REGIONAL DIFFERENCES AND AGE-RELATED CHANGES OF APPARENT DIFFUSION COEFFICIENT (ADC) IN VERTEBRAL BONE MARROW OF HEALTHY ADULT.

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TARGET AUDIENCE

The target audience is practicing radiologists, MRI researchers, orthopedists, and other physicians interested in musculoskeletal disorders.

OBJECTIVE

Bone marrow of healthy people change with the growth of age[1]. Red bone marrow decreases and yellow bone marrow increases. T1 and T2 values reduce when age grows. Diffusion-weighted MRI imaging is an emerging technique to assess bone marrow abnormality. Because of the dynamic changes occurring in the bone marrow compartment, normal values may need to adapt for age and anatomic location to avoid misinterpretation.

There has been very limited quantitative DWI study published on age-related influences on the lumbar vertebral marrow. However, as far as the authors know, the regional differences of the whole vertebral bone marrow have not been evaluated in previous studies. The purpose of this study was to evaluate the regional differences and age-related diffusivity in vertebral bone marrow by measuring of apparent diffusion coefficient (ADC) values in cervical, thoracic, lumbar, sacral and both iliac bone marrow in healthy adults.

SUBJECTS AND METHOD

MR echo-planar diffusion weighted imaging (DWI) examinations were performed on 1.5 Tesla Magnetom Aera with b-values of 0 and 700 s/mm^2 in 92 healthy subjects (37 female and 55 male; mean age 57.9 ± 12.9 years, age range 27-91 years old). Spherical regions of interest (ROI) were measured in the center of the 7th cervical vertebral body, 6th thoracic vertebral body, 2nd lumbar vertebral body, sacrum and both ilia. Each ROI included 15-20 pixels. ROI placement in the vertebral centers was verified on the sagittal T2-weighted image. Regional differences of ADC values of these vertebral regions were compared by t-test. Correlations of ADC values with age were analyzed with Pearson's correlation.

RESULTS & DISCUSSION

The ADC values between vertebral regions showed significant difference ($p<0.01$). Mean ADC value of cervical vertebrae (0.761 ± 0.098) $\times 10^{-3}$ mm^2/s was significantly higher than that of thoracic vertebrae (0.70186 ± 0.094) $\times 10^{-3}$ mm^2/s, lumbar vertebra (0.719 ± 0.097) $\times 10^{-3}$ mm^2/s, sacrum (0.695 ± 0.115) $\times 10^{-3}$ mm^2/s and both ilia (0.66 ± 0.1) $\times 10^{-3}$ mm^2/s. Mean ADC value of lumbar vertebrae was also significantly ($p<0.001$) higher than right (0.661± 0.1) $\times 10^{-3}$ and left ilium (0.665± 0.1). The ADC value of all vertebral regions showed no correlation with age.

Our results concord with the Zhang et al[2] that no correlation of ADC value and age in the lumbar vertebral marrow. On the contrary, Herrmann et al[3] showed a significant negative correlation of ADC values in the lumbar bone marrow to age. It may be explained by that pediatric subjects were not included in Zhang's and current study. Current study also demonstrated the regional differences in mean ADC value in vertebral bone marrow. Decrease of ADC value from the upper to lower vertebra may be explained by more pronounced mechanical stress or different amount of water and fat content in different regions of vertebral bone marrow. Further studies are needed to confirm these preliminary data. Our study was also limited by relatively small sample size.

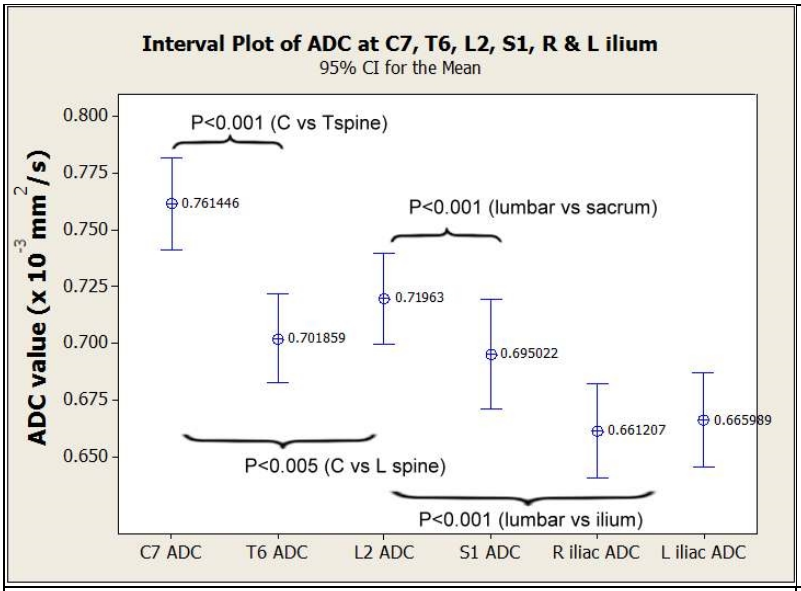

FIG. 1. Interval plot showed the mean ADC value of cervical vertebrae was significantly higher than that of thoracic vertebrae, lumbar vertebra, sacrum and both ilia. Mean ADC value of lumbar vertebrae was also significantly higher than right and left ilium.

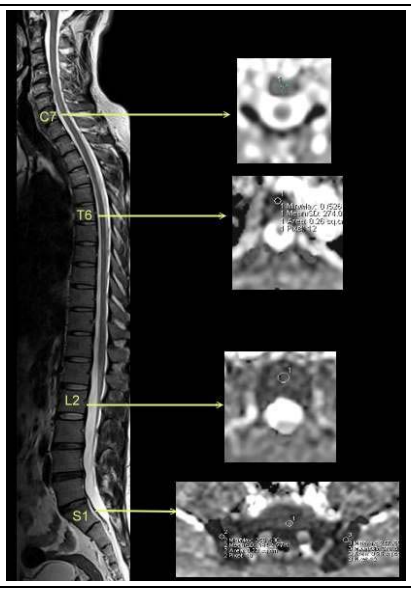

FIG. 2. ADC-values were measured in the 7th cervical vertebral body, 6th thoracic vertebral body, 2nd lumbar vertebral body, sacrum and both ilia in a healthy subject.

CONCLUSION

Current study showed that apparent diffusion coefficient (ADC) in vertebral bone marrow is influenced by the anatomical region but not significantly affected by ages.

REFERENCES

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