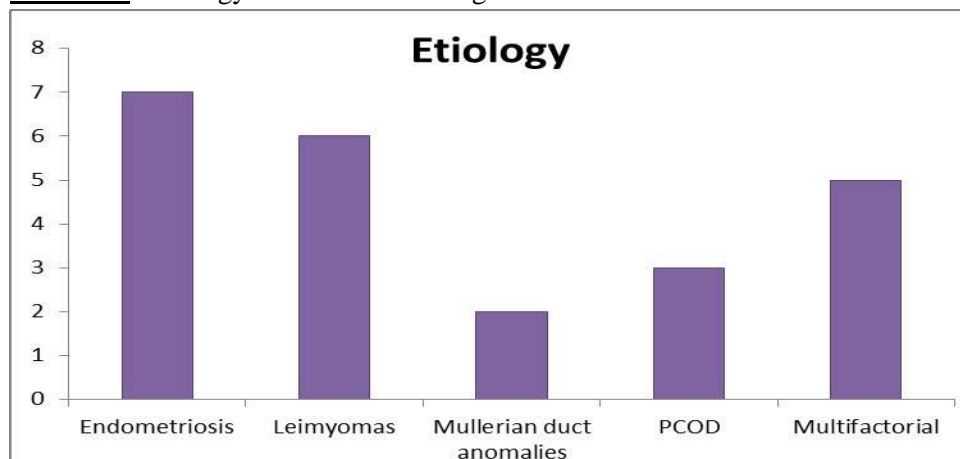
patent in two patients. 2 out of 3 patients showed unilateral tubal occlusion on conventional HSG were diagnosed with unilateral tubal occlusion on MR HSG while one had patent tubes. About 23 patients had other abnormalities on MR imaging. 7 patients had ovarian endometriosis, 6 had leiomyomas, 2 patients had mullerian duct anomalies, 3 patients had features of polycystic ovarian disease and 5 patients had multifactorial etiology. No cause could be found in 9 patients. Analysis of the questionnaires administered to the patients showed that 36 out of 40(90%) patients who completed the study were fully satisfied with the procedure.

**Chart – 1** demonstrating fallopian tubal patency and blockage whether unilateral or bilateral. **Chart – 2** demonstrating etiology of causes of finding in MR HSG in infertile women excluding Tubal causes.

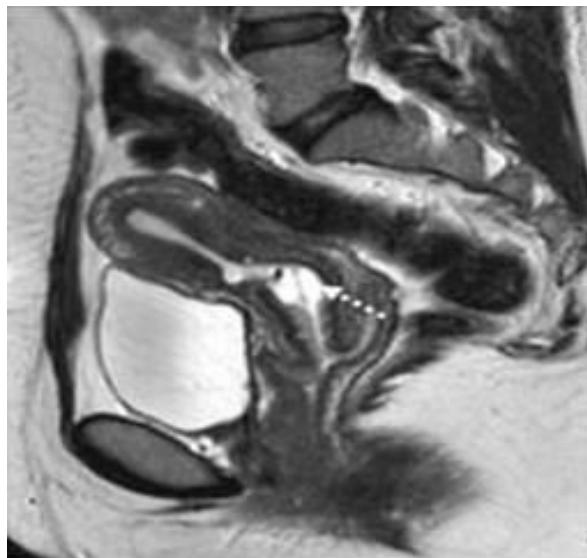
**Chart – 1:** Fallopian tubal patency and blockage whether unilateral or bilateral.



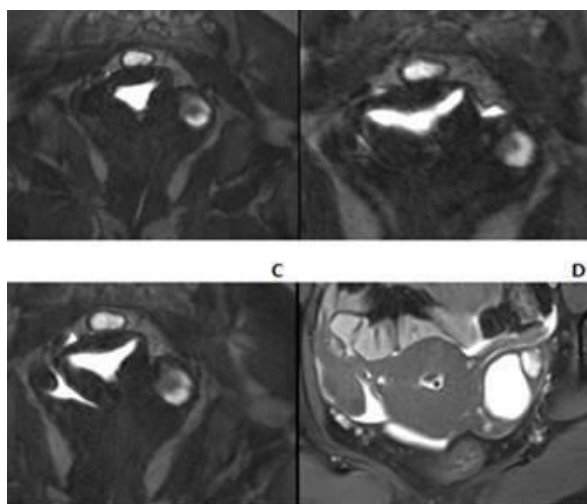
**Chart – 2:** Etiology of causes of finding in MR HSG in infertile women excluding Tubal causes.



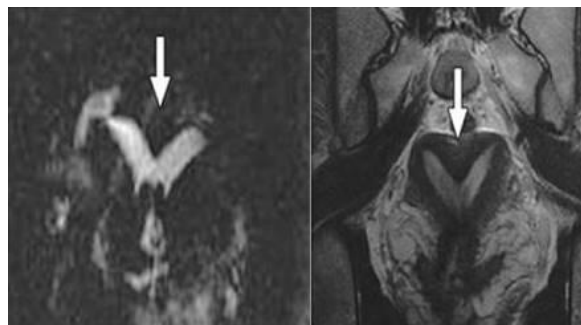
**Photo – 1:** Normal MR-HSG sagittal T2 image with dotted line arrow revealing the balloon catheter.



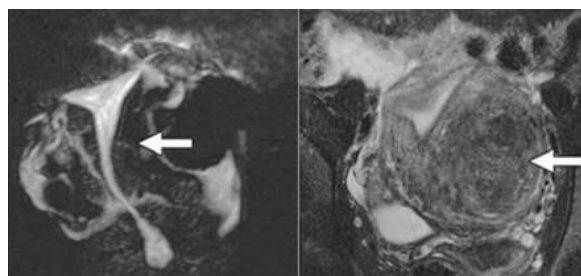
**Photo – 2:** First MR-HSG reveals distension of uterine cavity with contrast. Second image shows left sided fallopian tube filled with contrast. Third image reveals filling of right sided fallopian tube with contrast. Last image reveals free peritoneal spills on both sides. Note is made of left sided endometrioma.



**Photo – 3:** Subtracted dynamic TRICKS MR HSG image shows indentation of fundus (arrow). Second coronal T2 weighted image through uterus shows normal contour a long serosal surface of fundus with indentation of myometrium and endometrium into uterine canal, indicating partial septate uterus (arrow).



**Photo – 4:** TRICKS MRI image revealing bilateral spill of contrast material and deformity of endometrial canal (arrow). Second axial T2 weighted MR image shows leiomyoma (arrow) causing deformity of endometrial canal seen on MR HSG.



## Conclusion

MR-HSG is a feasible, useful, innovative and well tolerated tool for the assessment of the uterus, fallopian tubes, ovaries and extra-uterine structures. MR-HSG is a new promising imaging approach to female infertility. MR-HSG scanning can be helpful in demonstrating tubal patency even in patients with documented tubal blockage on conventional HSG.

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