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# Segmental Branch Renal Artery Stenosis Diagnosed with Captopril Renography

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There have been only a few reports of post-Captopril renography diagnosing segmental renal arterial stenosis. These previous case reports have involved an accessory renal artery when multiple renal arteries were present. This case report describes Captopril-induced segmental dysfunction due to an intrarenal branch stenosis of a single renal artery.

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Captopril renography has been found useful for the noninvasive diagnosis of renin-dependent renovascular hypertension. Most reports to date have described captopril-induced unilateral or bilateral deterioration in renal function with angiotensin-converting enzyme inhibition in patients with main renal artery stenosis. There have been a few case reports describing the use of captopril renography to diagnose stenosis of an accessory renal artery when multiple renal arteries are present. This case report describes captopril-induced segmental dysfunction due to a branch stenosis of a single renal artery.

## CASE REPORT

A 74-yr-old obese black female with a past history of hypertension, coronary artery disease, peripheral vascular disease, and a cerebral vascular accident, presented with lightheadedness and new onset atrial fibrillation. She had not been taking any medications for at least 2 mo. On admission the patient was in no acute distress but was noted to have a blood pressure of 200/124 mm Hg and a irregular ventricular heart rate of 160. No lumbar or abdominal bruits were appreciated. The serum creatinine was 0.7 mg/ml. During hospitalization, the patient's rapid atrial fibrillation was controlled with digoxin and her blood pressure with hydrochlorothiazide and methyldopa.

Captopril renography was ordered to rule out renal artery stenosis as a cause for her hypertension. Her antihypertensive medications noted above were not discontinued. The patient received 25 mg of Captopril by mouth and was hydrated with 500 cc of intravenous half-normal saline during 1 hr of observation. Baseline blood pressure was 142/84; after Captopril it fell

to 102/70, then stabilized at 116/72 at 1 hr. Renography was then performed with 15 mCi  $^{99m}\text{Tc}$ -DTPA using a large field of view camera with an all-purpose, parallel-hole collimator. The flow study was acquired on the computer as 1-sec frames for 1 min. Dynamic imaging was acquired as 30-sec frames for 30 min (Fig. 1A). Iodine-131-hippuran was then administered intravenously immediately followed by 20 mg of Lasix. A high-energy collimator was used. Sixty-second frames were acquired on the computer for an additional 30 min (Fig. 2A). Since the Captopril study was abnormal, the patient had a repeat  $^{99m}\text{Tc}$ -DTPA and  $^{131}\text{I}$ -hippuran study performed without Captopril the following days (Figs. 1B, 2B). Time-activity curves were generated (Fig. 3). One week later renal angiography was performed (Fig. 4).

As a result of this patient's multiple medical problems and a recent history of a cerebral vascular accident, as well as the complex nature of her lesions, her clinicians felt that she was not a candidate for invasive treatment of her renal vascular hypertension. Therefore, she was discharged from the hospital and her blood pressure was controlled with antihypertensive medication.

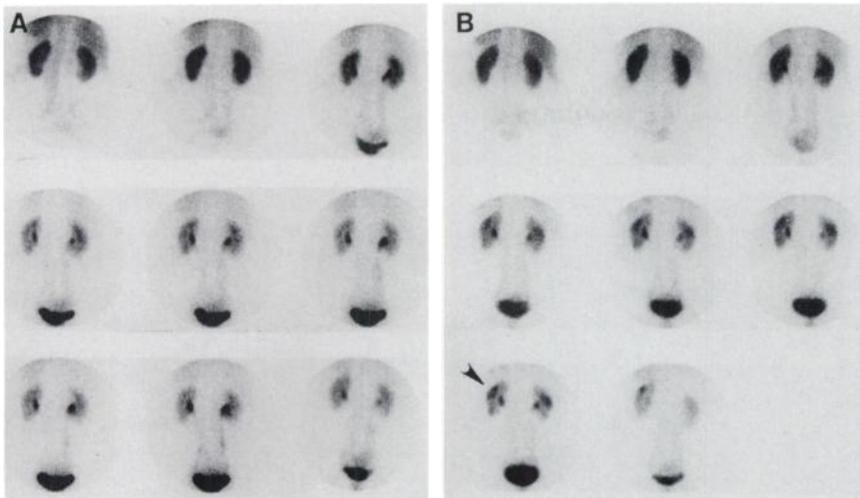
## DISCUSSION

Captopril renography has proven very useful for the diagnosis of renin-dependent renal artery stenosis (1-5). Most studies to date have reported a post-Captopril-induced global decrease in unilateral or bilateral renal function which has correlated with main renal artery stenosis on angiography. However, few reports have diagnosed renal vascular hypertension due to segmental renal arterial occlusions. There have been three recent reports of post-Captopril studies diagnosing segmental disease secondary to a stenosis of an accessory renal artery (6-8). This case report describes Captopril-induced segmental dysfunction due to an intrarenal branch stenosis of a single renal artery.

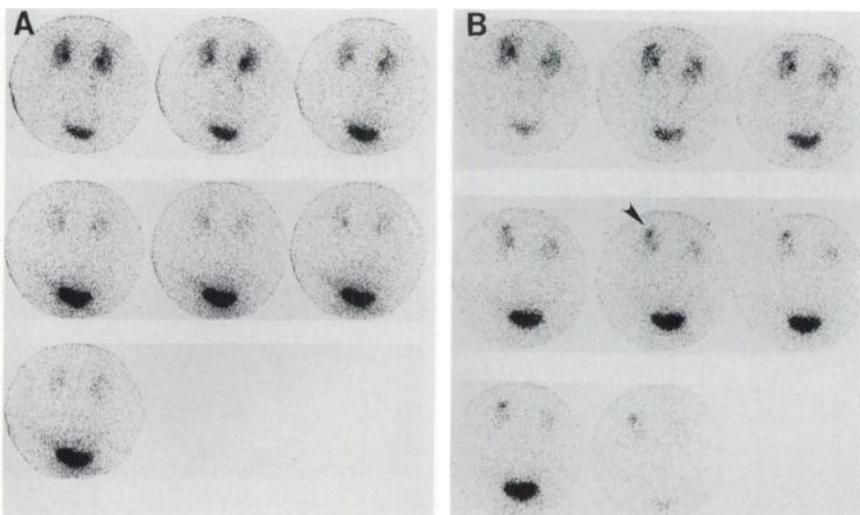
Segmental renal artery stenosis has been reported to occur in 11% of patients in one large angiographic series (9). However, it seems to be uncommonly detected with Captopril renography. This may be due to the inability of radionuclide renography to detect small regions of dysfunction or to the fact that the lesions are not often renin-dependent. The diagnosis in this patient was initially made by visual inspection of the images. Routine whole-kidney time-activity curves were not remarkable (Fig. 3, top). However, segmental regions of interest were useful in confirming the post-Captopril regional delay in clearance in the left kidney (Fig. 3, middle, lower). The less certain abnormality seen in the right kidney, which cleared post-

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**FIGURE 1.** (A) Pre-Captopril  $^{99m}\text{Tc}$ -DTPA 5-min per frame sequential images show normal uptake and washout of both kidneys. (B) Post-Captopril images show a focal area of delayed clearance in the superior pole of the left kidney (arrow-head). Another area of delayed clearance is seen in the right kidney, however it clears post-voiding.

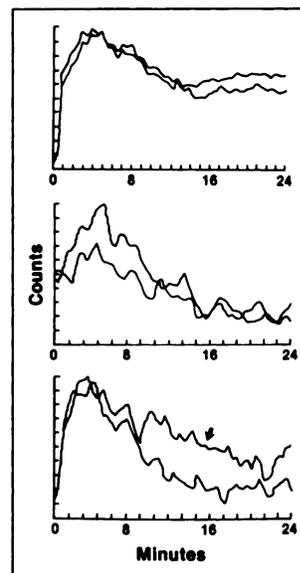


**FIGURE 2.** (A) Pre-Captopril  $^{131}\text{I}$ -hippuran 5-min sequential images show normal uptake and clearance. (B) Post-Captopril images show a focal area of delayed clearance in the superior pole of the left kidney (arrow-head).

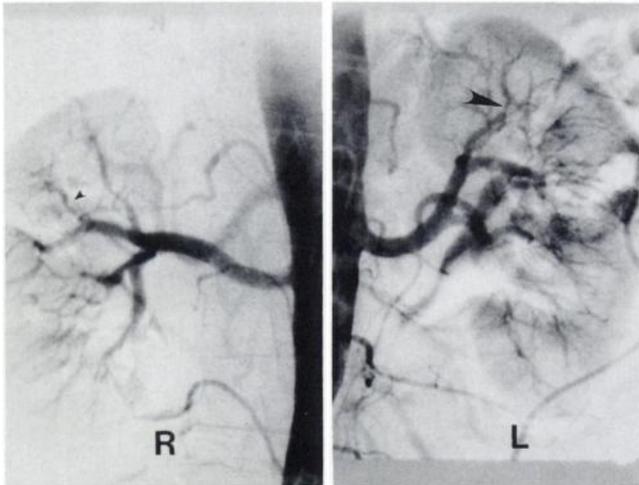
voiding, could not be similarly confirmed with regional time-activity curves and was not clearly seen on the  $^{131}\text{I}$ -hippuran study, although angiographic correlation suggested a similar problem on the right.

There has been some disagreement as to the radiopharmaceutical agent of choice for diagnosing renal vascular hypertension via Captopril renography (1,3,5). This case report demonstrated segmental delayed clearance with both  $^{99m}\text{Tc}$ -DTPA and  $^{131}\text{I}$ -hippuran in the left kidney, but only a  $^{99m}\text{Tc}$ -DTPA abnormality on the right. Recent studies now suggest that the new renal radiopharmaceutical,  $^{99m}\text{Tc}$ -MAG3, may also be useful for detecting renin-dependent renal vascular hypertension (10).

The therapy for main renal artery stenosis is not always applicable for treatment of intrarenal branch arterial stenosis. Vascular reconstruction used for main renal artery stenosis is technically difficult in such patients (11). However, surgical techniques for intrarenal disease are expanding. Novick has attempted microvascular techniques in branch stenoses (12). Patients who are not candidates for



**FIGURE 3.** (Above) Post-Captopril  $^{99m}\text{Tc}$ -DTPA whole kidney time-activity curves show no differences between the right and left kidneys. The pre-captopril study was similar. The  $^{131}\text{I}$ -hippuran curves were also similar. (Middle) Baseline study without Captopril. Two regions of interest were drawn for the left kidney, one of the upper pole and another for the lower pole. The curves show a similar time to peak and clearance rate. (Below) Post-Captopril study. The same two regions of interest, as in Figure 3 (Middle) were drawn for the left kidney, one for the upper pole and another for the lower pole. The upper pole curve (arrow-head) shows delayed clearance compared to the left lower pole.



**FIGURE 4.** Renal angiogram with digital subtraction shows a stenotic lesion (large arrowhead) in a segmental branch of the left renal artery that corresponds to the functional abnormality seen on the  $^{99m}\text{Tc}$ -DTPA and  $^{131}\text{I}$ -hippuran studies. A stenotic lesion is also seen on the right (small arrowhead), which corresponds to the area of possible delayed clearance seen on the  $^{99m}\text{Tc}$ -DTPA study (Fig. 1B).

invasive procedures are generally controlled on antihypertensive therapy.

In summary, this case report illustrates that Captopril renography can detect renin-dependent segmental branch renal artery stenoses. These can be detected visually, how-

ever, regional time-activity curves may be useful in confirming the diagnosis.

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