Diffusion weighted imaging of the uterus : Regional ADC variation with oral contraceptive usage and comparison with cervical cancer.

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Introduction

Apparent Diffusion Coefficient (ADC) measurements have shown some promise in differentiating between normal and cancerous tissue in the uterus and cervix (Naganawa, Tamai). This study aims to determine ADC values for the normal regions of cervix and uterus and compare them to the ADC value of cervical cancer. The effect of the oral contraceptive pill (OCP) was also investigated.

Materials and methods

Subjects

Group 1 consisted of 18 women with cervical intraepithelial neoplasia (CIN) detected on a screening smear due for cone biopsy – 16 patients pre menopausal (12 taking the OCP), one post menopausal and one patient status unknown. Group 2 consisted of 18 patients with clinically obvious (stage 1b2) cervical tumours. Cone biopsy performed after imaging in the patients without invasive tumour showed no evidence of cervical cancer; patients with known malignancy were treated surgically and the presence of cervical cancer was confirmed at subsequent histology.

Imaging

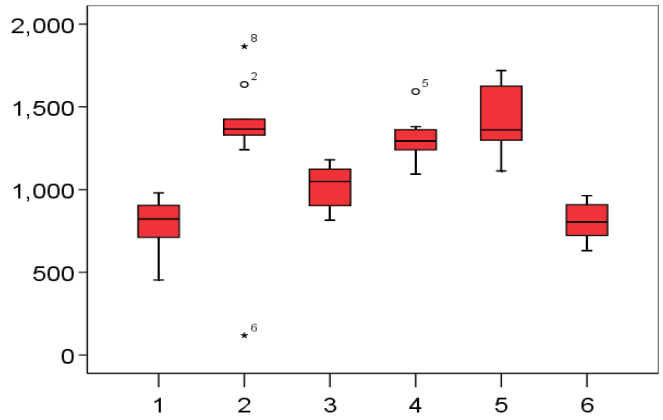
MRI was performed on a 1.5T Philips Intera using a 37 mm endovaginal ring coil [2] designed specifically to image the cervix. T2-W fast spin-echo 4500/80 msec [TR/TE] images were obtained in 3 orthogonal planes to the cervix (sagittal, coronal and transverse) using a 256 acquisition matrix, an 11cm field of view and a 3mm slice thickness. Single shot diffusion-weighted echo-planar images 2500/69 msec [TR/TE] were acquired with a 96 matrix reconstructed to 128, 20cm field of view and 4mm slice thickness. Four b-values 0,300,500 and 800 s/mm^2 were employed. Twelve 4mm thick slices provided coverage of the cervix with an image acquisition time of 1min 24secs. Isotropic (ADC) maps were generated with the system software using all b values and taking an average value for the 3 directions of diffusion sensitization.

Image analysis

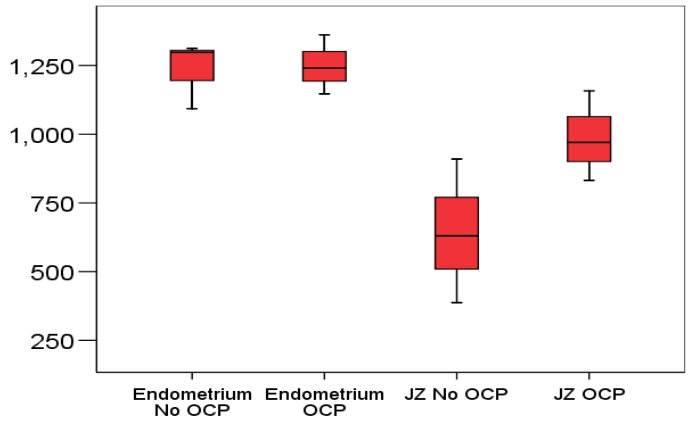
On the ADC maps of group 1, regions of interest (ROIs) were drawn over cervical epithelium, cervical stroma, endometrium, junctional zone (JZ) and outer myometrium. Visual correlation of the ADC maps with anatomical information on the corresponding T2-W image was used to aid ROI placement. Mean values of ADC from these ROIs were obtained. In group 2 ROIs encompassing the entire tumour gave whole tumour ADCs which therefore took into account heterogeneity of ADC within the tumour.

Results

Mean ADC values (x10 ¯6 mm^2/s +/-standard deviation) were: cervical epithelium 1432+/-183; endometrium 1297+/-136; junctional zone 826+/-109; outer myometrium 1392+/-181; cervical stroma 1073+/-218; cervical tumour 847+/-218. Mean ADC values of tumour were significantly different to cervical epithelium and cervical stroma ($p<0.05$).



Boxplot comparing ADC values (x10 -6 mm^2/s -Y axis) of cervical tumour-1, cervical epithelium-2, cervical stroma-3, endometrium-4, outer myometrium -5 and junctional zone-6.



Boxplot comparing ADC values (x10 -6 mm^2/s -Y axis) of endometrium and JZ in patients not taking and taking the OCP.

Conclusion

ADCs of cervical tumour are significantly lower than for cervical stroma and epithelium and may be useful in detecting stromal invasion in small lesions. Endometrial ADCs did not change with OCP usage. ADCs of the JZ however did increase with OCP usage. The small patient numbers in this ongoing study meant that these values did not reach significance.

References : Naganawa S, Sato C, Kumada H. Eur Rad 2005; 15: 71-78. Tamai K, Koyama T, Saga T et al. JMRI 2007;26: 682-687.

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