

tioning, from metastases. In this series of pathologically proven adrenal lesions, threshold values for size and attenuation correctly classified all metastatic adrenal lesions while still maintaining a relatively high sensitivity. Masses exceeding these thresholds may still be benign and are therefore best evaluated by percutaneous biopsy if long-term sta-

bility cannot be documented and metastatic disease in the adrenal gland is of clinical concern.

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#### REFERENCES

1. Glazer HS, Weyman PJ, Sagel SS, Levitt RG, McClellan BL. Nonfunctioning adrenal masses: incidental discovery on computed tomography. *Am J Roentgenol* 1982; 139:81-85.
2. Robbins SL, Cotran RS. Pathologic basis of disease. 2nd ed. Philadelphia: WB Saunders Company, 1979.
3. Oliver TW Jr, Bernardino ME, Miller JL, et al. Isolated adrenal masses in non-small-cell bronchogenic carcinoma. *Radiology* 1984; 153:217-218.
4. Lee MJ, Hahn PF, Papanicolaou N, et al. Benign and malignant adrenal masses: CT distinction with attenuation coefficients, size, and observer analysis. *Radiology* 1991; 179:415-418.
5. Husband JE, Hawkes DJ, Peckham MJ. CT estimations of mean attenuation values and volume in testicular tumors: a comparison with surgical and histologic findings. *Radiology* 1982; 144:553-558.
6. Doppman JL, Gill JR Jr, Miller DL, et al. Distinction between hyperaldosteronism due to bilateral adrenal hyperplasia and unilateral aldosteronoma: reliability of CT. *Radiology* 1992; 184:677-682.
7. DeLong ER, DeLong DM, Clarke-Pearson DL. Comparing the areas under two or more correlated receiver operating charac-

- teristic curves: a nonparametric approach. *Biometrics* 1988; 44:837-845.
8. McClish DK. Analyzing a portion of the ROC curve. *Med Decis Making* 1989; 9:190-195.
9. Francis IR, Smid A, Gross MD, et al. Adrenal masses in oncologic patients: functional and morphologic evaluation. *Radiology* 1988; 166:353-356.
10. Remer EM, Weinfeld RM, Glazer GM, et al. Hyperfunctioning and nonhyperfunctioning benign adrenal cortical lesions: characterization and comparison with MR imaging. *Radiology* 1989; 171:681-685.
11. Glazer GM, Woolsey EJ, Borrello J, et al. Adrenal tissue characterization using MR imaging. *Radiology* 1986; 158:73-79.
12. Reinig JW, Doppman JL, Dwyer AJ, Frank J. MRI of indeterminate adrenal masses. *Am J Roentgenol* 1986; 147:493-496.
13. Chezmar JL, Robbins SM, Nelson RC, et al. Adrenal masses: characterization with T1-weighted MR imaging. *Radiology* 1988; 166:357-359.
14. Chang A, Glazer HS, Lee JKT, Ling D, Heiken JP. Adrenal gland: MR imaging. *Radiology* 1987; 163:123-128.
15. Baker ME, Blinder R, Spritzer C, et al. MR evaluation of adrenal masses at 1.5 T. *Am J Roentgenol* 1989; 153:307-312.
16. Glazer GM. MR imaging of the liver, kidneys, and adrenal glands. *Radiology* 1988; 166:303-312.

### Commentary

Computed tomographic (CT) scanning was the first noninvasive test with sufficient resolution to locate small adrenocortical tumors with a high degree of diagnostic accuracy. However, its widespread use has created new diagnostic challenges for physicians. Currently, high-resolution abdominal CT scanning reveals incidental adrenal masses in 0.6% of patients. Although most asymptomatic and previously undetected adrenal masses are benign and nonfunctional, several diseases must be ruled out. These disorders include pheochromocytoma, subclinical functional adrenal adenomas, early adrenal carcinoma, and metastases.

In their study, Singer and coworkers assessed the clinical utility of unenhanced CT scanning to differentiate benign adrenocortical adenomas from metastatic adrenal lesions. They evaluated 12 pathologically proven metastatic lesions and 12 adenomas and found that metastatic lesions were significantly larger and had significantly higher attenuation coefficients than benign adenomas. They also performed receiver operating characteristic analysis

and found that size and attenuation were equally useful in distinguishing benign from malignant lesions. These findings extend the observations of Lee and coworkers<sup>1</sup> and, if corroborated by larger prospective studies, will provide an alternative to biopsy and magnetic resonance imaging.

However, CT examination alone will not provide complete information for proper management. A complete history, a thorough physical examination, appropriate laboratory and hormonal assessment, and CT evaluation are all needed for conclusive diagnosis and therapy.

EMMANUEL L. BRAVO, MD  
Department of Cardiovascular Biology  
The Cleveland Clinic Foundation

#### REFERENCES

1. Lee MJ, Hahn PF, Papanicolaou N, et al. Benign and malignant adrenal masses: CT distinction with attenuation coefficients, size, and observer analysis. *Radiology* 1991; 179:415-418.

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