Eur Rad Commentary

VI-RADS for diagnosis and management of urinary bladder cancer

Text

The rising incidence of bladder cancer, shortage of medical experts, and lack of financial resources has become a challenge for global public health systems [1]. Bladder cancer is categorized mainly into non-muscle invasive (NMIBC) and muscle-invasive (MIBC) disease, considering detrusor muscle infiltration, which affects dramatically therapeutic planning [2]. NMIBC, accounting for 2/3 of patients presenting with bladder cancer, are highly recurrent tumors that are managed with a strict monitoring schedule with cystoscopy – for the assessment of the bladder - and CT-urography – for the assessment of the upper urothelial tract - [3], given the risk of progression to muscle-invasive stage up to 50% [4]. To ease the global burden of this disease, the scientific community and policy makers has highlighted the need to identify less invasive and more affordable diagnostic and therapeutic pathways for both primary and recurring bladder tumors. Imaging can represent the game changer for the management of bladder cancer.

Magnetic resonance imaging (MRI) is an imaging modality with a high contrast resolution that allows to visualize the layers of the bladder wall, therefore to appropriately stage the disease [5]. In 2018, Vesical-Imaging Reporting and Data System has been developed by an international multidisciplinary panel of experts to standardize bladder MRI acquisition, interpretation and reporting [6]. The acquisition protocol includes the integration of three techniques: T2-weighted imaging, diffusion-weighted imaging, and dynamic contrast-enhanced MRI. Each reflects into three categories - structural, diffusion and contrast-enhanced - which make up the scoring to provide likelihood of detrusor muscle involvement on a 5-point assessment scale [6]. The document provides an algorithm to report the final VI-RADS assessment scoring, a structured report and a dedicated anatomical map [6].

Up to now, a large body of evidence has been produced by the scientific community. Of these, several papers are level 2a and 2b studies proving an optimal inter-reader agreement and diagnostic performance of the score. The latest systematic review and meta-analysis, including 2477 patients reported pooled sensitivity of 87% (95% CI 0.82–0.91), specificity of 86% (95% CI 0.80–0.90), and area under the curve of 0.93 (95%CI: 0.90, 0.95) – when using VI-RADS 3 or above as biomarker of muscle-invasion [7]. The evidentiary supported the introduction of the VI-RADS scoring system into the European guidelines, which now state "In local staging, MRI is superior to CT in terms of differentiating T1 from T2 disease" [3]. No recommendations have been made on the use of MRI as first line test before tumor resection [3]. Provided future evidence from randomized head-to-head comparative multi-institutional clinical trials, on the role of MRI in the

pre-surgical setting compared to cystoscopy, and the impact on patients survival, guidelines might be shaped further, just like it happened in 2019 with prostate MRI [8].

Bladder MRI provides indeed strong clinical advantages when applied both pre-operatively for staging purposes, and after tumor resection for disease monitoring or assessment of treatment response.

In the pre-surgical setting, a staging bladder MRI with VI-RADS scoring provide a selection criterion for high-risk NMIBC who should be managed with therapeutic resection and who could avoid unnecessary secondary resection of the tumor, currently always performed after 4-6 weeks from the primary one. Also, MR imaging allows to correctly and timely stage MIBC, that can be directed to sampling resection, or for those understaged after primary resection MRI correctly select patients who should be surgically re-staged.

In this sense, a bladder cancer MRI pathway might replace the interventional procedure for diagnostic intent or secondary tumor resection, promoting a paradigm shift toward a non-invasive staging of bladder cancer.

After tumor resection, for patients diagnosed with MIBC for which systemic therapy is recommended, MRI and a modified version of the VI-RADS scoring developed based on prior VI-RADS score, presence of residual tumor, its size and infiltration of the muscularis layer – the neoadjuvant chemotherapy [nac]VI-RADS - can be implemented for the assessment of response to therapy [9].

Of note, NAC treatment in responders and in patients who show complete response (pT0N0) has a major impact on overall survival, and an optimal imaging tool should allow to select the potential responders and accurately evaluate the clinical response. Our goal is accomplished when the radiological restaging is comparable to pathological restaging, and that is why we need a comprehensive technique, such as MRI, to do so.

In a preliminary report nacVI-RADS categories were able to match all the final radical cystectomy pathology reports both for complete pT0 responders and, more interestingly, for patients defined as partial or minimal responders, who only showed some radiological downstaging. However, the study was descriptive given the small cohort investigate [9].

Future developments include investigating the role of bladder MRI and VI-RADS as non-invasive prediction tool. The VI-RADS score has the potential to become a clinical predictor of perioperative outcomes, as well as a tool for predicting tumour aggressiveness and response to therapy. Multiple studies have demonstrated the validity of MRI functional sequences and quantitative parameters

for predicting tumour grade [10, 11]. Also, radiomics and machine learning applications of medical images has developed exponentially over the past decade, in the field of oncological imaging, including for bladder cancer. Despite early promises provided by several investigations [12, 13], larger multi-centre datasets are needed before radiomics, and machine learning algorithms can be used in routine clinical practice to support and improve local staging of bladder cancer and assist in optimising therapeutic management.

Possible barriers to the clinical implementation and applicability of bladder MRI are the mutual trust among physicians and the sustainability in non-academic, non-tertiary referral centers. Also, accessibility for MRI scans and experienced uroradiologists might limit bladder MRI implementation. An interactive education program on bladder MRI and the VI-RADS score can improve readers' diagnostic performance over time, especially when reporting is above 100-150 cases [14]. Initiatives towards dedicated educational projects and certification for bladder MRI and VI-RADS reporting, are needed from international or national radiological societies.

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