

Preoperative T staging of urinary bladder: Diagnostic performance of diffusion-weighted MR imaging at 3.0 T

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INTRODUCTION:

Clinical management of urinary bladder cancer is determined primarily on the basis of distinguishing superficial tumors (stage T1 or lower) from invasive ones (stage T2 or higher) because the treatment options differ considerably. Therefore, preoperative imaging studies would play an important diagnostic role if they could be used to precisely differentiate between the two categories of bladder cancer. Several previous studies have suggested that diffusion-weighted (DW) MR imaging at 1.5 T was useful for diagnosing T stage (1-4). However, to our knowledge, there have been no previous reports to evaluate the ability of DW MR imaging at 3.0T for diagnosing T stage. The purpose of this study was to evaluate the ability of DW MR imaging at 3.0T for diagnosing T stage in bladder cancer.

MATERIALS AND METHODS:

Thirty-nine consecutive patients known to have or suspected of having urinary bladder cancer underwent MRI that included T2WI (TR/TEff, 4,500/82) and DWI (TR/TE, 3,800/70; b-values, 50, 500, and 1,000 s/mm²) using a 3 T whole body scanner (MAGNETOM Trio, A Tim 3.0T; Siemens Medical System, Erlangen, Germany) with a body-matrix coil and a spine-matrix coil. Urinary bladder cancer was pathologically proven in all patients. Two radiologists interpreted T2-weighted images alone and T2-weighted plus DW images. Conventional criteria were used for interpreting T2-weighted images. For DW images, the criteria proposed by Takeuchi et al. were applied (2). A thin, flat, high signal intensity (SI) area corresponding to the tumor with a low SI submucosal stalk or thickened submucosa, which resembles an inchworm (inchworm sign), was diagnosed as T1 or less. A high SI tumor without submucosal components and with a smooth tumor margin was diagnosed as T2. A high SI tumor extended into the perivesical fat with an irregular margin was diagnosed as T3, and extended into adjacent organs was diagnosed as T4. We used pathologic stages documented in the official pathologic reports as the standard of reference. The McNemar test was used to examine differences in accuracy, sensitivity, and specificity.

RESULTS:

The pathologic stages were T1 or lower in 24 patients, T2 in nine, T3 in three, and T4 in three. Sensitivity, specificity, and accuracy for differentiating T1 tumors from T2 to T4 tumors are summarized in Table 1. Sensitivity and accuracy obtained by using T2-weighted plus DW images were significantly better than those obtained by using T2-weighted images alone ($P = 0.02$). Sensitivity, specificity, and accuracy for differentiating T2 or lower tumors from T3 or higher tumors are summarized in Table 2. Overall accuracies for diagnosing tumor stage are summarized in Table 3. The overall accuracy for diagnosing tumor stage with T2-weighted plus DW images was significantly better than that obtained by using T2-weighted images alone ($P = 0.02$).

CONCLUSION:

DW images at 3.0 T can provide useful information for evaluating the T stage of bladder cancer, particularly in differentiating T1 or lower tumors from T2 or higher tumors.

Table 1 Diagnostic performance of differentiating T1 tumors from T2 to T4 tumors

Diagnostic performance	T2WI	DWI	P Value
Sensitivity	12/24 (50.0%)	20/24 (83.3%)	0.02
Specificity	14/15 (93.3%)	13/15 (86.7%)	> 0.05
Accuracy	26/39 (66.7%)	33/39 (84.6%)	0.02

Table 2 Diagnostic performance of differentiating T2 or lower tumors from T3 or higher tumors

Diagnostic performance	T2WI	DWI	P Value
Sensitivity	19/26 (73.1%)	23/26 (88.5%)	> 0.05
Specificity	5/6 (83.3%)	5/6 (83.3%)	> 0.05
Accuracy	24/32 (75.0%)	28/32 (87.5%)	> 0.05

Table 3 Diagnostic performance of overall accuracies for diagnosing tumor stage

Diagnostic performance	T2WI	DWI	P Value
Accuracy	23/39 (59.0%)	32/39 (82.1%)	0.03
Overdiagnosis rate	14/39 (35.9%)	6/39 (15.4%)	N.A.
Underdiagnosis rate	2/39 (5.1%)	1/39 (2.6%)	N.A.

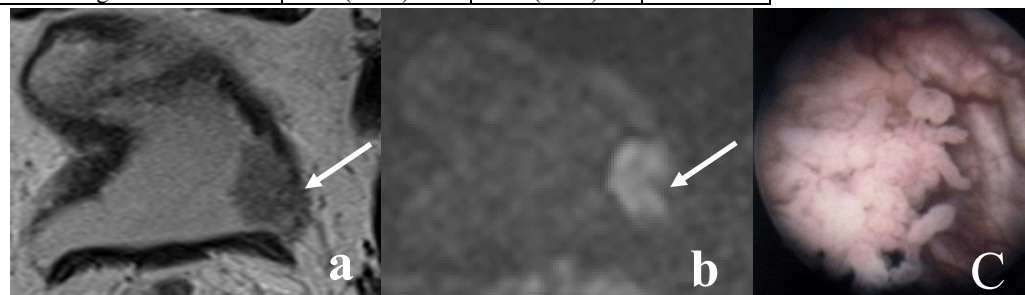


Figure 1 Stage pT1 papillary urothelial carcinoma in a 60-year-old man. (a) Axial T2-weighted image shows that the low SI line of the bladder seems to be disrupted focally in the region underlying the tumor (arrow). (b) Axial DW image shows tumor with a low SI stalk (arrow) that extends from the left lateral bladder wall to the tumor. (c) Cystoscopic finding shows the papillary tumor with a stalk.

References

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