Diagnosis of Renovascular Hypertension with Captopril Renal Scintigraphy in a Patient with a Solitary Kidney

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A patient with a solitary kidney due to renal agenesis and contralateral kidney perfusion impairment due to renal artery stenosis was successfully treated with percutaneous transluminal renal angioplasty. Preintervention diagnostic work-up included captopril renal scintigraphy, which was suggestive of high probability of renovascular hypertension. Scintigraphic assessment 2 mo after angioplasty failed to show any abnormality after captopril administration, a finding in line with blood pressure beneficial response to renal artery revascularization. A 12-mo follow-up confirmed cure of hypertension.

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Renal nuclear medicine plays an important role in proper management of renovascular hypertension (RVH) (*1*), especially since captopril administration has proved effective in improving diagnostic capabilities of scintigraphic studies (*2*). Captopril renal scintigraphy has been proposed both for identifying renal artery stenosis (RAS) in hypertensive patients (*3*) and determining the adequacy of intervention in patients submitted for renal revascularization (*4*).

However, experimental studies in dogs (*5*) have shown that the one-kidney, one-clip (1K,1C) model, presumed to be a volume-dependent rather than a renin-dependent form of hypertension, has failed to show any captopril-induced worsening, the typical scintigraphic diagnostic sign for RVH.

This paper reviews a hypertensive patient with a solitary kidney who was evaluated by captopril renography before and after dilatation of a severe stenosis of the renal artery.

CASE REPORT

A 23-yr-old male was referred for evaluation of hypertension diagnosed 2 yr before and initially well controlled by medical treatment. Subsequently, despite the use of multiple antihypertensive agents, blood pressure became refractory to drug therapy. On admission, the patient's blood pressure was 190/100 mmHg and serum creatinine 158 μmole/liter.

Captopril renal scintigraphy was carried out using ^{99m}Tc-DTPA in accordance with a technique described elsewhere (*6*). The left kidney was not identified in either the baseline or captopril study (Fig. 1), whereas the right kidney, which had no abnormalities under baseline conditions, showed kidney uptake reduction and a marked increase in renal tracer transit time, with a steeply rising

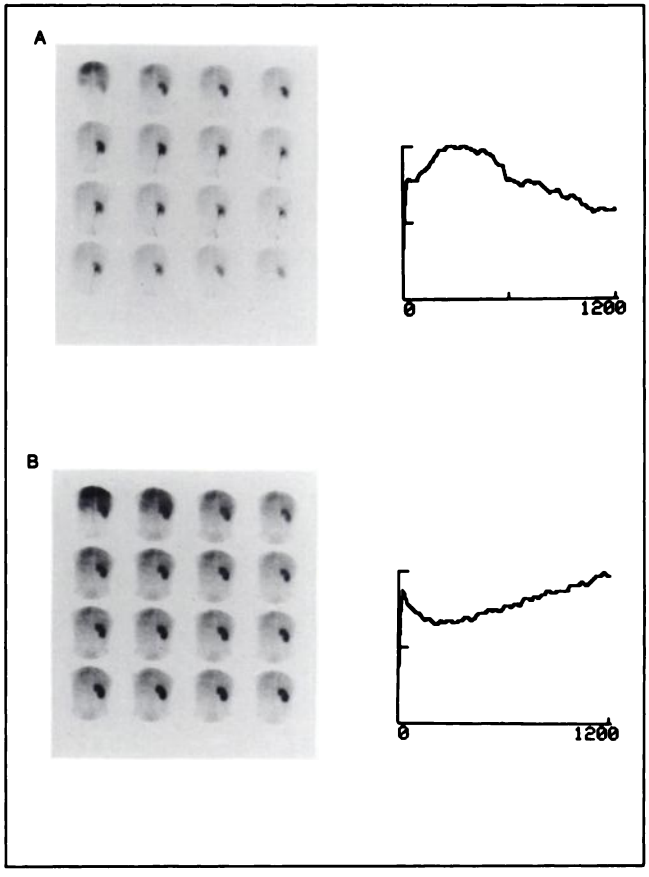

FIGURE 1. Preangioplasty scintigraphic study. The left renal kidney is absent both in baseline conditions (A) and after captopril administration (B). The right kidney is normal in the baseline study but is heavily affected by captopril (Baseline: parenchymal transit time = 187 sec; time to maximum counts = 240 sec; retained cortical activity = 52%. After captopril: parenchymal transit time = 344 sec; time to maximum counts = 1110 sec; retained cortical activity = 97%).

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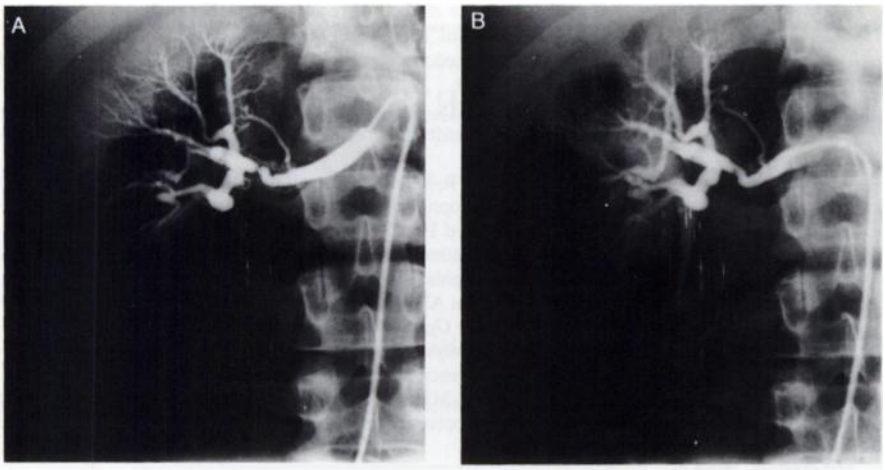

BEFORE PTRA AFTER PTRA

FIGURE 2. Preangioplasty arteriography (A). A severe stenosis is present at the level of the distal right renal artery. After PTCA (B), arteriography depicts a good result with disappearance of the stenosis.

renogram and no visualization of pelvi-calyceal structures after captopril administration (Fig. 1B).

Renal angiography performed 2 days later revealed left kidney agenesis with absence of the corresponding renal artery. The right artery was affected by severe stenosis (Fig. 2A), which was successfully treated with percutaneous transluminal angioplasty (PCTA), as shown by a post-PCTA angiogram (Fig. 2B). After intervention, the patient's blood pressure decreased to 150/90 mmHg, and the patient was placed on reduced therapy.

A captopril renal study carried out 2 mo after intervention proved absolutely normal, thus confirming the amelioration of renal perfusion and function (Fig. 3). At 12-mo follow-up, his blood pressure without medical therapy was 140/80 mmHg and serum creatinine was 123 μmole/liter.

DISCUSSION

Renovascular disease in a patient with a solitary kidney constitutes an uncommon condition. Renal agenesis has been found in 1 of 600 autopsies (*7*), but to date nephrectomy remains the most frequent cause of single kidney loss (*8*). Some of these single kidney patients may eventually develop RAS, which puts them at high risk for renal insufficiency.

Patients with RAS in a solitary kidney are particularly interesting since they correspond to the 1K,1C experimental model. Unlike the two-kidney, one-clip (2K,1C), model where the renin-dependency of blood pressure elevation has already been demonstrated (*5*), 1K,1C hypertension has been regarded as a volume-dependent form of hypertension (*9*).

These physiopathological considerations are particularly important when dealing with captopril renography, since the diagnostic efficacy of captopril renal scintigraphy depends on the capacity of captopril to unmask renin-angiotensin system activation. Indeed, captopril renal scintigraphy's role in patients with a single kidney has yet to be proved, whereas observations in experimental models are contradictory (*5,10*).

Nevertheless, in our patient, captopril renal scintigraphy strongly suggested the renin-dependency of this patient's hypertensive state, and postangioplasty renography was apparently normalized. This finding is in line with beneficial clinical response to revascularization.

His blood pressure decreased rapidly after intervention and at 12-mo follow-up the patient was considered cured.

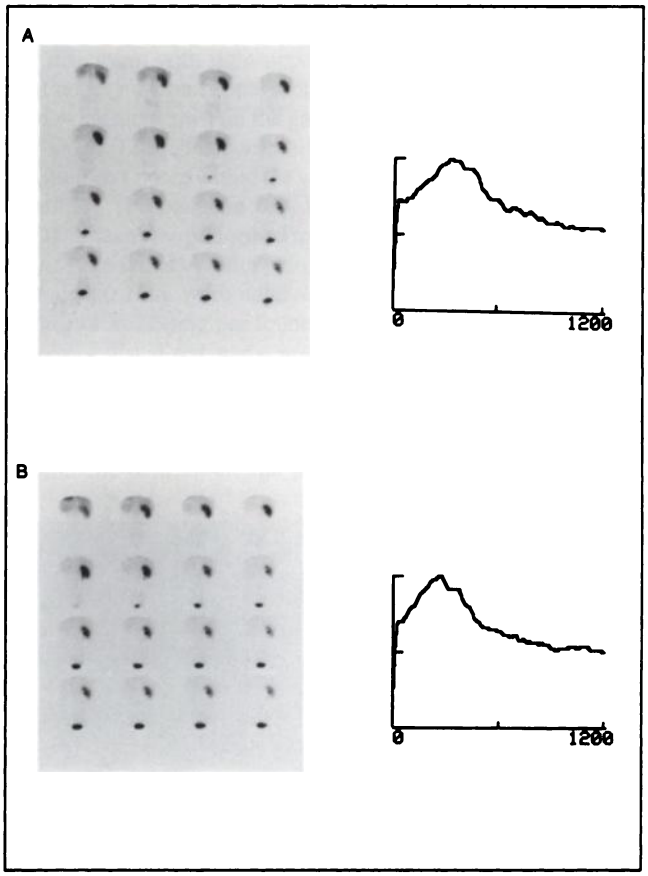

FIGURE 3. Postangioplasty scintigraphic study resulted in normal baseline conditions before and after captopril administration (A-B). This confirms complete restoration of right kidney function (Baseline: parenchymal transit time = 203 sec; time to maximum counts = 300 sec; retained cortical activity = 52%. After captopril: parenchymal transit time = 171 sec; time to maximum counts = 250 sec; retained cortical activity = 48%).

This proves that the renin-angiotensin system played a central role in causing hypertension.

In conclusion, the presence of a solitary kidney does not necessarily prevent RVH from being successfully diagnosed by captopril renography.

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