



## Editorial

## Special issue on prostate imaging



We are delighted to have the opportunity to bring together this *Clinical Radiology* special issue focused on prostate imaging. It is fascinating to consider how the prostatic diagnostic pathway has evolved in recent years, with radiology now at the forefront and with the UK leading the world in providing magnetic resonance imaging (MRI) prior to initial prostate biopsy. Prostate MRI has evolved tremendously from the initial excitement of T2-weighted imaging differentiating prostate zonal anatomy in the early 1980s.<sup>1</sup> Early attempts at tumour detection with spectroscopy were then supplemented by dynamic-contrast enhanced (DCE) in the 1990s,<sup>2,3</sup> with endorectal coils going from being essential to improve signal, to falling out of favour due to cost and issues of patient comfort; however, it was the “game changing” introduction of diffusion-weighted (DWI) sequences in more recent times<sup>4</sup> that made the case for multiparametric (mp) MRI a compelling one.

The UK-led PROMIS and PRECISION trials<sup>5,6</sup> emphasised the value of pre-biopsy MRI to direct biopsy in cases of a positive result in order to “get it right first time”, and to avoid biopsy in low-risk patients when MRI is negative. Further compelling Level 1 evidence for this paradigm has been provided by the recent MRI-first and 4M trials.<sup>7,8</sup> The MRI pre-biopsy pathway has attractive cost-saving potential if biopsy can be safely omitted, and additionally, avoids pathway delays for dissipation of haemorrhage post-biopsy. Indeed, the “rule-out” ability of a negative MRI was higher within these four studies (pooled negative predictive value [NPV] 91.7%) than the “rule-in” ability of a score 3–5, positive MRI (positive predictive value [PPV] 49.9%). The theoretical biopsy avoidance rates (all patients underwent systematic biopsy) across these studies was 21–49%. In this edition, Barrett *et al.* present their “real-world” 3-year outcome data, with 44.4% of patients avoiding biopsy, and importantly, a NPV of 92.8% for those with negative MRI and undergoing initial or follow-up biopsy based on a higher clinical risk.<sup>9</sup> A word of caution is, however, highlighted regarding the challenges for this pathway in meeting 28-day diagnostic targets.

This evidence base forms the rationale for the recently updated National Institute for Health and Care Excellence (NICE) guidelines recommending the use of pre-biopsy MRI. Jonathan Richenberg provides a fascinating insight into this

process, including the reasoning behind an early review trigger, the robustness of the methodology, and the items that engendered the most debate.<sup>10</sup> This will be of particular interest to those unfamiliar with the processes and considering joining NICE committees of the future, regardless of any interest in prostate cancer work-up. Many UK centres had already acted to introduce pre-biopsy MRI based on a reasoned interpretation of the 2014 edition of the NICE guidelines. Davies *et al.*, in a survey of 151 UK trusts, report on the current “state of the nation” for provision of prostate MRI and compare the results to a similar analysis in 2016.<sup>11</sup> Generally, there has been a trend toward increased availability of pre-biopsy MRI (from 75% to 86%), but there remains regional variation, with lower provision in the devolved nations. Biparametric (bp) MRI without gadolinium contrast remains standard in around a third of trusts. The authors discuss the possible reasons behind this and ways of overcoming barriers to further MRI adoption. Interestingly, although abbreviated bpMRI protocols have been proposed as a means of increasing MRI access, centres utilising bpMRI actually offer less pre-biopsy MRI (70%) than those performing mpMRI (80%).

The evidence for prostate mpMRI seems overwhelming, however, it comes with a caveat: maintaining quality. This needs to be achieved at every stage of the process, from patient preparation as highlighted by Caglic *et al.*,<sup>12</sup> through to image acquisition and radiologist interpretation. Standardisation initially developed by the European Society of Urogenital Radiology (ESUR), and subsequently, termed the Prostate Imaging-Reporting and Data System (PI-RADS) guidelines have been key to achieving this.<sup>13</sup> The recently published version 2.1 update to these guidelines is discussed in the review by Barrett *et al.* who also explore some of the reasoning behind the minor changes that have been made.<sup>14</sup> Although we are now in the third iteration of these guidelines, Burn *et al.* show that there is a wide variation in the compliance with PI-RADS recommended acquisition protocols across 15 regional hospitals in southwest England.<sup>15</sup> Other interesting findings in this study include a link between scanner age >7 years and reduced image quality, and the fact that DCE consistently provides more reliable image quality than either T2 or DWI, which adds into the ongoing

debate regarding bpMRI and mpMRI. When it comes to the issue of image interpretation, the current UK recommendations are to use a Likert rather than PI-RADS system.<sup>16,17</sup> Likert assessment takes into account clinical factors such as age, prostate-specific antigen (PSA), gland volume, and family history and is supported by outcome data from the PROMIS and MRI-first studies.<sup>5,6</sup> In reality, the two systems are not so different, and Latifoltojar *et al.* eloquently highlight the similarities and differences between PI-RADS and Likert scoring in their review article.<sup>18</sup>

Once MRI has been performed and reported, the results need to be acted on: in the case of a positive call, the next management step will typically be a targeted biopsy. Das *et al.* describe the ways in which this can be performed from a “low-tech” cognitive approach, which can be operator dependent, through to being in-gantry, under direct MRI guidance.<sup>19</sup> The latter requires significant capital investment and can be time intensive, and often a compromise approach is adopted by fusing MRI to real-time ultrasound images to enable biopsy in an outpatient setting. Following diagnosis, management steps need to be considered, and it is important to appreciate how these options are evolving independent of radiological advances. Historic outcome data have been based on results of systematic transrectal biopsy and staging by bone scintigraphy and computed tomography (CT); evolving pathways with targeted biopsy of the most aggressive part of the tumour and detection of micro-metastatic disease with whole-body MRI of <sup>68</sup>GA-labelled prostate-specific membrane antigen (PSMA) positron-emission tomography (PET) are likely to alter this paradigm. Vincent Khoo describes how this changing landscape is affecting treatment options, with the emergence of the novel concept of oligometastatic and oligoprogressive disease, and how these terms can sometimes be confusing and often used with overlapping meaning.<sup>20</sup> No look towards the future in radiology would be complete without consideration of artificial intelligence or machine learning. Patel *et al.* review the potential for texture analysis techniques to aid prostatic tumour detection and differentiate aggressive disease,<sup>21</sup> but highlight the need for further prospective studies before translation into routine clinical practice can be realised.

We hope you enjoy reading these varied and interesting articles, and we would like to thank all the authors for sharing their expertise.

## Conflicts of interest

The authors declare no conflict of interest.

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