ULTRASHORT TE (UTE) MAGNETIC RESONANCE IMAGING OF THE SPINE IN THALASSEMIA

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Introduction

Back pain is a common symptom in adult patients with homozygous thalassemia. Ho et al (1) have described increased severity of degenerative disc disease in thalassemia compared with age matched controls. The distribution of disc disease was also atypical, with equal involvement of the lower thoracic and lumbar intervertebral discs, as compared to a predilection for degenerative change in the lowest two lumbar discs in the control population.

We have implemented a pulse sequence with an ultrashort echo time (0.08 ms) (2-4) and this technique was used to image the lower thoracic and lumbar spine in three patients with thalassemia.

Subjects and Methods

All studies were approved by the Institutional Review Board. The basic pulse sequence employed a half radiofrequency (rf) excitation followed by radial imaging of k-space from the center out (3,4). Slice thickness was 4-6 mm. 8-12 multiple sagittal slices were obtained simultaneously with a flip angle (for long T_2 components) of 80^o and a slice gap of 10%. Conventional T_1 weighted spin echo (TR/TE = 500/8 ms) and T_2 weighted fast spin echo (TR/TE_{eff} = 2500/91 ms) scans were also performed with the same FOV and slice thickness.

Three normal controls with no significant history of back pain (aged 29, 33 and 58 years, all male) were studied. Scans from two patients with severe degenerative disc disease (aged 54 and 71 years respectively, both female) who were examined with the same sequences were reviewed. Three patients with thalassemia were studied.

Results

Fat and long T2 suppressed images from the normal controls showed faint higher signal lines in the region of the annulus fibrosus and end plate.

The fat and long T2 suppressed images from patients with severe degenerative disc disease showed a loss of disc height and alignment within the spine. The central disc signal was low with only small areas of increased signal from the annulus fibrosus and other sites.

All three patients with thalassemia showed high signal intensity bands parallel to the vertebral end plates in discs in the lower thoracic and upper lumbar spine. This was most obvious in the patient with the most severe degenerative disease but was also present in the patient without MR signs of degenerative disc disease. The distribution corresponded with that previously described for degenerative disc disease in thalassemia

Discussion

The parallel bands of high signal are very unusual and to our knowledge have not previously been described in MR studies of disc disease. The nearest equivalent is the appearance produced by Gadolinium chelates 4-8 hours after intravenous administration. The transport of this agent from the vertebral end-plate into the disc results in an increase in signal in bands parallel to the end-plates.

The cause of the high signal bands is not known but there are several possibilities. Increased iron deposition in the intervertebral discs could shorten the T_1 and T_2* of this tissue. With conventional sequences the decrease in T_2* could mean that the signal was low or undetectable. The distribution within discs would be consistent with diffusion of iron into the disc through the vertebral end plates.

Excessive iron has a toxic effect in many tissues and it is possible that it may be significant in cause premature disc disease in patients with thalassemia. The degenerative process may be accelerated and be seen concurrently with iron deposition.

It is possible that in other diseases which produce increased iron deposition in tissues such as haemochromatosis may show changes in discs. It is also possible that similar effects may be detectable in other related connective tissues such as tendons, ligaments, menisci and articular cartilage.

References

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