

PELVIS: Added value of Diffusion-Weighted MRI NM deSouza

- Diffusion-weighted (DW-) MRI is proving invaluable for detection, staging and response assessment of pelvic malignancy
- Standardized methodology and rigorous quality assurance are essential for robust measurements that are usable in multicentre response assessment trials

DW-MRI exploits intrinsic tissue contrast generated by movement of water within tissues over distances of around 1-20 microns. In soft tissue tumors, quantitative ADC maps can be used in conjunction with conventional T2-W images to improve tumor detection and staging, and are increasingly being explored as quantitative functional biomarkers of prognosis and response. In **prostate cancer**, the addition of DW-MRI improves the sensitivity and specificity for detecting Stage 1 and 2 tumors from 50.0% and 79.6% respectively on T2-W alone to 73.2% and 80.8%¹. ADC has also been explored as a marker for disease aggressiveness by comparing tumor values between patients with low- vs. higher-risk organ-confined prostate cancer. In monitoring patients managed by active surveillance, tumor ADCs showed significant reduction with time in patients who were upgraded histologically or progressed to radical treatment while changes in those that did not progress were not significant². In **rectal cancer**, ADCs have been reported to differentiate tumor from both healthy and inflammatory colon with 93% sensitivity and 93% specificity³. Tumors achieving downstaging have been associated with significantly lower pre-treatment mean ADC values than non-downstaged tumors, suggesting the absence of significant necrosis before treatment as a favorable prognostic factor⁴. In **ovarian cancer**, DW-MRI depicts deposits on the visceral peritoneum as foci of high signal intensity against a background of suppressed signal from surrounding ascites, bowel contents and fat. Preliminary data using histogram analyses of ADCs derived from multiple target lesions indicates the ability of DW-MRI to differentiate responders from non-responders after 1 cycle of chemotherapy⁵. In **cervical cancer**, ADC of cervical tumors is significantly lower than normal cervical stroma⁶, improving tumor detection, particularly in early stage disease. ADC is significantly lower in poorly compared with well/moderately differentiated cervical tumors⁷. ADC values can differentiate malignant from benign **endometrial** lesions with a sensitivity, specificity and accuracy of 85%, 100% and 92% respectively⁸. The accuracy of DW-MRI in assessing myometrial invasion has been shown to be comparable to DCE-MRI which it could replace in preoperative evaluation⁹.

1. Morgan VA, et al. Evaluation of the potential of diffusion-weighted imaging in prostate cancer detection. *Acta Radiol* 2007; 48:695-703.

2. Morgan VA, et al. Diffusion-weighted magnetic resonance imaging for monitoring prostate cancer progression in patients managed by active surveillance. *Br J Radiol*. 2011;84:31-7.

3. Kilickesmez O, et al. Diffusion-weighted imaging of the rectosigmoid colon: preliminary findings. *J Comput Assist Tomogr* 2009; 33:863-866.

4. Sun YS, et al. Locally advanced rectal carcinoma treated with preoperative chemotherapy and radiation therapy. *Radiology* 2010; 254:170-178.

5. Kyriazi S, et al. Metastatic ovarian and primary peritoneal cancer: assessing chemotherapy response with diffusion-weighted MR imaging--value of histogram analysis of apparent diffusion coefficients. *Radiology*. 2011;261:182-92.

6. Charles-Edwards EM et al. Diffusion-weighted imaging in cervical cancer with an endovaginal technique: potential value for improving tumor detection in stage Ia/Ib1 disease. *Radiology* 2008; 249:541-50

7. Payne GS, et al. Evaluation of magnetic resonance diffusion and spectroscopy measurements as predictive biomarkers in stage 1 cervical cancer. *Gynecol Oncol* 2010; 116:246-252.

8. Fujii et al. Diagnostic accuracy of the apparent diffusion coefficient in differentiating benign from malignant uterine endometrial cavity lesions: initial results. *Eur Radiol* 2008; 18:384-389.

9. Rechichi G, et al. Myometrial invasion in endometrial cancer: diagnostic performance of diffusion-weighted MR imaging at 1.5-T. *Eur Radiol* 2010; 20:754-762.