Evaluation of the Kidneys Oxygenation in Normal Subjects and Patients with Renal Transplant by BOLD MRI

W. Xiao[1], M. Zhang[1], Q. Wang[1], and G. Cao[2]

[1]Radiology, First Affiliated Hospital, School of Medicine, Zhejiang University, Hangzhou, China, People's Republic of, [2]GE Healthcare China

Introduction Deoxyhemoglobin could be used as an endogenous contrast agent for the noninvasive assessment of tissue oxygen bioavailability on blood oxygen level-dependent (BOLD) magnetic resonance imaging (MRI). Increasing of the R2* value may indicate increased deoxyhemoglobin and decreased partial pressures of oxygen (PaO2) in tissues. The intense local inflammation oxidative stress, and cytokine profile observed during transplanted kidneys with acute rejection could alter corticomedullary hemodynamics. In this study, we evaluated the oxygenation state of the kidneys in normal subjects and patients with renal transplants using BOLD MRI, tried to find acute renal rejection in early stage, instead of invasive transplant biopsies.

Materials and Methods BOLD MRI was performed in 15 healthy volunteers, 98 renal-transplant patients with normal renal function, 18 with biopsy-proved acute rejection. MRI was performed on 1.5-T scanner system with 16 gradient-recalled-echoes at a gap of 1mm and a 5-mm section thickness in the coronal plane. The parameters were as follows: TE:2.5-90 and TR:100msec; flip angle:35°; bandwidth:31kHz; matrix:192×128. ROIs were placed in the medulla and cortex of the renal according to both gray-scale imaging and color maps. The R2*(1/sec) values for the cortex and medulla of the kidneys were recorded, respectively. Statistical analysis was performed using Student t tests. A threshold of R2* values was identified to discriminate transplanted kidneys with acute rejection and those with normal function.

Results The R2* values of the medullary and cortex in normal function transplants and volunteers kidneys were quite similar, while the R2* values of the medulla in the acute rejection transplants were lower than that in the normal function grafts (P = 0.01). Furthermore, all the R2* values of the medulla with acute rejection were lower than 13/sec. Taking the R2* value of 13/sec as a threshold, acute rejection could be differentiated from normal function kidneys in all the cases.

Fig 1. R2* color maps of the acute rejection renal (left), normal function transplants (middle) and volunteers renal (right)

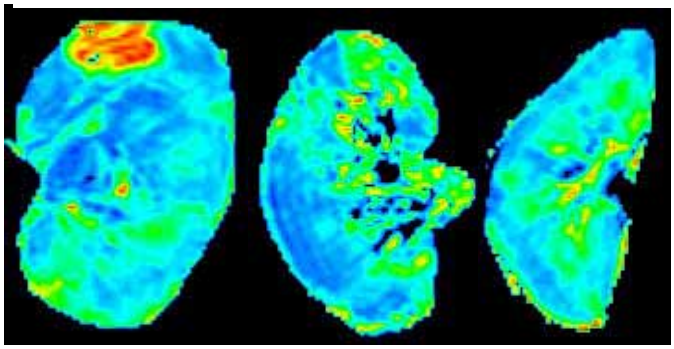

Table 1. R2* Values of Cortex and Medulla in three groups

	Cortical(1/sec)	Medulla(1/sec)
volunteers(15)	11.722±0.49	19.812±1.86
normal function (98)	10.335±0.26	18.224±0.70
acute rejection(19)	9.498±0.25	11.606±0.623*

* P < 0.05

Conclusion Normally function transplants had a similar R2* values of the medullary and cortex as volunteers renal, which indicated that the patients with normally function transplants had almost the same oxygen consumption as healthy subjects kindeys. Greatly decreased R2* value of the medulla in grafts (<13/sec) were associated with a risk of acute rejection episodes.

Reference

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Supported by ZJKJT (2006C23022)