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Detection of Endometrial Cancer through Magnetic Resonance diffusion Weighted Imaging

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ABSTRACT

Background: The most common malignancy in the reproductive system of female is the Endometrial carcinoma, that is represent the fourth common women cancer in the world. The first line to treat any disease that's be in diagnosing tools.
Aim of The Work: To enhancing the role of diffusion weighted magnetic resonance imaging (MRI) to detect the endometrial cancer.
Patients and Methods: The study included 25 patients referred from the gynecological outpatient clinic to assess the endometrium, in range between 45-75 year-old with dysfunctional uterine bleeding, bleeding of post-menopausal, and taken tamoxifen through 1.5 tesla diffusion weighted MRI Achiva Philips 32 channels.
Results: PDR problems are related with considerable improvement in Aging patients was 59.96 ± 7.9 year-old, 88% presented with postmenopausal bleeding and 12% menorrhagia, which 79% histopathological adenocarcinoma 16% unspecific carcinoma, grading tumor was grade I in 52%, 28% grade II, and 20% in grade III, In DW1 images, we found that high signal was present among all selected patients (25 females).
Conclusion: The most important and accurate imaging technique in endometrial cancer staging is the MRI diffusion weighted more than T2W conventional images alone.

Keywords: *Endometrial Cancer; Magnetic Resonance, diffusion weighted imaging.*

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INTRODUCTION

Endometrial cancer is the fourth most common female cancer and the most common malignant tumor of the female productive system. Multiple risk factors include unchallenged estrogen intake, tamoxifen use, nulliparity, longevity, increased obesity levels, and diabetes are responsible for contribute to the disease's prevalence [1].

Endometrial cytology, specimen, and curettage have long been the gold standard for diagnosing endometrial part. However, because these procedures are frequently conducted blindly, they do not necessarily yield a definitive diagnosis. Furthermore, they are difficult to conduct in patients who have stenosis of the stenosis in vagina or cervix canal [2].

Although transvaginal sonography has been advocated as the first-line diagnostic method for determining endometrial thickness, its use is limited by operator expertise, uterine position, and vaginal abnormalities [3].

Magnetic resonance imaging (MRI) is increasingly being used for identifying endometrial disorders and as a problem-solving tool while there is a diagnostic difficulty due to it's own outstanding soft tissue contrasting resolution, multi-planar imaging capacity, and post-processing tools [4].

In developed nations, endometrial carcinoma is the most common malignant tumour of the genitourinary tract. The yearly prevalence has been steady over the previous decade, with an estimated 25.1 cases per 100, 000 females [5].

In developed countries, endometrial carcinoma is the most frequent reproductive cancer. The majority of patients appear with menstrual or postpartum hemorrhage, with 70–80 percent having stage I illness at the time of presentation [6].

Endometrial carcinoma has a variety of prognostic markers, including histologic grade, degree of myometrial invasion, and metastasis through lymph node [7].

The degree of myometrial invasion is the most single greatest significant predictor, with a 50% threshold separating FIGO (International Federation of Gynecology and Obstetrics) stage I into Ia and Ib [8].

Increased probability of pelvic lymph node involvement and parameterized extension are linked to deep myometrial invasion [7].

The major clinical challenges are the optimal selection of patients at high risk for advanced disease who would benefit from more extensive surgical procedures (ie, lymph node dissection) and avoiding overtreatment in minimal risk individuals. Complications from lymphadenectomy have been documented to occur in up to 17% of cases. Obese and diabetic patients are at a higher risk of surgical complications [9].

The large percentage of endometrial cancers are discovered at a preliminary phase in postmenopausal women with unusual uterine hemorrhage. The 5-year overall survival rate is 81.7 percent, however it varies widely amongst tumour histologies and stages, ranging from 20 to 91 percent [10] .

When examining the woman pelvis, advances in magnetic resonance imaging (MRI) technology enable outstanding soft tissue contrast resolution with multi planar possibilities. [11] .

Physiological imaging methods are becoming increasingly popular. Diffusion-weighted imaging (DWI) with quantitative apparent diffusion coefficient (ADC) assessment is a one-of-a-kind, non - invasive technique that has been found to enhance the radiological identification of malignant tumors [12] .

Diffusion weighted MR imaging is a type of the physiological imaging that shows details concerning fluid movement, tissue cellularity, and cellular membranes integrity. When used in conjunction with traditional MR imaging sequences, it has the potential to increase tissue characterization [13].

When opposed to low grade endometrial carcinomas, high grade endometrial carcinomas have a higher cellular density and are likely to have lower ADC values. As a result, the clinical value of ADC assessment in endometrial cancer is believed to be in non-invasively forecasting tumor grading pre – operative [13] .

Endometrial cancer and regular endometrium may be distinguished using DW-MRI. The function of contrast enhanced MRI is to grade a known endometrial carcinoma and has minimal clinical use in the diagnosis of endometrial cancer, which is established by endometrial biopsy [11].

We aimed from this study to enhancing the role of diffusion weighted magnetic resonance imaging (MRI) to detect the endometrial cancer.

PATIENTS AND METHODS

25 patients in age between 45-75 year-old post-menopausal bleeding with dysfunctional uterine bleeding under tamoxifen medication, which was imaging under Achiva Philips MRI 1.5T 32 channels.

We divided the ordinary concentration within the tumours by the intensity of the myometrium in the DWI and post contrast photos for a comparative analysis of the DWI (b1000 s/mm2) and image enhancement pattern (b1000q = DWI signal-intensity lesion/DWI signal-intensity myometrium, Cq = post contrast signal-intensity lesion/post contrast signal-intensity myometrium).

A combination of T2-weighted MR imaging sequence, DWI, ADC maps and post contrast MR imaging were used in staging of endometrial. The MRI staging followed the FIGO staging system.

As applicable, numerical data were reported as mean and standard deviation or median and range. Qualitative data were expressed as frequency and percentage, then ROC analysis (Receiver Operator Characteristic) was done to select the best cutoff point for ADC value. The findings on MRI were analyzed and correlated with histopathological findings after biopsy or resection with follow -up imaging clinical examination and investigations when available, The location, size, form, and borders of the tumor, signal characteristics and enhancement patterns, and means and lowest ADC values for data analysis were among the MRI aspects that were examined.

RESULTS

this study conducted through 25 female patients in age 59.96 ± 7.9 year-old, 88% of them was postmenopausal bleeding and the others 12% with menorrhagia, with histopathology we found 76% as adenocarcinoma and 16% as unspecified carinoma with 4% as mixed mullirin and serous papillary. 52% was in grade I and 28% in grade II but 20% was in stage III, whish stage 1A was the most common stage among examined sample, and 1B was as 20%, both stages II, IIA, IIB performed 4%, on other hand 8% found in IIIA, IVA, IVB stage as we can see it in table (1). the size of 48% of participants had tumors less than 3 cm, while 52% found more than 3 cm in size. Sixty-six percent of patients had differentiated tumours, whereas twenty-four percent had poor differentiation.

Stage	Value
IA	11 (44)
IB	5 (20)
II	1 (4)
IIA	1 (4)
IIB	1 (4)
IIIA	2 (8)
IVA	2 (8)
IVB	2 (8)

Table 1: showing the tumor staging of the selected participants (n=25).In DW1 images appeared as high signal in all patients, however, in ADC images the low intensity signals found in all patients also, but in CE images we found that heterogeneous signals.

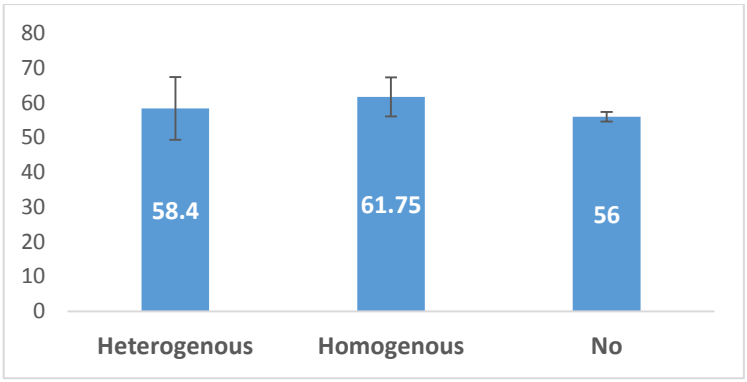

Fig. 1: showing the relation between age of the participants and CE images by MRI in selected patients (n=25).

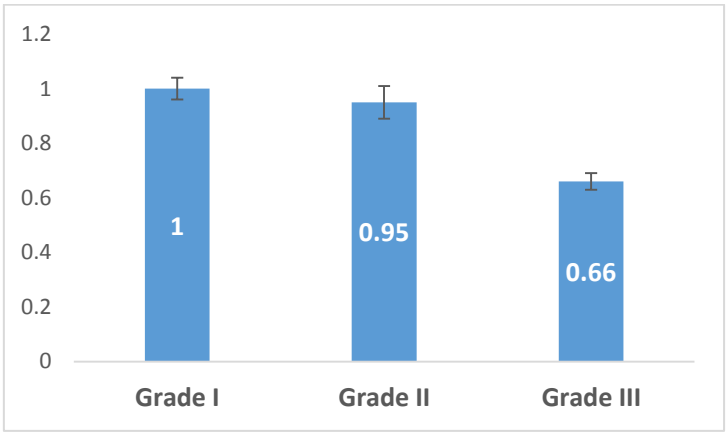

Fig. 2: showing the relation between ADC values and tumor grading among selected patients.

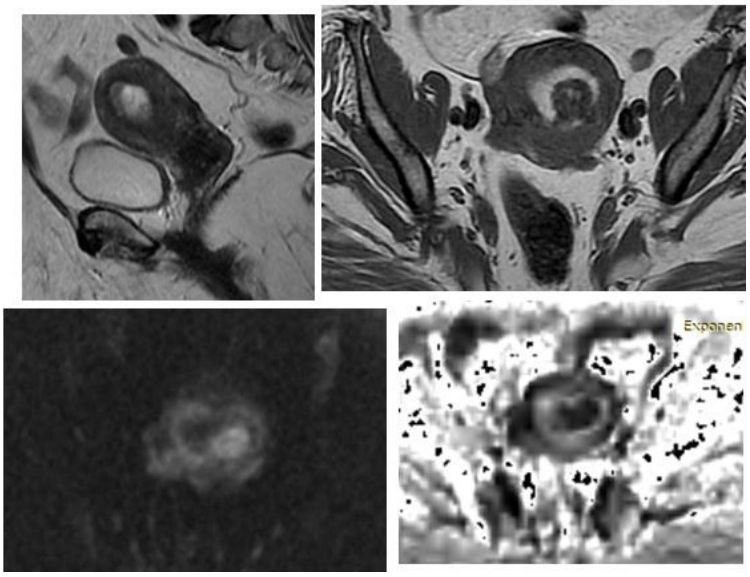

Fig. 3: Female patient, 62 year old, with history of postmenopausal bleeding since 5 months. DW-MRI was recommended.

MRI sagittal T2WIs (A) axial T1WIs: (B): showed AVF uterus with increased endometrial thickness with well-defined endometrial lesion exhibit a low signal intensity on T1WI and heterogeneous predominant high signal intensity on T2WI. Axial DWI (C): ADC map (D) showed high signal intensity on DWI and low signal intensity on ADC map denoting restricted diffusion. No gross myometrial junctional zone invasion. This lesion considered Stage Ia regarding FIGO staging. Which was pathologically confirmed as Grade I adenocarcinoma.

DISCUSSION

In developed nations, endometrial carcinoma is the most common malignant tumor of the women genitourinary tract. The yearly prevalence has been steady over the previous decade, with an expected 25.1 cases per 100, 000 women (Siegel et al., 2015)[5]. The great majority of endometrial cancers are discovered at an early stage in postmenopausal women with unusual uterine bleeding. The 5-year overall survival rate is 81.7 percent; however, it varies widely amongst tumour histologies and stages, ranging from 20 to 91 percent. [10].

It is critical for radiologists to include the histopathological classifications I or II in their reports. These subtypes vary not only in histology and risk factors, but also in clinical aspects such as the stage at which they occur, the risk of spread, and the rate of recurrence. Type I endometrial cancer accounts for 80–85% of all endometrial malignancies, is estrogen-responsive, and has a good prognosis [14].

Diffusion-weighted (DW) magnetic resonance imaging (MRI) identifies random microscopic mobility of molecules (Brownian motion), resulting in tissue contrast that differs from that of traditional MR T1-weighted (T1W) and T2-weighted (T2W) images. DW imaging (DWI) was first employed exclusively in the central nervous system, specifically to diagnose acute brain infarctions. This approach has recently gained popularity for detecting malignant tumors and determining the histological characterization of localized lesions in the abdomen and pelvis [15].

In DW images in our study, we found that high signal intensity was present among all studied females. In ADC images the, we found that low signal intensity was present among all studied females.

Comparable to our results, (Chen et al. 2011)[16], who sought to determine the clinical utility of magnetic resonance whole-body DWI in the staging of uterine cervical cancer, observed that the DWI picture revealed a high signal intensity metastasis with a lower ADC value. In addition, (Ichikawa et al. 2006)[17] found that metastatic and non-metastatic nodes in colorectal cancer patients were both seen as high-signal intensity areas on DW images.

Previous research on patients with head and neck tumors has found that DW pictures and ADC maps may accurately distinguish metastatic from benign cervical lymph nodes, even when the results are contradictory. (Sumi et al., 2006)[18] observed that metastatic nodes had greater ADC values than benign nodes, however other authors (Razek et al., 2006)[19]; (Holzapfel et al., 2009)[20] discovered that malignant nodes had lower ADC values.

According to the present study, in CE images, heterogenous signal were present among 12 (54.5%) females. Homogenous signal was present among 8 (32 %) females in this study. Presence of homogenous signal and absence of signal by contrast-enhanced (CE) image were associated with well differentiated tumors (p= 0.04).

In contrast to our findings, (Park et al., 2006)[21] found that on T2WI, 25 (71%) of 35 patients with endometrial cancer had homogenous signal intensity and 10 (29%) had heterogeneous signal intensity.

Endometrial cancer has a different prognosis depending on the patient's age. (Agrawal et al., 2012)[2]. Concerning T1-weighted imaging signals, we found that patients with low intensity signals were significantly older than those with inter and isotense signals (p=0.003). Presence of both isointense and low intensity signals in T1-weighted imaging was associated with adenocarcinoma in histo-pathological diagnosis (p=0.003). To see if dynamic CE MR scanning and late CE T1WI may help distinguish between the various lesions that cause endometrial cavity abnormalities. (Park et al., 2006)[21] contained 59 pathologically verified endometrial lesions, including 35 endometrial malignancies, that revealed an abnormality of the uterine cavity. On late CE T1WI, they found that all endometrial carcinomas had a hypointense signal intensity. The signal intensities of the carcinoma and the other groups, which included all benign uterine lesions and sarcomas, were shown to be significantly different ($p<0.05$).

And this was in concordance with what we reported in this study.

Regarding T2WI image signals, we found no association between signal intensity and any of age of patient, histo-pathological diagnosis, tumor grading, tumor staging, tumor size or differentiation. In a research by Park et al. (2006)[21], there was no massive distinction in signal intensity between endometrial cancer, sarcoma, and other benign uterine lesions on T2WI.

The inclusion of T2-weighted pictures, diffusion-weighted images, and contrast-enhanced images in MR imaging protocols enhances staging and treatment planning in patients with endometrial cancer (Rauch et al., 2014)[12]. Concerning T2-weighted imaging signals, we found no association between signal intensity and any of age of patient, histo-pathological diagnosis, tumor grading, tumor staging, tumor size or differentiation. (Park et al., 2006)[21] found no significant difference in signal intensity on T2WI between endometrial cancer, sarcoma, and other benign uterine lesions, which is consistent with our findings.

To minimize possible errors in image interpretation, such as T2 shine-through, fluid limitation in normal and non-malignant tissues, and lesions with poor cellularity, DW pictures should always be reviewed in conjunction with ADC maps [(23)]. We discovered that the average ADC value of endometrial cancer was 0.9 0.1103 mm2/s, with a range of 0.5 to 2103 mm2/s. We also discovered a link between lower ADC levels and higher tumour grades (p0.001).

Tamai and colleagues found a tendency toward lower ADC levels in higher-grade endometrial tumours, which is similar to our findings [13]. Also, (Ma et al.,

2021)[24] found that low-grade endometrioid adenocarcinoma was linked with greater ADC values ($P<0.05$) when they used preoperative MRI datasets of 317 patients with endometrial cancer to construct volumetric ADC histogram metrics.

In our study, average ADC value in grade I endometrial cancer patients was $1 \pm 0.04 \times 10{-}3$ mm2/s. In grade II, it was 0.95 0.06 103 mm2/s, while in grade III, it was 0.66 0.03 103 mm2/s. Similarly, (Bharwani et al., 2011)[25] discovered that grade 3 tumours had fewer ADCs than grade 1 tumours; however, the difference was not significant. In concordance with our finding, (Ma et al., 2021)[24] reported that a mean ADC $\geq 0.892 \times 10{-}3$ mm2/s ability to distinguish grade I endometrioid cancer from grade II and grade III endometrioid adenocarcinoma.

CONCLUSION

To summarize, DW-MRI is an essential imaging tool that, when compared to traditional T2W images alone, may allow for more accurate endometrial cancer detection. T1-weighted imaging was found to be helpful for non-invasive predicting the subtype of endometrial cancer. CE imaging was found to be helpful for non-invasive predicting the differentiation of endometrial cancer. In endometrial cancer, there is a substantial negative connection between ADC levels and tumor grade.

Conflict of interest : none

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