Combined T2 and Diffusion Weighted MRI for Localization of Prostate Cancer

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INTRODUCTION: Localization of prostate cancer is of importance given the emergence of disease targeted therapies such as intensity modulated radiotherapy, interstitial brachytherapy and cryosurgery as part of patient care. Recently a number of investigators have demonstrated the potential utility of DWI to detect prostate cancer as it shows a lower ADC than the normal peripheral zone.

PURPOSE: To compare the accuracy of T2 weighted MRI alone with T2 combined with diffusion weighted MRI (DWI+T2) for the localization of prostate cancer.

METHODS: T2 weighted and DWI (b-val 600 s/mm2) was preformed in 49 patients prior to radical prostatectomy using an endorectal coil at 1.5T (Signa Excite, GE Medical Systems) as part of this prospective trial. The peripheral zone (PZ) of the prostate was divided into sextants and the transition zone (TZ) into left and right. A radiologist reviewed the T2 images alone and then the T2 images combined with ADC maps calculated from the DWI (DWI+T2). A FIXED window and level setting was used for viewing all ADC maps. Each region was scored on 5 point scale for the likelihood of tumor. The area under the receiver operator characteristic (ROC) curve was used to assess accuracy.

RESULTS: In the peripheral zone the area (Az) under the ROC curve was significantly higher (p=0.004) for DWI+T2 (Az =0.89 than T2 (Az=0.81). Performance was poorer in the transition zone for both DWI+T2 (Az =0.78) and T2 (Az =0.79) (Fig 1). For similar specificity [91% (222/243) vs 84% (204/243)], sensitivity was significant higher for DWI+T2 than T2 [81% (120/149) vs 54% (81/149), p<0.001] (Fig 2).
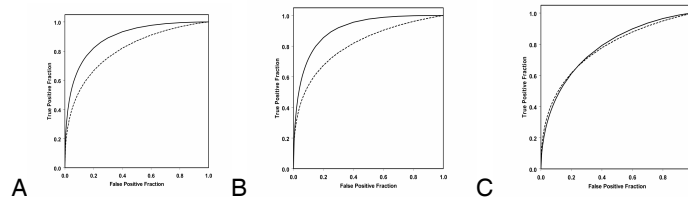

Fig 1 Receiver operator curves (ROC) for T2 and DWI+T2
A) For the peripheral zone (PZ) and transition zone (TZ) combined the area under the ROC curve (Az=0.87) was significantly higher (p=0.006) for DWI + T2 than T2 alone (Az = 0.8). B) For the PZ Az was significantly higher (p=0.004) for DWI+T2 (Az=0.89) than T2 alone (Az = 0.81). C) Test performance was poor for the TZ alone with similar results for T2 (Az = 0.79) and DWI+T2 (Az=0.78). Dotted lines – T2, Solid line – DWI + T2, DWI = diffusion weighted imaging
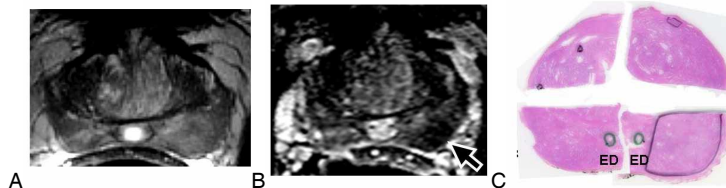

Fig 2 Tumor seen on ADC map and not on T2 images
This 46 year old male patient had a PSA of 9.9 ng/ml, and a Gleason score 7 tumor.
A) T2 weighted image shows generalized decrease signal in the peripheral zone with no focal mass on the left side scored as 2-possible cancer. B) ADC map calculated from DWI images at b-value 0 and 600 s/mm2 shown at a window width of 1650x10-6 mm2/s and level of 1675 x10-6 mm2/s demonstrated a clear focal mass in the left peripheral zone (arrow) scored as a 4-definite cancer. Corresponding pathologic specimen shows a Gleason 3+4 cancer (outlined).

CONCLUSION: DWI + T2 weighted MRI is significantly better than T2 imaging alone in the localization of prostate cancer in the prostate, particularly in the peripheral zone.