

## The State of Prostate MRI in 2013: Into the Breach

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In their comprehensive review of the state of the art of prostate MRI technology, Gupta et al do a masterful job of summarizing the technically complex subject of multiparametric MRI (mpMRI). The review is a good primer for anyone getting started in bringing mpMRI of the prostate to his or her institution. However, while the “what” of mpMRI is well covered; we would like to use this space to expand on the “why.”

This article appears at an interesting time for prostate cancer diagnostics. In 2012, the US Preventive Services Task Force, after a careful study of many large international prostate specific antigen (PSA) screening studies, awarded PSA screening the dubious distinction of a “D” grade, reflecting, at best, a modest improvement in prostate cancer-specific survival achieved at the cost of substantial bladder, bowel, and sexual side effects. Although such a conclusion has long been privately expressed by practitioners in the field, this very public lampooning of PSA screening put many physicians on the defensive. The studies reviewed were flawed, there was contamination on the control arm, and patient selection was questionable. Now that all these points have been made, the field has begun the inevitable shift from denial to acceptance. PSA screening, at least the way we used it, was simply not that good.[1]

However, prostate cancer remains a big healthcare problem. It is the second leading cause of male cancer death, with approximately 30,000 deaths per year in the United States.[2] Metastatic prostate cancer is a miserable human condition, and even with a promising crop of new therapeutic agents, remains incurable. Surely the answer is not to abandon the concept of screening and return to the days of patients presenting on the brink of cord compression?

It is clear that we can use PSA more intelligently, and we will. But while we argue over the failings of PSA, we neglect an important second failing of our current model: the random prostate biopsy. Random biopsies, prompted by a rising PSA level, have been performed in ever-growing numbers. The result has been a PSA-induced epidemic of low-grade tumors, often microscopic in size and of highly questionable clinical significance. Meanwhile, large tumors outside the routine biopsy template are routinely missed.

Into the breach enters mpMRI. Using the multiparametric approach described by Gupta et al, larger and higher-grade tumors can be readily defined. At the same time, tiny, low-grade tumors are commonly invisible on mpMRI.[3] The absence of a large or multifocal lesion predicts a benign disease course, increasing the success of active surveillance.[4] The methodology of mpMRI has benefited from technological advances, including the advent of 3-Tesla MRI scanners, improved diffusion-weighted sequences with fewer artifacts, and better image-processing methods. Countless studies have validated the role of MRI in cancer detection, characterization, active surveillance, and treatment monitoring. Yet for all these advances, and even including the promising data suggesting that mpMRI can predict tumor aggressiveness, the truly catalytic event made possible by MRI is the MRI-guided biopsy.[5]

There are several approaches to MRI-guided biopsy. The first approach we used at the National Cancer Institute was the “in gantry” MRI biopsy. This was cumbersome, time-consuming, expensive, and worst of all, could never, ever meet the demands of our patient population (15 to

20 patients per week).[6] In the mid-2000s, the concept of fusing ultrasound (US) with CT and MRI for percutaneous biopsies became a reality. When applied to the prostate, the fusion of MRI and US became an obvious solution for the random biopsy. In a 15-minute session, the data from the mpMRI can be fused to the ultrasound, and multiple targeted biopsies can be obtained.[7] Is it perfect? No—registration is not always exact. Is it a game-changer? Absolutely! No longer will samples be obtained randomly from the prostate; instead, as with virtually every other biopsy in the body, the needle will be directed into suspicious areas based on MRI characteristics.

A growing number of vendors are offering turnkey MRI-US fusion platform solutions that will enable this procedure to be performed outside of tertiary referral hospitals.[8] The concept of directly targeting biopsies is obvious to physician, patient, and payer, and is already beginning to be reimbursed. Do large, prospective studies exist documenting its efficacy? No, we need to do them. But this is the kind of technology that advances ahead of the data because the status of current screening is in such sad shape and the need is so evident.

That is not to say that there are not substantial barriers still ahead. There is a steep learning curve for prostate MRI. Radiologists, already burdened by information overload, are loathe to learn yet another new imaging method. But this has to change. There is also a lack of standardization and of a lexicon that will allow physicians to communicate with each other. This is being corrected by a new interpretive guideline called PI-RADS (Prostate Imaging Reporting and Data System; modeled after a similar guideline for breast imaging called BI-RADS). This guideline should be in place in the near future.[9]

This leaves the substantial issue of the cost of MRI. For widespread use, the cost of mpMRI must be reduced. This can be achieved by shortening and simplifying the exam. The endorectal coil needs to be eliminated, except for specialized staging studies. Perhaps even the use of contrast media can be dispensed with. This could result in a simple 10- to 15-minute exam requiring no prep that could be priced reasonably and could be made widely available.

Thus, the concept of mpMRI comes at an important time in the history of prostate cancer screening. It is a method that provides anatomic information about the location, number, size, and risk of prostate cancers. It permits more accurate targeted biopsies that will improve the quality of tissue obtained, thereby reducing the rate of upstaging associated with random biopsies. It has a wide number of applications in men with or suspected to have prostate cancer. There are some barriers to overcome, but the energetic and resourceful field of imaging scientists will doubtless conquer these technological hurdles if they are given priority. This could mean that a patient in the future would receive a highly accurate diagnosis of prostate cancer, based on a simple non-endorectal coil mpMRI exam, an imaging study that could also be relied on for management decisions. Unnecessary procedures could be avoided, sparing men the side effects of unwarranted definitive prostate cancer treatment. Care could be directed to those who need it most. Neoadjuvant treatments capable of improving or even curing a tumor without further treatment might be able to be used with increased frequency. The widespread criticism of PSA has created a “screening gap.” Will mpMRI fill the breach?

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