Can Reduced Phase Field of View Diffusion Weighted Imaging Increase Diagnostic Confidence when Imaging the Female Pelvis?

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Target audience: MR researchers, body radiologists, gynaecologists, oncologists, radiographers/imaging technicians

Introduction: Diffusion weighted imaging (DWI) is increasingly used in body imaging. In our own practice we routinely utilize DWI in the imaging of gynaecological malignancies. We have found DWI to be particularly useful in determining the extent of the primary lesion thereby improving the accuracy of FIGO (International Federation of Gynecology and Obstetrics) staging. However, standard EPI based DWI suffers from relativity poor spatial resolution and phase wrap round artifact. Traditionally, DWI has been acquired axially to limit scan time and phase wrap round artifact when utilizing a reduced phase FOV. However, many important anatomical boundaries are better visualized in the sagittal plane (e.g. posterior vaginal wall and rectum). Recently, spatially selective excitation DWI has become available[1]. This technology combines a spatially selective slice select gradient with a spatially selective phase encoding gradient. Consequently, a reduced phase direction FOV can be used without associated phase wrap round artifact, thereby allowing the acquisition of small FOV sagittal DWI. Additionally, due to the reduced FOV spatial resolution is also improved.

Purpose: The purpose of this study is to determine the technical feasibility of spatially selective DWI in the imaging of the female pelvis and obtain preliminary comparative data against traditional T2W images.

Methods: All MR examinations were performed on a GE Healthcare 3.0T MR750 scanner in combination with a 32 channel receive only phased array torso coil in all but one case, where due to the patient's body habitus, the body coil was used. To facilitate spatially selective excitation DWI a 'FOCUS' single shot EPI based pulse sequence was utilized with the following imaging parameters: TR/TE 3000/58.1ms, bandwidth 250kHz, FOV 240 x 120mm, matrix 160 x 80, b = 0 s/mm^2 (1 average) and 1000 s/mm^2 (16 averages), diffusion gradients were applied in all three orthogonal directions, scan time 2minutes 30 seconds for 16 slice locations. To minimize TE and therefore increase SNR real time field adjustment was utilized. B_0 inhomogeneities were minimized with the use of a volume shim. Following data acquisition a radiologist with more than 15 years' experience in body MRI reviewed the image datasets commenting on concordance or discordance between traditional T2W images and FOCUS DWI and whether or not FOCUS DWI increased their diagnostic confidence.

Results: FOCUS DWI was successfully obtained from 14 patients with the following pathology: 8 endometrial malignancies; 1 recurrent endometrial cancer involving vaginal vault; 1 anal margin cancer; 1 recurrent ovarian cancer involving rectum; 1 cancer of the cervix uteri; 1 primary vaginal wall malignancy and 1 avascular fibroid. FOCUS was found to be concordant with traditional T2W images in 8/14 cases. Discordance was noted in 6/14 cases. In each of these 6 cases FOCUS images indicated that the disease present was less extensive than that noted via traditional T2W images. Additionally, diagnostic confidence was increased in 12/14 cases with the addition of FOCUS DWI. Representative cases are presented in Figure I.

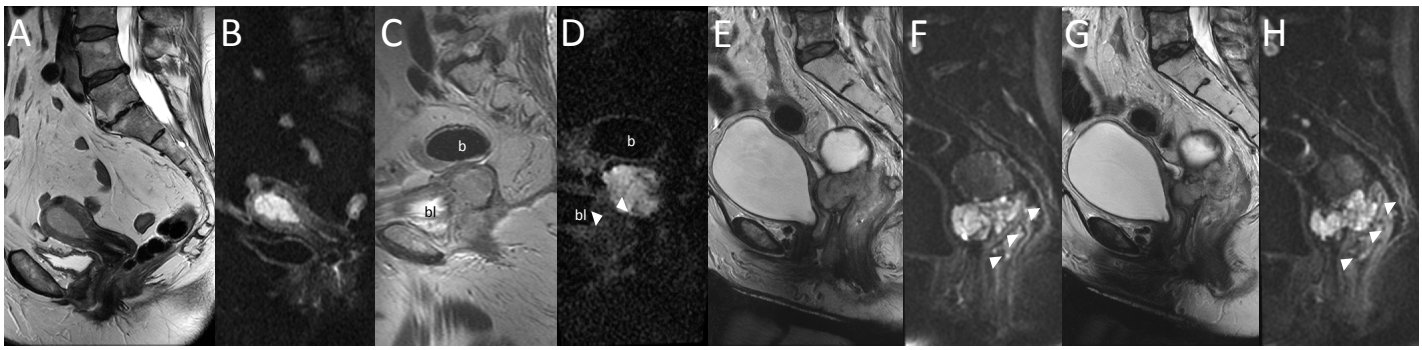

Figure I. Traditional T2W and FOCUS (b=1000 s/mm^2) sagittal images from three different individuals: Patient 1 (A and B), patient 2 (C and D) and patient 3 (E-F). For patient 1 an intermediate signal intensity mass within the endometrial cavity is noted (A). Corresponding high signal intensity is demonstrated in the FOCUS image (B) resulting in concordance. Patient 2 was imaged in the body coil. T2W imaging (C) reveals an intermediate signal intensity mass at the vaginal vault abutting the bowel (b) superiorly. The same mass appears to invade into the bladder (bl) since no clear boundary is observed. FOCUS images (D) demonstrate a clear boundary (arrowheads) between the mass and the bladder wall. On T2W images an intermediate signal intensity mass appears to invade into the bowel mucosa in patient 3 (E and G). However FOCUS images (F and H) demonstrate a boundary between the high signal intensity mass and the bowel mucosa (arrowheads).

Conclusion: These preliminary results suggest that sagittal FOCUS imaging of the female pelvis is feasible. Further, the addition of reduced FOV FOCUS diffusion imaging to traditional T2W images increases the diagnostic confidence when reporting gynaecological masses. FOCUS seemed to be particularly useful in determining the depth of tumour invasion, particularly when considering infiltrating patterns of tumour growth in the uterus, cervix and vagina**.**

References: [1]Saritas EU. et al. Magn Reson Med 2008;60:468-473.