Annals of Nuclear Medicine Vol. 5, No. 4, 163–165, 1991

Phantom kidney: A CT correlation

Teruhito MOCHIZUKI, Martin CHARRON, Ajit N. SHAH and W. Newlon TAUXE

Department of Radiology, Division of Nuclear Medicine, University of Pittsburgh School of Medicine

The phantom kidney is a "kidney-like" apparition which may be seen in dynamic renal scintigraphy typically in post-nephrectomy patients or in patients with unilateral renal agenesis. We report a case of a phantom kidney demonstrated in the angiographic phase of renal scintigraphy with ^{99m}Tc-dimercaputosuccinic acid (^{99m}Tc-DMSA) in a patient who was nephrectomyzed 14 years previously. After comparison with the CT images, we conclude that our patient's finding was caused by an increased mesenteric vascularity, possibly post-prandial. Several conditions which may cause the phantom kidney effect, have been reported, but increased mesenteric vascularity seems to be the most common cause.

Key words: technetium-99m-DMSA, renal scintigraphy, nephrectomy, phantom kidney

INTRODUCTION

DYNAMIC RENAL SCINTIGRAPHY is a widely used routine test in nuclear medicine. The angiographic phase is usually included in the test and is helpful in evaluating renal blood flow. In a test of a nephrectomyzed patient or of a patient with agenesis, we may see "kidney-like" vascularity in the renal bed. At times, this finding could easily be misinterpreted as a kidney, perhaps with reduced function. Awareness of this phenomenon could help in avoiding such a mistake. This phantom kidney is probably fairly common.

CASE REPORT

A nineteen-year-old male received left nephrectomy at the age of five due to Wilms' tumor. Though the patient had no symptoms, he was being followed up to rule out possible tumor recurrence, since his right kidney was observed to have an irregular shape by ultrasound and CT. A renal scintigraphic study using ^{99m}Tc-dimercuputosuccinic acid (^{99m}Tc-DMSA) was performed for that purpose. The patient was laid in a supine position on the imaging table and the data were acquired posteriorly with a gamma-camera equipped with a low energy general purpose collimator (Starcom, GE). Immediately after the intravenous administration of 185 MBq (5 mCi) of ^{99m}Tc-DMSA, the first set of data, i.e. for the angiographic phase, was acquired at one second per frame for one minute, then reformatted first to sequential four second images to evaluate vascularity. The second set of images, i.e. for static phase was acquired two hours later posteriorly.

The first angiographic phase depicted the "kidney-like" vascularity on the left below the spleen (Fig. 1-a–1-c). In the second or static phase, the "phantom kidney" disappeared and only the right kidney became evident (Fig. 1-d). The comparative CT demonstrated a mass like small bowel in the left renal bed and a normal sized spleen in the normal position. No other vascular lesions such as recurrent tumor, inflammation or scar which might cause the phantom kidney were observed (Fig. 2).

DISCUSSION

Phantom kidneys have been reported sporadically in case reports on the use of different kinds of radiopharmaceuticals and have been attributed to radioactivity in the vasculature of the mesentery[1,2] or the spleen.[3,4] There is only one citation available in the literature where the cause of the phantom kidney

Received May 22, 1991, revision accepted July 26, 1991.

For reprints contact: Teruhito Mochizuki, M.D., Radiology, Ehime University School of Medicine, 454-Shitsukawa, Shigenobu-cho, Onsen-gun, Ehime 791-02, JAPAN.

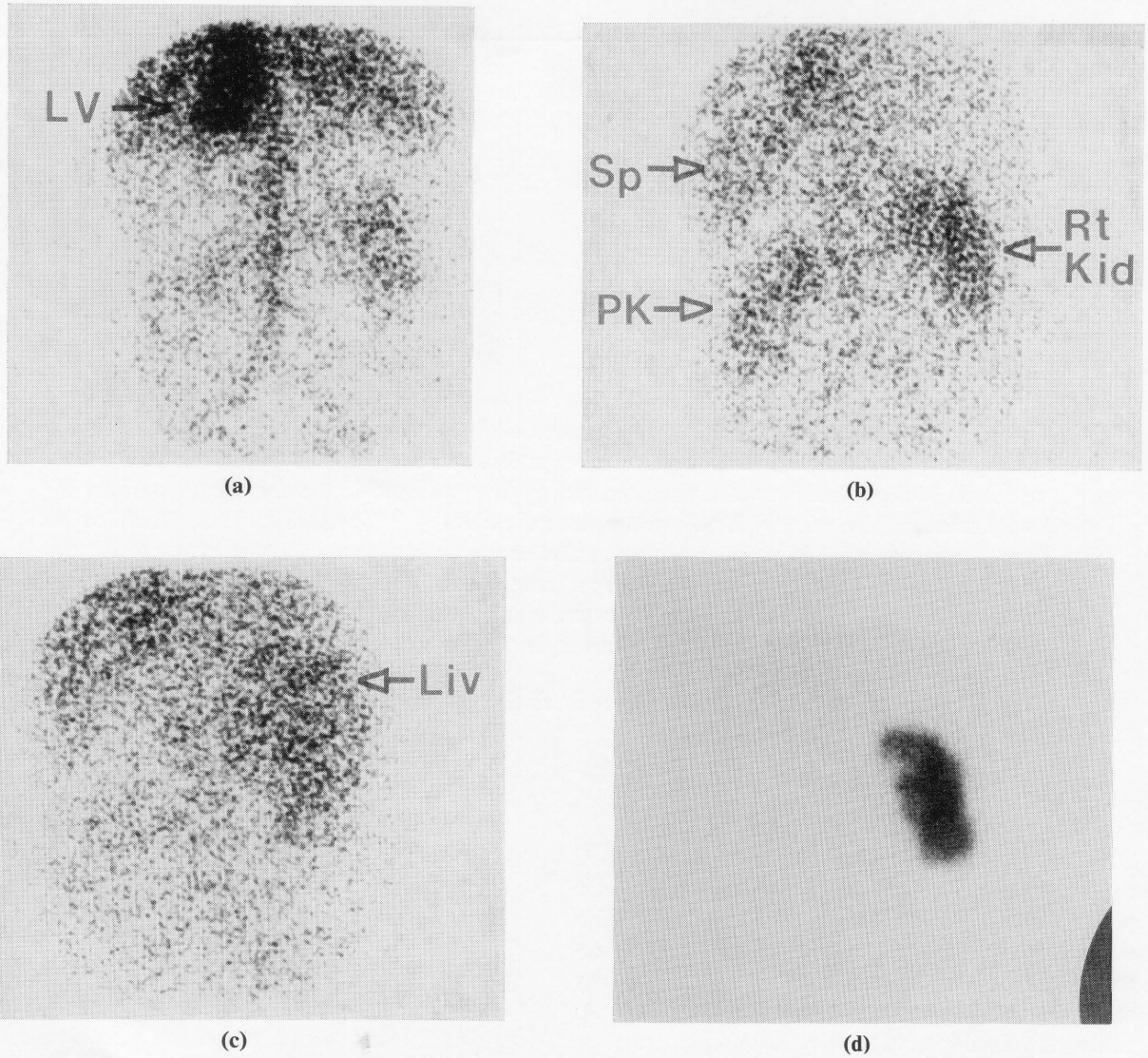
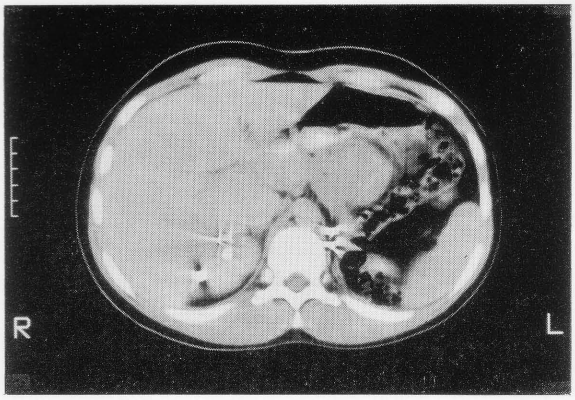


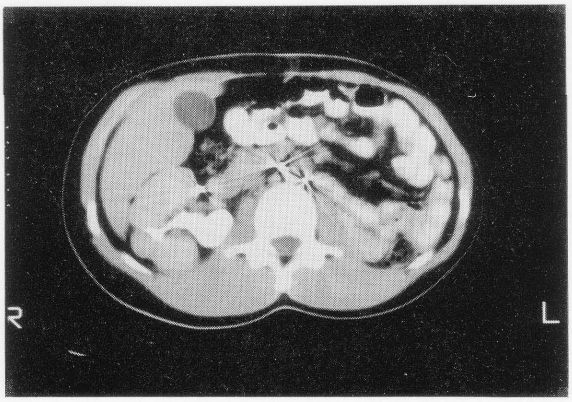
Fig. 1 A ^{99m}Tc-DMSA renal scintigram of the patient. An early arterial phase demonstrates the lungs, left ventricle (LV), aorta, right kidney, and "kidney-like" vascularity over the left renal bed where no kidney was known to exist (a). In the middle arterial phase, this "phantom kidney" (PK) is more evident: splenic vascularity (Sp) can be clearly distinguished (b). In the venous or portal phase, the "phantom kidney" became obscure and the liver (Liv) activity becomes prominent (c). The activity follows the pathway of the blood in the portal system from the aorta to the mesentery to the liver. In the static phase, the "phantom kidney" has disappeared and only the right kidney is evident (d).

was sought by analyzing multiple cases. Merisky et al.[5] surveyed 39 nephrectomyzed patients, and found 13 phantom kidneys in 22 left nephrectomyzed patients and four in 17 right nephrectomyzed patients. The time duration between the nephrectomy and the renal scintigraphy varied from four weeks to nineteen years. They stated that in their series the phantom kidneys were clearly distinguishable from the splenic or mesenteric flow. Splenic activity was ruled out as a cause of the apparition, since both the splenic and renal activities were clearly visualized in all of the cases. This may validate our estimation that the splenic activity is a rare cause of the phantom kidney. However, there is no persuasive verification as to how they ruled out mesenteric vascular activity as a possible cause. They concluded that the cause of the phantom kidney was difficult to explain but probably was due to the "shine through" of non-specific blood pool activity.

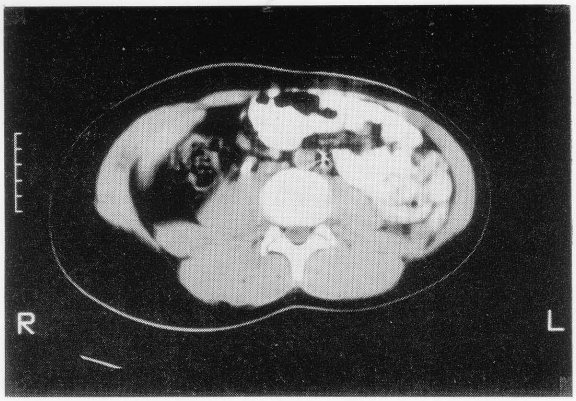
From a thorough comparison with the CT images, we believe that our phantom kidney was caused by radioactivity arising in the mesentery of the small bowel for the following reasons. The following are the indirect manifestations: (1) The mesenteric ac-



(a)



(b)



(c)

Fig. 2 Contrast enhancement CT images. At the level of the upper pole of the right kidney, a normal sized spleen is seen in the normal position and the colon is seen to occupy the upper part of the space formerly occupied by the left kidney (a). At the middle level of the right kidney, the small bowel occupies the space (b). At the level of the lower edge of the liver and just below the right kidney, the small bowel is evident simulating a mass; this level is the center of the "phantom kidney" (c) (cf. Fig. 1-b). No other cause such as recurrent tumor, inflammatory mass or scar tissue, which may cause the "phantom kidney", is likely.

tivity seems to have enough vascularity to be detected in the angiographic phase of the renal scintigraphy; a) Small bowel wall enhancement in successfully performed dynamic CT is one of the proofs of its prominent vascularity among the visceral organs and it is significantly higher than the enhancement from the non-specific blood pool, b) Often mesenteric activity is observed in the angiographic phase of follow up studies of patients after renal transplantation: (2) In CT images, as seen in our case and in two cases demonstrated by Merisky et al.[5] the small bowel appears like a mass in the renal bed: (3) Gastric activity caused by the free Tc-99m or I-131 would have produced a quite different pattern from what we observed: (4) The appearance of incidental vascular tumors in this area is so rare that it is not to be considered seriously in the different diagnoses, but in our case a tumor was ruled out by CT: (5) Inflammatory lesions or hyperemia at the incision site are unlikely to cause the phantom kidney since many of them are observed long after nephrectomy or in patients with agenesis of the kidney where none would be expected. The left side prominence in the study of Merisky et al.[5] (L: 13/22, R: 4/17) may reflect the fact that the mesentery in the larger (left) renal bed is more prominent than that in the smaller (right) bed.

Probably most of the phantom kidneys are caused by mesenteric vascularity and the phenomenon is more likely to be encountered in the postprandial state.

ACKNOWLEDGMENT

The authors gratefully acknowledge the assistance of Ms. Judith K Holden in preparing the manuscript.

REFERENCES

1. Rambler LE, Winter PF, Johnson PM: Mesenteric vasculature masquerading as a kidney at renal imaging. *Radiology* 120: 369–370, 1976
2. Holmes ER III, Klingensmith WC III, Kirchner PT, et al: Phantom kidney in technetium 99m DTPA studies of renal blood flow: case report. *J Nucl Med* 18: 702–705, 1977
3. Lin DS. Phantom kidney on perfusion renal imaging. *Semin Nucl Med* 14: 59–61, 1984
4. Chu DDM, Belzberg AS: Phantom kidney on renal scintigraphy. *Clin Nucl Med* 16: 62–63, 1991
5. Merimsky E, Greenstein A, Baron J, et al: Phantom kidney: a pitfall in radionuclide study of urinary tract. *Urology* 30: 85–87, 1987
6. Mochizuki T, Fabiszewski NW, Shah AN, et al: Mischief of free Tc-99m in DTPA renal study. *Clin Nucl Med* 16: 455–456, 1991
7. McKusick KA, Malmud LS, Kirshner PT, et al: An interesting artifact in radionuclide imaging of the kidneys. *J Nucl Med* 14: 113–114, 1973