

Diffusion Tensor Imaging of the kidneys: functional assessment in the renal artery stenosis

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Target Audience

Scientists and clinicians who are interested in the field of diffusion MRI technique and kidney pathologies.

Purpose

To evaluate the capability of the diffusion tensor imaging (DTI) to detect parenchymal involvement in renal artery stenosis (RAS) by measuring Apparent Diffusion Coefficient (ADC) and Fractional Anisotropy (FA).

Methods

Seventeen patients with RAS (10 men; mean age 52.3 years) and 15 patients (9 men; mean age 37.7 years) who did not have kidney diseases, were studied with a 1.5T HDxt MRI scanner (GE Healthcare, Waukesha, WI). RAS was detected by using contrast-enhanced magnetic resonance angiography (CE-MRA). In all cases, DTI sequence was added to the routine MRI study protocol. Cortical and medullary Regions of Interest (ROI) were placed to obtain the corresponding ADC and FA values. Normal kidneys constituted the control group and kidney with hemodynamic RAS (>50%) constituted the study group. Student's *t*-test was used to compare the mean values of ADC and FA, for each ROI site, between the two groups.

Results

The mean values of ADC and FA in the control group was: $2.53 \pm 0.16 \times 10^{-3} \text{mm}^2/\text{s}$ for cortical ADC, $2.21 \pm 0.18 \times 10^{-3} \text{mm}^2/\text{s}$ for medullary ADC, 0.31 ± 0.062 for cortical FA and 0.39 ± 0.055 for medullary FA. There was no significant difference between the two kidneys values.

By using CE-MRA, hemodynamic RAS was detected in 14 patients, bilateral in 2: overall, 16 kidneys constituted the study group. The comparison between the two groups showed that medullary ADC/FA in the study group were significantly lower than in the control group ($P=0.034$ and 0.022 , respectively); there was no significant difference for the other parameters.

Discussion

DTI of the kidney is a new imaging application that allows renal function to be studied¹⁻⁴. This study showed the capability of DTI to detect the alterations of diffusivity in the kidney affected by RAS compared to normal kidney. Further studies with a larger population are needed to understand if changes in diffusivity in the RAS are significantly related to damage from reduced perfusion and whether they are reversible after reperfusion (DTI's role in the choice of the patient undergoing reperfusion).

Conclusion

The DTI could be a useful tool in evaluating renal alteration in hemodynamic RAS.

Reference

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