Nuada Medical *Technology for Life*

London Uroradiology

Prostate MRI
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Prostate MRI: Information for Urologists

Introduction – Who We Are

London Uroradiology has been formed by a group of consultant radiologists working at University College Hospital, and one of our specific interests is imaging the prostate. We have extensive NHS and private practice experience and are focusing our private MRI prostate scanning at Nuada Medical Specialist Imaging Centre's 3T Verio MRI scanner at 45 Queen Anne Street, just off Harley Street.

We report around 20 prostate MRI scans a week at UCH, and are involved in research into many of the different ways we might use the technique. We believe strongly in the value of prostate MR performed before biopsy. This short document explains what we believe are its benefits, and its limitations. We hope you find it helpful, and should you be interested in discussing any elements of it, we would be pleased to talk to you. Our contact details are at the end of this document.

Significant and Insignificant Disease

Insignficant disease is hard to define. At a consensus meeting of European Urologists and Radiologists on prostate MRI we settled on one definition (Gleason 3+4 disease grade or lower, and volume <0.5cc). Others have used a more stringent criterion: volume of 0.2cc and absence of Gleason 4 or 5 tumour [1] [2]. The commonest definition in imaging studies is tumour >0.5cc (around 9-10mm in each axis), which we will use when describing the performance of MRI below.

MRI Sequences

Most MRIs of the prostate performed in the UK use T1 and T2-weighted sequences alone. This is in part because most scans are been performed *after* biopsy to stage intermediate risk disease. Such a scan has three fundamental disadvantages: Firstly, around 20-40% of significant tumours are missed. Second, there are many false positives (with inflammation, haemorrhage, and scarring mimicking tumour). Third, post-biopsy haemorrhage can last for up to 3 months and seriously degrades the quality of the scan.

Adding dynamic contrast enhancement and diffusion-weighted imaging improves both the *detection* of tumour and reduces false positives. Beware studies describing the specificity of T2 weighted MRI as between 70 and 80%: very often the prostate has been divided into small quadrants for the analysis, and the figure for the whole prostate ends up much lower, so that on T2 weighted sequences alone it is usually hard to reliably exclude tumour: there are many 'equivocal' scans with false positive findings [3]. Adding contrast and diffusion sequences takes the sensitivity of MRI to over 90% for significant tumour, *including in the transition zone*, and *without the need for an endorectal coil*[4]. Note that this figure is considerably higher than a 12 core transrectal biopsy (around 80% for significant tumour [5]). Contrast and diffusion also enable us to reliably exclude disease in up to half of patients who do not have a significant tumour, but there is still some way to go, and false positives (or the equivocal scan) remain a problem.

What are the Benefits of the 3T Scanner ?

The 3T MRI machines give a step up in signal to noise ratio. This can either make the scan *faster* or of *higher resolution*, or a combination of both. In particular, images of the capsule are excellent at 3T *without* an endorectal coil. Dynamic sequences can have a higher spatial or temporal resolution, and some of our research at UCH is addressing which is the most important. We have not found any significant drawbacks: in virtually all case we would prefer, as radiologists, to interpret images taken on a 3T scanner.

Is an Endorectal Coil Necessary ?

Endorectal coils are extensively used in the USA. They have been used because the traditional 1.5T scanner has struggled to provide enough signal to provide diagnostic images, particularly when using spectroscopy. Recent evidence has suggested that spectroscopy adds little to a 'multi-parametric' MR which includes T2, diffusion, contrast and diffusion sequences. Such a scan can be obtained in around 30 minutes on a 3T machine with a flexible, lightweight 'surface' coil that lies on top of the lower abdomen and pelvis. It is not at all uncomfortable, in marked contrast to an endorectal coil: some patients fall asleep during the scan. We believe that the advent of 3T scanners and improved surface coils has obviated the need for endorectal coils in the great majority of cases.

How Can MRI Be Used ?

1. *Pre Biopsy*: Performing MRI before biopsy has several potential advantages:

i) The biopsy can be targeted. In particular, the 25-30% of tumours that occur in the anterior part of the gland can be reliable detected [4 7], and biopsies targeted to this area. All of us who perform prostate MRI regularly have several examples of large anterior tumours which were missed on standard biopsies but detected on targeted samples.

ii) In some patients (around one third to a half at the moment), the MRI is so convincingly negative that we can say *more reliably than with biopsy* that there is unlikely to be significant disease in the gland. MRI will miss a large proportion of *insignificant* disease, which might be seen as an advantage. Whether to proceed with the

biopsy can then be left to the patient: is he willing to risk a small chance of significant disease for the benefit of not detecting an insignificant tumour? If he proceeds to biopsy, the combination of MRI (with its ability to detect anterior tumours) and 12 core sampling of the peripheral zone is very reassuring if negative, and may reduce the need for repeat (or 'saturation') biopsies.

iii) There is no artefact from post biopsy haemorrhage. We regularly see outside post biopsy MRIs at UCH in which haemorrhage has resulted in the reporting of equivocal or likely extracapsular extension. This is such a problem that we normally recommend that a post biopsy scan is not performed for at least 8 weeks.

In summary: MRI may in some patients prevent the need for biopsy. Even if biopsy goes ahead, it will be more accurate with the MRI at hand. If the biopsy is then negative, MRI adds considerably to the certainty that a significant tumour is not being missed. If the biopsy is positive, we have the most accurate possible information about local stage to plan treatment, without a wait of 2 months for the haemorrhage to settle. *Whether tumour has been detected or not, MRI has been useful.*

2. *Staging after the detection of tumour:* If it is imperative to scan soon after biopsy, we can still obtain useful information, and in particular diffusion-weighted images can still be used to exclude an anterior tumour.

Sensitivity for the detection of extracapsular disease with an endorectal coil at 1.5T is around 85% (with specificity 95%) [8]. Reliable data is not yet available for 3T imaging with a surface coil, but we hope believe it will be at least as effective as at 1.5T.

The performance of MRI in lymph node staging is not as impressive: almost half of involved nodes will not be detected by the size criteria that we use (similar to CT), but if there are enlarged nodes in the context of a positive biopsy, they are highly likely to represent spread [9].

3. *Previously negative biopsies, PSA still raised or rising:* This is in our opinion a strong indication for MRI. Anterior tumours can be beyond the reach of even repeat saturation biopsies, and there is convincing recent data that shows increased pickup of tumours at repeat biopsy if MRI has been used for targeting [10]. If the biopsy is *negative,* the reassurance it provides may reduce the need for subsequent saturation biopsies.

4. *Active surveillance:* Most patients undergoing active surveillance have low grade, low volume disease, which is often not well seen on MRI. However, 0.5cc lesions still measure around 1cm in diameter, and can often be seen on MRI. Whether the disease is visible or not, MRI can be used to check that there has not been significant disease progression, and we suspect that it will perform better than repeat biopsy in this context, although there is little published data (we are looking at this at UCH). Given the poor correlation between PSA level and tumour size in patients likely to be undergoing active surveillance [11], MRI may well be better than PSA surveillance too.

5. *Rising PSA after radical treatment*. We are a little more reluctant to perform prostate biopsy after radiotherapy (especially brachytherapy) than in the naive gland. MRI performs very well in this context, with a sensitivity of at least 72% for recurrent disease after radiotherapy [12]. MRI is also an excellent tool for monitoring the early and late effects of cryotherapy and High Intensity Focused Ultrasound, and for following up patients for residual disease [13]. It is likely to become even more important in focal therapy: for targeting, and for follow up, because small rises in PSA from recurrent tumour are likely to be masked by production from residual prostate.

Our Standards For Reporting

Prostate MRI is challenging, and there is still room for perceptual error. Fifteen years ago, transition zone disease was regarded as virtually undetectable; now, because we have learned about its appearance, we very often see it on T2 weighted sequences. The technology has improved, but experience plays a large part. For this reason, all London Uroradiology scans will be double reported.

This has implications for reporting time. In some cases, an urgent MRI is important, and if requested we can produce a report within 48 hours, although in some cases the second reporter may have to issue the final report outside this time. In normal cases we will produce the report within 5 working days.

Many of the benefits of MRI to the urologist stem from localising the disease, and we will produce reports both with a diagrammatic representation of the tumour and several representative images. We will be happy to provide some sample reports with this document. Extracapsular extension, relation to external sphincter, anterior disease and tumour volume will all routinely be reported.

References

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