SONOGRAPHIC FEATURES OF ATN AND OF ACUTE REJECTION IN RENAL ALLOGRAFTS

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Summary

The sonographic changes occurring during post transplant acute tubular necrosis and rejection are discussed. Seven patients with proven ATN are shown to maintain normal sonographic features and exhibit normal hypertrophy. In contrast during acute rejection the findings in 21 patients included in order of frequency the following 1) sudden increase in renal volume, 2) prominent medullary pyramids, 3) abnormal echogenicity, 4) decreased amplitude of the central sinus echoes, 5) increased cortical thickness, 6) crescent shaped fluid collections and 7) indistinct corticomedullary boundary.

Introduction

Recent improvements in sonographic technology resulting in better resolution of grey scale units have facilitated the display of the renal anatomy in detail. In addition to being a valuable tool in the diagnosis of post transplant peri-renal fluid collections and hydronephrosis [1,2], ultrasound has provided an accurate, non-invasive technique for studying the pathological changes that occur in acute post transplant renal failure both experimentally and clinically [3–6].

This study analyses the sonographic findings in 28 renal allograft recipients who developed acute post transplant renal failure and in whom the diagnosis of ATN or of acute rejection was proven by a combination of clinical, radiological and histological studies.

Patients and methods

Twenty-eight recipients of cadaveric allografts (21 males, 7 females; mean age 41.6 years ± 2.0 SEM) were studied. Baseline sonograms were obtained 48–72 hours post transplant and at intervals depending on the clinical state of the patient until nephrectomy or until the return to normal renal function.
The diagnosis of ATN was supported in 7 patients by clinical, laboratory and radionuclide studies and by the response to conservative management which excluded any therapy for acute rejection.

Acute rejection was proven in 19 patients by histological criteria post nephrectomy and in the remaining 2 by arteriography. Only patients who underwent nephrectomy during the first 60 days post transplant were included in the study. The sonograms were performed using a commercially available ultrasound unit with 3.5 or 5MHz focused transducers. In all cases, the baseline study was used for comparison with subsequent studies.

Results

In well functioning kidneys and all those with ATN (Figure 1) the characteristics of the normal renal parenchyma remained unaltered. Renal hypertrophy resulted in volume increases of 0–10% during the first week; 10–20% by the end of the second week and 20–35% by the end of the third week.

During acute rejection a sudden increase in renal volume and prominence of the medullary pyramids (Figures 2 and 3) were the earliest and most consistent changes from baseline. Other changes seen in order of frequency, were abnormal cortical echogenicity with increased or decreased echoes depending on the stage of rejection; crescent shaped fluid collections; increased cortical thickness; decreased amplitude of the central sinus echoes and indistinct cortico-medullary boundary (Table 1).

Figure 1. ATN

1A. Baseline study. Normal sonogram. c = cortex, s = renal sinus. 1B. After 9 days of no function and need for regular haemodialysis the sonogram remains unchanged
Figure 2. Acute Rejection
2A. Normal renal architecture on baseline study. c = cortex, s = central sinus, p = medullary pyramid, † = arcuate artery and L = liver. 2B. Fourteen days post transplant acute rejection changes, i.e. a) increased volume, b) prominent medullary pyramids (P), c) decreased central sinus echoes (S) and crescent sign (†)

Figure 3. Acute Rejection
3A. Normal baseline study. c = cortex, s = central sinus. 3B. Acute rejection changes 21 days post transplant. a) increase in volume, b) indistinct cortico-medullary boundary (c), c) decreased central sinus echoes, and d) prominent medullary pyramids (P)

Discussion
The clinical and laboratory findings in ATN and acute rejection are often very similar and impossible to distinguish from one another. Radionuclide studies provide useful functional and anatomical information but can rarely be used
TABLE I. Incidence of sonographic changes from baseline in acute tubular necrosis and acute rejection

<table>
<thead>
<tr>
<th>Clinical condition</th>
<th>Sudden increase in volumepyramids %</th>
<th>Prominent medullary pyramids %</th>
<th>Abnormal Echogenicity %</th>
<th>Crescent Sign %</th>
<th>Increased Cortical thickness %</th>
<th>Decreased Amplitude in central Sinus Echoes %</th>
<th>Indistinct Cortico-medullary boundary %</th>
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<td>ATN</td>
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<td>Acute Rejection</td>
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conclusively to differentiate between ATN and rejection.

In previous clinical and experimental reports by our group [4,5] and others [6] ATN has been associated with unremarkable sonographic features. In this study all cases of ATN examined by sonography showed preservation of the normal renal architecture in addition to a normal growth rate similar to that seen in well functioning kidneys.

During acute rejection, sonograms are always abnormal. Sudden graft enlargement, prominence of the medullary pyramids and abnormal parenchymal echogenicity occur almost consistently. Invariably at least two of these features are seen in all cases of acute rejection.

Other investigators have described indistinct cortico-medullary boundaries and distortion of the renal outline as prominent features of acute rejection [3,5]. In our experience loss of the cortico-medullary boundary was observed in only 54% of the cases and unless rejection was complicated by rupture of the graft, the renal outline was always preserved.

Technical standardisation and baseline sonograms obtained 48 to 72 hours post transplant increase the value of ultrasound in the diagnosis of early post transplant renal failure. Whenever the differentiation between ATN and rejection is uncertain on the basis of clinical, laboratory and nuclear medicine studies, the diagnosis of ATN is supported by a normal sonographic appearance.

Acknowledgments

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References


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Open Discussion

BRIGGS (Glasgow) In a well established rejection episode the ultrasound certainly shows these changes, but I would challenge the fact that it would be the earliest way of detecting rejection. If one used a scan with technetium one could pick up rejection at a much earlier stage than with the ultrasound.

CRUZ The technetium glucoheptate study, if it is the one you are referring to, which measures the aorto-transplant time, can be abnormal in both ATN and rejection as I showed in one of my slides. Thus it can be misleading. I think it is fair to say that radionuclide studies are not always conclusive.

MALEK (Chairman) I cannot understand how you can have only one sonographic picture of rejection.

CRUZ I think it is very important to first have standardised techniques and a baseline study that you can use for comparison subsequently. If there is rejection, the kidney will appear globular with swollen pyramids or will show any of the other findings described. It is important to emphasise that in rejection, unlike in ATN, the sonograms are always abnormal.