

Pseudo 3D DWI of the Female Pelvis: A Potential Means of Increasing Staging Accuracy

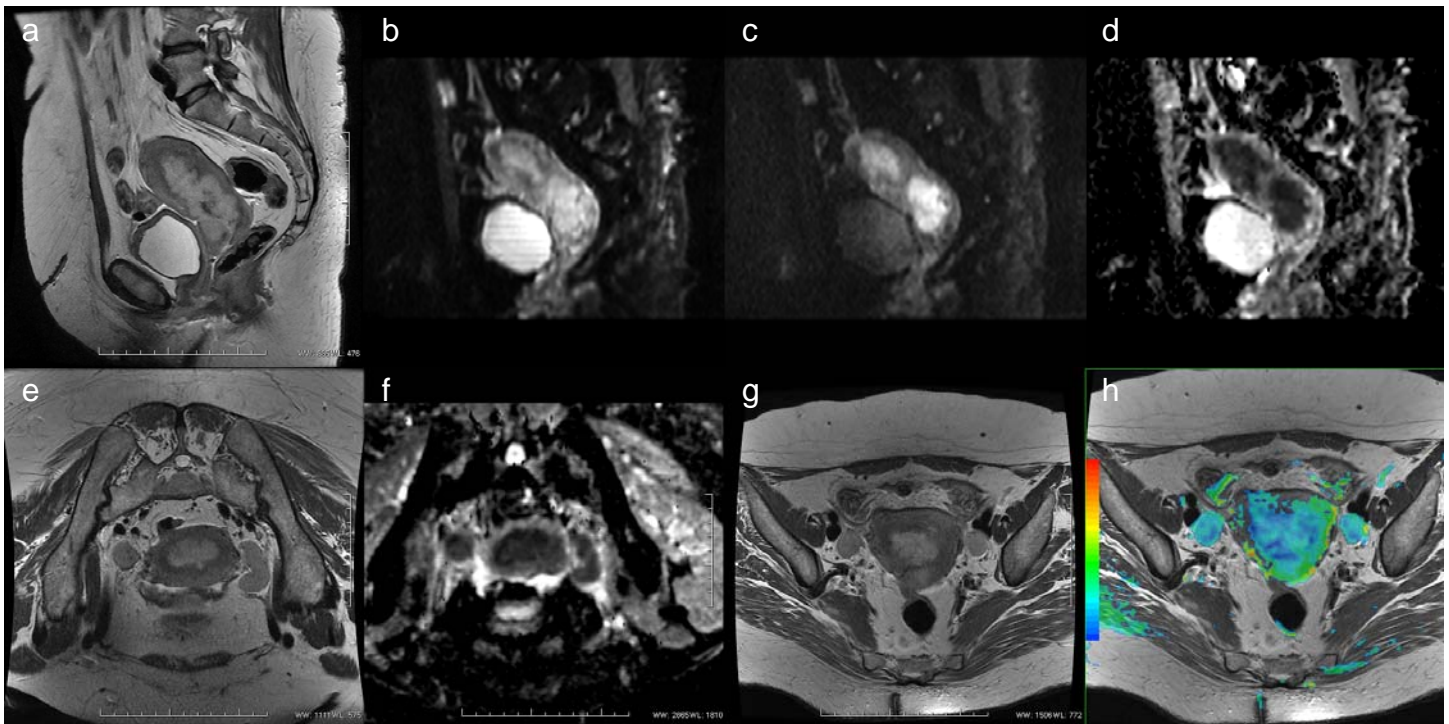
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Introduction After initially establishing itself in neuroimaging applications DWI is now increasingly used in body imaging. In our practice we routinely use DWI in the examination of female malignancies of the pelvis. DWI helps to determine the extent of the primary lesion, local lymph node involvement and distance metastasis, particularly bone and liver, thereby improving the accuracy of the FIGO stage. DWI is inherently a low SNR technique particularly so in the body where surface coils are positioned at a further distance away from the anatomy of interest than in neuroimaging. Consequently, multiple averages are utilised to increase the available SNR with resulting increases in scan time. In our own practice we obtain DWI axially through the pelvis since this results in the least geometric distortions. However, to fully assess the uterus and cervix DWI acquired in the sagittal plane and perpendicular to the long axis of the uterus/cervix would be advantageous. Obviously, these additional sequence would lead to an increased total scan time. The acquisition of a '3D' DWI would not only provide a means of reformatting DWI in any desired plane but would also facilitate registration/fusion with other available imaging while maintaining an acceptable imaging time.

Methods All MR examinations were performed on a GE Healthcare 3.0T HDx scanner in combination with an 8 channel receive only phased array coil. To facilitate '3D' DWI an EPI VECTOR pulse sequence was utilised. This sequence differs from the product EPI DWI scheme since all diffusion gradients are applied simultaneously resulting in a vector diffusion gradient as opposed to the sequential (AP, RL, SI) application in product EPI DWI. Consequently, the VECTOR scheme results in a halving of the scan time compared to the product DWI sequence after including the $b = 0 \text{ s/mm}^2$ image. To enable a '3D' acquisition 2D 5mm slices were acquired with a 2.4mm slice spacing thereby providing a pseudo 3D sequence that can be reformatted in any desired plane as opposed to a true volume excitation. Other imaging parameters were as follows: TR/TE 7900/65.1ms, bandwidth 250kHz, FOV 380 x 380mm, matrix 192 x 224, parallel imaging factor 2, averages 16, $b = 0$ and 600 s/mm^2 scan time 4minutes 13 seconds for 72 slice location.

Results '3D' DWI was successfully obtained in more than 20 patients. Fig 1 demonstrates the results from one typical examination. The ability to reformat the source axial data into any plane and fusion of ADC data onto axial T2 FSE images are illustrated. Sagittal T2 FSE, reformatted $b=0\text{s/mm}^2$, $b=600\text{s/mm}^2$ and ADC images, low ADC dark, high ADC bright (Fig 1a, b, c, d) reveal a expansion of the endometrial stripe with irregular borders which extend through the junctional zone into the myometrium, the lesion also extends through external os into the endo-cervical canal. T2 FSE and reformatted ADC images were both obtained perpendicular to the long axis of the uterus (Fig 1e and f) and reveal the presence of malignant lymph nodes, however, no invasion into the parametrium was noted. Fig 1g and h demonstrate an axial T2 FSE image and a fusion of this image with ADC data.



Conclusions '3D' DWI can be obtained in a clinically acceptable imaging time allowing the reformatting of DWI data into any desired plane. This methodology would lead to considerable time savings since one '3D' DWI sequence could potentially replace several 2D DWI sequences. Further the ADC data can be registered/fused to additional imaging. These abilities increase the diagnostic confidence in the FIGO staging in this cohort of patients.