Updates in the role of diagnostic imaging in evaluation Of female infertility

Essay

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By

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Abstract

Women preseting with infertility undergo many laboratory tests and imaging studies to exclude endocrine disturbances, congenital anomalies of the genital tract, uterine abnormality, and occlusion of the fallopian tubes. Three-dimensional ultrasound (3D US) is a highly reproducible method in female infertility to evaluate suspected uterine malformations and other Pathologies.
MR HSG can be used in the female infertility as MRA can be used as Alternative to HSG can be used in the female infertility as MRA can be used as
Alternative to HSG images in assessment of tubal patency.
Cine MRI is used to demonstrate the uterine peristalsis as the dysfunction Of uterine peristalsis can be considered as a cause of infertility.

Key words: 3D US, 3D SIS, 3DCIS, 3-DPD, 3D dMR-HSG, the hybrid Radiography/MRI system, 3D MR angiographic sequence, cine MRI.

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Abbreviations

Abbreviation	
HSG	Hysterosalpingography.
EVS	Endovaginal Scan.
MRI	Magnetic Resonance Imaging.
PCOS	Poly Cystic Ovarian Syndrome.
PID	Pelvic Inflammatory Disease.
3D US	Three Dimensional Ultrasound.
3D	Three Dimensional.
2 D	Two Dimensional.
3D dMR-HSG	Three dimensional dynamic MR Hysterosalpingography.
TAS	Trans Abdominal Scan.
AFS	American Fertility Society.
DES	Diethyelstilbestrol.
VOCAL	Virtual Organ Computer Aided Analysis.
SIS	Saline Infusion Sonohysterography.
CIS	Contrast Infusion Sonohysterography.
3-DPD	3 Dimensional Power Doppler US.
RI	Resitive Index.
MIP	Maximum Intensity Projections.
TRICKS	3D Time-Resolved Imaging of Contrast Kinetics.
JZ	Junctional Zone
RARE	Rapid Acquisition with Relaxation Enhancement.
OC	Oral Contraceptives.
PG	Prostaglandins.
HASTE	Half-fourier-Acquisition Single-shot Turbo spin-Echo.

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INTRODUCTION

Infertility is defined as 1 year of unprotected intercourse that does not result in pregnancy. In recent years, demand for infertility services and treatment of infertility have increased. Laparoscopy, hysteroscopy, and hysterosalpingography (HSG) are the most effective techniques currently used to evaluate female pelvic disorders related to infertility. Although Endovaginal Scan (EVS) has been the foremost imaging modality for assessing the female genital tract, magnetic resonance imaging (MRI) has also been used for over 10 years to evaluate problems associated with female infertility **(Imaoka et al, 2003)[1].**

Medical treatment of a couple's infertility depends upon the causes of infertility. The goals of imaging are to determine these causes(male, female, mixed, unexplained), to evaluate their severity and type on the female side central, ovarian, uterine, tubal, peritoneal and endometriosis in order to propose an adapted treatment **(Maubon et al, 2008)[2].**

The causes of female infertility include ovulatory disorders (ie, pituitary adenoma and polycystic ovarian syndrome [PCOS]), disorders of fallopian tubes (ie, hydrosalpinx and pelvic inflammatory disease [PID]), uterine disorder (ie, müllerian duct anomaly, adenomyosis and leiomyoma) and pelvic endometriosis **(Imaoka et al, 2003)[1].**

HSG has become a commonly performed examination due to recent advances and improvements in, as well as the increasing popularity of, reproductive medicine. HSG plays an important role in the evaluation of abnormalities related to the uterus and fallopian tubes. Uterine abnormalities that can be detected at HSG include congenital anomalies, polyps, leiomyomas, surgical changes, synechiae, and adenomyosis. Tubal abnormalities that can be detected include tubal occlusion,

salpingitis isthmica nodosum, polyps, hydrosalpinx, and peritubal adhesions. Some complications can occur with HSG—most notably, bleeding and infection—and awareness of the possible complications of HSG is essential. Nevertheless, HSG remains a valuable tool in the evaluation of the uterus and fallopian tubes. **(Simpson et al, 2006)[3].**

HSG retains its indication to study tubal patency, it can be completed by tubal catheterization in cases of proximal tubal obstruction **(Mauubon et al, 2008)[2].**

With recent advances in computer technology and display techniques, Three-dimensional ultrasonography (3D US) will likely play an increasingly important role in medicine. 3D US is rapidly gaining popularity as it moves out of the research environment and into the clinical setting. This modality offers several distinct advantages over conventional US, including 3D image reconstruction with a single pass of the US beam, virtually unlimited viewing perspectives; accurate assessment of long-term effects of treatment; and more accurate, repeatable evaluation of anatomic structures and disease entities. 3D pelvic US allows volume data sets to be acquired with both transvaginal and transabdominal probes. **(Downey et al, 2000)[4].**

3D reformations (volume of data acquired and reconstructed in the transverse, sagittal and coronal planes) improve visualization of the uterine fundus and aid in identification or exclusion of a fundal contour abnormalities **(Ghate et al, 2008)[5].**

The 3 D Coronal view of the uterus is a valuable adjunct to a 2 D pelvic scan, particularly in patients presenting with infertility or suspected endometrial lesions **(Benacerraf et al, 2008)[6].**

Although laparoscopy, hysteroscopy, HSG and EVS are the most effective techniques for evaluation of pelvic disorders related to female infertility, MRI is used in a variety of clinical settings in diagnosis, treatment and management. **(Imaoka et al, 2003)[1].**

Three dimensional dynamic MR-hysterosalpingography (3D dMR-HSG) represents a new and promising imaging approach to female infertility causing less pain and avoiding exposure of the ovaries to ionizing radiation. By using higher viscosity MR contrast agent, it allows not only visualization of uterine cavity and fallopian tube patency but also direct visualization of fallopian tubes. **(Unterweger et al, 2002)[7].**

Cine MR imaging is a novel technique for diagnosis and evaluation of the pelvic organs, especially the uterus. The uterus, an organ of smooth muscle, has an inherent contractility that characterizes it as different from other visceral organs. This sustained contraction has occasionally been shown on static images as a finding masquerading as a leiomyoma or as adenomyosis. Cine mode MR imaging clearly shows the configuration of the myometrium during these dynamic changes, as well as its signal intensity during contractions. Uterine peristalsis, the subtle and rhythmic contractions of the inner myometrium, is also clearly identifiable on cine mode images as a wavy movement of the endometrium and/or inner myometrium. The direction and frequency of uterine peristalsis are different in each of the menstrual cycle phases and are thought to have important roles in uterine function, such as in fertility and menstrual blood discharge. **(Fujiwara et al, 2003)[8].**

Anticholinergic agents significantly suppress sporadic myometrial contractions and uterine peristalsis, in addition to intestinal motion, all of which may contribute to improved quality of conventional uterine MRI **(Nakai et al, 2007)[9].**

Using a clinically available MR angiographic sequence TRICKs (3D time-resolved imaging of contrast kinetics) to enhance the value of MRI in women with infertility, MR HSG effectively shows tubal patency and can be considered when both conventional HSG and standard MRI are necessary for evaluation of women with infertility, such as in women with suspected uterine anomalies or extra uterine disease **(Sadowski et al, 2008)1[0].**

The hybrid radiography/MRI system (pelvic MRI was followed by HSG without moving the patient) provided good quality HSG and MR images. We were able to assess tubal anatomy and patency and uterine anatomy and to detect pelvic abnormalities including fibroids and adenomyosis. Furthermore, MR images and radiographs were superimposed to clarify HSG findings **(Freeman- Walsh et al, 2008)[11].**

MRI is the best imaging method available because of its superior ability to reliably visualize complex uterovaginal anatomy **(Olpin et al, 2009)[12].**

Aim Of Work

The purpose of this study is to highlight the role of recent imaging techniques in evaluation of the female infertility cases such as the hybrid radiography /MRI system, MR angiographic sequence, Cine MRI and 3D US pelvic scan to enhance the value of imaging in management of female infertility.

Chapter one

RADIOLOGY OF THE FEMALE PELVIS

Multiple imaging modalities are used in evaluation of pelvic disorders related to female infertility . HSG and US are the most effective techniques for evaluation of pelvic disorders related to female infertility, MRI is used in a variety of clinical settings in diagnosis, treatment and management. **(Imaoka et al, 2003)[1].**

I- ULTRASOUND

US, either transabdominal or endovaginal, is the mainstay imaging of the pelvis. Transabdominal scan (TAS) is usually performed with a 3-4 MHZ sector or convex probe and requires the patient to have a full bladder. The distended bladder displaces small bowel out of the pelvis, pushes the uterus posteriorly and the ovaries laterally towards the pelvic sidewalls. The optimally distended bladder projects just beyond the fundus of a normal sized uterus. If the bladder is inadequately distended, the pelvic structures may be obscured by bowel gas. But if it is over distended, the uterus becomes elongated and the ovaries too far laterally (figure 1). Longitudinal (sagittal) and transverse scans are performed using the bladder as a window. **(Ryan et al, 2004)[13]**