

## Detection of pelvic lymph nodes: Diffusion Weighted Imaging increases lymph node detection rate when added to conventional MRI.

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**Background:** Lymph node involvement is an important prognostic factor; metastases in lymph nodes indicate poor survival and a marked decrease in 5-year survival rate for all gynaecological cancers.<sup>1</sup> So, for further treatment planning, assessment of lymph node involvement is of utmost importance. The lymph node status of cervical cancer is assessed during surgery when the primary tumour is removed and a pelvic lymph node dissection (PLND) is performed. A PLND includes the systematic removal of the bilateral lymph node bearing connective tissue along the common iliac artery, external iliac artery, internal iliac artery, and the obturator fossa. The number of pelvic lymph nodes detected by radiological modalities is substantially lower than the number removed by surgeons (approximately 10 MRI detected pelvic nodes vs. 20 surgically removed pelvic nodes).<sup>2-4</sup> The detection rate may increase by diffusion weighted imaging (DWI).<sup>5</sup> Heavily diffusion weighted images with fat suppression result in high contrast-to-noise ratios in which lymph nodes (both malignant and benign) are highlighted.

**Objective:** The purpose of this study is to investigate whether addition of heavily diffusion weighted imaging (DWI) to a conventional MRI sequence would help radiologists to increase the detection rate of pelvic lymph nodes.

**Methods:** Twenty consecutive patients with cervical cancer had a presurgical conventional MR sequence followed by DWI sequence. The scans were made on a 3.0T MR scanner using a SENSE cardiac coil. The following imaging sequences were used for the conventional MRI analysis: axial T1 fast field echo, axial T2 turbo spin echo, axial and sagittal SPAIR fat-suppressed T2. The DWI spin echo sequence used single shot EPI. Four b-values were used; 0, 150, 499 and 1000 s/mm<sup>2</sup>. All images were obtained with a slice thickness/gap of 4/0 mm, and the matrix size was 512x512. The field of view was set from symphysis pubis to bifurcation of the aorta. All patients subsequently had a PLND and histopathologically examination of the lymph nodes. The two radiologists independently evaluated the images, number, size and localisation of the lymph nodes (both on the T2-weighted scans and the heavily diffusion weighted scan) were recorded. Results were compared to the surgically removed nodes.

**Results:** DWI resulted into additional detection of 21 (134 to 155) and 28 lymph nodes (177 to 205) in 19 cervical cancer patients combined for both observers respectively. One patient experienced claustrophobia and only the conventional scan data could be included in further analyses. The addition of DWI in additional to conventional MRI resulted in a 14% higher detection rate. However, wide ranges in the number of lymph nodes detected per patient were present for both observers (range 2 – 30 and 4 – 25 totally for observer 1 and 2 respectively) and for histopathological examination (range 9 – 59). Only 33% of the lymph nodes found at pathological examination (total: 551 pelvic nodes) were detected by imaging, conventional MRI and DWI combined. Lymph nodes detected on DWI when added to conventional MRI were smaller than lymph nodes detected by conventional MRI alone (Figure 1 and 2). The benefit of DWI is mainly for lymph nodes with a short axis diameter less than 6 mm and/or nodes with a long axis diameter of less than 8 mm.

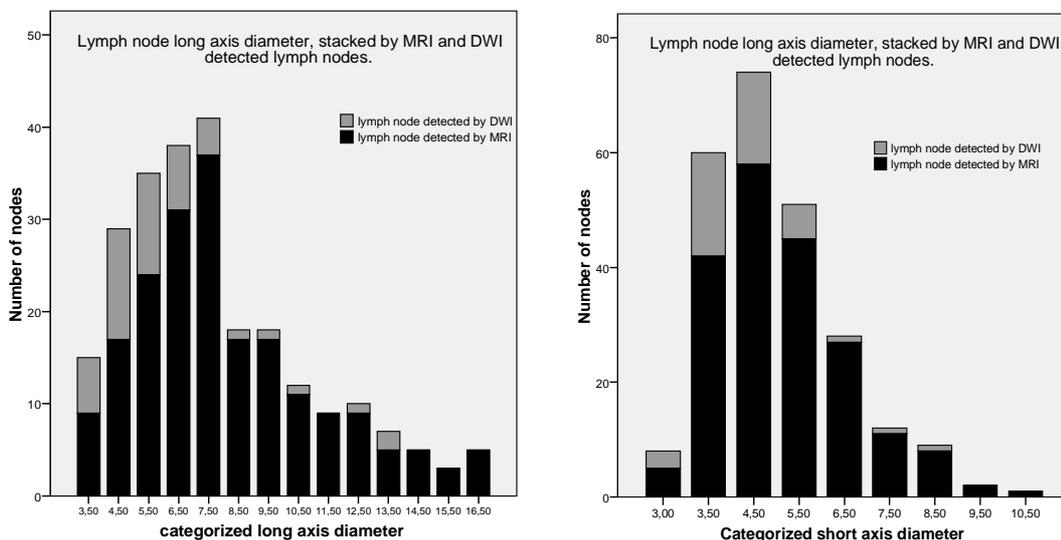


Figure 1 and 2: Number of nodes detected by DWI and conventional MRI categorized by long and short axis diameter (mm) respectively.

**Conclusion:** DWI improved the detection rate of pelvic lymph nodes. Lymph nodes detected by DWI in addition to conventional MRI were on average significantly smaller than those detected by conventional MR. Although the detection of lymph nodes increased with DWI, still over 60% was missed compared to the number removed by surgery. Its clinical value has to be established with the detection of tumour positive nodes. We hypothesize that sensitivity of MR imaging in nodal staging could further increase if DWI is able to localise more lymph nodes; and subsequently evaluate these nodes by the apparent diffusion coefficient.

References: 1) Tsai CS, Lai CH, Wang CC et al. Gynecol Oncol 1999;5:328-33. 2) Yang WT, Lam WW, Yu MY et al. AJR 2000;175:759-66. 3) Piura B, Rabinovich A, Friger M. Eur J Gynaecol Oncol 2006;27:463-6. 4) Pieterse QD, Kenter GG, Gaarenstroom KN et al. Eur J Surg Oncol 2007; 33:216-21. 5) Nakai G, Matsuki M, Inada Y et al. JCAT 2008;32; 764-8.