



ROLE OF DIFFUSION WEIGHTED MR IMAGING IN PROSTATE LESIONS

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AIMS AND OBJECTIVES

The aim of the study is to evaluate the role of Diffusion Weighted Imaging in Prostate lesions.

MATERIALS AND METHODS

A prospective study of 24 patients between the age group 39 - 86 years, with prostatic complaints like hesitancy, poor stream, acute retention of urine, urgency, urge incontinence and nocturia was done in our Institute (Between January 2018 - september 2018). Patients who had recent biopsy and no HPE report were excluded. All 24 patients were subjected to MRI and HPE. MRI was performed in 1.5 Tesla MRI GE, using HD8 Channel torso coil, TRUS guided biopsy was performed machine, equipped with 7.5 MHz Transrectal probe. Patient was placed in supine position in the MR gantry.

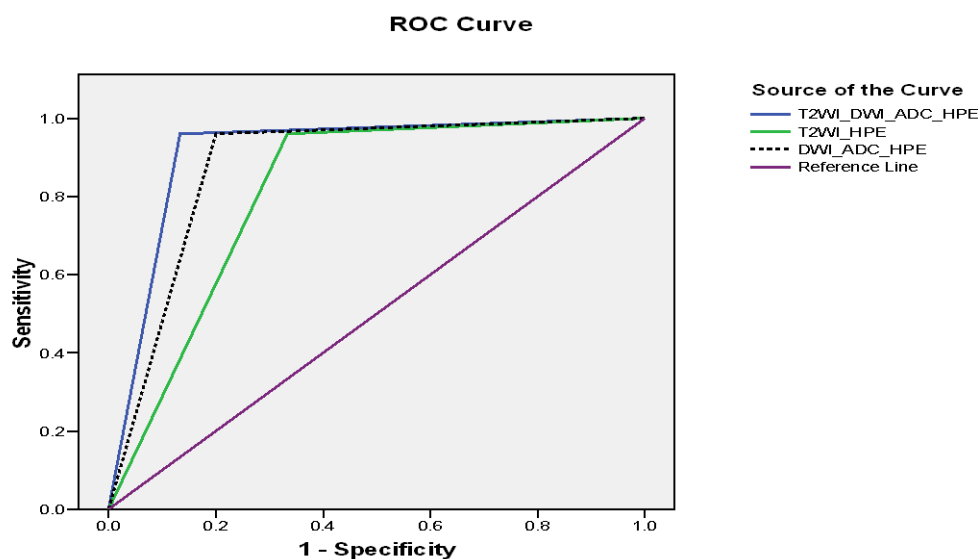
A scout sagittal section was obtained through the prostate for planning of coronal and axial views. Section were taken extending from base to the apex of the prostate including the seminal vesicles. In addition to routine sequences used, Axial Diffusion Weighted Imaging (DWI) with single shot Echo planar Imaging (EPI) (b value \rightarrow 0 and 1000 sec/mm²) TR: 3400 ms, TE: 66 ms., Matrix : 200 x 160, No of slices: 20-25, Slice thickness: 5 mm with 0.0 mm interslice gap, FOV – 340 mm, Number of excitation (NEX) : 4.0, Acquisition time : 1 min 30 sec. The ADC was calculated according to $ADC = (1/b_2 - b_1) \ln (S_2/S_1)$, where S1 and S2 are the signal intensities in the regions of interest (ROI) obtained with different gradient factors (b values of 0 and 1000 s/mm²). The ROIs were always placed within the actual mass, and the diameter of the ROI was 30 ± 10 mm².

The ADC distribution was demonstrated on an axial ADC color map.. To evaluate those patient with osteoblastic bone secondaries. After putting the patient in left lateral position, Digital rectal examination was done, to confirm the prostatic enlargement and to localize the nodular lesions. Under aseptic precautions, biopsy was taken in a systematic way from 6 sites (each from central zone, anterior and posterior peripheral zone - on either side) and also from suspicious lesions. All these materials are put in separate bottles and labeled the region of biopsy.

Results and Discussion

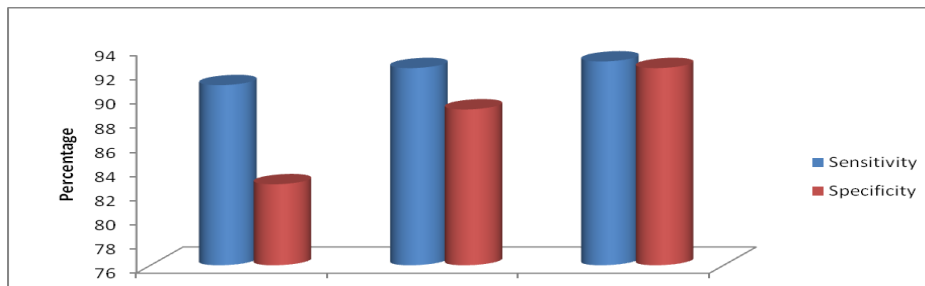
MR examination with T2 Weighted Imaging (T2WI), Diffusion Weighted Imaging (DWI) and Apparent Diffusion Coefficient Values (ADC) were performed in 24 patients. Patients belonged to age group 39-87 years. The results were compared with the histopathological results obtained by TRUS guided biopsy and TURP specimen.

A majority of the patients (70%) were having generalized enlargement of prostate with main symptoms as nocturia (68%) and hesitancy (50%). T2 Weighted Imaging (T2WI) MRI alone, the extent and invasion of prostate cancer into peri prostatic tissues were delineated. Also taking a hypointense lesion in the PZ in T2W1 as significant of malignancy, T2WI MRI alone showed **sensitivity of 90.9% and specificity of 82.7%**.



By taking Diffusion Weighted Imaging (DWI) and Apparent Diffusion Coefficient Values (ADC) values (**DWI + ADC**) alone, taking diffusion restriction and Low ADC value ($1.0 - 1.3 \times 10^{-3} \text{ mm}^2/\text{sec}$) as significant of malignancy, it showed **sensitivity of 92.3 % and specificity of 88.8%**. By combining T2 Weighted Imaging (T2WI), Diffusion Weighted Imaging (DWI) and Apparent Diffusion Coefficient Values (ADC) values (**T2W + DWI + ADC**) MRI, taking hypointense nodule with diffusion restriction and Low ADC value ($1.0 - 1.3 \times 10^{-3} \text{ mm}^2/\text{sec}$) as significant of malignancy, it showed **sensitivity of 92.8% and specificity of 92.3%**. A weighted **Cohen's kappa** coefficient measure of T2 Weighted Imaging **T2WI MRI alone** was found to be **0.66**, Diffusion weighted imaging alone (**DWI + ADC**) alone was **0.78** and for (**T2W + DWI + ADC**) MRI, it was **0.84**. Values of **kappa** were classified as **bad** (less than 0.4), **good** (0.4-0.75) or **excellent** (greater than 0.75), following **Landis**

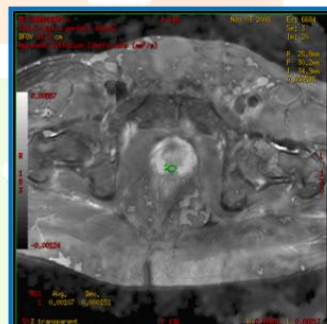
and Koch's criteria. Similarly, **intra class correlation coefficient** with 95% confidence interval for T2 Weighted Imaging **T2WI MRI alone** was found to be 0.47 – 0.82, for Diffusion weighted imaging (**DWI + ADC**)**alone** was 0.62 - 0.88 and for (**T2W + DWI + ADC**) **MRI** was 0.72-0.91.



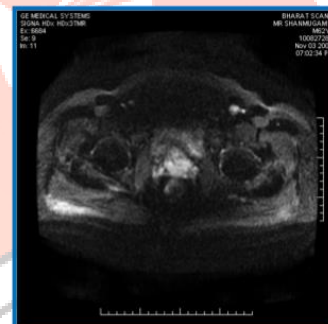
Value of intra class correlation coefficient which are nearer to 1.00, indicates an excellent correlation. Our study showed that the ADC values of malignant prostate nodules were significantly lower than in non malignant prostate tissue. Based on Receiver Operating Characteristic (ROC) curve analysis, T2W with DWI and ADC values (**T2W + DWI + ADC**) **MRI (92.3%)** had potential to **improve specificity** for detecting malignant nodules compared to **T2WI alone (82.7%)** and **DWI + ADC Imaging alone (88.8%)**. TRUS is also an excellent modality to do guided biopsy and helps to increase the yield of procedure, comparing to the blind biopsy technique.



a Axial T2 shows hypointense lesion in peripheral zone of prostate



b low ADC value $1.0 \times 10^{-3} \text{ mm}^2/\text{sec}$



1c .DWI shows restricted diffusion as bright signal

Case 1. 75 yrs male hpe proven case of prostatic carcinoma

Diffusion Weighted Imaging (DWI) with Apparent Diffusion Coefficient values (ADC) is a good modality to characterize prostatic lesions as benign and malignant, compared to T2 weighted imaging alone. T2 Hypointense nodule with restricted diffusion and low ADC values ($1.1 - 1.3 \times 10^{-3} \text{ mm}^2 / \text{sec}$) is a reliable sign of malignancy. T2 Mixed to hyperintense lesion with no restricted diffusion and high ADC values ($1.6 - 1.9 \times 10^{-3} \text{ mm}^2 / \text{sec}$) is a good sign of benignity. However, Prostatic abscess show severe restricted diffusion with very low ADC value ($0.4 - 0.6 \times 10^{-3} \text{ mm}^2 / \text{sec}$). DWI with ADC Values is also useful in detecting malignant nodules in central zone of prostate. T2WI with DWI is more sensitive than and as specific as dynamic contrast enhanced MRI and MR Spectroscopy in detecting prostate cancer. To conclude, Diffusion Weighted Imaging (DWI) with Apparent

coefficient values (ADC) can be included in routine imaging protocol for prostate. It would complement other imaging modalities like MR Spectroscopy and contrast enhanced dynamic MRI in cancer detection.

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