

Scintigraphic demonstration of renal cell carcinoma with I-131-6 β -iodomethyl-19-norcholesterol: A case report

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Extraadrenal abnormal uptake on adrenocortical scintigraphy has been reported rarely in the normal gallbladder, lipid cell tumor of the ovary, or in clear cell type renal cell carcinoma. Clear cell type renal cell carcinoma contains glycogen and cholesterol like the adrenal gland, but the uptake of the radionuclide I-131 cholesterol has been reported to be low and not sufficient to image it. Right renal and adrenal masses were incidentally discovered on abdominal CT scan in a patient with chronic renal failure resulting in bilateral acquired cystic kidney disease. Adrenocortical scintigraphy done to know the nature of the adrenal mass showed high uptake corresponding to the right renal mass and the right adrenal mass. Clear cell type renal cell carcinoma and adrenal adenoma with prominent clear cells were histologically confirmed on hematoxylin-eosin stain and in an immunohistochemical study with renal cell antibody. Not only low-density lipoprotein receptors mediated uptake but also overall replacement of the right non-tumorous renal parenchyma by acquired cysts may have played a role in imaging the renal cell carcinoma on adrenocortical scintigraphy.

Key words: adrenocortical scintigraphy, renal cell carcinoma, adrenal adenoma

INTRODUCTION

THE RADIOLABELED ANALOGUE I-131-6 β -iodomethyl-19-norcholesterol (I-131cholesterol) is transported like native cholesterol in the circulation and binds to low-density lipoprotein (LDL) receptors in adrenocortical cells. It has been clinically useful in differentiating adrenal adenoma from nonadenoma such as carcinoma or metastasis. Clear cell type renal cell carcinoma contains glycogen and cholesterol like the adrenal gland, but uptake of the radionuclide I-131 cholesterol has been reported to be low and not sufficient to image it.¹ We report a case where renal cell carcinoma was well demonstrated on I-131 cholesterol scintigrams.

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CASE REPORT

This case is a 50-year-old female with chronic renal failure resulting in acquired cystic kidney disease. She had been on hemodialysis since 1980. In 1990, she had parathyroidectomy with implantation of parathyroid tissue in the soft tissue of the forearm. In May 1998, she was admitted to our hospital for work-up of high serum amylase levels. The laboratory data on admission were: RBC $3.45 \times 10^6/\text{mm}^3$, WBC $5.05 \times 10^3/\text{mm}^3$, serum creatinine 11.07 mg/dl (0.4-1.1), BUN 72 mg/dl (8-21), Na 139.0 mEq/L (136-152), K 5.31 mEq/L (3.5-5.0), and serum amylase 352 U/ml (52-150). A CT scan was performed to check for pancreatic disease. Noncontrast CT revealed a 4 cm low attenuation mass relative to the muscle in the right acquired cystic kidney. Contrast CT (Fig. 1) showed enhancement of the mass and a centrally non-enhanced area probably that of necrosis. A well-defined inhomogeneous right adrenal mass, 4 cm in size, was also revealed on precontrast CT scan and was inhomogeneously enhanced after contrast administration (Fig. 2). No abnormality in the pancreas was noted. To



Fig. 1 The right renal mass that was low in attenuation on precontrast CT scan is shown here on the postcontrast CT scan to be well-enhanced except in the central area (arrow). Note also both kidneys overall replaced by multiple acquired cysts and a small solid mass (curved arrow) in the left kidney which is followed.

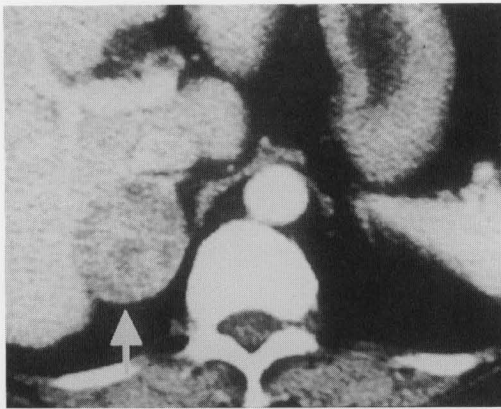


Fig. 2 The low attenuation right adrenal mass on precontrast CT scan is shown here to be inhomogeneously enhanced on postcontrast CT scan (arrow).

know the nature of this adrenal mass, adrenocortical scintigraphy was done and serum adrenal hormone levels were measured. Adrenocortical scintigraphy was performed 7 and 10 days after injection of 37 MBq I-131-6 β -iodomethyl-19-norcholesterol without dexamethasone suppression. Posterior and anterior images of the abdomen were taken with a GE MAXXUS (General Electric Medical System, Milwaukee, WI) two-headed gamma camera and high energy parallel hole collimator with a preset time of 15 minutes on 7 days and 17 minutes on 10 days after injection and a 512 \times 512 matrix. An adrenocortical scintigram (Fig. 3) showed concordant uptake in the right adrenal consistent with an adrenal adenoma. Surprisingly uptake of the radionuclide in the right kidney was also noted. The serum aldosterone showed an increased level of 1,700 pg/ml (normal value 56–150). A preoperative diagnosis of right renal cell carcinoma and

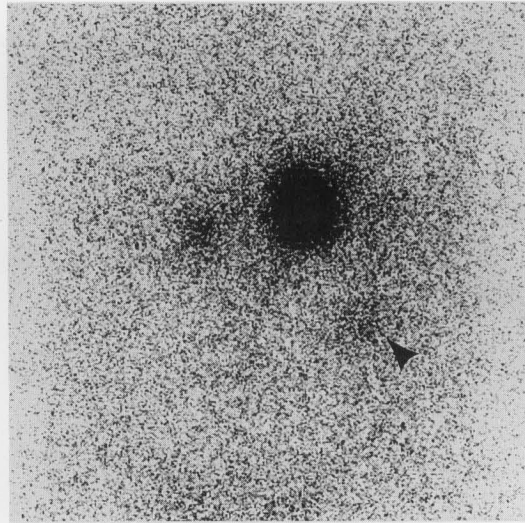


Fig. 3 Adrenocortical scintigraphy (posterior view) 10 days after injection of I-131 cholesterol shows marked uptake of radiotracer of the right adrenal mass compared to the normal left adrenal. A high uptake (arrowhead) of I-131 cholesterol is noted corresponding to the right renal mass.

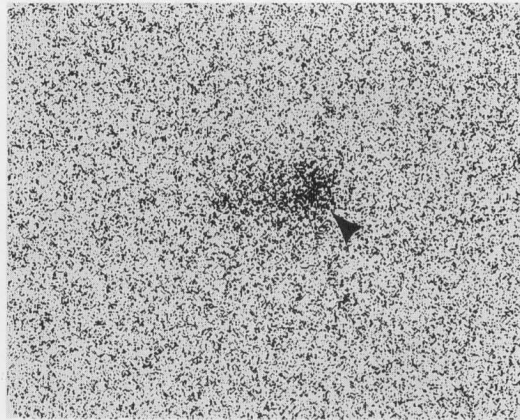


Fig. 4 A scintigram of the surgically resected right kidney taken soon after operation reveals high uptake (arrowhead) corresponding to the renal mass.

primary aldosteronoma of the right adrenal gland was made. Right nephrectomy and right adrenalectomy were done 6 days after the adrenocortical scintigraphy. Clear cell type renal cell carcinoma in the right renal mass and adrenal adenoma with prominent clear cells and hemorrhage in the right adrenal mass were pathologically diagnosed on hematoxylin-eosin stain and immunohistochemical stain with renal cell antibody. A scintigram of the surgically resected right kidney taken soon after operation showed radionuclide uptake of the renal mass (Fig. 4).

DISCUSSION

The radionuclide analogue I-131-6 β -iodomethyl-19-

norcholesterol has been clinically useful in differentiating adrenal adenoma from nonadenoma such as carcinoma or metastasis. It is transported like native cholesterol in the circulation bound to low-density lipoprotein (LDL), binds to LDL receptors on adrenocortical cells, and is subsequently internalized and esterified, but unlike cholesterol, is not metabolized and remains within the adrenal gland.² Hyperfunctioning zona glomerulosa tissue has stronger uptake of the radiolabeled cholesterol than normal functioning cells and adrenocortical scintigraphy although not absolute is highly sensitive in detecting a hyperfunctioning adrenal mass.³

Abnormal uptake on adrenocortical scintigraphy has been reported in the normal gallbladder,⁴ clear cell type renal cell carcinoma⁵ and lipid cell tumor of the ovary⁶ as well as adrenal adenoma. In the present case, no accumulation in the gallbladder was seen in the anterior view in adrenocortical scintigraphy. The possibility of accumulation of I-131 cholesterol in the non-tumorous renal parenchyma is less likely because both kidneys are completely replaced by multiple acquired cysts.

In the case presented here, there is definite uptake in the right renal cell carcinoma, and to our knowledge, only one case has been reported before.⁵ Generally, adrenocortical scintigraphy is not done as a work-up for patients with renal disease, so we do not really know if it is rare after all. Clear cell type renal cell carcinoma histologically has high glycogen and cholesterol content, particularly esterified cholesterol, and approaches that of the adrenal gland. Clayman et al.,¹ in their investigation of 5 cases of clear cell type renal cell carcinoma, on the uptake and release of intravenously injected I-131 cholesterol, demonstrated tissue uptake of renal cell carcinoma even if it was less than adrenal tissue and not sufficient to image it. Tumor cells in renal cell carcinoma have been found to have low LDL receptor-mediated uptake or none at all, but they also showed that there was significantly slower efflux from renal cell carcinoma tissue than from the normal kidney. Rudling and Collins⁷ have shown that despite the great accumulation of cholesterol in human renal cell carcinoma, LDL receptors at the mRNA level are reduced. And no increase in the activity or efficiency of these LDL receptors was demonstrated. They suggested that maybe there are other pathways of transport of cholesterol in human renal cell carcinoma. In their set of 29 cases, however, 9 (31%) were found to have higher levels of LDL receptors than in normal kidney tissue. In our present case, and as Tsukamoto et al.⁵ have reported, the renal cell carcinoma may have had sufficient LDL receptors to be able to accumulate enough radiolabeled cholesterol for it to be imaged on adrenocortical scintigraphy. We could not, however, prove this because no immunohistochemical study was done on LDL receptor. Overall replacement of the right non-tumorous renal parenchyma by acquired cysts may also have played a role

in imaging the renal cell carcinoma on adrenocortical scintigraphy.

In the diagnosis of a nonhyperfunctioning adrenal mass, concordant uptake on adrenocortical scintigraphy usually signifies the benign nature of the mass, such as adrenal adenoma or nodular hyperplasia, whereas a discordant pattern indicates a destructive or space-occupying nonadenomatous lesion including primary and metastatic malignancy.^{2,8,9} Nevertheless, cases of clear cell type renal cell carcinoma metastasis to the adrenal have recently been reported to accumulate radionuclide I-131 cholesterol.⁵ When there is concordant uptake in the nonhyperfunctioning adrenal mass, regardless of the uptake in renal cell carcinoma in patients with clear cell type renal cell carcinoma, an isolated adrenal metastasis from clear cell type renal cell carcinoma, the presence of a metastatic focus within or adjacent to an adrenal adenoma, as well as an adrenal adenoma, should be included in the differential diagnosis.

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