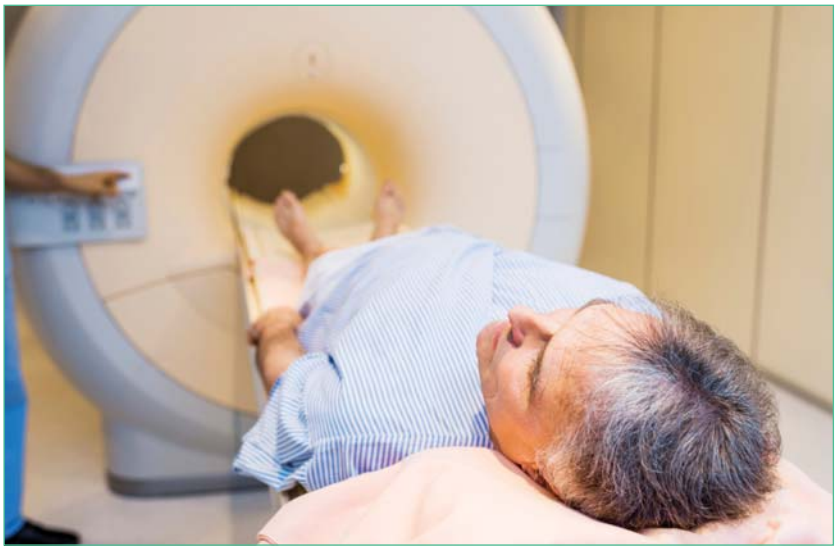
Can magnetic resonance imaging solve the prostate cancer conundrum?

Australian research advances technique that may make prostate cancer screening less invasive and more accurate



The debate about prostate-specific antigen (PSA) testing for the diagnosis of prostate cancer continues to rage. The United States Preventive Services Task Force (USPSTF) and the equivalent Canadian body have both advised against PSA screening.[1,2] On the other hand, many authoritative bodies, including the American Urological Association,[3] the National Comprehensive Cancer Network (US), the American Cancer Society, the European Association of Urology,[4] and our own Urological Society of Australia and New Zealand recommend that, instead of population-based screening, decisions about PSA testing of men aged 55–69 years should be shared by doctors and individual patients.

"It was found that mpMRI was considerably more sensitive than TRUS biopsy in detecting significant cancer"

While the USPSTF acknowledged the potential benefit of PSA screening for reducing cancer mortality and morbidity, it decided that the significant potential harms outweighed this benefit. The ongoing impact on the patient's quality of life of the side effects of the various treatments, such as erectile dysfunction and urinary incontinence, are well documented,[5] but the diagnostic biopsy itself is also associated with potential morbidity and, if rarely, mortality.[6,7]

These harms can be summarised as the overdiagnosis and overtreatment of indolent prostate cancer. The root cause of this problem is the troubling inaccuracy of the current diagnostic process that is still considered the standard of care — an elevated PSA level leading to a transrectal ultrasound-guided (TRUS) biopsy.

The poor specificity of PSA for significant prostate cancer is well known.[8] What may not be such common knowledge is that about half of all TRUS biopsies are negative for cancer.[9] This might seem to imply that a large proportion of men undergoing this invasive procedure do not have prostate cancer. We know, however, that some do, in fact, have significant prostate cancer, but the TRUS biopsy, being a blind random sampling of the gland, has missed it.[10]

In addition, a large proportion of the prostate cancer currently diagnosed by the combination of an elevated PSA level and a TRUS biopsy is actually low-risk disease.[11] The vast majority of such cases require nothing more than active surveillance, but many of the men involved, unfortunately, are subjected to unnecessary treatments.[12]

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Multiparametric magnetic resonance imaging

A diagnostic test, that can detect significant prostate cancer, but can exclude indolent disease, has therefore been desperately needed. Multiparametric magnetic resonance imaging (mpMRI) may turn out to be that test.

Prostate assessment by MRI has been available for many years, but only recently has it shown real promise. This has been achieved by combining multiple parameters, including T2-weighted imaging, diffusion-weighted imaging and dynamic contrast enhancement, and by reporting results in a standardised fashion, such as the framework provided by the Prostate Imaging–Reporting and Data System.[13]

Recently published mpMRI research by two Australian groups may provide the breakthrough for this approach.

In Brisbane, Pokorny and colleagues undertook a prospective study that compared 12-core TRUS biopsy with mpMRI. Targeted biopsies of suspicious lesions were performed to confirm the mpMRI findings. It was found that mpMRI was considerably more sensitive than TRUS biopsy in detecting significant cancer, with negative predictive values (NPVs) of 97% and 72%, respectively. That is, only 3% of significant cancers were missed by mpMRI, compared with 28% not detected by TRUS biopsy. At the same time, performing only mpMRI-targeted biopsies reduced the

diagnosis of indolent disease by as much as 89%, and the need for biopsy by 51%.[14]

In Sydney, Thompson and colleagues compared mpMRI with 30-core transperineal biopsy, presumed to be a more accurate assessment of the presence of cancer. They also found excellent NPVs of 92%–96% for mpMRI, depending on the definition of "significant cancer". The overdiagnosis of low-risk cancer by 34% would have been reduced by mpMRI-targeted biopsies, and the need for biopsy by 50%.[15]

The future role of mpMRI in prostate cancer diagnosis

These landmark reports argue in favour of a significant future role for mpMRI in the diagnosis of prostate cancer. It has already entered prostate cancer guidelines in the United Kingdom, where the National Institute for Health and Care Excellence recently recommended that mpMRI be considered for men with a negative TRUS biopsy, to determine whether a further biopsy is required.[16]

Although mpMRI might initially seem an expensive addition to the diagnostic algorithm, recent evidence suggests that it may ultimately be cost-effective.[17] In Australia, however, the costs of an mpMRI prostate assessment ($400–$1000) are not currently reimbursed by Medicare.

It is important to note that the excellent results obtained in the Australian studies relied heavily on the immense mpMRI experience of the radiologists and urologists involved. Such expertise remains unusual. Further, the results need to be validated by larger multicentre studies before mpMRI can be considered for routine use.

In the meantime, a prostate mpMRI should be ordered by urologists only with caution and after discussing it with radiologists with the necessary expertise. At our institution, we conduct a regular multidisciplinary prostate mpMRI meeting, a practice we recommend both as a means of quality control and for accelerating the development of expertise.

It is also imperative that long-term patient outcomes are investigated in settings where MRI has been included in the diagnostic algorithm, so that the value of this exciting advance can be accurately assessed. For this purpose, we have maintained an institutional ethics committee-approved prospective database of all such patients, and look forward to sharing our findings in the future.

The role of mpMRI in prostate cancer detection is rapidly evolving. By enabling targeted biopsies that exclusively detect significant cancer, mpMRI may provide the diagnostic accuracy that has been so sorely lacking. As such, it has the potential to revolutionise both the diagnosis and treatment of prostate cancer.

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