Author's Accepted Manuscript

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PII: S0022-5347(16)30958-2
DOI: 10.1016/j.juro.2016.07.084
Reference: JURO 13903

To appear in: *The Journal of Urology*
Accepted Date: 26 July 2016

Please cite this article as: Priester A, Natarajan S, Khoshnoodi P, Margolis DJ, Raman SS, Reiter RE, Huang J, Grundfest W, Marks LS, MRI Underestimation of Prostate Cancer Geometry: Use of Patient-Specific Molds to Correlate Images with Whole-Mount Pathology, *The Journal of Urology*® (2016), doi: 10.1016/j.juro.2016.07.084.

MRI Underestimation of Prostate Cancer Geometry: Use of Patient-Specific Molds to Correlate Images with Whole-Mount Pathology

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ABSTRACT:

Purpose: To evaluate the accuracy of magnetic resonance imaging in determining the size and shape of localized prostate cancer.

Materials and Methods: Subjects were 114 men who all had multi-parametric MRI before radical prostatectomy, with patient-specific mold processing of the specimen, 2013-2015. T2-weighted images were used to contour the prostate capsule and cancer-suspicious regions of interest (ROIs). The contours were used to design and 3D-print custom molds, which permitted alignment of excised prostates with MR images. Tumors were reconstructed in 3D from digitized whole-mount sections. Tumors were then matched with ROIs and their relative geometries were compared.

Results: 222 tumors were evident on whole-mount sections, 118 of which had been identified on MRI. For the 118 ROIs, the mean volume was 0.8 cc and the longest 3D diameter was 17 mm. However, for matched pathologic tumors, most of which were GS ≥ 3+4, the mean volume was 2.5 cc and the longest 3D diameter was 28 mm. The median tumor had a 13.5 mm maximal extent beyond the MRI contour, and 80% of cancer volume from matched tumors was outside of ROI boundaries. Size estimation was most accurate in the axial plane, and least accurate along the base-apex axis.

Conclusions: MRI consistently underestimates the size and extent of prostate tumors. Prostate cancer foci had an average diameter 11 mm longer and a volume 3 times greater than T2-weighted MRI segmentations. These results may have important implications for the assessment and treatment of prostate cancer.

Key Words*:* Prostatic Neoplasms; Magnetic Resonance Imaging; Image Processing; Pathology; Prostate cancer

Running Head: *Prostate Molds Show MRI Underestimation of Tumors*