Can Renal Scan Findings Predict Biopsy-Proven Allograft Rejection?

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Objectives: **To assess the usefulness of isotopic renogram in diagnosing acute renal graft rejection.**
Materials and Methods: **Degree of perfusion and allograft uptake of tracer were correlated with the clinical and biopsy diagnoses in 15 postrenal transplant patients with varying degrees of renal impairment. Renographic findings and perfusion calculations were done by a blinded observer.**
Results: **A strong correlation was found between renal histology and renal scan findings in 13 of 15 patients. Sensitivity and specificity of renal scanning in diagnosing acute rejection were 85% and 50% respectively (using renal biopsy findings as the gold standard).**
Conclusion: **Our results demonstrate a strong correlation between blinded perfusion assessment and biopsy-proven acute rejection. We conclude, therefore, that single renal flow scan with DTPA (noninvasive/nonnephrotoxic) allows a physician to tailor therapy for acute renal graft dysfunction. We suggest that in cases with a renographic diagnosis of AR, the patient should receive standard antirejection therapy. Renal biopsy should be reserved for those instances when the renographic findings are not definitive and those when the patient fails to respond to a standard methylprednisolone therapy.**

Key words: *Renal scan, Acute rejection, Acute tubular necrosis*

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Several past studies have examined the correlation between renal scan and histology findings on allograft biopsy. Most have found a correlation between the scan findings (DTPA/MAG3) and renal biopsy [1, 2]. We believe that the renal scan is an underutilized tool for detecting rejection in the renal transplant population.

The major point of discrimination has been between acute tubular necrosis (ATN) and acute rejection (AR) [1, 2]. Previous investigators have found fractional mean transit time with DTPA in kidney allografts useful in differentiating between AR and ATN [1]. The gold standard for diagnosing AR is renal biopsy. However, a noninvasive study that could replace the need for resection of a biopsy specimen would be a welcome addition to the decision-making process.

It has been our clinical experience that renal scans (which are most often done before the renal biopsy results are available) correlate with the results of the biopsy. Therefore, we sought to retrospectively review our renal biopsy results and correlate them with the scan findings to evaluate the sensitivity and specificity of renographic findings in the diagnosis of acute allograft rejection.

Patients and Methods

We retrospectively reviewed all patients (n = 53) who had undergone an allograft biopsy for acute deterioration of renal function since January 2000. Of these, 28 had a diagnosis other than acute deterioration of renal function as an indication for renal biopsy and were excluded from further study. The remaining 25 had acute renal failure as an indication for performing the renal biopsy. Of these, 15 had renal scans and therefore were the basis of this study

To perform the scans, 3.5 mCi Tc-EC or Tc-MAG3 was intravenously injected, and images were acquired at 1-second intervals for 60 seconds and then at 20-second intervals for 105 frames with an

ADAC Vertex Camera (Phillips Medical Systems, NA, Bothwell, Wash, USA) with a low-energy collimator using a 128 × 128 × 16 matrix. Images were taken, each lasting one half to one second, for 30 to 60 minutes. Area of interest curves were obtained from renal grafts with background subtraction.

All the renal scans were reviewed by a single nuclear medicine physician. This physician was asked to read the scans from the original films and record his findings without knowledge of the clinical diagnosis or biopsy findings. Table 1 shows the renographic findings used to make the diagnosis of acute rejection or acute tubular necrosis. Renal function and renal perfusion were categorized as poor (< 30%), average (30%-70%), or good (> 70%) and were judged from the images and area of interest curves. ATN was diagnosed radiologically if there were a combination of good renal perfusion and impaired (average or poor) renal function present in the history. AR was diagnosed with an appropriate clinical history in the presence of poor renal perfusion and function.

Results

Fifteen patients who had had both a renal biopsy and a renal scan performed (within 7 days of each other) were included in this study. A single observer blinded to the results of the renal biopsy findings made the radiologic diagnoses.

A 2 × 2 table was generated, and the sensitivity and specificity of renal scanning in diagnosing AR were found to be 85% and 50% respectively. The negative and positive predictive values were 50% and 85% respectively. Out of the fifteen patients studied, 13 had a positive correlation between the biopsy and renographic findings (Table 2)

Discussion

Many researchers have previously demonstrated the utility of complicated parameters of renal scans and their correlation with renal histology [1,2]. In our study, we relied upon a simple mechanism of using an experienced nuclear radiologist to interpret scans and his assessment of the degree of perfusion and tracer uptake by the allograft. We found a strong correlation between renal histology and renal scan findings in 13 of 15 patients.

We calculated the sensitivity and specificity of renal scanning in diagnosing AR as being 85% and 50% respectively (using the renal biopsy findings as the gold standard). These findings compare well with those known for fine needle aspiration biopsy, which has a sensitivity of 90% and a specificity of 90% [3]. Using perforin mRNA 0.9 fg/mg per total mRNA yields a sensitivity and specificity of 83%. Combined analysis of perforin, granzyme B, and Fas ligand has a 100% sensitivity and 100% specificity for AR [4].

Another study used gadolinium–DTPA-enhanced magnetic resonance imaging and Doppler ultrasound. This study of 24 patients concluded that MR

Table 1. Pattern of Renal Perfusion in Acute Rejection and Acute Tubular Necrosis

Renal perfusion	Renal function	Renographic diagnosis
Poor	Poor	Acute rejection
Good	Poor	ATN

ATN, acute tubular necrosis

Table 2. Correlation between radiological and renal biopsy findings

Patient No.	Perfusion	Function	Radiologic Diagnosis	Pathological Diagnosis	Correlation
1	30%	50%	Acute rejection	Acute rejection	Yes
2	10%	15%	Acute rejection	Acute rejection	Yes
3	20%	20%	Acute rejection	Acute rejection	Yes
4	60%	30%	Resolving tubular injury	Resolving acute tubular necrosis	Yes
5	30%	20%	Mixed pattern of ATN/ acute rejection	Thrombotic microangiopathy	No
6	60%	30%	Acute tubular necrosis	Acute cellular rejection	No
7	40%	30%	Acute rejection	Acute rejection	Yes
8	50%	60%	Acute tubular injury with infarction	Acute tubular necrosis	Yes
9	30%	20%	Acute rejection	Acute rejection	Yes
10	40%	40%	Acute rejection	Acute rejection with polyoma virus interstitial nephritis	Yes
11	30%	40%	Acute rejection	Acute rejection	Yes
12	30%	50%	Acute rejection	Acute rejection	Yes
13	80%	60%	Normal	Nonspecific	Yes
14	10%	10%	Acute tubular necrosis	Humoral rejection with extensive infarction	Yes
15	90%	50%	Severe ATN	Thrombotic microangiopathy with ATN	Yes

ATN, acute tubular necrosis

imaging seemed to be a sensitive tool for differentiating between ATN and AR in postrenal transplantation [5].

In our study, we found a strong correlation between the findings of a blinded radiologist and biopsy-proven AR. Cases of acute humoral rejection and thrombotic microangiopathy, where tubular damage is probably a major element of the disease process, the major finding on nuclear scan was ATN. Hence, where the nuclear flow scan demonstrates acute tubular necrosis, thrombotic microangiopathy and acute humoral rejection should be considered in the differential diagnosis of graft dysfunction.

In conclusion, single renal flow scan with DTPA (noninvasive/nonnephrotoxic) allows the physician to tailor therapy for acute renal graft dysfunction. We suggest that in cases with a renographic diagnosis of AR, the patient should receive standard antirejection therapy. Renal biopsy should be reserved for those instances when the renographic findings are not definitive and when the patient fails to respond to a standard methylprednisolone therapy.

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