

The Performance of Multi Parametric Magnetic Resonance Imaging (mp-MRI) in Diagnosis of Prostate Cancer

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DESCRIPTION

The Multi Parametric Magnetic Resonance Imaging (mp-MRI) is usually the preferred method in the diagnosis of Prostate Cancer (PCa) in view of the relatively high sensitivity. However, with the wide application in clinical practice, there are also some problems deserving attention in mp-MRI. Moreover, the diagnostic performance of mp-MRI in PCa diagnosis still needs further exploration and confirmation.

According to the latest Prostate Imaging Reporting and Data System version 2.1 (PI-RADS v_{2.1}), sequences of Multi Parametric Magnetic Resonance Imaging (mp-MRI) in prostate included T₂-weighted turbo-spin echo imaging (T₂ WI), diffusion-weighted spin-echo echo planar imaging (DWI) with different b-values (0/100/400/1000sec/mm²), Apparent Diffusion Coefficient (ADC) maps calculated by linear least-square with all b values, and Dynamic Contrast Enhancement (DCE) acquired using time-resolved gradient-echo [1]. Just due to the stringent technical standards and multisequence display of prostate disease, the application of mp-MRI has improved the diagnosis of prostate cancer (PCa) and obtained more and more approvals gradually. Moreover, MRI-ultrasound fusion Targeted Biopsy (MRI-TBx) directed by mp-MRI has been proved originally effective for it could increase the detection rate of Clinically Significant Prostate Cancer (csPCa) with fewer cores compared to systematic biopsy while decrease the detection rate of non-clinically significant Prostate Cancer (nsPCa) at the same time [2-4]. MRI could also reduce the unnecessary prostate biopsy by approximately 25% (5). Therefore, many guidelines have recommended pre-biopsy MRI examination [5,6]. However, there are still some problems in mp-MRI deserving attention for PCa diagnosis.

Firstly, compared to PCa lesions in Peripheral Zone (PZ) which mostly demonstrated markedly hyper intense signal in DWI, presentations of PCa in Transition Zone (TZ) were more heterogeneous and diverse, which could be low, high or mixed signals [1]. Thus MRI could characterize some csPCa as benign

with the ratio up to 58%, and PCa lesions in TZ formed the majority of all the misdiagnosis [7,8]. Secondly, several studies have also showed that MRI might wrongly diagnose some benign lesions as a highly likely probability of PCa with the ratio arriving at 33-52%, which occurred more frequently in PI-RADS 4-5 [9,10]. It was concluded that prostatic intraepithelial neoplasia may contributed to false-positive MRI findings, and men with PI-RADS 4-5 but a negative targeted biopsy outcome should be critically reviewed and considered for a repeat biopsy [11]. Thirdly, although the PI-RADS pushed forward MR imaging interpretation to a further standardization management, it had limited effects on achieving excellent inter-observer agreements, especially for suspicious lesions in TZ [1]. Some studies already reported variable interobserver agreements with κ coefficient ranging from 0.310 to 0.673, mostly indicating fair agreements [12]. Fourthly, compared to contrast-enhanced ultrasound, mp-MRI has inevitable deficiencies in detecting the increased angiogenesis associated with PCa [13]. It should be acknowledged that DCE in PI-RADS played a very limited role and even did not work on the scoring of suspicious lesions in TZ. Therefore, concerns have been raised about the emerging examination method of Bi Parametric MRI (bp-MRI, MRI without DCE). Significantly, although the value of bp-MRI in the detection of PCa had been suggested by some studies, it was not applied widely in clinical practice in view of the restricted suitable population and necessary prerequisite of high-quality imaging [14,15].

In general, some problems in mp-MRI still represented a dilemma for the detection of PCa in clinical practice and desperately needed a solution. The role of mp-MRI in prostate cancer diagnosis needs further exploration and confirmation although with increased approvals. Additionally, with the development of multimodal ultrasound such as Contrast-Enhanced Ultra Sound (CEUS), elastography ultrasound, 2D and 3D Tran's rectal ultrasonography, it might be worth exploring that whether multimodal ultrasound could help MRI improve the diagnostic performance.

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