Prostate Cancer Detection of Multifocal Tumors on 3T Multi-Parametric MR Imaging: Correlation with Histopathology

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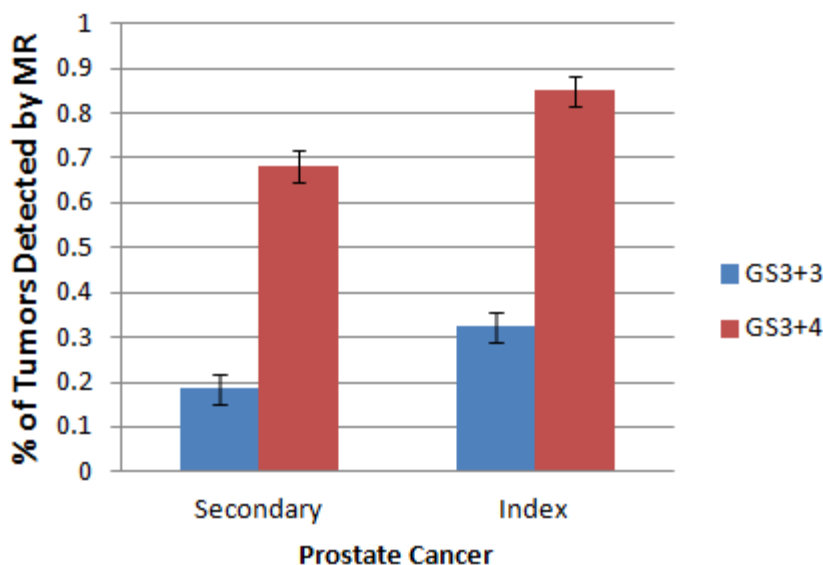
Target audience: Radiologists, Urologists

Purpose: Our objective was to determine the impact of carcinoma of the prostate (CaP) multifocality in CaP detection in men with underwent preoperative multiparametric prostate MR imaging.

Methods: A HIPPA-compliant, IRB approved retrospective study of 122 consecutive men who underwent endorectal coil multiparametric prostate MR imaging prior to robotic-assisted radical prostatectomy from October 2010 to February 2013 was performed. Clinical (age, PSA, biopsy), MR imaging (T2, DWI, DCE and MRSI), and pathologic features [Gleason Score (GS), axial diameter, multifocality] were obtained. A CaP was considered solitary if a single lesion was present on corresponding whole mount histopathology section. If a patient had 2 or more lesions on WMHP, CaP was considered multifocal. Index tumor was defined as the lesion with the highest GS or largest tumor if multiple tumors had the same GS. A GU radiologist and GU pathologist collectively reviewed each case. Chi-square analysis was use for categorical variable and t-test for continuous variable. Multivariable logistic regression was performed to determine the impact of multifocality on CaP detection A p-value of 0.05 was considered significant.

Results: 122 patients had 283 unique CaP foci on WMHP. Of 283 lesions, 134 (47.3%) were detected on MR and 11(74.5%) were GS 3+3, 23 (15.4%) GS 3+4, 9 (6.0%) GS4+3, and 6 (4.0%) GS 8-10. The mean lesion size was 1.3 cm (range 0.05-3.9 cm). 44 (36.1%) men had a single lesion and 78 (63.9%) had multifocal lesions. MR missed 149/283 (52.6%) lesions of which 111/149 (74.5%) were GS 3+3 and 139/238 (58.4%) were multifocal GS 3+3. A higher proportion of single lesions were detected compared to multifocal lesions [39/44 (88.6%) vs. 151/285 (53%) , p<0.01], respectively. On multivariable logistic regression using lesion size and GS as covariates, multifocality was an independent predictor of CaP detection (p<0.01). The odds of CaP detection of multifocal lesions reduced by 86.2% after adjusting for size and grade. However, when stratified by index lesion, there was no difference in CaP detection between solitary index multifocal index lesions (88.3 v 78.4%, p=0.17). After adjusting for lesion size and grade, there was no difference in CaP detection of solitary index lesions compared to index lesions with concomitant multifocal tumors (p=0.1) .

Discussion: We found that 63.9% of patients had multifocal CaP on MR imaging and majority were missed by MR. However, when stratified by index tumor, multifocality did not factor into tumor detection. As suggested by Noguchi et al solitary tumor or index tumors is the most important predictor of PSA recurrence post. Liu demonstrated that prostate metastasis are monoclonal and arise from index lesions. These findings suggest that the most important function of MRI is to identify the "index" lesion. In our population, MR imaging identified 81.9% of index lesions.

Conclusion: Our findings have implications for focal therapies for CaPs. MR imaging can be to effectively identify majority of index lesions.

Graph: Proportion of Tumors Detected by MR Stratified by Index Lesion and Grade

1. Noguchi M, et al . Prognostic factors for multifocal prostate cancer in radical prostatectomy specimens: lack of significance of secondary cancers. *J Urol.* 2003;170(2 Pt 1):459-463.
2. Liu W, et al. Copy number analysis indicates monoclonal origin of lethal metastatic prostate cancer. *Nat Med.* 2009;15(5):559-565