



# What are roles of multiparametric magnetic resonance imaging prior to transurethral resection of bladder tumor?

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Accurate tumor staging, particularly diagnosing the presence of muscle invasion, is crucial for the management of non-metastatic bladder cancer (BC) patients; those without muscle invasion are generally managed conservatively with transurethral resection of bladder tumor (TURB) and intravesical instillation therapy while those with muscle-invasive BC (MIBC) need more intensive therapy such as radical cystectomy plus urinary diversion or definitive chemoradiation. Although multiparametric magnetic resonance imaging (mpMRI) had been used for local assessment of BC, there were no standardized criteria of interpretation. Recently, the Vesical Imaging-Reporting And Data System (VI-RADS), consisting of a 5-scale scoring system, was proposed to define a standardized approach to imaging and reading mpMRI for BC, and to evaluate the possibility of MIBC (1). Barchetti *et al.* evaluated accuracy and inter-observer variability of VI-RADS for detecting MIBC in 75 BC patients who took mpMRI prior to TURB (2). Two radiologists reviewed mpMRI and scored index lesions according to VI-RADS. Area under curve (AUC) of the receiver operating characteristics curves were 0.926 and 0.873 for the two readers, and inter-observer agreement was good with a  $\kappa$  score of 0.731. This is the first published validation study for VI-RADS in BC patients.

In the field of urology, pre-biopsy mpMRI of the prostate and evaluation using the Prostate Imaging-Reporting And Data System (PI-RADS) have now been widely used for men with suspected prostate cancer (PC). Behind the prevalence of

pre-biopsy mpMRI of the prostate is evidence demonstrated by a randomized study that pre-biopsy mpMRI followed by targeted biopsy of MRI-positive lesions is superior to systematic multisite biopsy without pre-biopsy mpMRI in terms of diagnosing clinically significant cancer (3). Unlike pre-biopsy mpMRI of the prostate, pre-TURB mpMRI has not yet been a routine workup among patients with suspected BC. Will pre-TURB mpMRI and VI-RADS prevail as a routine procedure? In terms of reproducibility of mpMRI findings, inter-observer agreement of PI-RADS was reported fair to moderate with  $\kappa$  score of 0.2 to 0.6 (4). Together with another validation study of VI-RADS showing excellent inter-observer agreement with a  $\kappa$  score of 0.85 (5), VI-RADS appears to be more reproducible than PI-RADS, which may facilitate diffusion of VI-RADS. However, there is a substantial difference in benefits obtained from mpMRI between patients with BC and those with suspected PC; the latter may avoid prostate biopsy or systematic multisite biopsy when mpMRI shows negative results whereas the former cannot avoid TURB for the therapeutic purpose regardless of the results of mpMRI of the bladder.

So, what does pre-TURB mpMRI benefit BC patients? First, pre-TURB assessment of the depth of tumor invasion with mpMRI may contribute to reducing the risk of bladder perforation during TURB. Urologists would attempt resection of the deep muscle layer only for suspected muscle-invasive lesions based on mpMRI findings, avoiding

unnecessary deep TURB in patients with low probability of MIBC and consequently reducing the risk of bladder perforation. A randomized study would be needed to verify this hypothesis. Second, pre-TURB mpMRI may provide prognostic information in NMIBC patients. Yajima *et al.* reported that the absence of an inchworm sign on diffusion-weighted MRI (DW-MRI) was significantly associated with progressive recurrence of T1 BC (6). Third, pre-TURB mpMRI may provide information on decision making for better strategies in MIBC patients. Apparent diffusion coefficient (ADC) values, which represent the degree of restriction of water molecule diffusion in tissues, can be measured on DW-MRI. ADC values were inversely correlated with Ki-67 labeling indices (LI) that reflect proliferative potential of tumor cells in MIBC tissues (7). Lower ADC values and higher Ki-67 LI were associated with favorable response to chemoradiation (7) and favorable prognosis after chemoradiation-based bladder-sparing therapy in MIBC patients (8). In contrast, higher Ki-67 LI was an independent risk factor for recurrence and cancer-specific mortality in BC patients treated with radical cystectomy (9). Further studies are needed to elucidate whether patients with MIBC of lower ADC values benefit from chemoradiation-based bladder-sparing therapy rather than radical cystectomy.

Cumulative data of pre-TURB mpMRI would elucidate its practical roles in management of BC patients. The prevalence of VI-RADS must facilitate the progress of clinical research in this field.

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## Footnote

*Conflicts of Interest:* The author has no conflicts of interest to declare.

*Ethical Statement:* The author is accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are

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