

MAGNETIC RESONANCE IMAGING IN RENAL TRANSPLANTS

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Summary

Nuclear magnetic resonance imaging (NMR) of renal transplants was performed to establish its sensitivity and specificity in the differential diagnosis of acute rejection and Cyclosporin A-nephrotoxicity.

The NMR appearances in acute rejection are variable. The size and shape of the kidney may be normal or an increase in volume and a globular shape may be seen. The cortico-medullary junction is faint or absent. The pyramids in acute rejection may be of normal size or enlarged. In Cyclosporin A-nephrotoxicity a normal renal volume and preservation of the cortico-medullary junction was seen, similar to that of a normal kidney.

The early results of this prospective study indicate that NMR is a promising technique in the diagnosis and differentiation of acute rejection and Cyclosporin A-nephrotoxicity.

Introduction

The purpose of this prospective study was to determine the sensitivity and specificity of NMR in the detection and differentiation of rejection and Cyclosporin A-nephrotoxicity.

NMR was carried out with a 0.5 T superconducting Gyroscan S5, applying both T1 and T2 weighted pulse sequences (IR: TI=400msec, TR=1400msec and SE with various TR: 250-2000msec; TE: 30-50msec, multiple echotechnique. The images were evaluated independently by two radiologists, without knowledge of clinical data. So far a total of 23 examinations in 19 patients have been performed. This number does not allow statistical conclusions. Representative cases of the normal transplant kidney, acute rejection and Cyclosporin A-nephrotoxicity will be described.

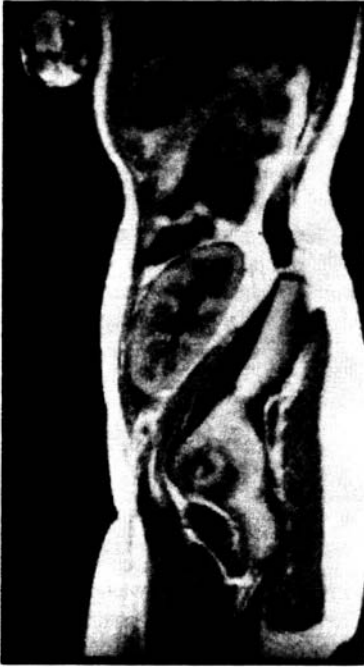


Figure 1. SE (TR=500msec, TE=30msec);
normal transplant kidney



Figure 2. SE (TR=400msec, TE=50msec);
acute rejection



Figure 3. SE (TR=400msec, TE=50msec);
acute rejection



Figure 4. SE (TR=500msec, TE=50msec);
Cyclosporin A-nephrotoxicity

Case reports

Case 1 received a cadaveric renal transplant using Cyclosporin A and low dose steroids. She never experienced a rejection episode. NMR was performed five months post-transplant during stable graft function (creatinine clearance 62ml/min) with low Cyclosporin A trough levels (217–258ng/ml whole blood by radioimmunoassay). NMR revealed a kidney of normal size and shape and an intact cortico-medullary junction (Figure 1).

Case 2 had received her second transplant from her brother while being treated with azathioprine and steroids; after initially excellent function, an anuric episode occurred on day nine which was successfully treated with antithymocyte globulin (ATG). NMR was performed during the rejection episode. At NMR the kidney was globular in shape and the cortico-medullary junction was indistinct (Figure 2).

Case 3 had received his first transplant using azathioprine and steroids. Because there was no initial function, a percutaneous renal biopsy was performed on the 12th day post-transplant, which showed severe rejection. On the 16th day ATG was commenced followed by a slow resumption of graft function. NMR was performed on the day of the kidney biopsy. The kidney was of normal size and shape at NMR. An indistinct cortico-medullary junction was noted (Figure 3).

Case 4 received a cadaveric renal transplant while being treated with Cyclosporin A and low dose steroids. On the ninth day post-transplant NMR was performed and showed a normal transplant kidney, with improving graft function (creatinine clearance 44ml/min) and relatively high Cyclosporin A trough levels (640–1300ng/ml). On day 33, a percutaneous renal biopsy was performed because of a deterioration in renal function. Histological examination showed normal renal tissue. Retrospectively the Cyclosporin A blood level was high (1400ng/ml), and NMR, done on the same day as the biopsy, showed a kidney of normal size and preserved cortico-medullary junction (Figure 4).

Discussion

The ability of NMR to image both cortex and medulla of the transplanted kidney without the use of intravenous contrast material makes it a potentially important modality for monitoring after renal transplantation [1–3].

Although the cortex and medulla are generally best differentiated on the T1 weighted SE images (TE: 30–50msec; TR: 250–500msec), we have observed good cortico-medullary demarcation using a much longer TR (900–1100msec). Particularly in cases of acute rejection enlargement of the pyramids was better appreciated with the latter pulse sequence. The NMR appearance of acute rejection may vary. The size and shape of the kidney may be normal or an increase in volume and a globular shape can be seen. The cortico-medullary junction is faint or absent [2,3]. The pyramids in acute rejection may be of normal size or enlarged. Since ATN and chronic rejection may also show both

a decreased or absent cortico-medullary demarcation, reliable differentiation of acute rejection may not be possible without additional clinical information. On the other hand, the NMR image of a transplanted kidney with Cyclosporin A-nephrotoxicity is very similar to that of a normal kidney and may therefore provide diagnostic information in the case of deterioration of graft function in a patient on Cyclosporin A therapy. In case of a simultaneous occurrence of both acute rejection and Cyclosporin A-nephrotoxicity, the NMR appearance is that of acute rejection. Our preliminary results indicate that NMR appears to be a useful non-invasive means of monitoring the transplanted kidney. However, in view of the limited number of observations more information is obviously needed before a statement can be made as to the ultimate role of NMR after renal transplantation.

References

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