DWI OF THE SPINE WITH A NON-CPMG SINGLE-SHOT FAST SPIN-ECHO SEQUENCE: INITIAL EXPERIENCE

A. Oner[1], T. Tali[1], A. Celik[2], F. Celikyay[1], P. Le Roux[3]

[1]Department of Radiology, Gazi University School of Medicine, Ankara, Ankara, Turkey, [2]GE Medical Systems, Istanbul, Turkey, [3]GE Medical Systems, Buc, France

INTRODUCTION

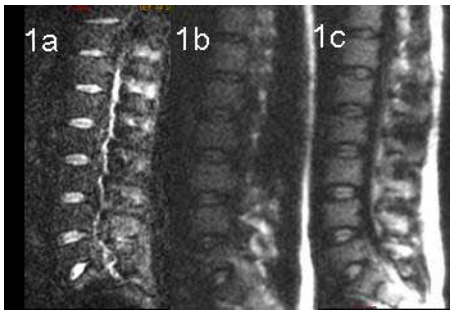
Diffusion-weighted imaging (DWI) is based on the random motion of water protons, and is increasingly used as an important diagnostic tool in the work-up of ischemic brain disorders . With its ability to detect altered water-proton mobility in couple of disorders, it may also be useful for the evaluation of bone marrow disorders. There are limited number of researches on spinal DWI, and it has been particularly used for the distinction of acute benign osteoporotic and malignant vertebral compression fractures (1, 2). The purpose of this study is to prospectively evaluate the improvement in the signal to noise ratio (SNR), with the use of a newly developped non-Carr-Purcell-Meiboom-Gill (non-CPMG) single-shot fast spin-echo (ssFSE) sequence, in the DWI of the spine and its affect on apparent diffusion coefficient (ADC) measurements.

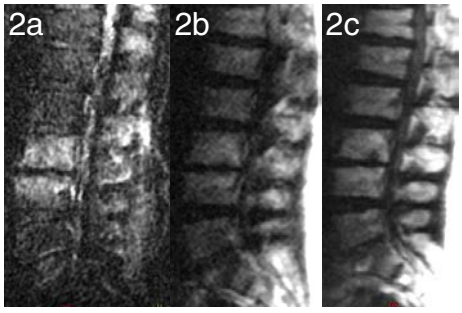
MATERIALS AND METHODS

Sixteen patients (9 normal, 3 spondylodiscitis, 4 metastases) were enrolled in this study. The Non-CPMG ssFSE DWI technique used here was based on the works of Le Roux (3, 4). Diffusion weighted images of the spine were obtained with an echo-planar (EPI) DWI sequence, followed by a non-CPMG ssFSE DWI technique. Non-CPMG ssFSE DWI images were acquired twice with 1 and 6 signal averaging in all patients. Two radiologists assigned an image quality score in consensus for each data set. SNR and ADC values were measured over a lesion free vertebral corpus in all series. When a vertebral lesion was present contrast to noise ratio (CNR) and ADC were also measured. Student *t* tests were used for statistical analysis.

RESULTS

Mean SNR values of the vertebrae were respectively 5.82±2.22; 11.68±2.86 and 24.31±7.35 for EPI DWI, Non-CPMG FSE DWI with 1 signal averaging and Non-CPMG ssFSE DWI with 6 signal averaging. SNR values associated with Non-CPMG ssFSE techniques were found to be significantly higher than those measured with the EPI based DWI technique ($p<0.01$). Mean ADC of the vertebrae were $0.53\pm0.15 \times 10^{-3}$ mm^2/ sec , $0.35\pm0.14 \times 10^{-3}$ mm^2/ sec and $0.32\pm0.12 \times 10^{-3}$ mm^2/ sec for EPI DWI, Non-CPMG ssFSE DWI with 1 signal averaging and 6 signal averaging, respectively. No significant difference was found among the two Non-CPMG ssFSE DWI sequences for ADC measurement ($p>0.05$). Whereas ADC measurements obtained with echo-planar DWI were found to be significantly higher than both Non-CPMG ssFSE DWI techniques. Image quality scores were found to be higher in both Non-CPMG ssFSE DWI techniques, compared to the EPI based DWI sequence. Fig. 1a, b, c) show respectively the EPI DWI, Non-CPMG ssFSE DWI with 1 signal averaging and 6 signal averaging of a patient with normal MRI findings. Fig. 2a, b, c) show respectively the EPI DWI, Non-CPMG ssFSE DWI with 1 signal averaging and 6 signal averaging of a patient with proven brucella spondylodiscitis at L4-5 disk space.





CONCLUSION

The use of the newly developped Non-CPMG ssFSE technique, with its reduced susceptibility artifacts and increased SNR, provides a significant improvement to current EPI based DWI of the spine and may be useful as a supplementary tool to conventional MRI for increasing diagnostic confidence in spinal pathologies.

REFERENCES

[1] Baur A et. al. Radiology 1998; 207:349-356. [2] Zhou XJ et. al. Am J Neuroradiol 2002; 23:165-170.[3] Le Roux P, JMR 2003 ;155:278-292[4] Le Roux P et. al., MAGMA 2002; 14:243-247.