Management of Renal Cell Carcinoma: Evaluation of Renal Masses by Modern Radiological Techniques

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The utility of ultrasound and computed tomography is compared to angiography and that of nephrotomography in the study of renal masses. Ultrasound and computed tomography, noninvasive methods, are replacing nephrotomography and, in some cases, angiography.

Diagnostic radiological support for the urologist and his patient, confronted with a possible renal neoplasm, is still based on the scout radiograph of the abdomen and the excretory urogram including tomography, with the renal angiogram providing the final standard. As the use of tomography associated with excretory urograms increases, nephrotomography as a separate procedure is not used as often. However, the new modalities of ultrasound (US) and computed tomography (CT) do challenge angiography in all cases and increasingly render angiography unnecessary. When a classical cyst can be demonstrated by CT or US, it can be followed either with serial examinations or it can be aspirated under ultrasound, CT or conventional fluoroscopic guidance. Fine needle aspiration biopsy of renal and pararenal areas with US or CT guidance is easily and safely performed.

Reports of delineation of renal tumor extension into the renal vein and inferior vena cava by US and CT are now in the literature. CT is able to reliably delineate extension of tumor into the peri- and pararenal spaces. Assisting in the preoperative assessment at the initial examination, these methods may also demonstrate metastases to abdominal lymph nodes and the liver.

Case Reports

Case 1

A 43-year-old woman was found to have a 4 x 9 cm mass in the right lumbar region. The urogram demonstrated a right renal mass arising from the lower pole. US studies (Figures 1A and 1B) showed an irregular, primarily cystic mass with echoes in its dependent portion. The CT examination (Figure 2) showed the mass to be smoothly rounded but with a wall nearly 1 cm thick in most areas and 2.5 cm thick in a crescent (arrow) medially and posteriorly. While most of the wall is thicker than a renal cyst, the localized marked thickening adjacent to the kidney indicated a tumor. The attenuation of the central portions of the mass indicated fluid. When a right renal nephrectomy and subsequent pathological studies were performed, a renal cell carcinoma was found. It was partially cystic, with a tough fibrous capsule, and with the tumor 2.5 cm long lying in the medial and posterior portions adjacent to the kidney.
Figs. 1A and 1B. Case 1.
Ultrasound examination of the right kidney. 1A. Longitudinal supine scan 7 cm to the right of the midline shows an irregular, primarily cystic mass (M) in the lower pole of the kidney (K). Echoes in the anterior portion of the mass are artifactual (L-liver). 1B. Transverse supine scan 3 cm cephalad to the iliac crest shows echoes in the dependent portion of the cystic mass suggesting that this is not a simple cyst.

Fig. 2. Case 1.
Computed tomography of the right kidney showing thick-walled cyst with tumor crescent (arrow).

Fig. 3. Case 2.
Tomogram of the right kidney reveals a 3 cm mass originating in the lower pole of the right kidney. Peripheral calcification is barely detectable.
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Case 2
A 75-year-old man complained of urinary retention and was found to have prostatic hypertrophy. Tomography done in conjunction with the excretory urogram (Figure 3) showed a deformity of the right renal outline with a 3 cm mass protruding from the lateral margin of the lower pole; slight calcification in the periphery of the mass was also barely visible. CT (Figure 4) confirmed the presence of a solid mass. The mass enhanced after intravenous contrast infusion, but it showed less density than the rest of the kidney. Pathological study of the resected specimen revealed a renal cell carcinoma.

Case 3
A 77-year-old man presented with pain in the left groin and left scrotal swelling. A plain film of the abdomen showed a mass in the left upper quadrant and enlargement of the left kidney. A urogram confirmed the presence of a mass in the lower pole of the left kidney, and the tomograms suggested a cyst since the center of the lesion did not become more dense. A 3 cm cyst in the upper pole of the left kidney and three small defects in the cortex of the right kidney were also demonstrated. US examination (Figure 5) revealed a 6 cm cyst along the midlateral aspect of the kidney. In the lower pole, adjacent to the cyst, a 6 cm irregular, solid mass compatible with a renal cell carcinoma was identified. A renal angiogram (Figure 6) confirmed the tumor. The left radical nephrectomy specimen included a 6 cm tumor mass largely extrarenal but still confined by the capsule. In the lateral portion of the left kidney a 6 cm cyst and two additional smaller cysts were noted. The lymph nodes were unremarkable.

Fig. 4. Case 2.
Computed tomography without contrast (A and B): The tumor is seen projecting posterolaterally from the right kidney. Computed tomography with contrast (C and D): The calcific rim of tumor is clearly seen (D) at a narrow window setting. Note the relative lack of enhancement of tumor.
Discussion

One advantage of US over CT is that it has no known, significant biological effects when administered to living tissue in diagnostic amounts. CT, by contrast, delivers ionizing radiation in amounts comparable to those of other diagnostic radiological examinations. Ultrasound has another advantage in that longitudinal and oblique sections can be produced with the same ease as the transverse sections. While CT can also construct these projections, additional radiation and special computer programs are required. Ultrasound on the other hand, is greatly handicapped by gas within the intestines because the beam is not transmitted through the gas. However, since the kidneys normally lie adjacent to the posterior abdominal wall, they usually can be delineated by scanning in the prone position. In some patients, overlying ribs may limit the examination.

In patients who have very little body fat visceral outlines are much less readily seen by CT, whereas with US this difficulty does not occur. However, rarely do patients have so little fat that renal outlines cannot be discerned at all.

Some advantages of CT are that it can detect minimal calcifications better than US, and it can give an absolute attenuation measurement which distinguishes fluid from solid organs and from fat. The resolution obtained by CT scanning is greater than that provided by US. Thus, smaller structures can be imaged. The peripelvic region is often better visualized by CT; the renal pelvis and calyces en-
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hance greatly after contrast, whereas other masses in this region will not. The fascial planes about the kidney can be imaged—a rather unique feature of CT which may prove useful in determining tumor extent.

The risk associated with the intravenous infusion of contrast media for computed tomography is similar to that for excretory urography.

Conclusion

In most cases, the US examination should be done before CT. If a cyst is detected by US, it is not necessary to employ CT or angiography. If the US examination reveals a solid lesion or is inconclusive, CT can be used to resolve any remaining questions. However, when solid nodules less than 3 cm in diameter are found by urography, CT should be performed first since the resolution of US for such small structures is inferior to CT. The use of nephrotomography as an independent procedure has decreased. As the use of US and CT becomes more widespread, a decrease in the use of angiography for diagnosis is anticipated also. However, angiography, in association with preoperative embolization of renal neoplasm to assist in control of blood loss at surgery, is very promising.

References
