

Prostate MRI For the Detection of Extracapsular Extension

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A SIXTY-YEAR OLD MALE WAS FOUND TO HAVE a palpable prostatic nodule on screening digital rectal examination. A serum **prostatic specific antigen (PSA)** assay yielded a concentration of 25.8 ng/ml (normal range 0-4 ng/ml). A transrectal ultrasound guided 12-core biopsy was then performed and confirmed Gleason 8 (4+4) and 9 (4+5) disease involving

both sides of the prostate. A staging CT of the chest, abdomen, and pelvis (not shown) revealed a borderline-enlarged left obturator lymph node without other evidence of distant metastatic disease. Given a clinically palpable tumor with a significantly elevated serum PSA and relatively high Gleason grade, the use of Partin tables predicted a high probability

of extracapsular tumor extension. To help guide clinical management, an MRI of the prostate gland using an endorectal coil was ordered. Multiplanar T2 weighted images of the prostate confirmed a large bilateral tumor involving the peripheral zones of the bilateral base and mid- portions of the prostate with extension into the central gland on the left. (Figures 1 and 2b) This was confirmed on **diffusion weighted imaging (DWI)** with calculation of **apparent diffusion coefficient maps (ADC)**. (Figures 2a and 2b) In addition, direct invasion of the seminal vesicles bilaterally,

left side greater than right, was also demonstrated with associated hematospermia on the left. (Figures 3a, 3b, and 3c) The previously identified left obturator lymph node was also re-identified and noted to be mildly enlarged with restricted diffusion, remaining suspicious for regional nodal metastasis. (Figure 4)

While surgical resection remains the most widely accepted curative treatment option for those with organ-confined disease, if there is evidence of extracapsular extension (T3 disease), surgery may result in an increased risk of incomplete resection, higher likelihood of micrometastatic disease elsewhere in the body, and higher morbidity. High-risk patients, therefore, especially those with evidence of seminal vesicle invasion or nodal metastases, are better served with alternative therapies such as external beam radiation and/or brachytherapy, hormonal therapy, and/or chemotherapy. For high-risk patients such as this, an MRI of the prostate gland using both a torso phased array coil and an endorectal coil remains the most sensitive imaging technique for local staging to guide Urologic management between primary surgical resection versus other less invasive treatment options. The use of an endorectal coil is essential to obtain adequate signal and spatial resolution to



Figure 1. Axial T2 weighted image of the prostate using an endorectal coil at the level of the mid-gland showing hypointense tumor (white arrows) bilaterally, left side larger than right, extending to the prostatic capsule on the left with focal extracapsular extension laterally on the left (black arrowhead). There is also extension into the central gland on the left.

resolve and stage tumors of the prostate. Traditionally, this has involved the use of a small field of view with high resolution T2 weighted images obtained in the axial, coronal, and sagittal planes where tumors appear hypointense upon a background of the normally hyperintense peripheral zone. Extracapsular extension is evident when there is disruption of the prostatic capsule, asymmetry in the neurovascular bundle, seminal vesicle invasion, or invasion into adjacent organs such as the bladder or rectum. While T2 signal hypointensity can also be seen with nonmalignant findings such as hemorrhage, prostatitis, and

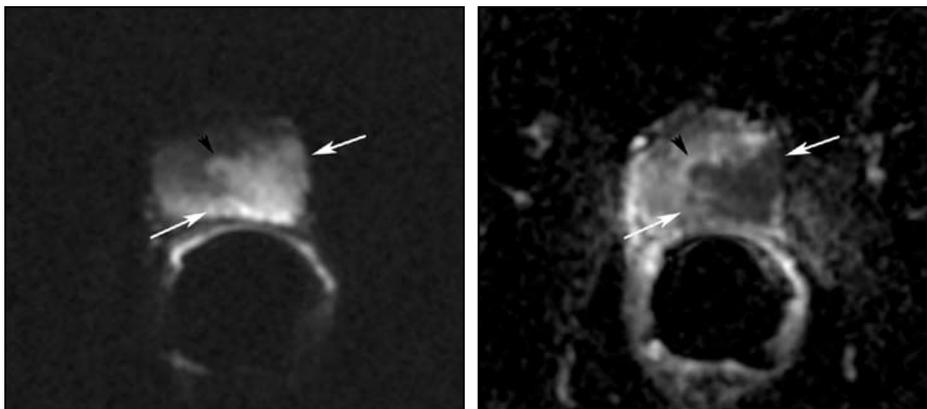


Figure 2. Diffusion weighted imaging of the prostate at the level of the mid-gland. a. (left) Diffusion weighted imaging with a b-value of 1000. b. (right) Apparent Diffusion Coefficient (ADC) map at the same level. Tumors, especially those of higher Gleason grade, show increased signal on DWI and correspondingly decreased values on ADC map (white arrows). Note the increased conspicuity of central gland involvement compared to T2 weighted images (black arrowhead).

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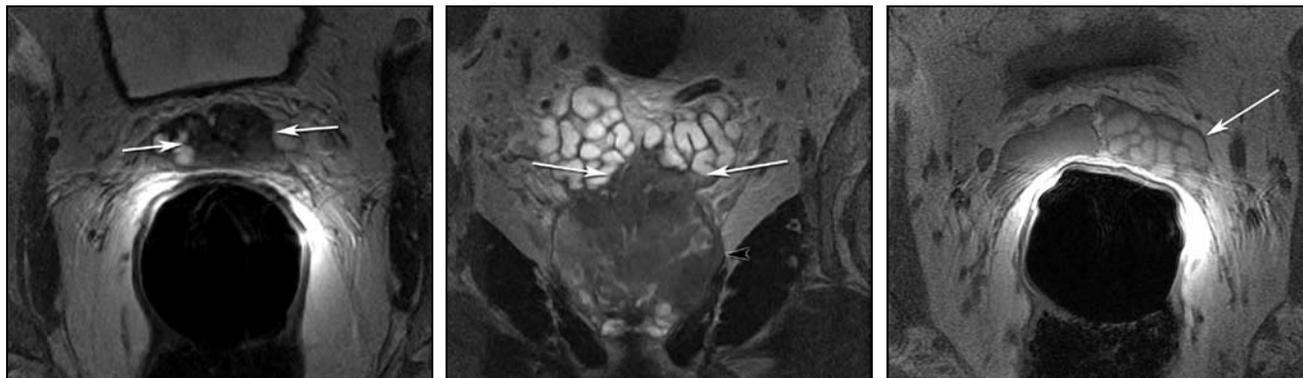


Figure 3. Seminal vesicle invasion on T2 weighted imaging. a. (left) Axial T2 weighted image at the level of the seminal vesicles shows bilateral hypointense tumor extension (white arrows). b. (center) Coronal T2 weighted image shows left sided seminal vesicle invasion is greater than on the right (white arrows). Also note the other focal area of extracapsular extension seen in Figure 1 (black arrowhead). c. (right) Axial T1 weighted image at the level of the seminal vesicles shows hyperintense signal within the seminal vesicles on the left (white arrow) consistent with hemorrhage and hemospermia which is not an uncommon finding following a prostate biopsy.

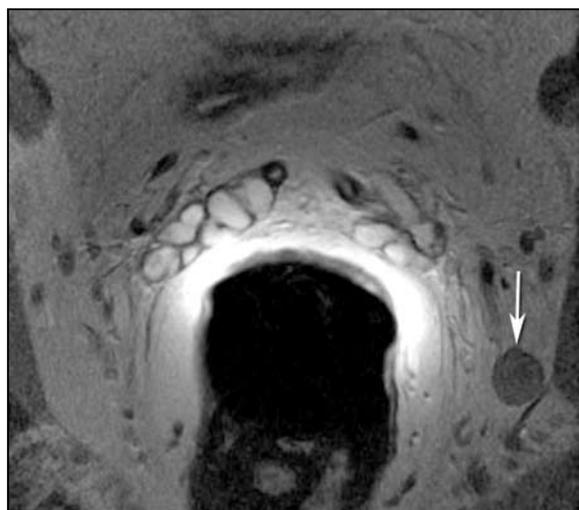


Figure 4. Axial T2 weighted image demonstrating an enlarged 12 mm left obturator lymph node. This showed restricted diffusion on DWI and ADC (not shown) raising suspicion for nodal metastasis.

changes following hormone or radiation therapy, correlation with T1 weighted images as well as the use of other functional techniques such as diffusion weighted imaging, MR spectroscopy, and dynamic contrast-enhanced MRI greatly aid in improving specificity.¹ As in this case, tumors that show higher signal on DWI and correspondingly lower ADC values also tend to correlate with a higher Gleason grade on histology.²

REFERENCES

1. Verma S, Rajesh A. A clinically relevant approach to imaging prostate cancer: review. *Am J Roentgenol.* 2011 Mar;196(3 Suppl):S1–10.
2. Woodfield CA, Tung GA, Grand DJ, Pezzullo JA, Machan JT, Renzulli JF 2nd. Diffusion-weighted MRI of peripheral zone prostate cancer: comparison of tumor apparent diffusion coefficient with Gleason score and percentage of tumor on core biopsy. *Am J Roentgenol.* 2010 Apr;194(4):W316–22.

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Disclosure of Financial Interests

The authors and/or their spouses/significant others have no financial interests to disclose.

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