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Value of Diffusion Weighted Magnetic Resonance Imaging in Diagnosis of Cervical Carcinoma

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Abstract

Background: Carcinoma of the uterine cervix is the third most frequently diagnosed malignancy in women worldwide. It remains a leading cause of cancer-related death for women in developing countries. Conventional MRI has an established role in gynecologic imaging. However, increasing clinical demand for improved lesion characterization and disease mapping to optimize patient management has resulted in the incorporation of newer sequences, such as diffusion-weighted imaging (DWI).

Aim of Study: The aim of this study is to evaluate the role of DW-MRI in the diagnosis of cervical carcinoma.

Patients and Methods: This is a descriptive exploratory (case-series) study that included 20 female patients diagnosed with cervical cancer, Pelvic MR, DWI and DCE- MR were done for all patient. The study was conducted in El-Demerdash Hospital from March 2019 – Feb. 2020.

Results: This study group consisted of 20 female patients diagnosed with cancer cervix, Pelvic MR with DWI and DCE-MR were done for all patients. Lesions in all cases were seen restricted on DWI (high signal intensity in DWI with low ADC map) with hetrogenous patterns was seen in (17/20, 85%) cases, homogenous patterns was seen in (2/20, 10%) and mural pattern in (1/20,5%) case. All lesions showed low ADC maps from 0.6 to 1.2 (x10^{-3} mm^2/sec), <0.8 x10^{-3} mm^2/sec was seen in 5 cases (25%) and ≥0.8 x10^{-3} mm^2/sec was seen in 15 cases (75%). A total 20 cervical cancer lesions, 5 lesions were stage IIA (25%), 10 lesions were stage IIB(10%), 4 lesions were stage IVA (20%) and 1 lesion was stage IVB (5%) of figo classification.

Conclusion: DWI is a potentially useful adjunct to conventional MRI in the evaluation of gynecologic tumors, thus improving the overall diagnostic accuracy, tumor staging.

Key Words: *MRI – DW-MRI – Cervical cancer.*

Introduction

CEVICAL cancer is the third most common cancer in women worldwide **[1]**. It remains a leading cause of cancer-related death for women in developing countries **[2]**.

Conventional MRI has an established role in gynecologic imaging. However, increasing clinical demand for improved lesion characterization and disease mapping to optimize patient management has resulted in the incorporation of newer sequences, such as diffusion-weighted imaging (DWI) **[4]**.

DWI is a noninvasive technique that enables the assessment of morphologic and physiologic changes in a single examination. It also allows for a quantitative evaluation of ADC from images with different *b*-values **[5]**.

This technique is a functional tool that relies on tissue water displacement to create a contrasted image. For correct evaluation and avoidance of pitfalls, the generated images must be interpreted alongside anatomical sequences. The apparent diffusion coefficient (ADC) map is also needed to reduce image misinterpretation **[6]**.

DWI can provide excellent tissue contrast, making it an excellent choice in cases where contrast administration is not possible. Furthermore, the additional scanning time is relatively short **[7]**.

DWI is a potentially useful adjunct to conventional MRI in the evaluation of gynecologic tumors, thus improving the overall diagnostic accuracy, tumor staging, prediction of response to therapy, and treatment follow-up **[8]**.

DWI and ADC map help in differentiation of benign from malignant zones of cervix without exogenous contrast **[8]**. The measurement of ADC value in patient with cervical cancer is an important factor for assessing response to chemoradiotherapy **[9]**.

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Aim of the work:

To evaluate the role of diffusion weighted magnetic resonance imaging (DW-MRI) in the diagnosis of cervical carcinoma.

Patients and Methods

The study group consisted of 20 female patients diagnosed with cervical cancer radiologically, Pelvic MR, DWI and DCE- MR were done for all patient. The patient's age ranged from 30 to 87 years old. The study was conducted in Radiology Department at Ain Shams University Hospitals. While, patients with contraindications to MRI were excluded from the study.

MRI imaging:

MR imaging were performed on 1.5 T machine (Achieva, Philips medical system, Eindhoven, Netherlands) using phased array pelvic coil. All the patients were imaged in the supine position with head first and were asked not to move during examination.

Imaging protocol:

T2 -weighted image in axial, sagittal and coronal planes. DW-MRI will be acquired in the axial plane prior to administration of contrast medium. Dynamic contrast-enhanced MRI: Post contrast T1 fat sat images will be obtained immediately after manually injected gadolinium.

Statistical analysis:

Data were analyzed using Statistical Program for Social Science (SPSS) version 20.0. Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

Results

The included 20 patients ages ranged between (30-87) years (mean age: 54.55±15.49), 50% of patients were ≤55 years and 50% of them were >55 years.

The irregular vaginal bleeding (35%), postmenopausal bleeding (65%) were the presentation of the study.

The size of lesion ranged between 2cm to 5cm (70%) and >5cm (30%) of size lesion (cm^2).

Table (1): Signal intensity of T1 and T2 in conventional MRI.

Signal intensity	T1	T2
Isointense	3	14
Low	17	1
High	0	5
Total	20	20

On T1 weighted images, isointense signal intensity was found in 3 cases (15%), low signal intensity was found in 17 cases (85%). On T2 weighted images, hyperintens signal intensity was found in 5 cases (25%), isointense signal intensity was found in 14 cases (70%), low intense signal intensity was found in 1 cases (5%). On T1 post contrast enhancement, heterogeneous enhancement was found in 17 cases (85%), homogenous enhancement was found in 2 cases (10%) and mural enhancement was found in 1 case (5%).

Lesions in all cases were seen restricted on DWI (high signal intensity in DWI with low ADC map) with hetrogenous patterns was seen in (17/20, 85%) cases, homogenous patterns was seen in (2/20, 10%) and mural pattern in (1/20, 5%) case.

Table (2): DWI signal intensity distribution of the study group.

DWI	Frequency	Percent
Restricted	20	100

Table (3): Quantitative ADC value ($x10^{-3} mm^2/sec$) distribution of the study group.

ADC Value ($x10^{-3} mm^2/sec$)	No.	%
<0.8 $x10^{-3} mm^2/sec$	5	25
≥0.8 $x10^{-3} mm^2/sec$	15	75
Total	20	100
Range (Mean±SD)	0.6-0.9 (0.79±0.08)	

All lesions showed low ADC maps from 0.6 to 1.2 ($x10^{-3} mm^2/sec$) and the mean was 0.6-0.9 (0.79±0.08).

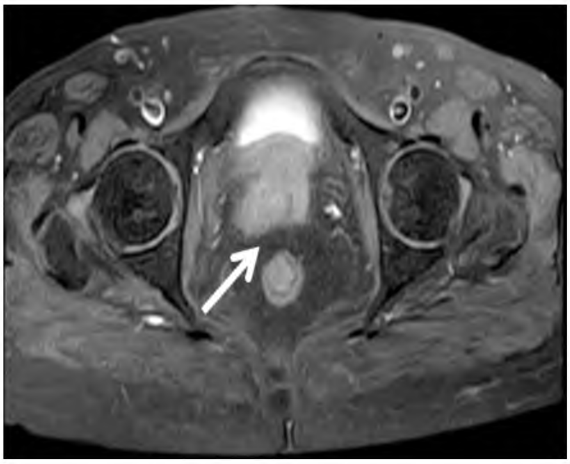
All lesions extended to the upper 1/3 of vagina (100%) and (10%) of cases extended to lower 1/3 of vagina.

The parametial invasion was seen in 15 cases (75%).

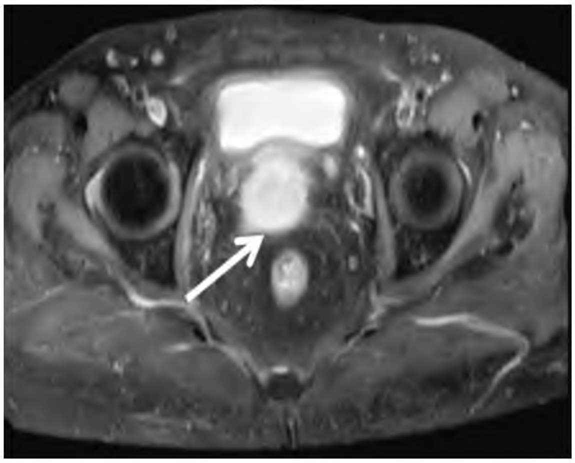
Lymp nodes involvement was seen in 17 of cases (85%).

A total 20 cervical cancer lesions, 5 lesions were stage IIA (25%), 10 lesions were stage IIB (10%), 4 lesions were stage IVA(20%) and 1 lesion was stage IVB (5%) of figo classification.

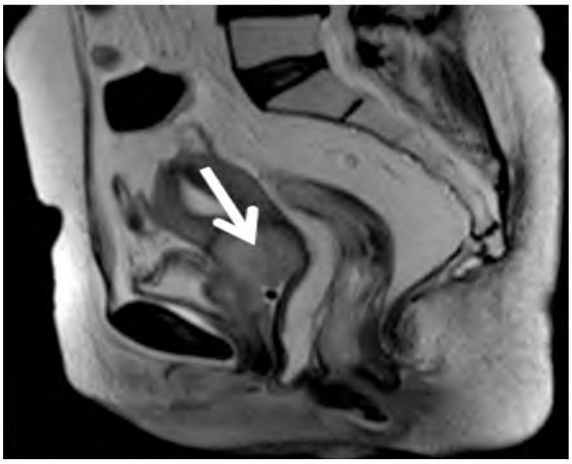
A Female patient 67 years old presenting with vaginal bleeding of two months duration (Fig. 1).



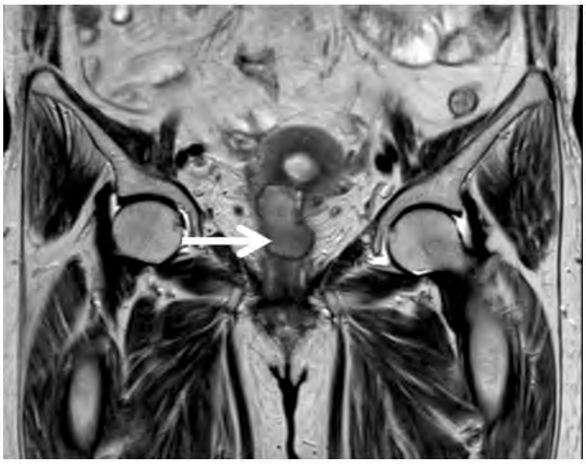
(A): Axial T2



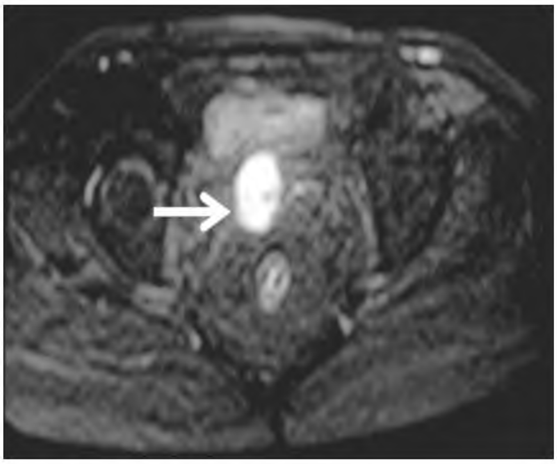
(B): Post contrast T1



(C): Sagiital T2



(D): Coronal T2

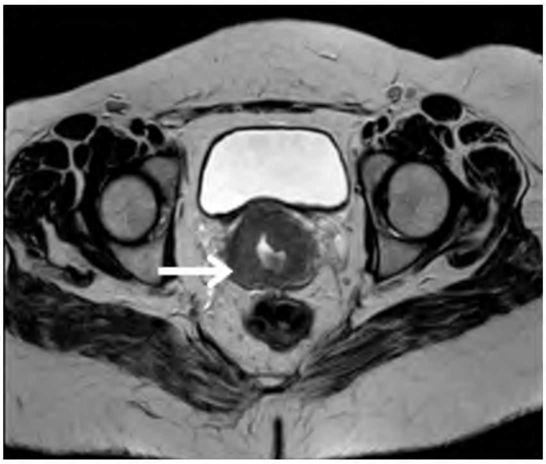


(E): DWI

(F): ADC

Fig. (1): DWI image in Fig. (E,F) revealed the presence of ill defined soft tissue mass lesion measuring 2.8x3.3x4.3cm extending downwards into the upper 2/3 of the vagina, no parametrial invasion. It shows high signal on DWI with homogenous pattern and low signal on the corresponding ADC maps (Fig. F). ADC value was (0.836 x 10^{-3} mm^2/s). The patient was diagnosed as cancer cervix with extensions as described, stage IIa with lymph nodes.

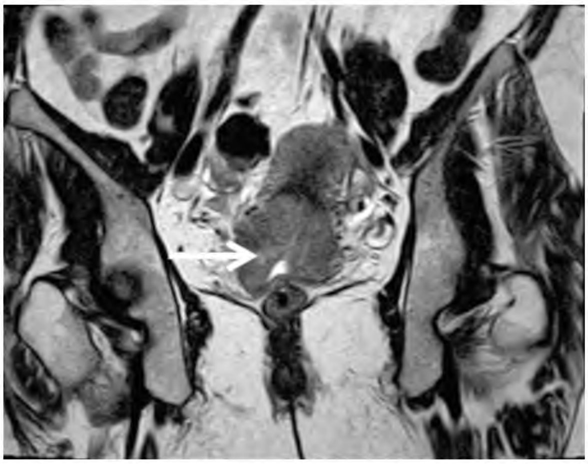
A female patient 39 years old presenting with vaginal bleeding (Fig. 2).



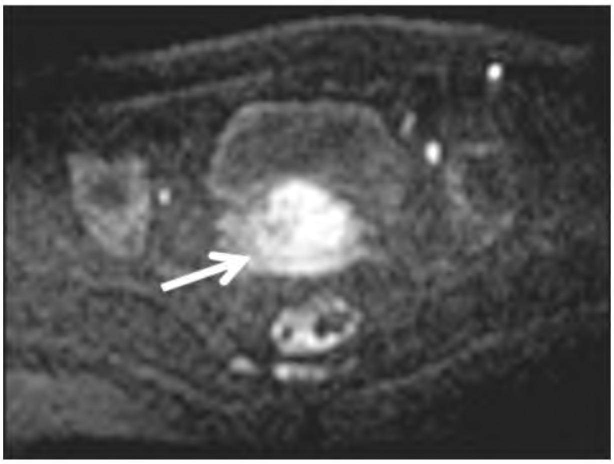
(A): Axial T2

(B): Post contrast T1

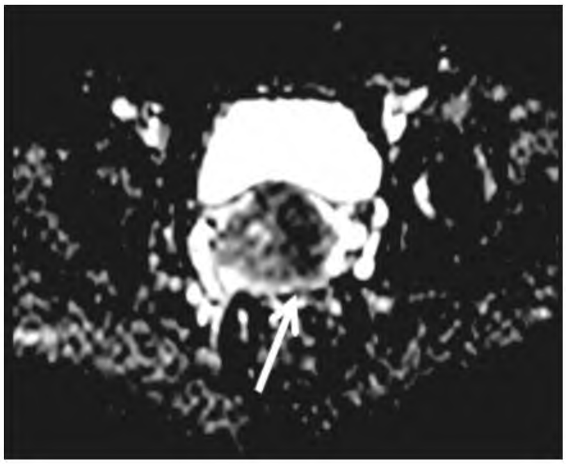
(C): Sagiital T2



(D): Coronal T2



(E): DWI

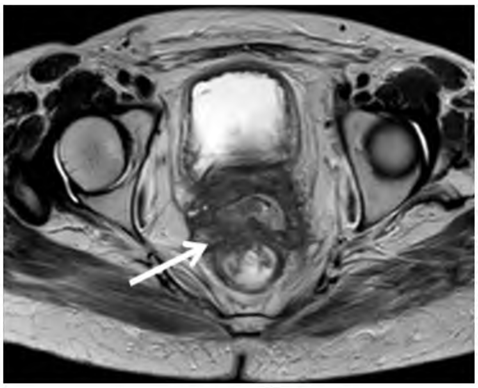


(F): ADC

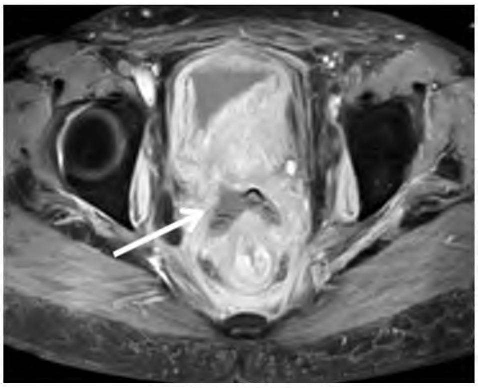
Fig. (2): DWI image Fig. (E,F) revealed the presence of ill defined soft tissue mass lesion measuring 4.2x4.8x5.4 cm, extending to upper one third of vagina with bilateral parametrial extension, The cervical lesions show high signal on DWI with homogenous pattern, and low signal on the corresponding ADC maps (Fig. F). ADC value was (0.7 $x10^{-3}$ mm^2/s). The patient was diagnosed as cervical carcinoma with extensions as described, stage stage IIb.

A female patient 49 years old presenting with vaginal bleeding (Fig. 3).

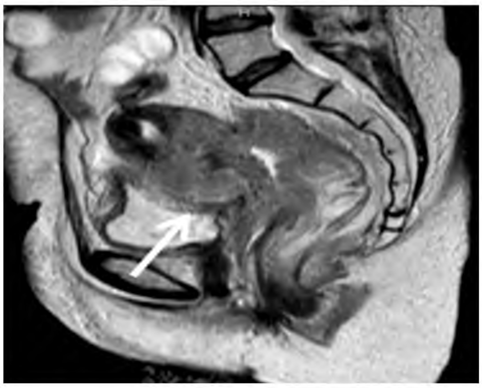
DWI images Fig. (E,F) revealed the presence of ill defined soft tissue mass lesion measuring 7x7.2x5.1cm, extending to lower 1/3 of vagina and it infelterate the Urinaruy bladder and rectum with bilateral parametrial invasion, Bilateral external iliac lymph nodes are seen. The cervical lesions show high signal on DWI with homogenous pattern, and low signal on the corresponding ADC maps (Fig. F). ADC value was (0.6 x10^{-3} mm^{2}/s). The patient was diagnosed as cancer cervix with extensions as described, stage IVa.



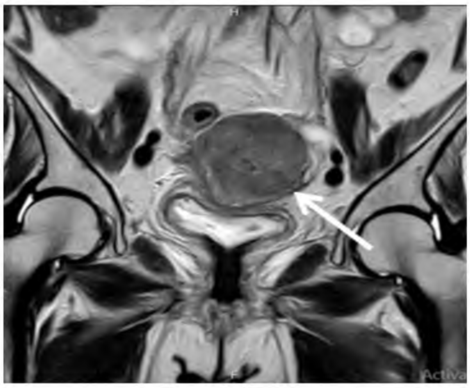
(A): Axial T2



(B): Post contrast T1



(C): Sagiital T2



(D): Coronal T2

(E): DWI

(F): ADC

Fig. (3): DWI images Fig. (E,F) revealed the presence of ill defined soft tissue mass lesion measuring 7x7.2x5.1cm, extending to lower 1/3 of vagina and it infelterate the Urinaruy bladder and rectum with bilateral parametrial invasion, Bilateral external iliac lymph nodes are seen. The cervical lesions show high signal on DWI with homogenous pattern, and low signal on the corresponding ADC maps (Fig. F). ADC value was (0.6 x10^{-3} mm^{2}/s), The patient was diagnosed as cancer cervix with extensions as described, stage IVa.

Discussion

Cevical cancer is the third most common cancer in women worldwide [1]. In Egypt, cervical cancer ranks as the second most frequent cancer after breast cancer [3].

This study was conducted at the Radiology Departement in Ain Shams University Hospitals. This study group consisted of 20 female patients diagnosed with cancer cervix, Pelvic MR with DWI and DCE-MR were done for all patients. The patient's age ranged from 30 to 87 years old. Ten patients (50%) were <55 years and ten (50%) were >55 years with mean age 54.5 years. The clinical presentations of women with cervical cancer are abnormal vaginal bleeding, vaginal discomfort, malodorous discharge and dysuria [10]. In our study, the clinical presentations were postmenopausal bleeding (13/20, 65%), vaginal bleeding (7/20, 35%).

Cervical carcinoma is isointense in T1 compared with pelvic muscles and high signal in T2 relative to the low signal of the cervical stroma [11]. Regarding the signal intensity of the cervical lesions at T1WIs in this study, hypointense T1 signal was seen in 17/20 (85%) cases and iso-intense signal in 3/20 (15%) cases. Hyper intense T2 signal was seen in (5/20, 25%) cases, intermediate signal intensity in (14 /20, 70%) and low signal intensity T2 in (1/20,5%). This was in agreement with Patel et al., 2010 who reported cervical tumors to give iso to high signal compared to cervical stroma on T2. However, delineation of the tumor can be challenging in young patients with intermediate signal cervix, especially in those with small tumors [12].

In Dynamic contrast-enhanced MRI (DCE-MRI) showed heterogeneous post-contrast enhancement in 17/20, (85%), homogenous post-contrast enhancement in 2/20 (10%) and mural enhancement in 1/20 (5%) cases. In Abdelsalam et al. [13], study The hypointense T1 signal was seen in 34/70 (48.5%) cases, iso-intense signal in 28/70 (40%) cases, hyper-intense T1 signal was seen in 6/70 (8.5%) cases.

T2WIs showed hyper-intense signal in 62/70 (88%) cases and intermediate signal in 2/70 (2.8%) cases and heterogeneous signal intensity in 6/70 (8.5%). Heterogeneous post-contrast enhancement was seen in 40/70, (57%), homogenous post-contrast enhancement in 20/70 (28.5%) and mural enhancement in 4/70 (9%) cases.

In qualitative analysis of DWI, the tumors cells appeared hyperintense (bright) at high *b*-value as water movement is restricted and hence reduced ADC values in ADC maps [14]. In this study all lesions showed diffusion restriction (high signal intensity in DWI and low signal intensity in ADC maps) with hetrogenous patterns was seen in (17/20, 85%) cases, homogenous patterns was seen in (2/20, 10%) and mural pattern in (1/20,5%) case. DWI can yield quantitative information that provides unique tumor characteristics. To our knowledge, the performance of DWI in the characterization of cervical carcinoma has been investigated only in a few studies. Naganawa et al., 2008 applied DWI to cervical carcinoma and found that the mean ADC value of cervical cancer lesions (1.09 ± 0.20 x10^{-3} mm^2/s) was lower than that of normal cervix (1.79 ± 0.24 x10^{-3} mm^2/s), Although the cohort used in that study contained a very small population (n=12) of cervical carcinoma, the result showed the potential ability of measuring the ADC value to differentiate between normal cervix and cervical cancer.

In a study of Hoogendam et al. [8] where the mean ADC of uterine cervical cancer of 20 cases was (0.9 x10^{-3} mm^2/sec). In a study conducted by Kuang et al., [15] to evaluate the potential value of apparent diffusion coefficient (ADC) measurement in the assessment of cervical cancer on 112 patients with cervical cancer underwent DWI in addition to routine MR imaging at 3.0-T MRI, the ADCs of cervical cancer were significantly lower than those of normal cervix (1.7x10^{-3} mm^2/sec). In a study carried out by McVeigh et al. [16], diffusion-weighted MRI was performed in 47 patients with cervical carcinoma a 1.5-T system with a *b*-value of 600s/mm^2, the mean ADC (mADC) of cervical carcinomas (0.89x10^{-3} mm^2/sec) was significantly lower than normal cervix (1.6x10^{-3} mm^2/sec). A study carried out by J. Magn et al., [17], the mean ADC values for cervical carcinoma were (0.916x 10-3±0.15 SD mm^2/s), Nakmura et al., 2012 studied 80 cervical cancer patients who underwent pelvic MRI within the 2 to 4 weeks before radical hysterectomy. They reported that the mean ADC value was (0.852 x10^{-3} mm^2/s). They also found that well differentiated tumors had higher ADC values than poorly differentiated tumors (1.2 x10^{-3} mm^2/s vs. 1.1 x10^{-3} mm^2/s) (p=0.01), While vast majority of studies have imaged early stage tumors with ADC values ranging between (0.86-1.38x10^{-3} mm^2/sec). In our study we measured the ADC values of cervical carcinoma was (0.6-0.9 x10^{-3} mm^2/sec). We found that the mean ADC value of cervical carcinoma was lower than that of normal cervical tissue, which was in agreement with previous studies.

Accurate assessment of parametrial infiltration is essential for the decision making in management of cervical cancer. Clinical assessment of parametrial and pelvic side wall invasion has a reported accuracy of only 29-53%. While an experienced clinician can usually detect gross parametrial invasion, early invasion usually goes undetected **[6]**.

DWI is a very promising technique that can help with detection and staging of cervical cancer. Most authors agreed that by using conventional MRI, a visible cervical tumor indicates stage Ib or higher **[18]**.

However, the detection of carcinoma in situ and early stage invasive cervical carcinoma (Ia) still remains a challenge. While Charles-Edwards et al., **[19]** reported that DWI with an endovaginal technique had potential value for improving tumor detection in stage Ia and Ib1 disease, particularly in patients with cone biopsy where granulation tissue makes interpretation of the T2-weighted images difficult.

In our study to demonstrate the extension of the tumor and the staging we demonstrated the extenstion of tumor to the vagina, parametrial invasion and lymph nodes metastasis. The cervical lesions extension to the upper 1/3 was seen in (19 /20, 90%) cases and to the lower 1/3 was seen in (2/20, 10%) cases. Also parametrial invasion was seen in (15 /20,75%), And lymph nodes involvement was seen in (17/20,85%). Although pelvic lymph node metastasis is not considered in figo staging, it is one of the important prognostic factors and presence of a positive node indicates poor prognosis in each stage **[20]**. Risk of nodal metastasis increases with tumor size, depth of stromal invasion, lymphovascular invasion and parametrial disease **[21]**.

Kim et al., **[21]** found that malignant nodes showed significantly less ADC values than those elicited by non-malignant nodes (0.7651 x10^{-3} mm^2/s±0.1137 versus 1.0021 x10^{-3} mm^2/s ±0.1859; *p*<.001) in patients undergoing lymph node dissection for cervical cancer. They used *b*=0 and *b*=1000s/mm^2. Nakai et al., **[22]** evaluated nodal status at 1.5T. In this study, the number of detected nodes improved.Our results were similar to Nakai et al., **[22]** concerning the superior ability of DW-MRI in detection of lymph nodes.

By measuring primary tumor ADC, lymph node ADC and lymph node long and short axis diameter, Lin et al., **[23]** were able to increase their sensitivity in the detection of metastatic lymph nodes from 25% to 83%. In our study DWI was more specific than the pre-contrast T2WI in the assessment of lymph node metastasis (100%). Staging of cancer cervix is very important to treatment as the treatment depends on the stage, surgical treatment is the preferred modality for the treatment of small, early stage 1b1/1b2 and 11A1 lesions. More advanced lesions (eg1b3 and higher) are treated with chemo/radiation therapy so imaging provides valuable clinical information during treatment Planning **[24]**.

In the present study, the staging of cancer cervix according to figo classification was figo IIa was seen in (5/20,25%), figo IIb was seen in (10/20, 40%), figo IVa was seen in (4/20, 20%), figo IV was seen in (1/20,5%).

Conclusion:

DWI is a potentially useful adjunct to conventional MRI in the evaluation of gynecologic tumors, thus improving the overall diagnostic accuracy, tumor staging.

References

1- FERLAY J., SOERJOMATARAM I., ERVIK M., et al.: IARC cancer base no11. International Agency for Research on Cancer; Lyon, France: 2013 [Accessed on June 8, 2013]. GLOB-OCAN 2012 v 1.0, Cancer incidence and mortality worldwide, 2012.

2- SOLOMON O., MATSUKI M. and INADA L.: Detection and evaluation of pelvic lymph nodes in patients with gynecologic malignancies using body diffusion-weighted magnetic resonance imaging. J. Comput. Assist. Tomogr., 32 (5): 764-768, 2007.

3- MONA S.E., NAGWA G.R.M., NESRINE F.H., YASSER IBRAHIM ORIEF and BASSMA MOHAMED EL SABAA: Prevalence of high risk human papillomavirus types 16/18 in cytologically abnormal cervical smears in Alexandria, Egypt. A cytological and molecular study, Middle East Fertility Society Journal, 18 (4): 253-267, 2013.

4- FREEMAN S., ALY A. and KATAOKA M.: The revised FIGO staging system for uterine malignancies: implications for MR imaging. RadioGraphics, 32: 1805-27, 2012.

5- NAMIMOTO T., AWAI K., NAKAURA T., YANAGA Y., HIRAI T. and YAMASHITA Y.: Role of diffusion-weighted imaging in the diagnosis of gynecological diseases. European Radiology, 19 (3): 745-760, 2009.

6- SALA E., ROCKALL A.G., FREEMAN S.J., MITCHELL D.G. and REINHOLD C.: The added role of MR imaging in treatment stratification of patients with gynecologic malignancies: What the radiologist needs to know. Radiology, 266 (3): 717-740, 2013.

7- LEVY A., CARAMELLA C., CHARGARI C., et al.: Accuracy of diffusion-weighted echo-planar MR imaging and ADC mapping in the evaluation of residual cervical carcinoma after radiation therapy. Gynecol. Oncol., 123: 110, 2011.

8- HOOGENDAM J.P., KLERKX W.M., de KORT G.A., BEEPAT S., ZWEEMER R.P., SIE-GO D.M., ET AL.: The influence of the b-value combination on apparent diffusion coefficient based Differentiation between malignant and benign tissue in cervical cancer. J. Magn. Reson. Imaging, 32: 376-82, 2010.

9- MAKINO T., YAMASAKI M., MIYATA H., YOSHIOKA S., TAKIGUCHI S., FUJIWARA Y., NAKAJIMA K., NISHIDA T., MORI M. and DOKI Y.: p53 Mutation status predicts pathological response to chemoradiotherapy in locally advanced esophageal cancer. Annals of Surgical Oncology, 17 (3): 804, 2010.

10- QASEEM A., HUMPHREY L.L., HARRIS R., STARKEY M. and DENBERG T.D.: Screening pelvic examination in adult women: A clinical practice guideline from the american college of physicians. Ann. Intern. Med., Jul 1; 161 (1): 67-72, 2014.

11- PANNU H.K., CORL F.M. and FISHMAN E.K.: CT evaluation of cervical cancer: Spectrum of disease. Radiographics, 21 (5): 1155-68, 2013.

12- WHITTAKER C.S., COADY A., CULVER L., RUSTIN G., PADWICK M. and PADHANI A.R.: Diffusion-weighted MR imaging of female pelvic tumors: A pictorial review. Radiographics, 29 (3): 759-774, 2009.

13- ABD ELSALAM S.M., MOKHTAR O., ADEL L., et al.: Impact of diffusion weighted magnetic resonance imaging in diagnosis of cervical cancer. Egypt J. Radiol. Nucl. Med., 51, 23, 2020.

14- RITA L., JOÃO L.D. and TERESA M.C.: Added value of diffusion-weighted MRI in detection of cervical cancer recurrence: Comparison with morphologic and dynamic contrast-enhanced MRI sequences. Diagn. Interv. Radiol., 21 (5): 368-375, 2013.

15- KUANG F., REN J., ZHONG Q., LIYUAN F., HUAN Y. and CHEN Z.: The value of apparent diffusion coefficient in the assessment of cervical cancer. Eur. Radiol., 23: 1050-8, 2013.

16- McVEIGH P., SYED A., MILOSEVIC M., et al.: Diffusion-weighted MRI in cervical cancer. Eur. Radiology, 18: 1058-1064, 2015.

17- MANGAL M., RAJESH K., CHAUDHARI K.R., PRASHANT C., PRAVIN G. and RUSHIKESH N.: MR imaging of carcinoma cervix. Indian J. Radiol. Imaging., 23 (3): 247-252, 2015.

18- ENGIN G.: Cervical cancer: MR imaging findings before, during, and after radiation therapy. Eur. Radiol., 16: 313-324, 2006.

19- CHARLES-EDWARDS E.M., MESSIOU C., MORGAN V.A., et al.: Diffusion-weighted imaging in cervical cancer with an endovaginal technique: Potential value for improving tumor detection in stage Ia and Ib1 disease. Radiology, 249 (2): 541-550, 2008.

20- SON H., KOSITWATTANARERK A., HAYES M.P., CHUANG L., RAHAMAN F. and HEIBA S.: PET/CT evaluation of cervical cancer: Spectrum of disease. Radio Graphics, 30: 1251-68, 2018.

21- KIM J.K., KIM K.A., PARK B.W., KIM N. and CHO K.S.: Feasibility of diffusion-weighted imaging in the differentiation of metastatic from nonmetastatic lymph nodes: Early experience. J. Magn. Reson. Imag. JMRI, 28 (3): 714-719, 2008.

22- NAKAI G., MATSUKI M., INADA Y., et al.: Detection and evaluation of pelvic lymph nodes in patients with gynecologic malignancies using body diffusion-weighted magnetic resonance imaging, 32 (5): 764-8, 2008.

23- LIN G., HO K.C., WANG J.J., et al.: Detection of lymph node metastasis in cervical and uterine cancers by diffusion-weighted magnetic resonance imaging at 3T, 28 (1): 128-35, 2008.

24- ROCKALL A.G., QURESHI M., PAPADOPOULOU I., SASO S., BUTTERFIELD N., THOMASSIN-NAGGARA I., et al.: Role of Imaging in Fertility-sparing Treatment of Gynecologic Malignancies. RadioGraphics. Radiological Society of North America, 36 (7): 2214-33, 2016.

دور الرنين المغناطيسى بالانتشار الجزيئى
فى تشخيص سرطان عنق الرحم

يعد الرنين المغناطيسى وسيلة مثالية للتشخيص ولقد أثبتت تفوقاً على الوسائل الأخرى للتشخيص بالنسبة لأمراض منطقة الحوض. يظهر الرنين المغناطيسى العلاقة التشريحية للأحشاء الداخلية بالحوض ومنها عنق الرحم.

يلعب الرنين الوظيفى دوراً هاماً فى التفريق بين الأنسجة السرطانية والغير سرطانية فى حالات سرطان الرحم وعنق الرحم وكذلك تحديد نوع التدخل الجراحى ودرجة الاستجابة للعلاج.

ومع تطور التقنيات الحديثة فى التشخيص، تم أستحداث تقنيات جديدة للتصوير الوظيفى، منها الرنين المغناطيسى بالانتشار الجزيئى والرنين المغناطيسى متعدد المراحل والتى أصبحت تستخدم الأن فى فحوصات البطن والحوض.

تعتمد فكرة الرنين المغناطيسى بالإنتشار الجزيئى على أن جزيئات الماء تنتشر بحرية فى البيئات منخفضة الخلوية، فى حين أن البيئات ذات الخلوية المرتفعة تؤدى إلى إعاقتها / تقيدها فى ظاهرة تسمى (الحركة البراونية). ونتيجة لذلك تظهر الأورام الخبيثة تقييد لجزيئات الماء وذلك لإرتفاع خلويتها على العكس من الأورام الحميدة.

وهذه التقنية لا تعتمد على حقن الصبغة وبالتالى يمكن إستخدامها خاصة فى الحالات التى يتجنب فيها استخدام الصبغة كما هو الحال فى حالة الحمل.

و لقد أظهرت نتائجنا أن أضافة الرنين المغناطيسى بخاصية الانتشار الجزيئى إلى التصوير التقليدى أدى إلى زيادة دقة التشخيص وجعله أكثر خصوصية لتحديد نوع الورم وتحديد درجة انتشار الأورام وبالتالى فى تحديد نوع العلاج المناسب ويمكنه المساعدة فى تحديد مدى الأستجابة للعلاج وفى إكتشاف رجوع المرض مرة أخرى وكذلك فى التخطيط للعلاج الأشعاعى.