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Addition of functional imaging in preoperative treatment planning of endometrial malignancies

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Abstract

Objective: This study was enrolled to assess the beneficial addition of functional MR imaging in the staging and preoperative planning of endometrial carcinoma compare with surgical and histopathological findings.

Methods: A one year prospective cross-sectional study was conducted from 10/3/2016 to 15/4/2017, at the Radiology department, Bab Elsharia University Hospital and private center. Forty seven patients with diagnosis of endometrial and cervical carcinoma, referred to radiology department for preoperative staging by Function MRI.

Results: the mean and standard deviation of age was 53±7.2. The difference between T2WI, DWI and DCE-MRI against final surgical pathology in obtaining myometrial invasion was (0.001 vs. 0.07, 0.08 respectively), parametrial invasion (0.005 vs. 0.31, 0.29 respectively). Accuracies in assigning lymph node metastasis between three sequences were 66%, 83% and 78% respectively. Staging accuracy was found to be more accurate in DWI and DCE-MRI (86% and 88% vs. 70% for T2WI).

Conclusion: Magnetic resonance imaging is a good, safe, accurate and non-invasive imaging modality in staging of endometrial carcinoma. It can be used as a first line radiological investigation in patients with endometrial carcinoma for treatment planning including decide operability, radicality, the type of operation and aids in the selection of patients who are in need to surgical treatment alone or adjunctive chemo-radiological therapy.

Key words: (Endometrial Carcinoma, DCE, DW-MRI)

Introduction

Endometrial cancer is the most commonly diagnosed gynecologic malignancy in developed countries (1), with a peak incidence between the ages of 55 and 65 years. Clinical staging is inaccurate; therefore, the International Federation of Gynecology and Obstetrics (FIGO) developed a surgical-pathologic staging system, revised in 2009 (2). Full FIGO staging consists of a total abdominal hysterectomy, bilateral salpingo-oophorectomy, peritoneal washings, and retroperitoneal lymph node dissection. MR imaging is not part of the FIGO staging system for endometrial cancer, although it increasingly plays an important role in surgical treatment planning(3). Staging MRI is recommended by the National Cancer Institute of France, the European Society of Radiology Guidelines and the Royal College of Radiologists. (4).

The combination of T2 WI and DCE-MRI offers high accuracy in staging endometrial cancer in the range of 83-91% (5). More recent studies have found oblique axial fused T2 and DW images have a high accuracy in assessing depth ofmyometrial invasion (6).In addition the orthogonal T2WI, DCE-MRI and DW images should co-register by slice location so as to enable correlation of findings on the different sequences. This improves staging accuracy (7).Metastasis to the regional lymph nodes is one of the most important prognostic factors in endometrial cancer and included in the FIGO

surgical staging of endometrial cancer. The presence of nodes upstages endometrial cancer to a stage IIIC1 or IIIC2, depending on whether pelvic or para-aortic nodes are involved (8). The FIGO staging of cervical cancer is clinical and does not include adenopathy. However, nodal involvement has significant prognostic implications and is very important in treatment planning (9).Many treatment options are available to patients with newly diagnosed endometrial, cervical, or ovarian cancer. MR imaging plays an important role in the patient's journey from the initial evaluation of disease extent to treatment selection and follow-up. In patients with endometrial cancer, MR imaging improves pretreatment risk stratification. It enables accurate surgical planning and selection of patients for pelvic or paraaortic lymph node dissection in high-risk disease, while obviating extended surgery in patients with low-risk disease. In patients with cervical cancer, MR imaging improves FIGO clinical staging accuracy, which leads to better treatment selection and planning. In those patients with cervical and endometrial cancer who wish to preserve fertility, MR imaging plays a paramount role in assessing eligibility for fertility-sparing surgical and medical procedures. In patients with ovarian cancer, MR imaging is a problem solving modality. There is growing evidence that DW MR imaging may play a role in more accurate mapping of the extent of the peritoneal disease when compared with CT. MR imaging certainly plays an important role for patients with recurrent ovarian cancer by enabling assessment of resectability in cases of solitary pelvic recurrences. Advances in MR imaging techniques, along with the growing role of the radiologist as part of a multidisciplinary treatment planning team, have become central in tailoring treatment options and frequently lead to modifications in the therapeutic approach in patients with gynecologic malignancies.

Table (1) reference (2)

Revised FIGO Staging of Endometrial Carcinoma with Corresponding MR Findings

FIGO Stage	Description of Stage	MR Imaging Findings
I	Tumor confined to corpus uteri	…
IA	Tumor extending to ≤50% of myometrial depth	Abnormal signal intensity (tumor) extends into the ≤50% of myometrium.
IB	Tumor extending to >50% of myometrial depth	Abnormal signal intensity (tumor) extends into >50% of myometrium
II	Tumor invades cervical stroma but does not extend beyond uterus	Disruption of hypointense stroma by tumor; note that widened internal os with tumor protruding into endocervical canal does not indicate stromal invasion
III	Local and/or regional spread of tumor	…
IIIA*	Tumor invades serosa of corpus uteri and/or adnexa	Disruption of continuity of outer myometrium; irregular uterine contour
IIIB	Vaginal and/or parametrial involvement	Segmental loss of hypointense vaginal wall
IIIC	Metastases to pelvic and/or paraaortic lymph nodes	Regional or paraaortic nodes >1 cm in short-axis diameter; additional suspicious features include multiple small rounded nodes, irregular nodal contour, abnormal signal intensity similar to that of primary tumor, presence of necrosis
IIIC1	Positive pelvic nodes	
IIIC2	Positive paraaortic lymph nodes with or without positive pelvic lymph nodes	
IV	Tumor invades bladder and/or bowel mucosa; distant metastases may be present	…
IVA	Tumor invasion of bladder and/or bowel mucosa (biopsy proved)	Abnormal signal intensity (tumor) disrupts normal hypointense muscle and invades bladder and/or rectal mucosa; note that bullous edema does not indicate stage IVA
IVB	Distant metastases, including intraabdominal metastases and/or inguinal lymph nodes	Tumor in distant sites or organs

Patients and methods

Between April 2016 and March 2017, a total of 47 patients with endometrial adenocarcinoma and cervical cancer, histologically documented by core biopsy were referred to Bab Elsharia radiology department for MRI examination of the pelvis. These patients included outside referrals as well as inpatients. Informed consent was obtained from all patients. Twenty patients were premenopausal and twenty seven were postmenopausal. Most common clinical presentation was postmenopausal

bleeding thirty two patients (68.1%) followed by inter-menstrual bleeding (12.7%) and nine patients (19.2%) presented with vaginal discharge.

Inclusion criteria: Patients' were histologically proven endometrial adenocarcinoma were included in the study.

Exclusion criteria:

1. Contraindications to contrast media, e.g. patients with renal failure and patients allergic to contrast media.
2. Contraindications to magnetic resonance imaging, e.g. claustrophobia, cardiac prosthesis and metallic plates.

Study Assumptions

1. The diagnosis of uterine malignancy was achieved by D/C biopsy and histologic diagnosis.
2. Preliminary ultrasound for all cases
3. All MRI reports were obtained by certified radiologists who were blinded to pathology reports.

Data Processing

The patients were subjected to:

1. Patient consent.
2. Full clinical assessment.
3. Checking for contraindication to MRI imaging (e.g. pacemaker, metallic implant, and severe claustrophobia).
4. Revision of the patient's laboratory investigations including renal function tests (blood urea and serum creatinine) as well as tumor marker.
5. Revision of the radiological investigations previously done for the patients.
6. All patients were underwent MR imaging of pelvis

MRI Technique:

High Resolution Multiplanar T2-weighted Imaging technique: The use of thin section (3 mm) oblique axial and sagittal T2WI (FOV 20-22 cm) is well established in the staging of endometrial cancer**.** T2WI is the key sequence in the evaluation of myometrial invasion, since this sequence provides depiction of the uterine zonal anatomy with the intermediate signal tumor well delineated against the low signal intensity junctional zone.

Dynamic Contrast Enhanced MR Imaging technique: Dynamic fat suppressed 3D T1 fast spoiled gradient echo images (3D FSPGR) are acquired in the sagittal plane. These may be obtained at 30, 60, and 120 seconds or by scanning continuously through the uterus for 2 minutes. This is followed by delayed (3-4 min) oblique axial fat suppressed 3D T1 weighted images along the axis of the uterus preferably with the same slice positioning as the oblique axial T2 weighted images

Diffusion Weighted imaging technique: DW images should be obtained with variable b values in the range of 50 and 500-1000 preferred in the pelvis. The images should ideally be acquired in the same plane and with a comparable FOV as the oblique axial T2 weighted and DCE images and then fused. If the images cannot be fused, the slice locations should be co-registered on all three sequences to permit correlation. During interpretation, it is important that DW images always be read in conjunction with apparent diffusion coefficient (ADC) maps to avoid misinterpretation related to T2 shine through.

7- All cases subjected to surgical hysterectomy with histopathologic examination as golden method for staging.

RESULT

In our study, 47 patients with diagnosis of endometrial carcinoma were enrolled. The patients' characteristics as in the following table:

Table 2: Patients' characteristics	
Age (mean± SD)	53±7.2
Menopause	
Premenopausal	15 (31.9%)
Postmenopausal	32 (68.1%)
Histologic type	
Endometrioid adenocarcinoma (Type I)	24 (51%)
Adenocarcinoma with tubulo-papillary differentiation	13 (27.65%)
Malignant mixed mullerian tumor (Carcinosarcoma)	7 (14.9%)
Undifferentiated carcinoma	3 (6.38%)
Grade	
Grade I	25 (53.2%)
Grade II	15 (31.2%)
Grade III	5 (10.6%)
Undifferentiated	2 (4.25%)
Clinical presentation	
Postmenopausal bleeding	32 (68.1%)
Inter-menstrual bleeding	6 (12.7%)
Vaginal discharge	9 (19.2%)
Lymph nodal enlargement	
Pelvic LN.	7 (14%)
Para-aortic LN.	4 (8%)
Surgical procedures	
Type I hysterectomy	2 (4.21%)
Type II hysterectomy	40 (85.1%)
Type III hysterectomy	5 (11.7%)

Myometrial Invasion

The depth of myometrial invasion was assessed and compared with the final surgical pathology as described by **Table 2**. Diagnostic indices were calculated as in Table 3.

Table 3: Assessment of myometrial invasion by T2WIs, DWI, DCE-MRI and surgical pathology in the studied group.

	T2WIs		DWI		DCE-MRI		Pathology	
	No.	%	No.	%	No.	%	No.	%
No or Superficial Invasion (<50%)	14	29.7	16	34	16	34	17	36.17
Deep Invasion (>50%)	33	70.3	31	66	31	66	40	63.82

Table 4: Diagnostic indices (sensitivity, specificity, PPV, NPV and efficacy) of the ability to assess deep myometrial invasion in the studied group.

	Sensitivity	Specificity	PPV*	NPV**	Efficacy	P value***
T2WIs	90.2%	70%	83.3%	88.2%	88%	0.001
DWI	100%	90%	93.8%	100%	96%	0.07
DCE-MRI	100%	88.9%	93.3%	100%	92.2%	0.08

*PPV: positive predictive value

**NPV: negative predictive value

***P value was obtained from comparing that technique versus surgical findings

Parametrial Invasion

Parametrial invasion was evaluted and plotted as in Table 5 & 6:

Table 5: Assessment of parametrial infiltration by T2WIs, DWI, DCE-MRI and pathology in the studied group.

	T2WIs		DWI		DCE-MRI		Pathology	
	No.	%	No.	%	No.	%	No.	%
No	29	72.5	20	50	20	50	15	37.5
Yes	11	27.5	20	50	20	50	25	62.5

Table 6: Diagnostic indices of parametrial invasion in Endometrial carcinoma						
	Sensitivity	**Specificity**	**PPV***	**NPV****	**Accuracy**	**P value*****
T2WIs	44%	80%	80	44	77%	.005
DWI	75%	100%	100	62.5	89%	0.31
DCE-MRI	77%	80%	83.33	50	90%	0.29

Lymph node involvement

Lymph node involvement was studies as a prognostic factor in Table 6 & 7:

Table 7: Lymph node involvement in different sequences and pathology								
	T2WIs		**DWI**		**DCE-MRI**		**Pathology**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
No	22	46.8	20	42.5	20	42.5	20	42.5
Yes	25	53.2	27	57.5	27	57.5	27	57.5

Table 8: Accuracy of lymph node staging by different sequences and pathology			
Sequence	Incorrect staging	**Correct staging**	Accuracy
T2WIs	16	31	**66%**
DW-MRI	8	39	**83%**
DCE-MRI	10	37	**78.8%**

Staging Accuracy

The overall accuracy of T2WIs, DW-MRI and DCE-MRI in staging endometrial carcinoma presented by 47 cases regarding the surgical staging/FIGO clinical staging is stated in **Table 8**.

Table 9: Accuracy of endometrial carcinoma staging

Sequence	Sequence Accuracy
T2WIs	**70%**
DW-MRI	**88%**
DCE-MRI	**86%**

There was statistical significant difference as regarding overall staging accuracy between T2WIs and both DW & DCE-MRI if compared to final surgical findings (p=0.006), However, there was no statistically significant difference between diffusion weighted or dynamic contrast enhanced MRI if compared to surgical pathological findings (p=0.992).

ADC and Tumor Grade

In our study analysis; an extra-attention was drawn to find out if there is a correlation between ADC measurement and the tumor grade. The 47 cases were included in that assessment and findings were presented in **Table 10** and **Figure 1.**

Table 10: Correlation between ADC and tumor grades in the studied patients (r= -0.25; p= 0.051).

Grade	N	Mean
I	25	0.8
II	15	0.7
III	5	0.75
Undifferentiated	2	0.77
Total	47	0.77

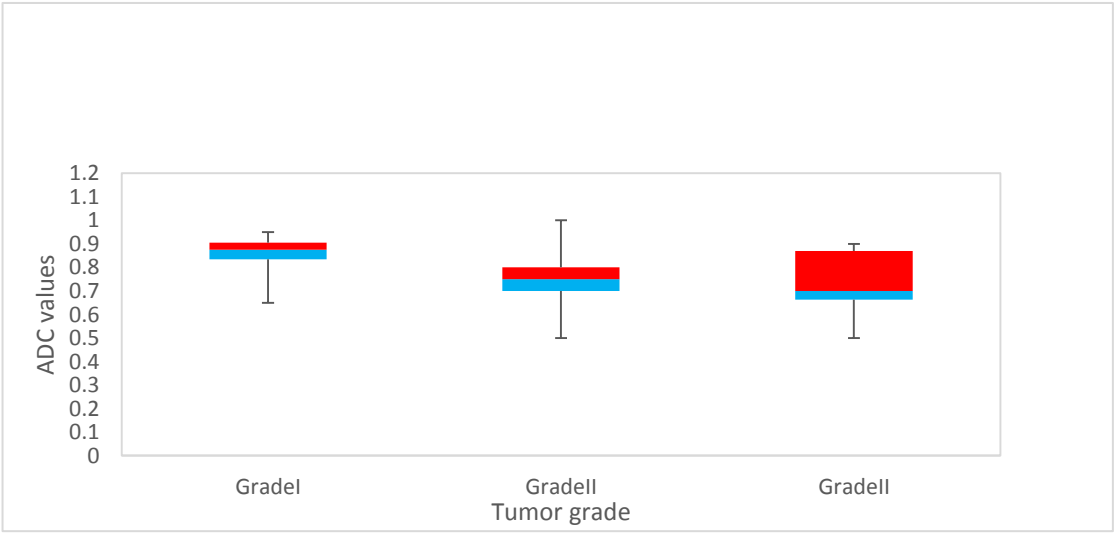

Figure 1: Box-and-whisker plot showing the minimum apparent diffusion coefficient (ADC) values ($x10^{-3}$ mm^2 /s) for different grades of endometrial carcinoma.

According to these data illustrated above; the minimum ADC value for endometrial and cervical cancer showed a trend for lower values in grade 3 tumors than grade 1; however, this did not reach a statistical significance.

Case Illustration

Case No. (1):

A 45-year old female patient with history of menometrorrhagia since 6 months, D&C biopsy was done and revealed grade III endometrioid carcinoma. MRI was recommended for preoperative staging.

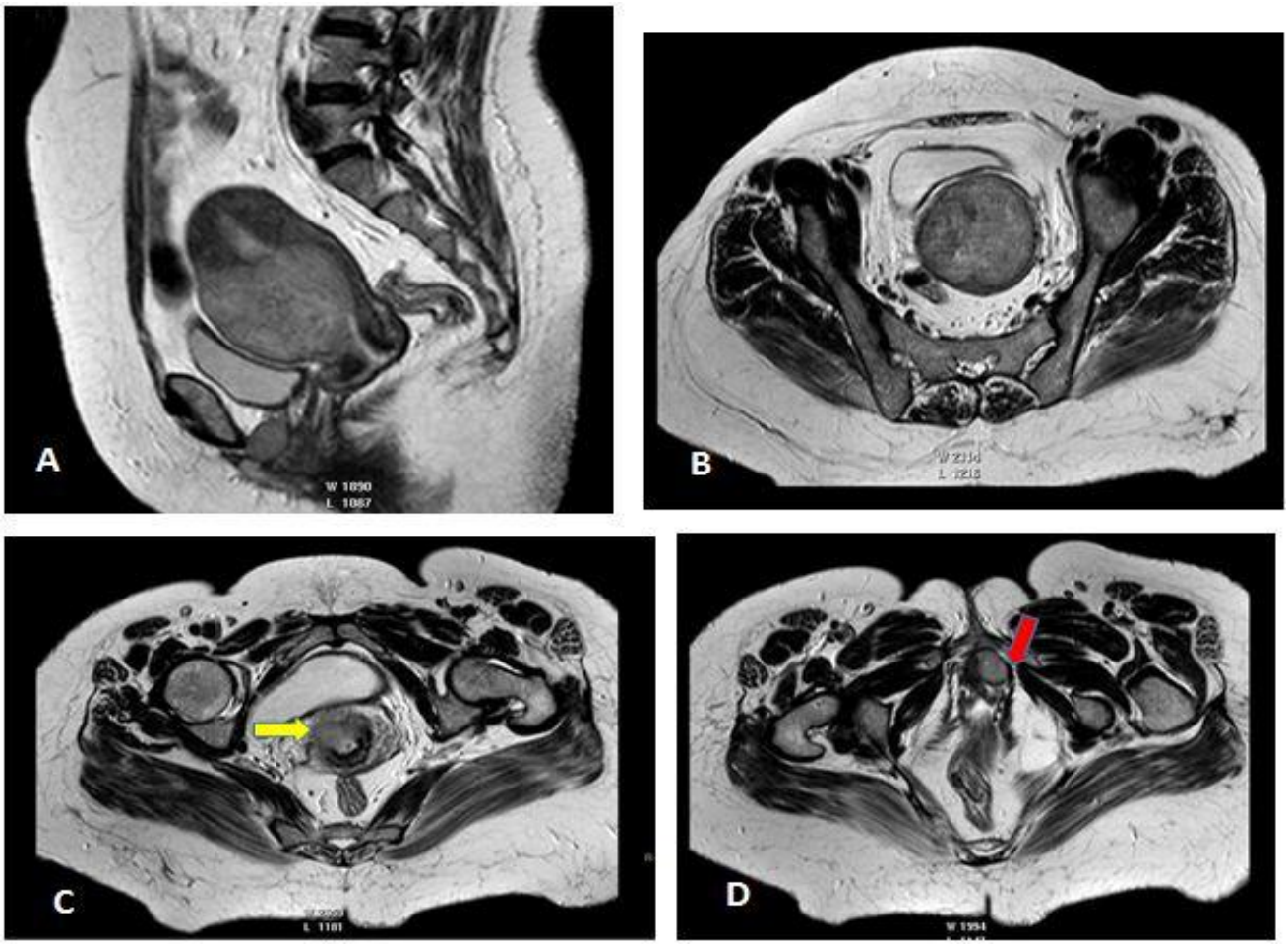

Figure 2: MRI Sagittal T2WIs (A) and axial T2WIs **(B, C and D)** showing a large endometrial mass of intermediate signal intensity invading the whole myometrial thickness with no evidence of serosal invasion. Suspected cervical stromal invasion is noted on the axial images (solid yellow arrow). The lower axial cuts show a small well defined left paraurethral solid mass of intermediate signal intensity (solid red arrow).

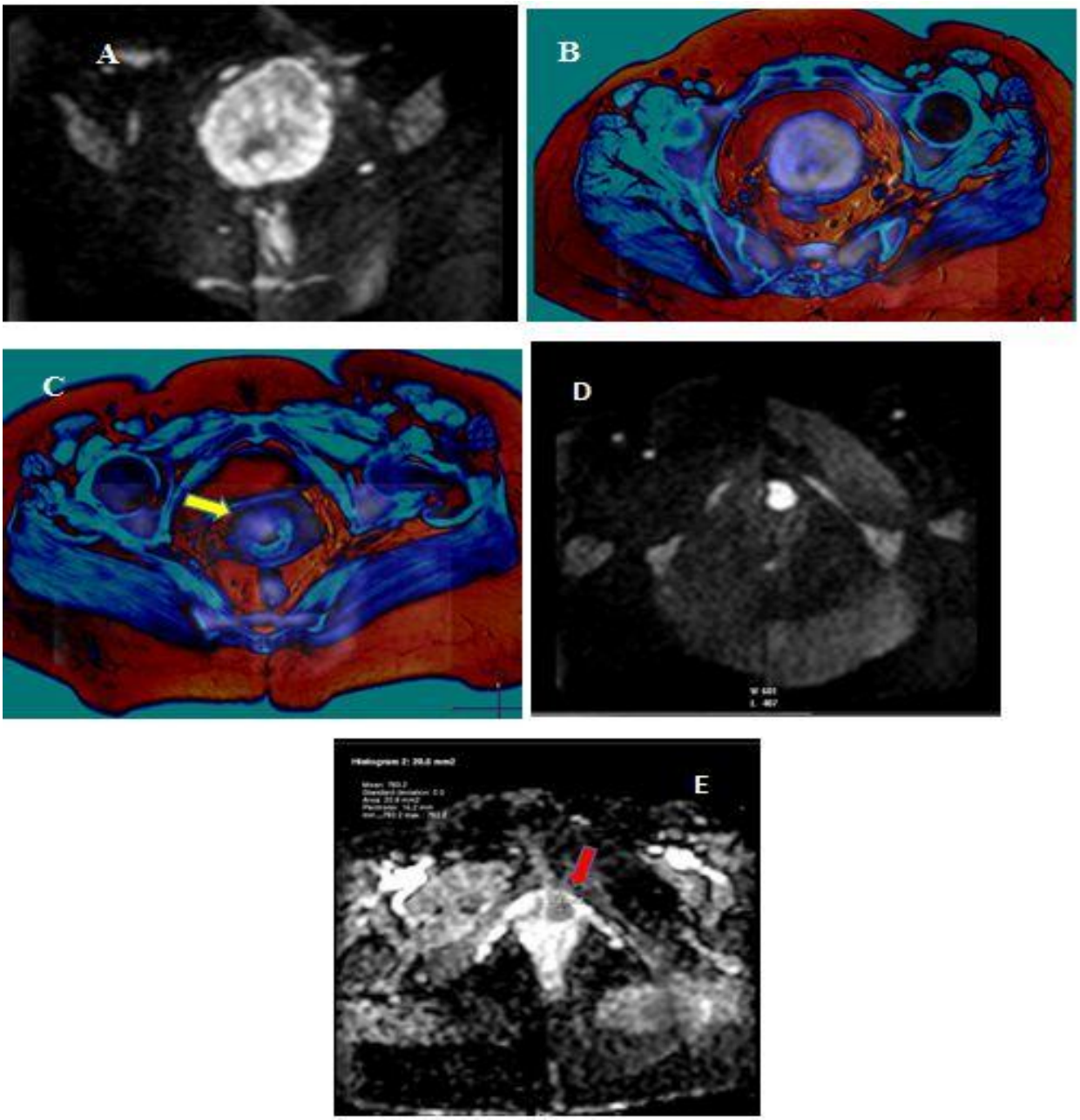

Figure 3: Axial oblique DWI (A and D) of b value 1000, T2/DW fused images (B and C) and ADC map (E) showing shows restricted diffusion regarding the endometrial carcinoma with full thickness myometrial invasion and suspected cervical stromal invasion (solid yellow arrow) as confirmed by the fused images(B and C). Lower cuts show the previously described paraurethral lesion being of restricted diffusion with estimated ADC value of $0.7x10^{-3}$ mm^2/sec suggesting metastatic deposit.

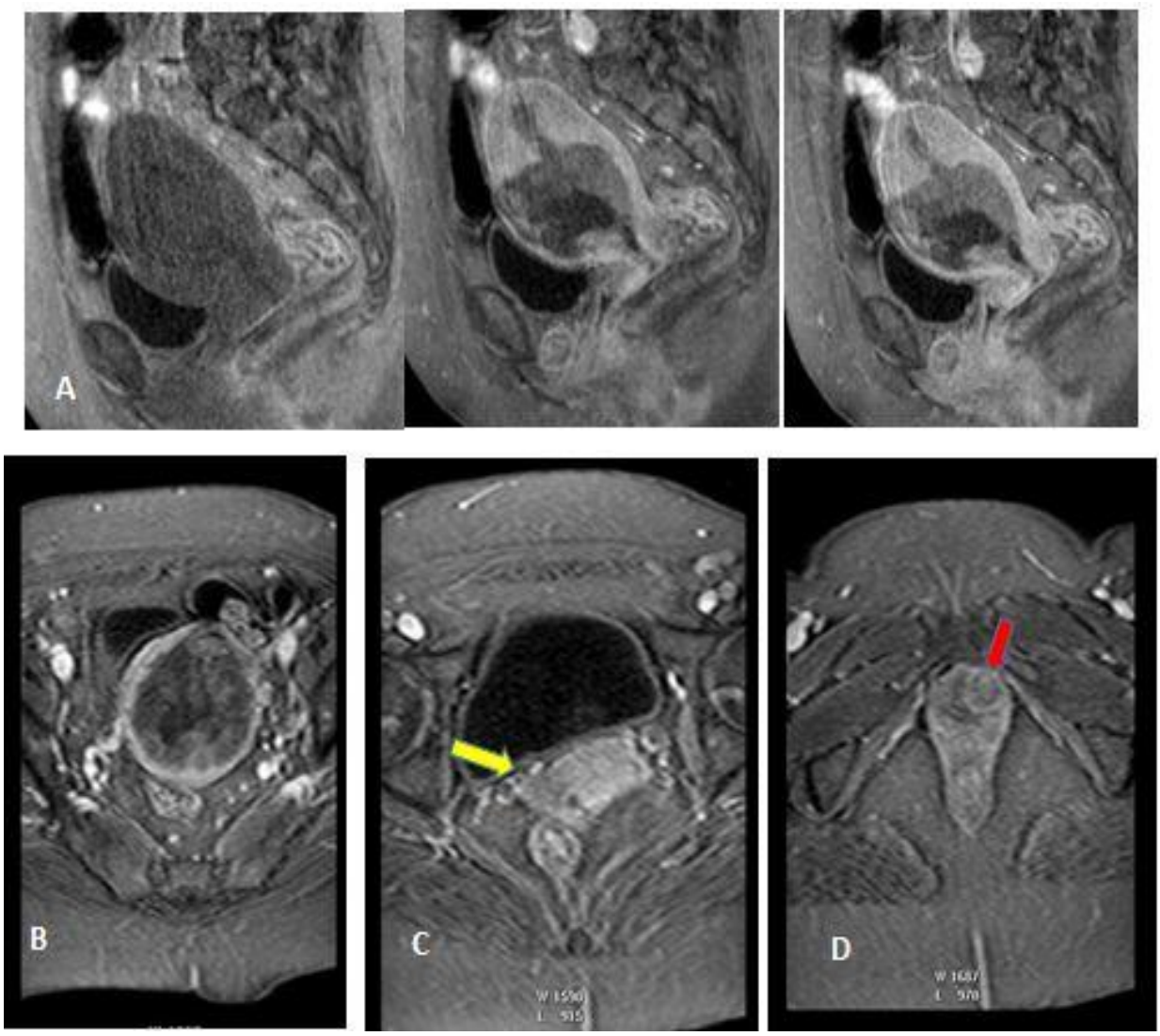

Figure 4: DCE-MRI sagittal images at 0, 2 and 3 minutes (A) and axial DCE-MRI at the level of the lesion (B), at the level of the cervix (C) and at the level of the paraurethral lesion (D) showing the contrast between the mass and intensely enhancing myometrium confirming full thickness myometrial invasion with preserved enhancing serosa. Cervical stromal invasion is suspected in the delayed image (4 min) by a poorly enhancing area within the enhancing stroma (solid yellow arrow). Heterogeneous enhancement of the paraurethral mass lesion is also noted.

omment:

The overall stage was stage IV by T2WIs, DW-MRI and DCE-MRI. The cervical stromal invasion that was suggested by the three sequences was excluded by the surgical pathology. On re-viewing the images, we suggested that such false impression could be attributed to the inaccurate scanning of the axial oblique plane.

Though correct staging was achieved by the 3 sequence, yet we have to admit that DWIs was superior to the other two sequences in its ability to detect the paraurethral soft tissue mass lesion owing to its distinct bright signal against the suppressed background signal.

Case No. (2):

A-61-year old female patient with history of postmenopausal bleeding since 6 months, D&C biopsy was done and revealed malignant mixed mullerian tumor. MRI was recommended for preoperative staging.

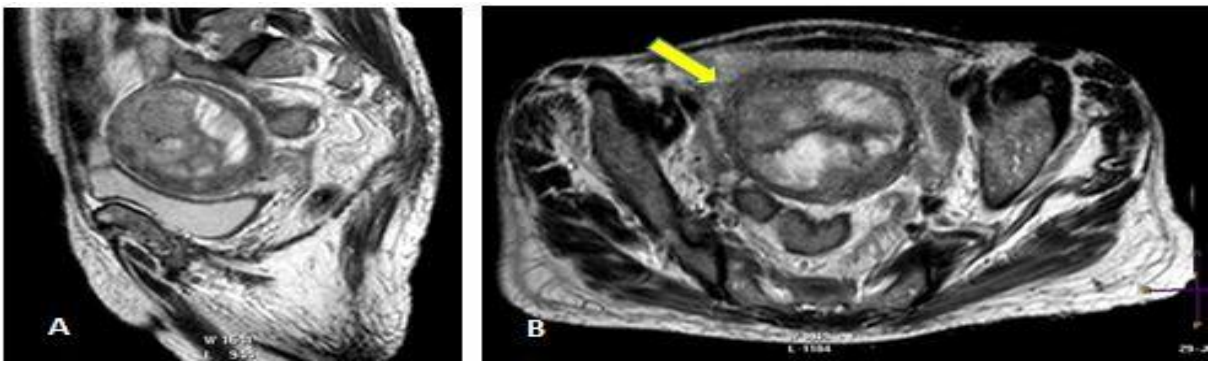

Figure 5: MRI sagittal T2WIs (A) and axial oblique T2WIs (B) showing a large endometrial mass of heterogeneous bright and intermediate signal intensity had seen distending the endometrial cavity. Indistinct junctional zone is noted (solid yellow arrow) and deep myometrial invasion was suggested.

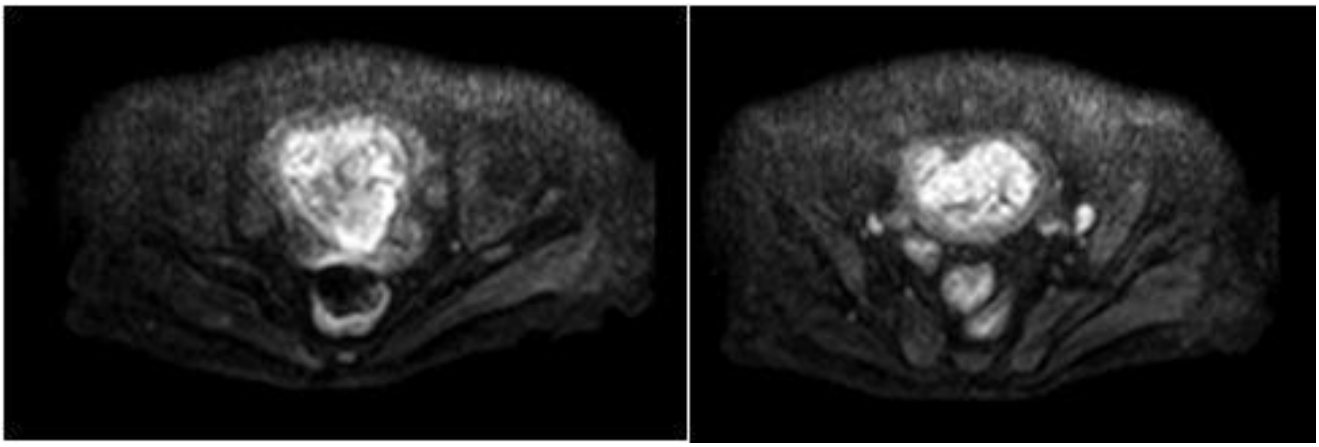

Figure 6: Axial oblique DWI at b-value 1000suggest superficial myometrial invasion. Such suggestion was confirmed by the surgical pathology.

Comment

Indistinct junctional zone is one of the most important reported pitfall of T2WIs especially in postmenopausal cases. In that case, deep myometrial invasion was suspected by dynamic post contrast study. However; DW-MRI was able to correctly stage the case as stage IA.

Case No. (3):

A-68-year old female patient with history of postmenopausal bleeding since 3 months, D&C biopsy was done and revealed grade I endometrioid adenocarcinoma. MRI was recommended for preoperative staging.

MRI with DWI and dynamic post contrast study was done

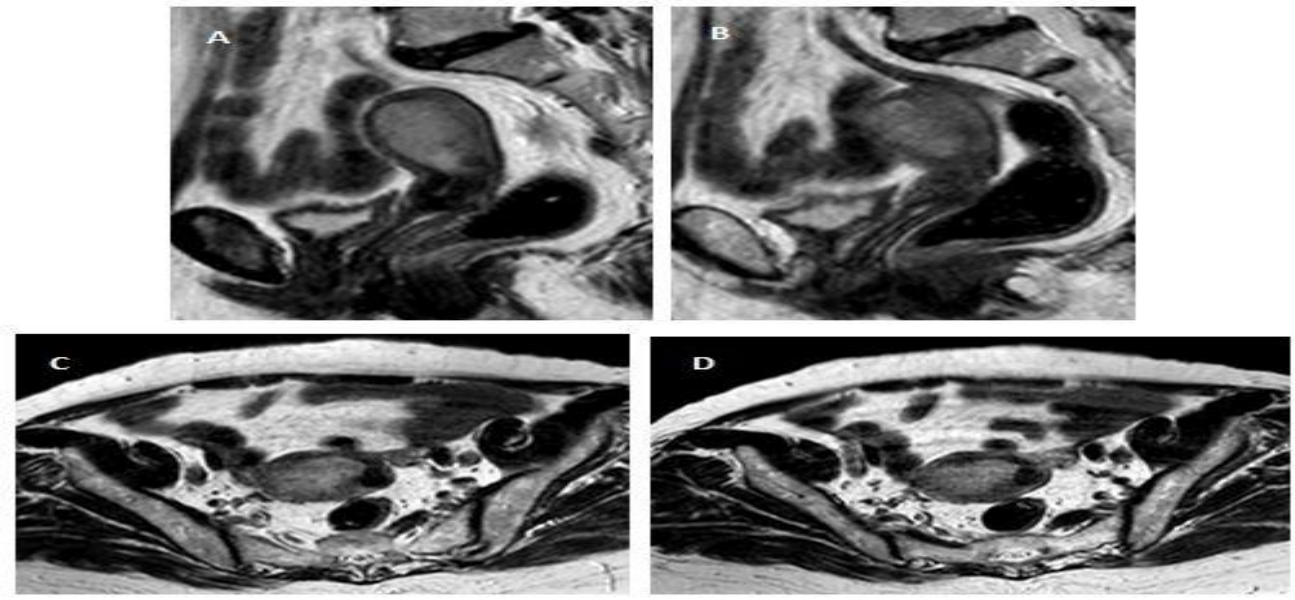

Figure 7: MRI sagittal T2WIs (A and B) and axial oblique T2WIs (C and D) show a large endometrial mass of intermediate signal intensity filling the endometrial cavity. Indistinct junctional zone is noted on the axial images with suggested deep endometrial invasion (Stage IB).

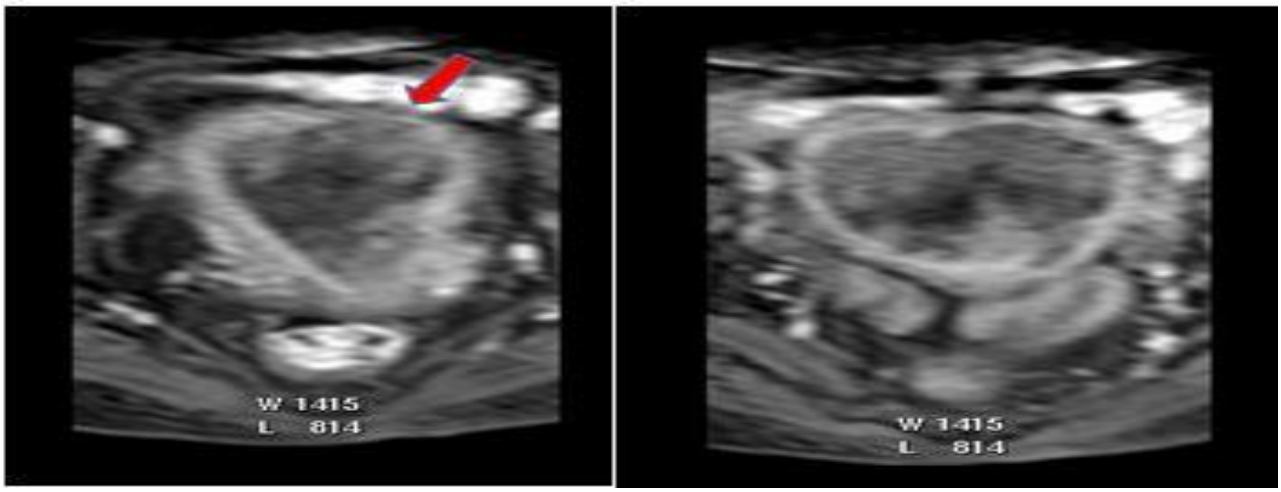

Figure 8: Reconstructed axial oblique DCE-MRI images at 2 minutes suggest deep myometrial invasion as well (solid red arrow).

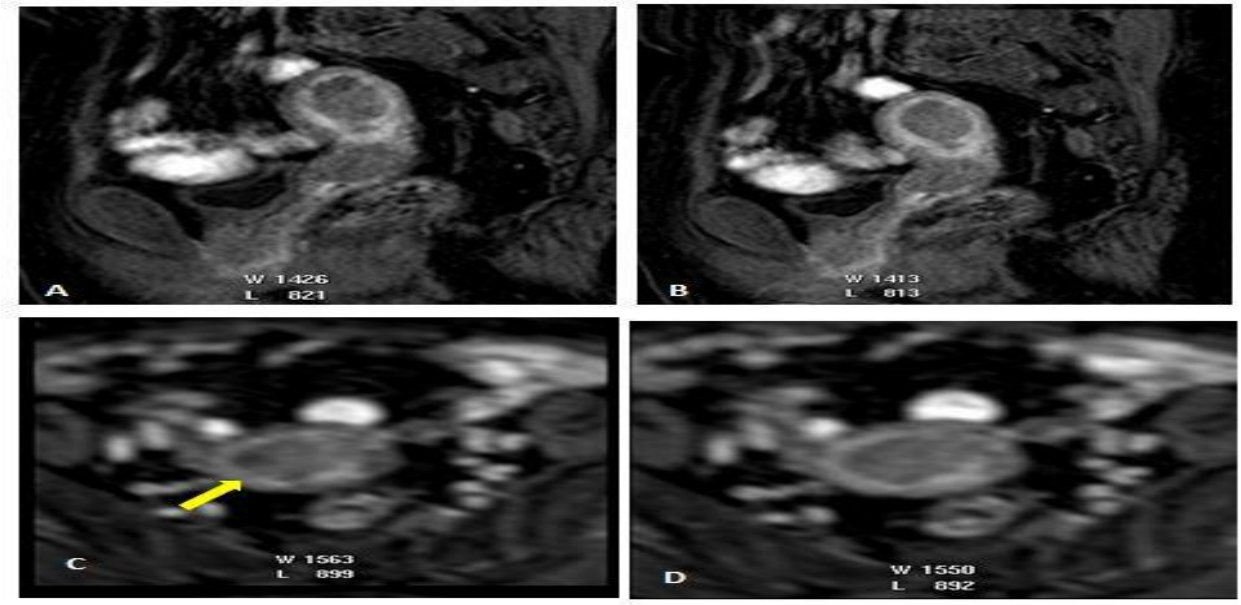

Figure 9: Sagittal (A&B) and axial oblique (C&D) dynamic post contrast study at 1 and 2 minshows preserved subendometrial enhancing band (solid yellow arrow). Accordingly absence of myometrial invasion was suggested and the tumor was believed to be confined to the endometrium (Stage IA).

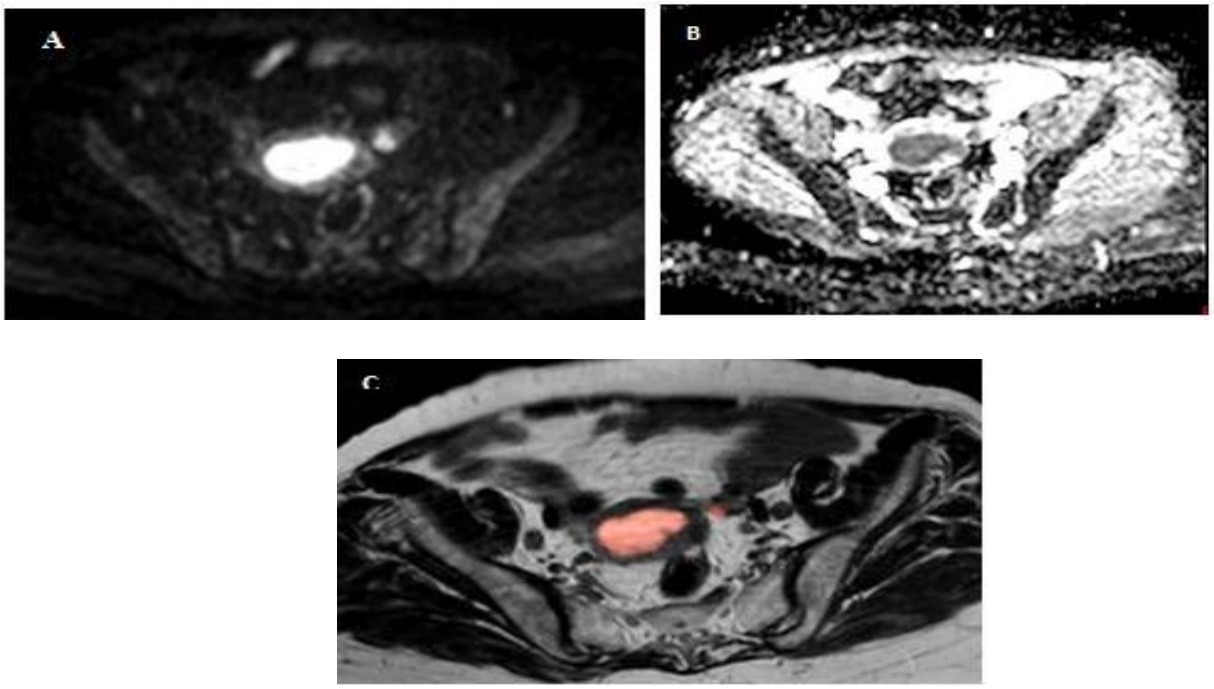

Figure 10: Axial oblique DWI at b value 1000 (A), ADC map (B) and T2/DW fused image (C) suggest deep myometrial invasion (>50 %), i.e. Stage IB.

Comment:

DCE-MRI study was better in staging that case to be stage IA and though superficial myometrial invasion was confirmed by surgery, that doesn't change the overall stage (according to the revised FIGO staging in 2009). The indistinct junctional zone and the presence of fibroid had affected the T2WIs and DWIs accuracy in staging that case as there was false impression of deep myometrial invasion presented in both sequences.

Case No. (4):

A-55-year old female patient with history of postmenopausal bleeding since 6 months, D&C biopsy was done and revealed grade II endometrioid adenocarcinoma. MRI was recommended for preoperative staging.

MRI with DWI and dynamic post contrast studies were done

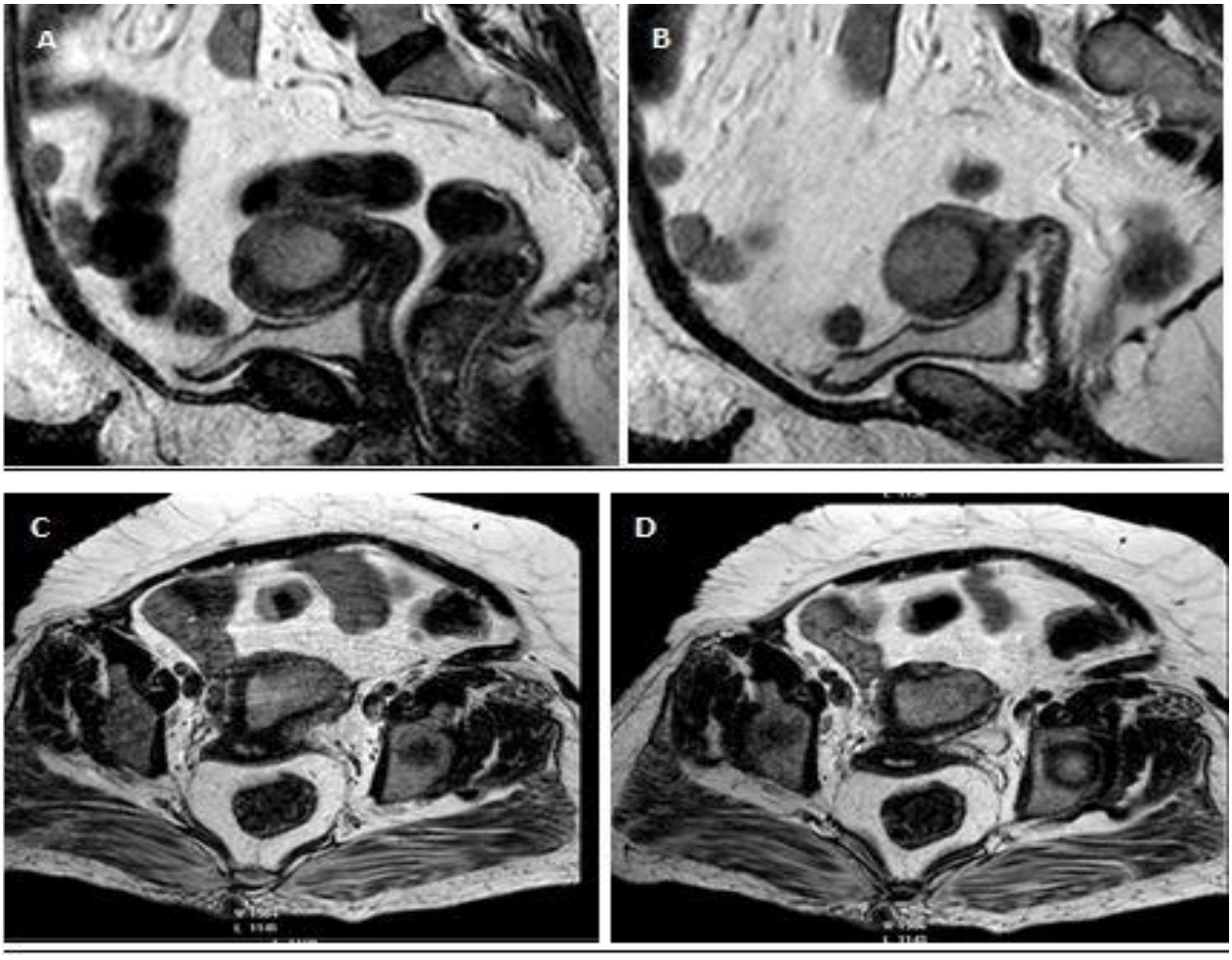

Figure 11:MRI sagittal (A and B) and axial oblique (C and D) T2WIs show a large endometrial mass of intermediate signal intensity filling the endometrial cavity invading the whole myometrial thickness at the fundus yet with intact serosal surface (Stage IB).

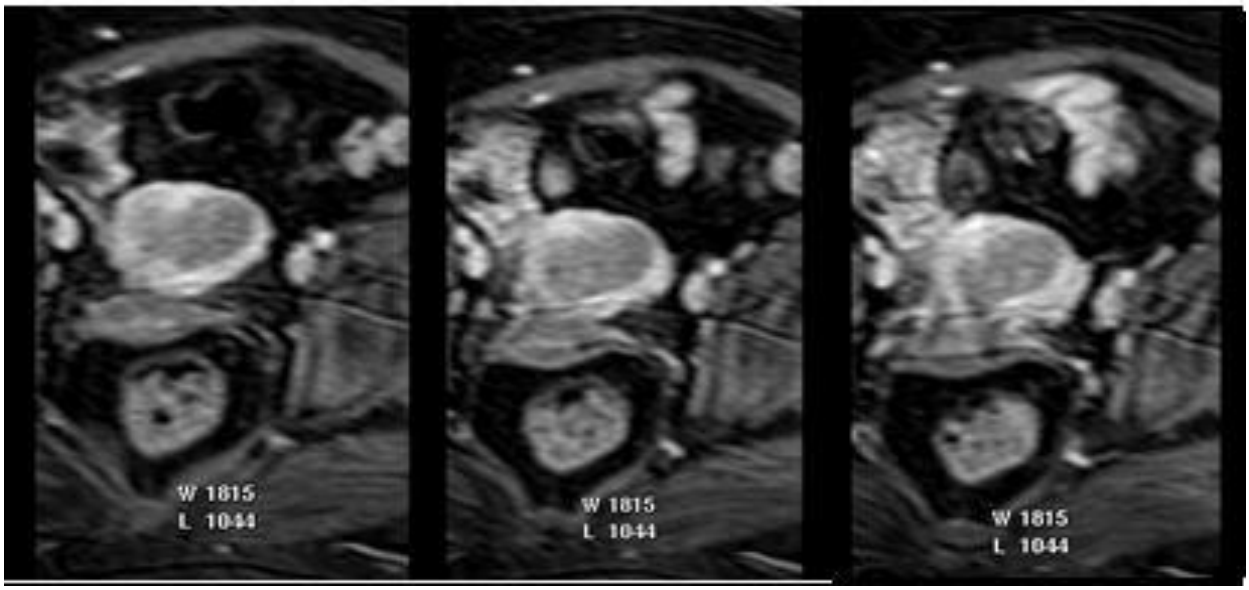

Figure 12: Reconstructed axial oblique DCE-MR images confirmed deep myometrial invasion with preserved enhancing overlying serosa (Stage IB).

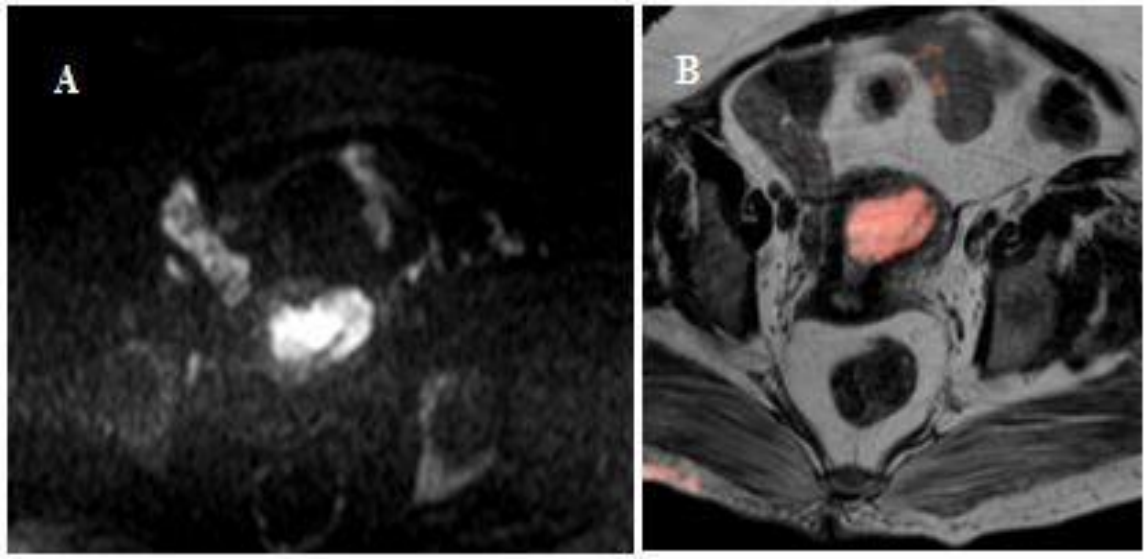

Figure 13: Axial oblique DWI (A) T2/DW fused images (B) also confirmed deep myometrial invasion with intact serosa (Stage IB).

Comment:

Conventional and functional imaging including DCE-MRI and DW-MRI had correctly staged the case as stage IB, as was confirmed later by surgical pathology.

Case No. (5)

A-54-year old female patient with history of postmenopausal bleeding since 4 months, Colposcopy guided biopsy was done and revealed moderately differentiated squamous cell cervical carcinoma. **MRI with DWI and dynamic post contrast study was done**.

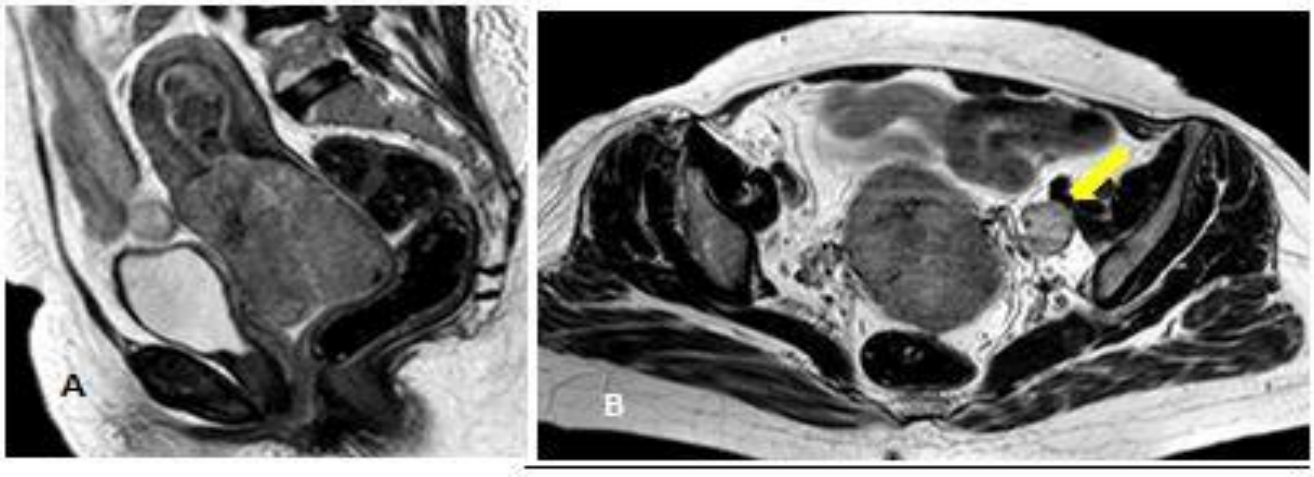

Figure 14: MRI sagittal (A) and axial oblique (B) T2WIsshowing a large cervical mass obstructed the uterine cavity with retained blood products; the mass is seen distending the upper vagina yet with no MR sign of mural or parametrial infiltration. A large rounded pelvic lymph node (yellow arrow) is seen measuring about 3 cm along its transverse diameter (Stage IB2).

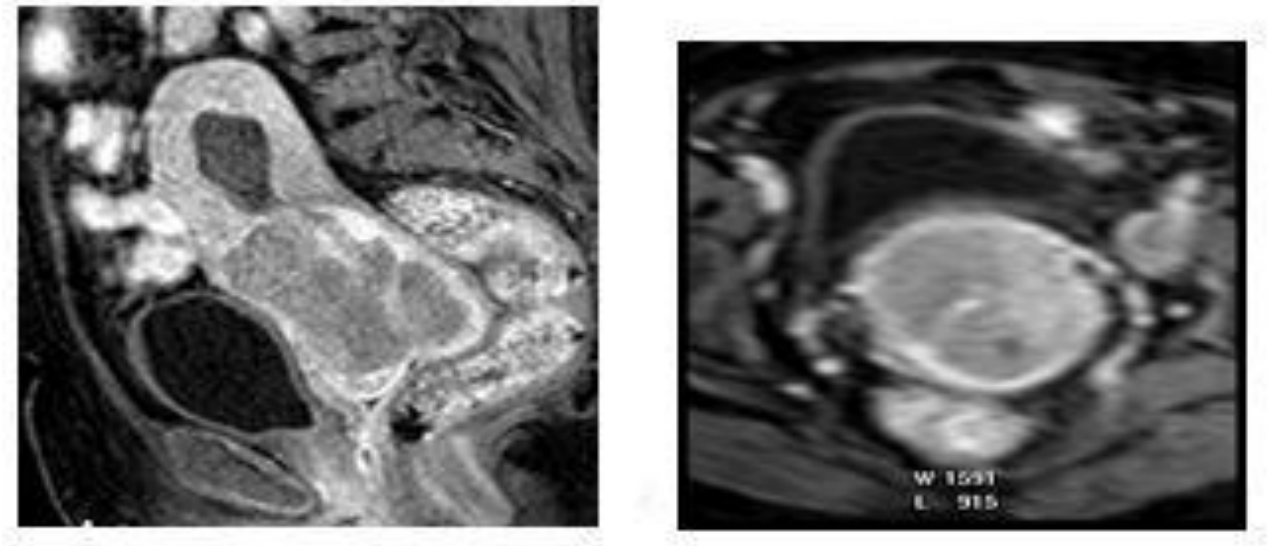

Figure 15: Sagittal (A) and reconstructed axial oblique (B) DCE-MRI at 4 minutes showing the large cervical mass. The mass is less enhancing than the surrounding residual cervical stroma with intact overlying serosa at delayed images (4 min) excluding parametrial infiltration. The enlarged pelvic lymph node is noted with mild heterogeneous enhancement (Stage IB2).

Comment: Though lymph node assessment doesn't change the overall stage, it is an important

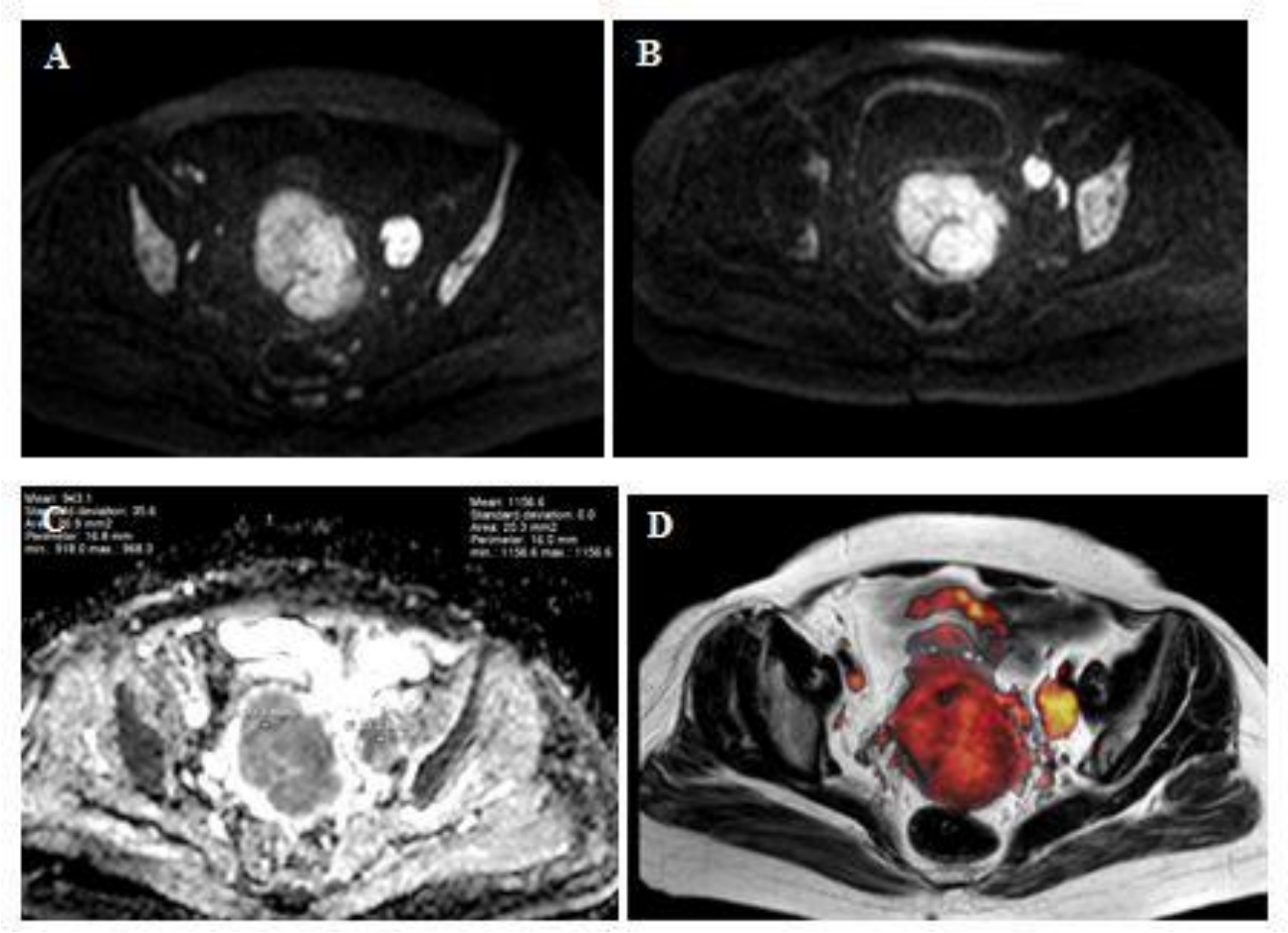

Figure 16: Axial oblique DWI at b value 1000 (A and B), ADC map (C) and T2/DW fused images (D) showing restricted diffusion of the large cervical mass and the enlarged pelvic lymph node. The estimated ADC measurement of the lymph node is 1.15x10^{-3}mm^2/sec (Stage IB2).

prognostic factor that must be put into consideration in the management plan. In that case by considering the ADC measurement, DW-MRI was able to truly exclude metastatic deposit. Such way of proper assessment wasn't possible by conventional or DCE-MR imaging

Case No. (6)

A-32-year old female patient with history of menometrorrhagia since 6 months, Colposcopy was done and revealed anterior wall small cervical ulcer from which biopsy was taken that revealed moderately differentiated squamous cell carcinoma.

MRI with DWI and dynamic post contrast studies were done.

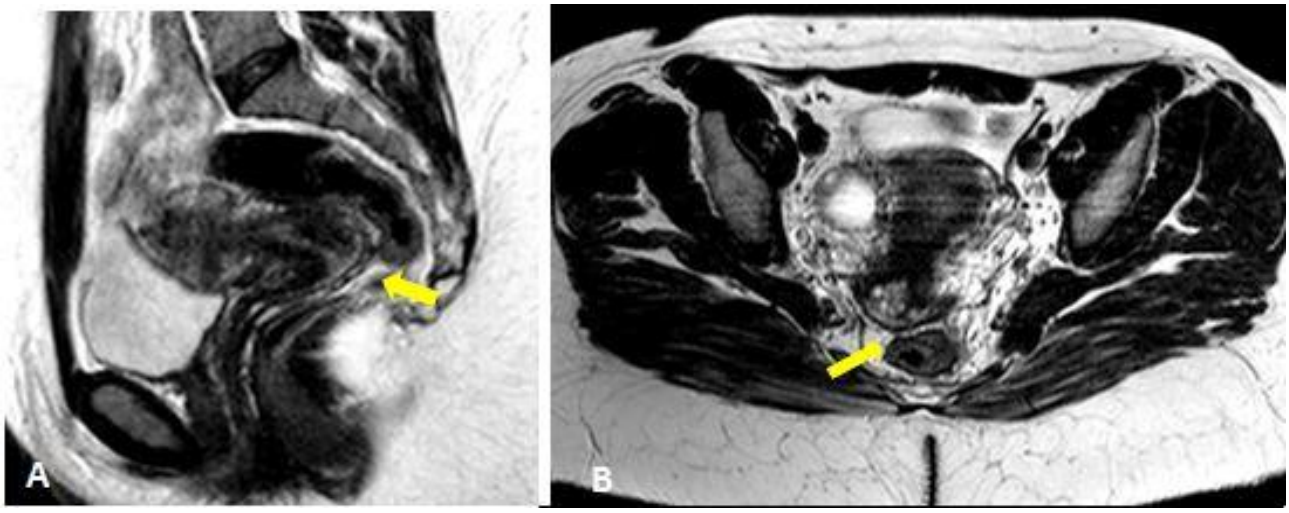

Figure 17: MRI sagittal (A) and axial oblique (B) T2WIs showing posterior wall semilunar area of abnormal slightly bright signal intensity of the cervical stroma (yellow arrow), there was no actual tumor mass bulk and the overlying cervical serosa was intact. Because the actual tumor was at the anterior wall, these changes were suggested to be due to post biopsy changes rather than malignancy.

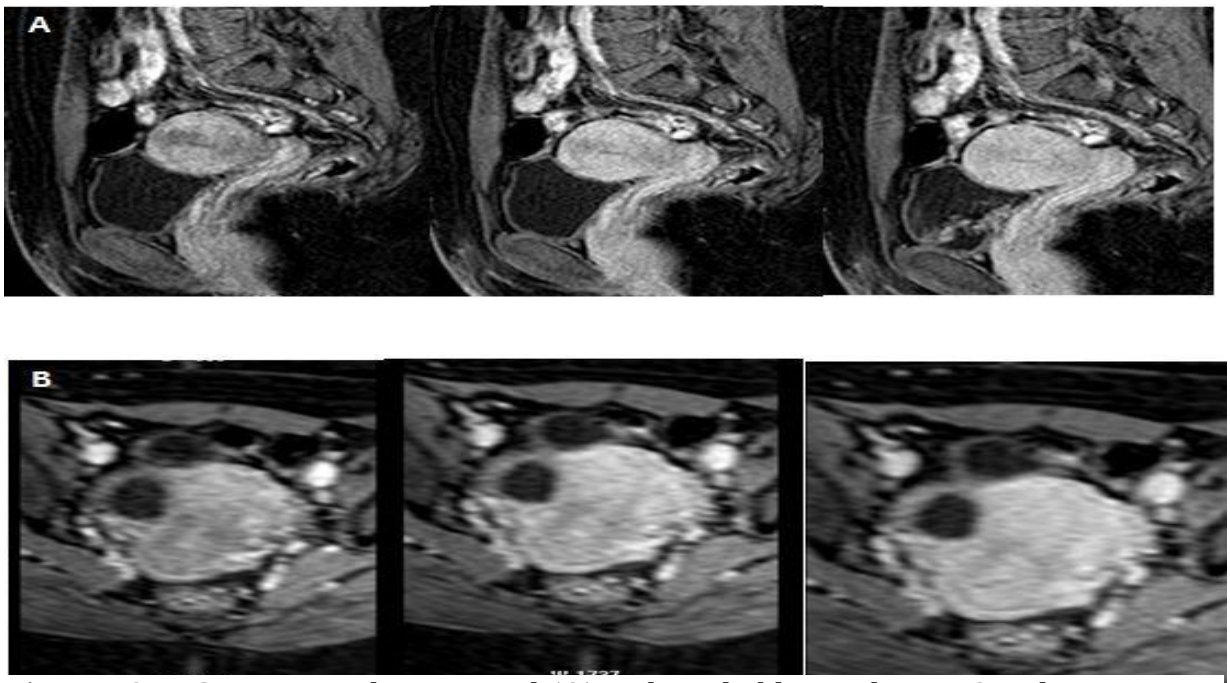

Figure 18: DCE-MRI study in sagittal (A) and axial oblique plane 2, 3 and 4 minutes show no areas of abnormal enhancement.

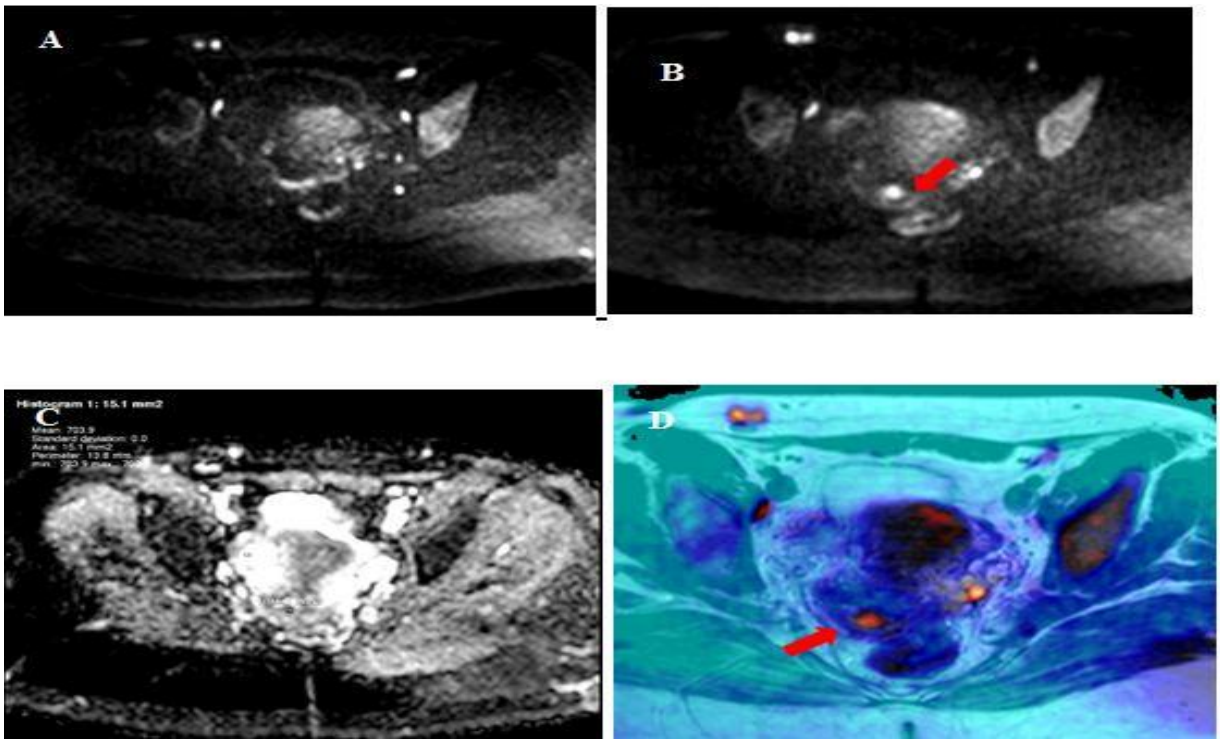

Figure 19: Axial oblique DWI at b value 1000 (A and B), ADC map (C) and T2/DW fused image (D)show an anterior wall focal area of restricted diffusion (red arrows) with estimated ADC measurement of $0.7x10^{-3}mm^2/sec$ suggesting malignant nature.

Comment:

According to the FIGO staging of cervical carcinoma, stage IA is a microinvasive lesion and it is considered IB once detected by MRI. Accordingly we considered that this case was underestimated by T2WIs and DCE-MRI because of their inability to detect the pathologically proved invasive cervical lesion. Thus that case was falsely staged as IA by T2WIs and DCE-MRI. Proper staging of IB1 was achieved by DW-MRI.

Case No. (7)

A-50-year old female patient with history of postmenopausal bleeding since 1 year, colposcopy guided biopsy was done and revealed moderately differentiated squamous cell cervical carcinoma.

MRI with DWI and dynamic post contrast studies were done.

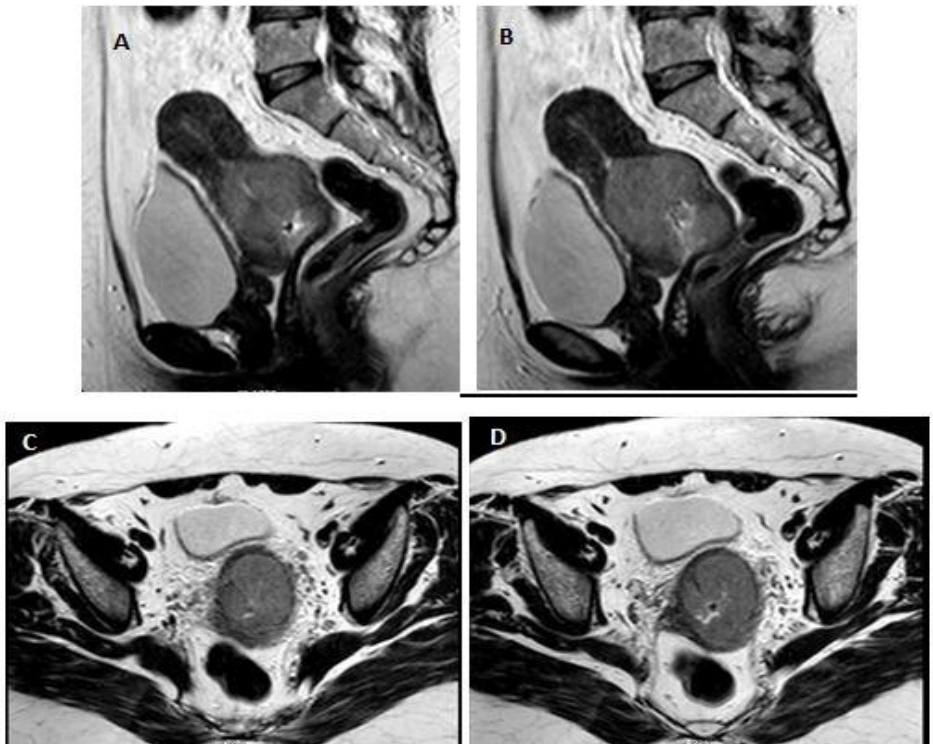

Figure 20: MRI sagittal (A&B) and axial oblique (C&D) T2WIs show a sizable cervical mass distending the cervical canal, invading the cervical stroma with suspected parametrial invasion on the right side (Stage IIB).

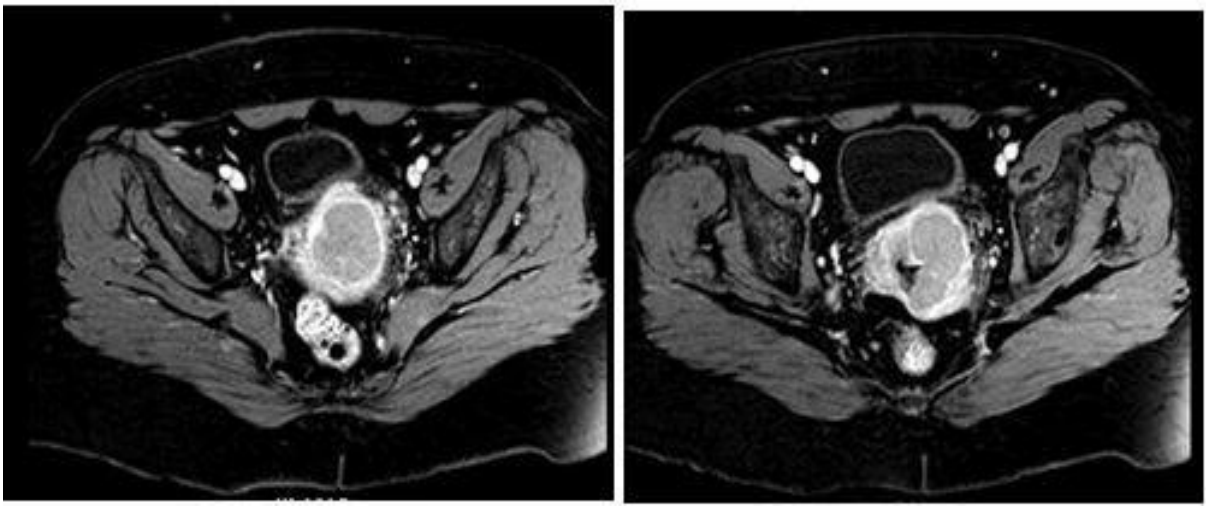

Figure 21: Axial oblique DCE-MRI at 4 minutes showing the poorly enhancing cervical mass with intact enhancing surrounding cervical stroma (Stage IB2).

Comment:

Overestimation of parametrial invasion is a reported pitfall of T2-weighted images and that was noted in that case. However, DCE-MRI and DW-MRI were able to reliably exclude parametrial infiltration and correctly stage the case as IB2.

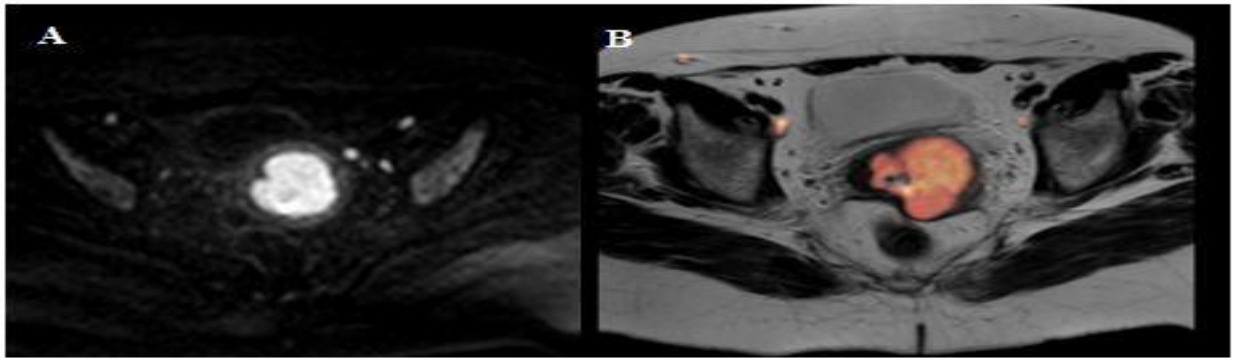

Figure 22: Axial oblique DWI at b value 1000(A) and T2/DWI fused images (B) show the cervical mass with restricted diffusion. The fused images confirmed the absence of parametrial invasion (Stage IB2).

Case No. (8)

A-60-year old female patient with history of postmenopausal bleeding since 4 months, colposcopy guided biopsy was done and revealed moderately differentiated basaloid cervical carcinoma.

MRI with DWI and dynamic post contrast studies were done.

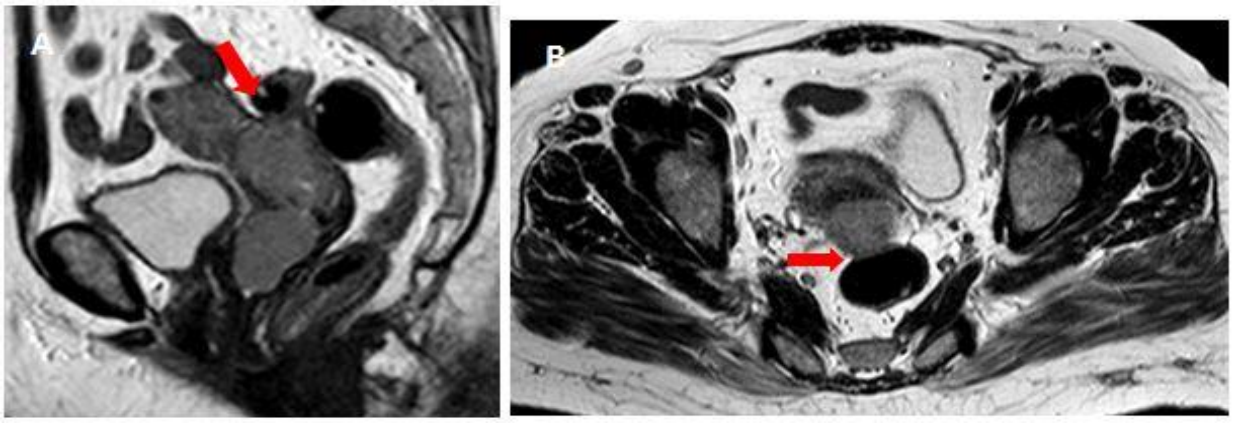

Figure 23: MRI sagittal (A) and axial oblique (B) T2WIs show large cervical mass distending the cervical canal and whole length of the vagina yet with no gross evidence of parametrial or vaginal wall infiltration. Fat plane loss between the mass and bowel loops (red arrow) raise the suspicion of bowel infiltration. Accordingly it was staged as IVA

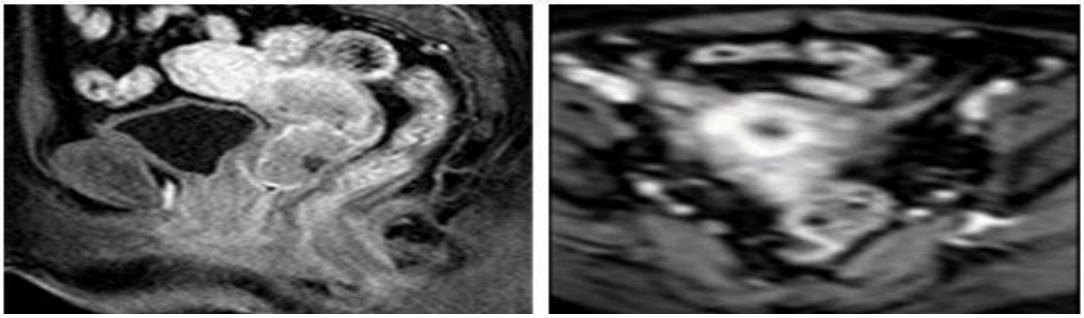

Figure 24: DCE-MRI in sagittal (A) and reconstructed axial oblique plane at 4 minutes show the large cervical mass with no MR evidence of vaginal, parametrial or bowel infiltration (Stage IB2).

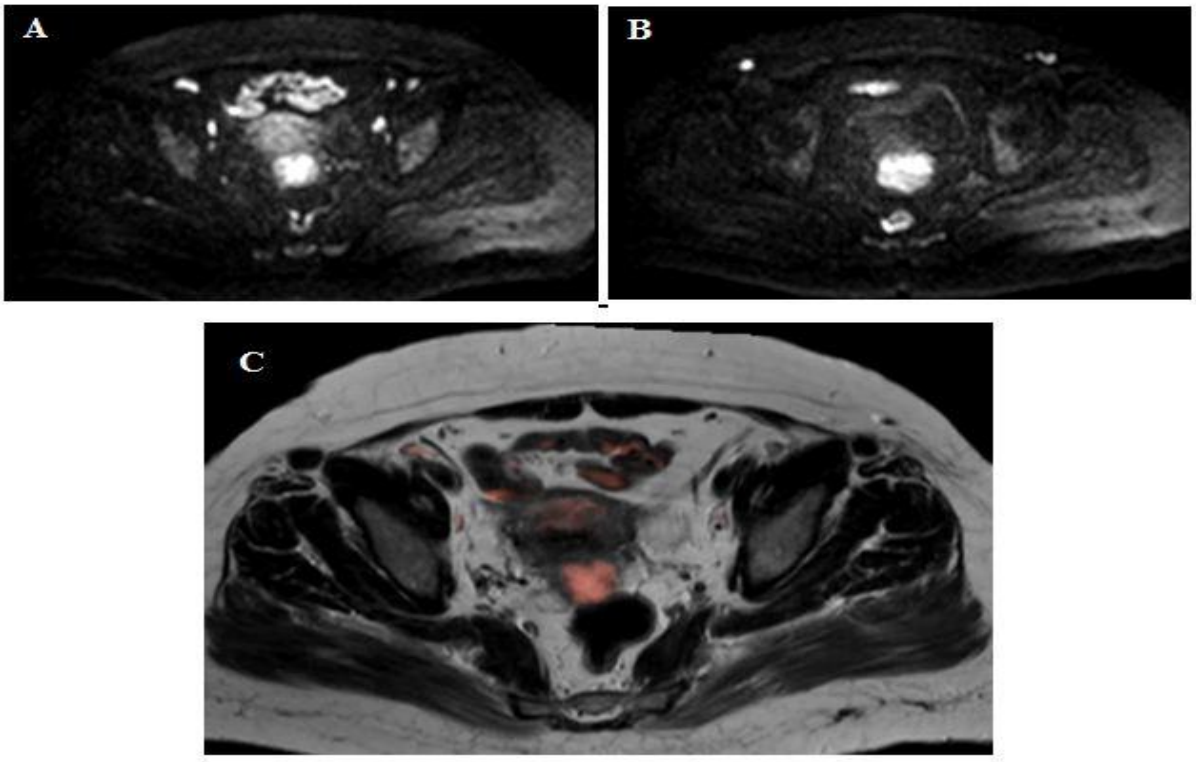

Figure 25: Axial oblique DWI at b value 1000(A and B) and T2/DWI fused images (C) confirmed the absence of bowel infiltration (Stage IB2).

Comment:

In that case DCE-MRI and T2/DW fused images could reliably exclude the suspected bowel infiltration previously evoked by T2WIs.

Discussion

Surgery is the treatment of choice in patients with noninfiltrative or locally advanced endometrial carcinoma. In this study, the capability of MR imaging was evaluated which can predict all factors requested by the surgical oncologists to plan surgical treatment. Endometrial carcinoma could be easily detected on T2-weighted MR images than T1 weighted images because endometrial relaxation time is equivalent to that of adjacent myometrium, and therefore the two tissues appeared isointense on T1- weighted images. Determining the presence and depth of myometrial invasion is a very important factor, as is used to predict nodal metastases, since patients with 50% or greater myometrial invasion have a six- to seven fold increased prevalence of pelvic and lumboaortic lymph node metastases compared to patients with myometrial invasion in whom is absent or less than 50%. The presence and depth of myometrial infiltration can be assessed on T2-weighted images as an interruption of the junctional zone, which appears low signal intinsity, contrary to endometrial adenocarcinoma, which appears high signal. In postmenopausal women, however, the junctional zone may be poorly visible and the myometrium may be thinned due to uterine involution, making the presence and depth of myometrial infiltration difficult to evaluate. In our study, the junctional zone was poorly visible in nine patients. Dynamic MR imaging should be performed to overcome this limitation, because it can depict different enhancement times of the

adenocarcinoma compared with those of the adjacent myometrium, improving the contrast resolution of the tumor and myometrium. In our study, combining axial fused T2-weighted, diffusion weighted and dynamic MR imaging, there was a significant correlation between MR imaging and histopathologic findings in the assessment of myometrial infiltration. This in agree with Beddy P et al., (10) Recently, combination of axial fused T2 and DW images have a higher accuracy in assessing depth of myometrial invasion, other studies reporting higher inter-observer agreement . Rechichi et al. (11) found that DWI was superior to T2WI and DCE with diagnostic indices like sensitivity, specificity, positive predictive value, and negative predictive value for DW images for assessing myometrial invasion of 84.6%, 70.6%, 52.4%, and 92.3%, respectively. Faria SC et al., (12) reported that the incorporation of all three sequences may facilitate preoperative staging of endometrial cancer.

Conclusion

MRI imaging with additional functional adjuvants are best modality for the preoperative staging of endometrial carcinoma. It helps to decide operability, radicality, the type of operation and aids in the selection of patients who are in need to surgical treatment alone or adjunctive chemo-radiological therapy.

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