

## Management of MR Imaging in Abnormal Uterine Bleeding

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### ABSTRACT

**Background:** Abnormal uterine bleeding (AUB) is a common condition that leads to increased health care costs and decreased quality of life. A systematic approach to AUB evaluation can simplify management and enhance women's well-being.

**Objective:** Management of MRI in women with AUB to detect any organic cause not detected with transvaginal ultrasonographic examination and if MRI add any advantage more than transvaginal ultrasound.

**Patients and methods:** Fifty women with abnormal uterine bleeding were referred from the outpatient clinic and inpatients of OB/GYN Department at Sohag University Hospital was subject for this study.

**Results:** MRI results in the diagnosis of fibroid had a sensitivity and specificity of 100% and the 2D TVS had a sensitivity of 80% and specificity 100%. The falsely positive MRI was focal type adenomyosis miss diagnosed as interstitial fibroid. The sensitivity of the MRI for the adenomyosis in our results was 100% with specificity was 95%. Our results of adenomyosis using 2D transvaginal ultrasound had sensitivity 80% and specificity 97.5%. Our results using MRI had a sensitivity of 100% in endometrial polyp detection with specificity 90.47%. TVS had a sensitivity of 50% with specificity 100%.

**Conclusion:** Management of MRI in abnormal uterine bleeding as equal as that of TVS but still TVS has the upper hand as the first imaging choice, real time imaging. patients also preferred TVS than MRI.

**Keywords:** Management of MR Imaging, Abnormal Uterine Bleeding, TVUS, FIGO, Quality of Life

### INTRODUCTION

AUB affects women of all ages and constitutes a major proportion of outpatient referrals to the department of gynecology. The lifetime prevalence of AUB in women is 30%. AUB can have a significant impact on women's quality of life. Most women present with HMB that affects their medical, social, economic and psychological well-being <sup>(1)</sup>.

Abnormal uterine bleeding (AUB), a frequent reason for outpatient and emergency department visits in reproductive-aged women, may substantially affect quality of life. Evaluation and management of AUB incurs high health care costs, especially when including the common use of hysterectomy <sup>(2)</sup>.

Fortunately, AUB can often be managed with safe, effective, and noninvasive medical treatments focused on the source of bleeding. Hormonal contraceptives remain a common medical therapy, and the 52-mg levonorgestrel intrauterine system (LNG IUS) is increasingly used to effectively manage troublesome bleeding before a surgical approach. The etiology in reproductive-aged women is almost always benign; however, evaluation and research into AUB was limited by the inconsistent use of terminology and documentation of etiology. The International Federation of Gynecology and Obstetrics (FIGO) Systems 1 and 2 were created to provide clear terminology and nomenclature to globally facilitate the accurate diagnostic and effective treatment approaches to AUB <sup>(3)</sup>.

The International Federation of Gynecology and Obstetrics (FIGO) has approved a new

classification system (PALM-COEIN) for causes of abnormal uterine bleeding (AUB) in non-gravid women of reproductive age. The classification system is stratified into nine basic categories that are arranged according to the acronym PALM-COEIN: Polyp, Adenomyosis, Leiomyoma, Malignancy and hyperplasia, Coagulopathy, Ovulatory Disorders, Endometrial, Iatrogenic, and Not Classified <sup>(4)</sup>.

Diffusion-weighted MRI (DWI) is a non-enhanced imaging technique that facilitates the display of tissue characteristics based on the difference in diffusion motion of water molecules. Several recent studies have reported DWI to be useful to detect and differentiate endometrial cancer from normal endometrium or a benign lesion <sup>(5)</sup>.

Recently, the use of DWI with MRI for gynecological malignancies has mainly concentrated not only on detection of disease, but also staging and differentiating benign from malignant tumors <sup>(6)</sup>.

Adenomyosis is defined as the presence of ectopic endometrial glands and stroma within the myometrium. It is a disease of the inner myometrium and results from infiltration of the basal endometrium into the underlying myometrium. Transvaginal ultrasonography (TVUS) and magnetic resonance imaging (MRI) are the main radiologic tools for this condition. A thickness of the junctional zone of at least 12 mm is the most frequent MRI criterion in establishing the presence of adenomyosis. Adenomyosis can appear as a diffuse or focal form. Adenomyosis is often associated with hormone-dependent lesions such as leiomyoma <sup>(7)</sup>.

**AIM OF THE WORK**

Management of MRI in women with AUB to detect any organic cause not detected with transvaginal ultrasonographic examination and if MRI add any advantage more than transvaginal ultrasound.

**Patient and methods:**

Inclusion criteria:

Fifty women with abnormal uterine bleeding who referred from the outpatient clinic and inpatients of OB/GYN Department at Sohag University Hospital were subjected for this study.

Exclusion criteria;

Patients with systemic diseases (liver, thyroid .....

- *Patients with positive pregnancy test*
- Patients on oral anticoagulants/ antithrombotic therapy
- Patients with hematological disorders

The included patients were undergoing;

- Clinical examination.
- Laboratory investigations (blood picture, renal and hepatic functions)
- Transvaginal ultrasound.
- Pelvic MRI:

All the data of history and clinical examination were obtained from the patient files of Obstetrics/Gynecology department. Demographic characteristics (age, residency, occupation and education), medical history, history of abdominal or pelvic surgery, and current medical conditions/medications (diabetes and hypertension), including a history of cancer (history of breast cancer). Information regarding menstrual patterns, reproductive history, history of contraceptive and hormone use, and menopausal status were obtained from the patient sheet.

**Ethical consideration and Written informed consent:**

An approval of the study was obtained from Sohag University academic and ethical committee and a written informed consent is obtained from all patients.

**Methods: -**

2D transvaginal ultrasound evaluation of the uterus in longitudinal and transverse views for evaluation of myometrium and endometrium.

The MRI sequences includes T1 (axial, coronal and sagittal) T1 FAT SAT (fat saturation) in axial and sagittal planes and T1 with gadolinium when indicates.

High resolution T2 weighted imaging of the pelvis in sagittal, axial oblique (perpendicular) (short axis T2 weighted images) and coronal oblique (parallel) to the uterine cavity (long axis T2 weighted images).

MRI diffusion; Diffusion with b factors of 0–100 and 800/mm<sup>2</sup>. The region of interest was defined within the tumor on T2-weighted

Exclusion criteria: Positive pregnancy test patient and systemic disease with bleeding tendency.

**Statistical analysis:**

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

**The following tests were done:**

- Independent-samples t-test of significance was used when comparing between two means.
- Chi-square (x<sup>2</sup>) test of significance was used in order to compare proportions between two qualitative parameters.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. The p-value was considered significant as the following:
  - Probability (P-value)
    - P-value <0.05 was considered significant.
    - P-value <0.001 was considered as highly significant.
    - P-value >0.05 was considered insignificant.

**RESULTS**

**Table 1: Characteristics of studied population.**

| Variable         | Summery statistics   |
|------------------|--|
| Age              | Mean± S.D 43.72±11.72<br>Median (range) 43 (23-75)                                   |
| Parity           | Nulliparous 8 cases (16%)<br>Multiparous 42 cases (84%)                              |
| Residency        | Rural 40 (80%)<br>Urban 10 (20%)   |
| Occupation       | Employee 7 (14%)<br>Housewife 43 (86%)   |
| Menstrual status | Premenopausal 27 (54.00%)<br>Perimenopausal 17 (34.00%)<br>Postmenopausal 6 (12.00%) |

This study included 50 women who had uterine causes of abnormal uterine bleeding. Their age ranged from 23-75years with median 43years and mean± SD (43.72±11.72).- Twenty-seven cases (54%) were premenopausal while the perimenopausal women were-17cases (34%) and the postmenopausal cases were 6 (12%).

**Table 2: MRI diagnosis of studied population:**

| MRI diagnosis         | Number (%) |
|-----------------------|------------|
| Normal                | 19 (38%)   |
| Adenomyosis           | 5 (10.00%) |
| Fibroid               | 7 (14.00%) |
| Polyp                 | 3(6.00%)   |
| Fibroid & adenomyosis | 3 (6.00%)  |
| Hyperplasia           | 3 (600%)   |
| Hyperplasia and polyp | 4(8%)      |
| Adenomyosis &Polyp    | 4 (8.00%)  |
| Fibroid&polyp         | 1(2%)      |
| Endometrial carcinoma | 1(2%)      |

MRI findings showed that, 19 cases were normal, and five cases had adenomyosis. Seven cases had multiple interstitial fibroid with variable size (1cm to 3cm) and one case had in addition submucosal fibroid 14mm while three cases had polyps' size (2-4cm). Also, three cases had combined fibroid as well as adenomyosis. Three cases had endometrial hyperplasia and 4 cases had hyperplasia and polyps. Four cases had combined findings of adenomyosis and polyps. Single patient had polyp in addition to fibroid while endometrial carcinoma was seen in a single patient.

**Table 3: Transvaginal ultrasound diagnosis of studied population.**

| Transvaginal ultrasound diagnosis | Number (%) TVS |
|-----------------------------------|----------------|
| Normal                            | 21 (42%)       |
| Fibroid                           | 8 (16.00%)     |
| Adenomyosis                       | 8 (16.00%)     |
| Hyperplasia                       | 7 (14.00%)     |
| polyp                             | 4(800%)        |
| Atrophic                          | 1(2%)          |
| Endometrial carcinoma             | 1(2%)          |

**Table 5: Accuracy rates of MRI & TVS for diagnoses of fibroid:**

| Study | Finding  | Pathological finding |        | Diagnostic potential (%) |       |
|-------|----------|----------------------|--------|--------------------------|-------|
|       |          | Abnormal             | Normal |                          |       |
| MRI   | Abnormal | 10                   | 1      | Sensitivity              | 100   |
|       |          |                      |        | Specificity              | 100   |
|       | Normal   | 0                    | 39     | PPV                      | 90.90 |
|       |          |                      |        | NPV                      | 100   |
|       |          |                      |        | Accuracy                 | 98    |
| TVS   | Abnormal | 8                    | 0      | Sensitivity              | 80    |
|       |          |                      |        | Specificity              | 100   |
|       | Normal   | 2                    | 40     | PPV                      | 100   |
|       |          |                      |        | NPV                      | 95.23 |
|       |          |                      |        | Accuracy                 | 96    |

MRI results in the diagnosis of fibroid had a sensitivity and specificity of 100% and the 2D TVS had a sensitivity of 80% and specificity 100 %. The falsely positive MRI was focal type adenomyosis miss diagnosed as interstitial fibroid. The TVS missed the diagnosis of submucosal fibroid case and miss an interstitial fibroid with the diffuse adenomyosis the size was 12mm.

In our study the transvaginal ultrasound examination diagnosed 21 cases as normal, eight cases had fibroid, eight cases had adenomyosis, seven cases had hyperplasia and four cases had polyp while one had case atrophic endometrium and one case endometrial carcinoma.

**Table 4: Histopathological diagnosis of studied population**

| Histopathological diagnosis       | Number (%) |
|-----------------------------------|------------|
| Proliferative type of endometrium | 22 (44%)   |
| Adenomyosis                       | 7 (14.00%) |
| Fibroid                           | 7 (14.00%) |
| Polyp                             | 4 (8.00%)  |
| Fibroid & adenomyosis             | 2 (4.00%)  |
| Hyperplasia                       | 2(4.00%)   |
| Polyp & hyperplasia               | 2(4.00%)   |
| Adenomyosis &Polyp                | 1 (2.00%)  |
| Fibroid&polyp                     | 1(2.00%)   |
| Atrophic endometrium              | 1(2.00%)   |
| Carcinoma                         | 1 (2.00%)  |

The histopathological results were obtained from all patients in the study after surgical biopsy from 10 cases, endometrial biopsy from 5 cases and D&C from 35 cases. Most of patients had endometrial proliferative disease that constituted 44% of study population (n= 22). Other piopsies revealed adenomyosis, fibroid & polyps and endometrial hyperplasia with or without polyp and atrophic endometrium. Only, one case was diagnosed as endometrial carcinoma.

**Table 6: Accuracy rates of MRI & TVS for diagnoses of adenomyosis:**

| Study    | Finding  | Pathological finding |        | Diagnostic potential (%) |       |
|----------|----------|----------------------|--------|--------------------------|-------|
|          |          | Abnormal             | Normal |                          |       |
| MRI      | Abnormal | 10                   | 2      | Sensitivity              | 100   |
|          | Normal   | 0                    | 38     | Specificity              | 95    |
|          |          |                      |        | PPV                      | 83.33 |
|          |          |                      |        | NPV                      | 100   |
| Accuracy | 96       |                      |        |                          |       |
| TVS      | Abnormal | 8                    | 1      | Sensitivity              | 80    |
|          | Normal   | 2                    | 39     | Specificity              | 97.5  |
|          |          |                      |        | PPV                      | 88.88 |
|          |          |                      |        | NPV                      | 95.12 |
|          |          |                      |        | Accuracy                 | 94    |

The sensitivity of the MRI for the adenomyosis in our results was 100% with specificity was 95%. Our results of adenomyosis using 2D transvaginal ultrasound had sensitivity 80% and specificity 97.5%.

**Table 7: Accuracy rates of MRI & TVS for diagnoses of polyp:**

| Study | Finding  | Pathological finding |        | Diagnostic potential (%) |       |
|-------|----------|----------------------|--------|--------------------------|-------|
|       |          | Abnormal             | Normal |                          |       |
| MRI   | Abnormal | 8                    | 4      | Sensitivity              | 100   |
|       | Normal   | 0                    | 38     | Specificity              | 90.47 |
|       |          |                      |        | PPV                      | 66.66 |
|       |          |                      |        | NPV                      | 100   |
|       |          |                      |        | Accuracy                 | 92    |
| TVS   | Abnormal | 4                    | 0      | Sensitivity              | 50    |
|       | Normal   | 4                    | 42     | Specificity              | 100   |
|       |          |                      |        | PPV                      | 100   |
|       |          |                      |        | NPV                      | 91.30 |
|       |          |                      |        | Accuracy                 | 92    |

Our results using MRI had a sensitivity of 100% in endometrial polyp detection with specificity 90.47%. TVS had a sensitivity of 50% with specificity 100%.

**Table 8: Accuracy rates of MRI & TVS for diagnoses of hyperplasia:**

| Study | Finding  | Pathological finding |        | Diagnostic potential (%) |       |
|-------|----------|----------------------|--------|--------------------------|-------|
|       |          | Abnormal             | Normal |                          |       |
| MRI   | Abnormal | 4                    | 3      | Sensitivity              | 100   |
|       | Normal   | 0                    | 43     | Specificity              | 93.47 |
|       |          |                      |        | PPV                      | 57.14 |
|       |          |                      |        | NPV                      | 100   |
|       |          |                      |        | Accuracy                 | 96    |
| TVS   | Abnormal | 3                    | 4      | Sensitivity              | 75    |
|       | Normal   | 1                    | 42     | Specificity              | 91.30 |
|       |          |                      |        | PPV                      | 42.85 |
|       |          |                      |        | NPV                      | 97.67 |
|       |          |                      |        | Accuracy                 | 90    |

In the diagnosis of endometrial hyperplasia MRI had a sensitivity of 100% and specificity 93.47% and the 2D TVS had a sensitivity 75% and specificity 91.30%.

**Table 9: Accuracy rates of MRI & TVS for diagnoses of endometrial carcinoma (one case):**

| Study | Finding  | Pathological finding |        | Diagnostic potential (%) |     |
|-------|----------|----------------------|--------|--------------------------|-----|
|       |          | Abnormal             | Normal |                          |     |
| MRI   | Abnormal | 1                    | 0      | Sensitivity              | 100 |
|       |          |                      |        | Specificity              | 100 |
|       | Normal   | 0                    | 49     | PPV                      | 100 |
|       |          |                      |        | NPP                      | 100 |
|       |          |                      |        | Accuracy                 | 100 |
| TVS   | Abnormal | 1                    | 0      | Sensitivity              | 100 |
|       |          |                      |        | Specificity              | 100 |
|       | Normal   | 0                    | 49     | PPV                      | 100 |
|       |          |                      |        | NPP                      | 100 |
|       |          |                      |        | Accuracy                 | 100 |

The results of MRI in endometrial carcinoma gave sensitivity and specificity like the results of TVS (100% sensitivity and 100% specificity) with accuracy 100%.

## DISCUSSION

Endometrial carcinoma is the most common gynecologic malignancy. It predominantly affects postmenopausal women. Clinically, patients present with abnormal uterine bleeding. Endometrial carcinoma is usually characterized by endometrial thickening or an endometrial mass. Some benign endometrial lesions such as endometrial hyperplasia and endometrial polyps may also cause uterine bleeding and endometrial thickening or a focal mass. Therefore, those pathologies should be discriminated to navigate the treatment process. Therefore, biopsy is recommended as a second-step diagnostic method when endometrial thickness exceeds 4 mm. However, endometrial biopsy or dilatation and curettage (D&C) may not be possible in postmenopausal patients due to endometrial atrophy, endometrial adhesions, or the requirement of general anesthesia. Magnetic resonance imaging (MRI), with its superior soft tissue contrast and multiplanar imaging capability, plays a key role in the evaluation of suspected endometrial pathology. Diffusion-weighted MRI (DWI) is a nonenhanced imaging technique that facilitates the display of tissue characteristics based on the difference in diffusion motion of water molecules. Several recent studies have reported DWI to be useful to detect and differentiate endometrial cancer from normal endometrium or a benign lesion (5).

In our study the most common cause of abnormal uterine bleeding is non-organic cause (46%) followed by adenomyosis (14%), fibroid (14%), polyp (8%), hyperplasia (4%), endometrial carcinoma (2%), fibroid & adenomyosis (4%), polyp & hyperplasia (4%), adenomyosis & polyp (2%) and fibroid & polyp (2%). Our results agreed with **Soleymani et al.** (8) who concluded that the proliferative endometrium and secretory

endometrium were the most common histopathological observations in AUB patients.

Also, our results agreed with **Singh and Ramana** (9) they also concluded that the commonest histopathological pattern in abnormal uterine bleeding was normal physiological phases of menstrual cycle.

In our study; abnormal uterine bleeding was more common in multipara. This agreed with **Singh and Ramana** (9), they concluded that the incidence of AUB was noticed to be increasing with parity.

Our study revealed that endometrial atrophy seen in one case 2% which agreed with **Singh and Ramana** (9), where endometrial atrophy accounted 3% of cases in their study.

Our study revealed MRI sensitivity for uterine pathology 100%, specificity 82.60%. This agreed with **Yadav** (10) who concluded that overall sensitivity for detection of lesions by MRI reached 100% while specificity was 98.41%. Our results disagreed with **Dueholm et al.** (11) who found the MRI sensitivity was 76% and specificity was 92% and disagree with **Ahmad et al.** (12) who found the sensitivity was 78.75% and specificity was 63.64%.

Our study revealed a sensitivity of TVS was 100% and specificity was 95.56% in detecting uterine pathology which agreed with **Babacan et al.** (13).

### The current study for premenopausal women patients:

MRI sensitivity was 100%, specificity 81.25%, PPV 78.57%, NPV 100% and accuracy 88.8%. The present results disagreed with **Dueholm et al.** (11) who concluded that the overall sensitivity MRI was 76%, specificity 92%, PPV 86% and NPV 86%. This can be explained by, his population number was one hundred and six consecutive premenopausal women who underwent hysterectomy for benign diseases.

Also, the study had evaluated the uterine cavity and disagreed with **Ahmad et al.** <sup>(12)</sup> in which MRI sensitivity reached 71.43 %, specificity 55.56 %, PPV 78.95%, NPV 45.45% and accuracy 66.67%. This discrepancy can be explained by low sensitivity of the MRI was done for all patients using GE (signa contour) 0.3T also that study evaluated the uterine cavity lesions only.

Our TVS sensitivity for uterine pathology in premenopausal women was 100%, specificity 87.5%, PPV 84.61%, NPV 100% and accuracy 92.59% this agreed with sensitivity of **Niharika** <sup>(14)</sup> in his study TVS sensitivity was 100% and specificity was 87% in identifying pathology. Also, our study results agreed with **Yela et al.** <sup>(18)</sup> who concluded that in the reproductive-age group, TVS had a sensitivity of 96.0% and accuracy of 91.5%. Our study disagreed with a study done by **Aslam et al.** <sup>(15)</sup> in which TVS sensitivity was 71.43% and specificity was 67.7 %. **Aslam et al.** <sup>(15)</sup> study included 100 women with abnormal uterine bleeding were submitted to sequential examination by transvaginal ultrasound eighty-eight women were premenopausal and 12 were postmenopausal women. Our study population was 50 cases (27 cases premenopausal, 17 perimenopause and 6 postmenopausal women.

#### The current study for perimenopause patients:

MRI sensitivity was 100%, specificity 83.3%, PPV 91.6%, NPV 100% and accuracy 94.1% to our knowledge no previous studies specifying the perimenopausal phase by MRI and our study included small number (17 cases) TVS in evaluation of uterine pathology in perimenopausal women had a sensitivity of 83.3%, specificity 100%, PPV 100%, NPV 71.42% and accuracy 88.23%. Our sensitivity and specificity were agreed with **Jain and Chakraborty** <sup>(16)</sup> in their study TVS sensitivity was 76% and specificity was 94%.

In post menopause women our study revealed sensitivity of TVS was 100% and specificity was 100% in detecting uterine pathology. This sensitivity agreed with **Alcázar et al.** <sup>(17)</sup> and **Yela et al.** <sup>(18)</sup>.

In the present work MRI had a sensitivity of 100% and specificity 100% for post-menopausal uterine lesions which disagreed with a study done by **Ahmad et al.** <sup>(12)</sup> in which the sensitivity was 88.24% and specificity was 69.23%. This discrepancy can be explained by the number of cases (our case 6 and their cases 30) and the study done for endometrial lesions only, our MRI was 1.5 TESELA and their MRI was 0.3 TESELA.

#### CONCLUSION

Management of MRI in abnormal uterine bleeding as equal as that of TVS but still TVS has the upper hand as the first imaging choice, real time imaging.

patients also preferred TVS than MRI. MRI diffusion sequence for female pelvis should be added to the routine protocol for female pelvis as regarding the differentiation of benign and malignant endometrial lesions.

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