Investigation of T2- hypointense lesions in suspected prostate cancer- could these “dirty 2” appearances be benign?

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Results: The initial sample consisted of nine male patients with either focal or diffuse hypo-intense prostate lesions on T2WI MRI. 4/9 patients were excluded due to: lack of TRUS biopsy post-MRI; presence of artefact obscuring the identification of concerning lesions on MRI; and known history of prostate cancer. From the five patients analysed in this study, the mean age was 61 years and the mean pre-biopsy PSA level was 5.14 ng/mL. Mean prostate size on MRI was 44.2 cc, and all patients had a PIRADS score of 3.

One patient with a diffuse hypo-intense T2WI MRI lesion involving both the peripheral and transition zones had histopathology-proven adenocarcinoma. It is not clear in his medical records if an initial digital rectal examination (DRE) was suspicious. His pre-biopsy PSA level was 3.5 ng/mL (normal range: less than 4.0 ng/mL) and PIRADS score of 3, with a prostate volume of 58 cc (prostate volume of >30cc being concerning for benign prostatic hyperplasia or prostate cancer). He had a Gleason’s score of 3+3=7, underwent a prostatectomy, had no subsequent surveillance MRI and now has normal PSA levels. The other 2/5 patients who went on to have histopathology-proven adenocarcinoma had diffuse hypo-intense lesions exclusively in the peripheral zone. One had a pre-biopsy PSA of 8.7 ng/mL and prostate volume of 27 cc; the other had a PSA of 2.7 ng/mL with a diffuse hypo-intense lesion involving the transition zone. Both had PIRADS scores of 3. Both these patients had Gleason’s scores of 3+4=7 and continue to undergo active surveillance in the form of repeat PSA levels every 6 months and follow up MRIs at 2 years post their initial diagnoses. Of these two patients, one has a PSA that continues to remain within normal range at 2.6 ng/mL, while the other has an increasing PSA on most recent testing.

Methods and Materials: This is a retrospective case series evaluating patients with suspicious T2WI MRI hypo-intense prostate lesions in our institution from January to December 2017. Clinical information about these patients, including PSA levels, histopathology reports, imaging findings, PIRADS scores, Gleason’s scores, and treatment outcomes, were collected from a central medical records database. Prostate MR scans were reviewed. The relevant data was analysed in Microsoft Excel spreadsheets.

Figure 1: T2WI MRI showing a 6mm hypointense lesion within the peripheral zone abutting the capsule transitional zone with a PIRADS score of 3. This patient had a PSA of 3.5 ng/mL, Gleason’s 4+3=7 and was later confirmed on histology to be adenocarcinoma.

Figure 2: 3D T2WI with maximum intensity projection showing multiple hypointense lesions involving both the peripheral and transition zones in a 57 year-old male with a PSA of 8.2 ng/mL. All lesions had a PIRADS score of 3.

Conclusion: Although there is a small sample size in this case series, it was noted that on T2WI MRI, in the absence of other obvious signs of prostate malignancy, prostate lesions concerning for cancer may appear as either hypo-intense diffuse or hypo-intense focal lesions. We found that the “dirty 2” appearance of diffuse hypo-intense T2WI prostate lesions may be consistent with prostate adenocarcinoma. These features are atypical for prostate adenocarcinoma in current literature which appears to comment mostly on prostate adenocarcinoma in the peripheral zone being well defined “focal” T2 hypo-intense lesions on MRI. Further studies with larger sample sizes are needed to confirm these preliminary findings and to establish distinguishing features of MRI between prostate cancers occurring within different zones of the prostate.

References:

The other 2/5 patients had focal hypo-intense T2WI lesions that were both found to have non-specific benign changes histologically. One of these patients had a lesion in the central zone of the prostate had a pre-biopsy PSA of 6.6 ng/mL, prostate size of 69c and a PIRADS score of 3. This patient had since had a follow up MRI and a recent PSA of 8.8ng/mL, and it noted to have benign prostatic hyperplasia. The other patient had a focal hypo-intense lesion in the transition zone. Their pre-biopsy PSA was 4.4 ng/mL, prostate size 37cc and unfortunately no PIRADS score was provided due to suboptimal DWI and ADC. This patient has not had any further surveillance.

None of the patients were deceased at the time of this study.

Purpose: The gold standard for diagnosing prostate cancer is histologically, via TRUS biopsy. (1) Magnetic Resonance Imaging (MRI) often facilitates the accurate detection and biopsy of suspicious lesions, (2), with prostate cancer typically appearing as either focal or diffuse hypo-intense lesions on T2 weighted images (T2WI), (4-6) This study attempts to determine how often these “dirty 2” hypointense lesions on T2WI MRI are confirmed to be prostate cancer instead of benign pathology by comparing T2WI/MRI findings with subsequent histological findings. T2WI on MRI helps to better define prostate anatomy based on the water content of different cells within different zones of the prostate. In particular, on T2WI the peripheral zone of the prostate appears as high-signal-intensity due to its high water content, and prostate cancer often appearing as a low-signal intensity in contrast, (3, 7) or “dirty”, due to its dense cellularity and subsequent lower water content. This also means T2WI less accurately detects cancer in other zones of the prostate (i.e. central and transition zones) which have less water content in comparison to the peripheral zone. Multiple pathologies can also appear hypo-intense on T2WI. For example, benign prostatic hyperplasia (BPH), which primarily affects the transition zone, typically has a homogenous appearance, and whether or not BPH appears as hypo-intense on T2WI depends on the ratio of affected glandular or stromal tissue. (3, 8) Similarly, prostatitis can also mimic prostate cancer on T2WI and is described in literature to be either diffuse or focal with a hypo-intense appearance due to increased inflammatory cellular infiltrates which restricts the degree of diffusion of T2 signal intensity. (3) MRI facilitates the detection, localization and staging of prostate cancer, but in current literature, T2WI alone is insufficient to distinguish between specific types of prostate cancer. Histopathology is the only means of definitive diagnosis. However, given the nature of T2WI, it is most accurate at identifying pathology within the peripheral zone, which is where 70% of prostate cancer occurs, with most the most common form being adenocarcinoma, with up to 80% occurring in the peripheral zone (3, 4, 7).