

*Research Article***Role of Magnetic Resonance Imaging (MRI) in Evaluation of Endometriosis****Adel M. S. Mohsen, Enas A. Abdel Gawad, Manal F. Abo-Samra, and Shaymaa Adel Mustafa**

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**Abstract**

**Introduction:** Endometriosis is classically defined as the presence of functional endometrial glands and stroma outside the uterine cavity (ectopic as opposed to normally located or eutopic endometrium). Endometriosis is a common and important clinical problem of women, predominantly those in the reproductive age group. The mean age at diagnosis is 25–29 years, but it is often greater in women who present with infertility rather than pelvic pain. **Patients and Methods:** This cross sectional study included 43 female patients that were presented to gynecological department of Minia University Hospital, suffering from infertility, pelvic pain, severe dysmenorrhea or vaginal hemorrhage. This study was conducted in the Radiology department, at El-Minia University hospital. Their ages ranged from 20 to 52 years old.

**Results:** This study included 43 female patients that were presented to gynecological department of Minia University Hospital, suffering from infertility, pelvic pain, severe dysmenorrhea or vaginal hemorrhage. This study was conducted in the Radiology department, at Minia University hospital and Minia Oncology center in the period from January 2014 to December 2016.

**Key words:** (MRI) Magnetic Resonance Imaging, (CT), computed tomography, (FOV), Field of view

**Introduction**

Endometriosis is classically defined as the presence of functional endometrial glands and stroma outside the uterine cavity (ectopic as opposed to normally located or eutopic endometrium). Endometriosis is a common and important clinical problem of women, predominantly those in the reproductive age group. The mean age at diagnosis is 25–29 years, but it is often greater in women who present with infertility rather than pelvic pain <sup>(1)</sup>.

The prevalence of endometriosis is difficult to determine accurately. Laparoscopy or surgery is required for the definitive diagnosis. Endometriosis has been reported in 4.1% of asymptomatic women undergoing laparoscopy for tubal ligation. However, 20% of women undergoing laparoscopic investigation for infertility and 24% of women with pelvic pain had endometriosis <sup>(2)</sup>. Overall prevalence, including both symptomatic and asymptomatic women, is estimated to be 5%–10% <sup>(3,4)</sup>.

Endometriosis is a complex disorder, and its causes are probably multifactorial. Three theories of histogenesis have been proposed: (a) metastatic theory (retrograde menstrual implantation, vascular and lymphatic spread, and intraoperative implantation), (b) metaplastic theory, and (c) induction theory <sup>(5)</sup>.

At pathologic analysis, it can vary from microscopic foci to large, grossly visible endometriotic cysts (endometriomas). Endometriotic cysts generally occur within the ovaries and are the result of repeated cyclic hemorrhage within a deep implant. They may completely replace normal ovarian tissue. Cyst walls are generally thick and fibrotic and commonly have areas of discoloration and dense fibrous adhesions. The cyst lining can vary from smooth and pale to shaggy and brown. Although cyst contents can be watery, they more typically are composed of thick, dark, degenerated blood products. This appearance has been called “chocolate cyst” <sup>(5)</sup>.

The most common sites for endometriotic implants is the ovary, but virtually all pelvic organs can be affected by the disease including anterior and posterior cul-de-sac, posterior broad ligament, uterosacral ligament, uterus, fallopian tubes, sigmoid colon, ureter and small intestine<sup>(6)</sup>.

The common symptoms associated with endometriosis include infertility and pelvic pain. These nonspecific symptoms can accompany a wide variety of disorders and are not pathognomonic for endometriosis. Unusual symptoms linked to atypical location of disease can also occur.

It is estimated that 30%–50% of women with endometriosis are infertile, and 20% of infertile women have endometriosis<sup>(2, 7)</sup>. Pelvic pain is a frequent complaint from women with endometriosis. Common symptoms include dysmenorrhea, dyspareunia, chronic pelvic pain, back pain, and rectal discomfort<sup>(4)</sup>.

The most widely used staging system for endometriosis is the 1985 Revised Classification of Endometriosis published by the American Fertility Society<sup>(4,8)</sup>. This system consists of three components: evaluation of the endometrial implants (location, size, and depth of penetration), degree of cul-de-sac obliteration, and evaluation of adhesions (amount of surface area involvement and appearance). On the basis of their score, patients are categorized as having minimal, mild, moderate or severe disease<sup>(5)</sup>.

Because symptoms are variable, patients may be referred for a diverse array of imaging studies, including excretory urography, barium studies, and computed tomography (CT). These techniques lack both sensitivity and specificity, and a variety of nonspecific radiologic findings may be seen<sup>(5)</sup>.

Ultrasonography (US) is the most common imaging modality used to evaluate suspected endometriosis. However, it is applicable only to the evaluation of endometriotic cysts; detection of adhesions or implants with US is only anecdotal. Ultrasonographic (US) features are variable and can mimic those of other benign and

malignant ovarian lesions. Low-level internal echoes and echogenic wall foci are more specific US features for endometriomas<sup>(5)</sup>.

Magnetic resonance (MR) imaging has proved to be a very useful and more specific imaging technique and is often used as a problem-solving tool. It affords a larger field of view than US, and the effect of adhesions on surrounding anatomic structures is better depicted. Therefore, MR imaging can be a helpful adjunct for evaluation of adnexal masses. It is the best noninvasive method to evaluate the locations affected by pelvic endometriosis<sup>(9)</sup>. Magnetic resonance imaging improves diagnostic accuracy of endometriosis, with endometriotic cysts typically appearing with high signal intensity on T1-weighted images and demonstrating “shading” on T2-weighted images.

Although MR imaging is limited in its ability to depict small endometrial implants and adhesions because their signal intensity is quite variable (may appear similar to normal endometrium, be hypointense with all pulse sequences, or be hyperintense with all pulse sequences), the advantages of MR imaging over laparoscopy include the ability to characterize endometriotic lesions and to evaluate extraperitoneal sites of involvement, contents of a pelvic mass, or lesions hidden by dense adhesions. The roles of the two modalities are therefore complementary<sup>(10)</sup>.

## Patients and Methods

This cross sectional study included 43 female patients that were presented to gynecological department of Minia University Hospital, suffering from infertility, pelvic pain, severe dysmenorrhea or vaginal hemorrhage. This study was conducted in the Radiology department, at El-Minia University hospital. Their ages ranged from 20 to 52 years old.

### Inclusion criteria:

All patients underwent pelvic MRI examination referred from gynecology department suspected to have endometriosis, based on clinical history and complete physical examination + / - other

investigations such as abdominal and pelvic ultrasonography or CT examination.

### 1- **MRI examination:**

#### **Preparation of the patient:**

- Fasting for 4-6 hours before examination is preferred to reduce bowel motion.
- The patient is asked to empty the bladder before examination to reduce motion artifact.
- Antiprestaltic agent is given.

#### **Patient positioning:**

The standard position for pelvic MRI is the comfortable supine position with a bolster placed under the knees.

#### **MRI Technique:**

Examinations are performed immediately postmenstrual (However, complete menstrual history is taken and recorded for purposes of interpretation).

MRI examination of the pelvis were performed for all the patients included in this study using Philips 1 T MRI system.

#### **Coil selection:**

The use of external pelvic phased-array coils is standard, which allows parallel imaging to be utilized during image acquisition.

#### **MRI protocol:**

The MRI protocol included high-resolution turbospin echo (TSE) T2-weighted imaging in the axial, coronal, and sagittal planes and spin-echo T1-weighted imaging in the axial and sagittal planes with and without fat suppression.

Fat-suppressed T1-weighted sequences are most reliable for the detection of bloody foci, whereas high-resolution T2-weighted sequences are used for the evaluation of fibrotic lesions, notably those that involve the pelvic ligaments, retrocervical space, or prevesical recess. In addition, for the diagnosis of endometriomas, a combination of T1-weighted and T2-weighted sequences is useful.

### 2- **Statistical analysis:**

- Descriptive statistics as regards clinical and MRI changes are presented as number and percentage.
- Correlation of MRI findings with comparison to the surgical results and histopathological data.
- Definition of true positive and false positive cases.
- Estimation of sensitivity and specificity of MRI in the diagnosis (evaluation) of endometriosis and its relation to infertility.

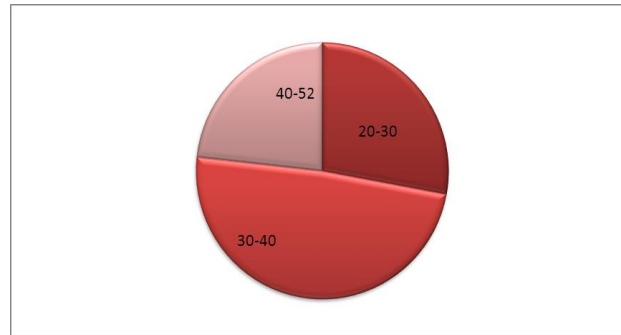
### **Results**

This study included 43 female patients that were presented to gynecological department of Minia University Hospital, suffering from infertility, pelvic pain, severe dysmenorrhea or vaginal hemorrhage. This study was conducted in the Radiology department, at Minia University hospital and Minia Oncology center in the period from January 2014 to December 2016.

There ages ranged from 20 to 52 years old (mean  $34.65 \pm SD 8.8$ ). According to their ages we divided them into three groups, as shows at table (1).

**Table (1): different age groups of this study**

Age distribution	Number
20 – 30	12
30 – 40	21
40 - 52	10
Total number = 43	



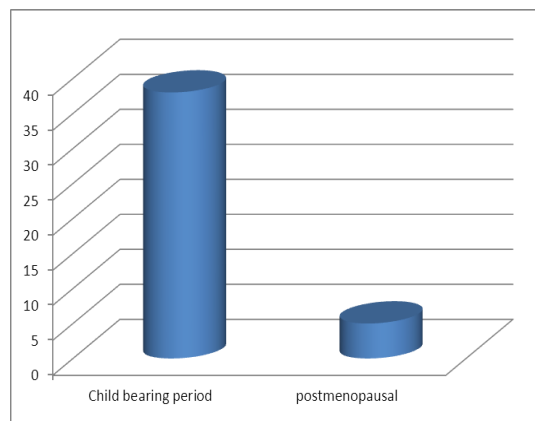
**Figure (1): different age groups of this study**

According to their menstrual history, 38 patients were at the child bearing period (12 of them were suffering from irregular menstruation) and 5 were postmenopausal,

also according to their marital status, 6 out of 43 were virgins and 37 were married. These data are shown at table (2) and figure (2).

**Table (5): number of patients as regarding their menstrual status**

Menstrual status	Number of patients
Child bearing period:	38
-married:	32
-virgin:	6
Postmenopausal:	5
(all of them are married)	
<b>Total no.</b>	<b>43</b>



**Figure (2): number of patients as regarding their marital status**

A 26 years old patient, nuli-parus, presented with chronic pelvic pain (in the form of severe dysmenorrhea).

**On MRI examination:**

Showed a well defined multi-locular cyst with a large hemorrhagic component that elicit T1 hyperintense signal and T2 hypointense signal, with still hyperintense signal at T1 fat suppressed sequence.

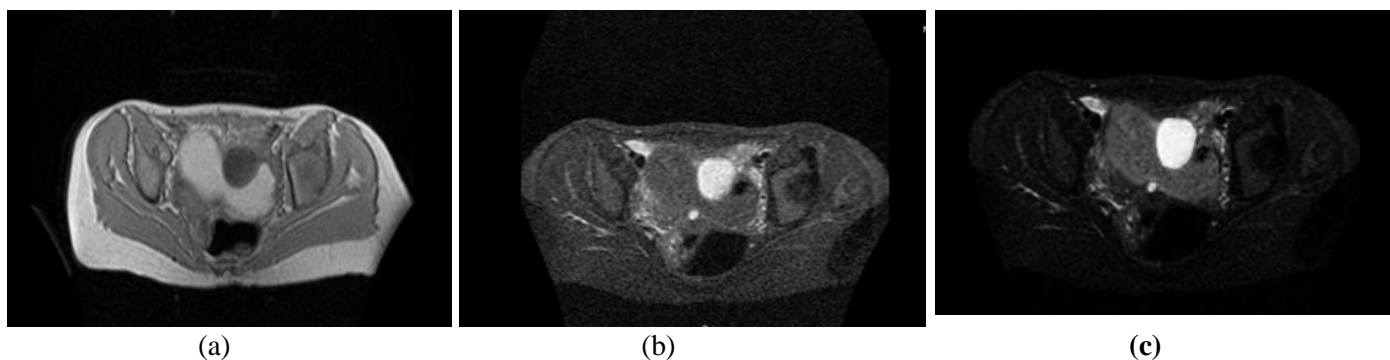
**Figures:**

- a) Axial T1 TSE
- b) Axial T2 TSE
- c) Axial T1 fat suppressed sequence.

**Intraoperative finding:**

Showed larger multi-locular cystic lesion at the mid-pelvis with its largest component contain a thick brownish fluid, mostly old blood (chocolate cyst)

**Histo-pathological examination** confirmed the diagnosis of ovarian endometrioma.



### Discussion

Endometriosis is a common and clinically important problem in women of child-bearing age. It is classically defined as the presence of functional endometrial glands and stroma outside the uterine cavity and musculature. This is distinct from adenomyosis, in which endometrial tissue is confined to the uterine musculature. It may vary from microscopic endometriotic implants to large cysts (86).

Laparoscopy is the standard of reference for the diagnosis of endometriosis. The diagnosis is made by noting the presence of either typical lesions consisting of blue-brown or black nodules or stains on peritoneal surfaces of the ovaries, fallopian tubes, uterus, uterosacral ligaments and bowel. These lesions are the result of tissue bleeding and retention of blood pigments. Though laparoscopy is the gold standard for diagnosis of endometriosis, but recent advances in imaging technology have improved non-operative diagnosis. Endometrioma are relatively easy to detect but small peritoneal deposits presents as a challenge. Other than pelvic surgery, the methods currently available to diagnose endometriosis include measurements of serum proteins such as CA-125, pelvic ultrasound, and magnetic resonance imaging (MRI).

Transvaginal ultrasonography (US) is usually the first imaging technique used to diagnose endometriosis and remains the most accessible technique. It is the method of choice for differentiating endometriomas from other ovarian cysts.

Plain film radiography, computed tomography (CT) scanning, and barium

studies are not sensitive for the diagnosis of endometriosis.

### Conclusion

This study concluded that, generally MRI has a relative low sensitivity in detecting all forms of endometriosis. However, MRI is highly sensitive in diagnosing ovarian endometrioma and differentiating it from other ovarian lesions such as dermoid cyst and ovarian cancer. Also, it is highly sensitive in detecting sites of deep pelvic endometriosis specially that of the uterosacral ligament and serosal surface of the uterus.

All MRI techniques may induce a potential discomfort for the patient, because of bowel preparation. Also, higher costs of carrying out MRI, and the need for expert radiologists, are a limitation of this diagnostic imaging for diagnosis of endometriosis compared with other imaging modalities such as ultrasound. Although MRI is an efficient means of examination, allowing a complete pelvic work up to be established. Also, magnetic resonance imaging for endometriotic ovarian cyst is requested in selected cases if ultrasound outcome is inconclusive, if malignant transformation is suspected, or both as it presents a high specificity in diagnosing endometriomas owing to its ability to characterize hemorrhage.

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