Nonfunctioning Adrenal Masses: Incidental Discovery on Computed Tomography

Sixteen adrenal masses were identified with computed tomography (CT) in patients who had no clinical or biochemical evidence of adrenal pathology. In five patients, an adrenalectomy was performed, disclosing either an adenoma or nodular hyperplasia. Autopsy disclosed a cortical adenoma in one patient who died from unrelated causes. In the remaining 10 patients, follow-up scans 4–16 months later revealed no change in the size of the masses. A management plan of nonfunctioning adrenal masses discovered incidentally on CT is proposed.

Computed tomography (CT) has been shown to easily demonstrate the normal adrenal glands. Even with older equipment, the glands were identified in up to 90% of patients [1, 2], whereas with newer scanners, over 95% of the normal adrenals can be depicted [3, 4]. In clinical studies, adrenal masses as small as 0.5 cm in diameter have been detected with CT [1, 5]. At autopsy the adrenal glands have been found to contain grossly visible nonfunctioning adenomas in about 2%–9% of adult patients [6–8]. Microscopic examination of these organs, in addition, may reveal nonuniform adrenal cortices with multiple small rounded nodules in up to 50% of patients. Therefore, it is not surprising that with improved CT technology, small adrenal masses are occasionally discovered as an incidental finding. In those patients without biochemical evidence of adrenal hyperfunction or without a known primary malignant neoplasm, these masses almost always represent nonfunctioning adrenal adenomas or focal areas of nodular hyperplasia. Several reports have described a few patients found with CT to have nonfunctioning adenomas [1, 5, 9, 10]. This study describes 16 patients with no clinical evidence of adrenal hyperfunction in whom small adrenal masses were depicted on CT. A management plan based on this experience, including either pathologic confirmation or follow-up CT scans, is offered.

Subjects and Methods

From 1979 to 1981, 16 adrenal masses were identified with CT in 16 patients without clinical or biochemical evidence of adrenal pathology. Incidental adrenal masses that had classic CT characteristics of adrenal cyst (i.e., sharply defined margins, homogeneous, and water density) or myelolipoma (fat density with septations or fibrous bands of tissue) were not included in this study. During the study period, about 2,200 patients had CT studies of the upper abdomen performed for a variety of indications.

Two of the masses were initially noted on excretory urography. The other masses were first demonstrated by CT. The ages of the patients (nine women, seven men) ranged from 40 to 76 years (average, 57 years). In three patients with known neoplastic disease, proof of the benign nature of the adrenal mass was pathologically documented in two, while the other had follow-up CT scans 11 months later showing no change in the size of the mass. Fifteen of the 16 CT scans were performed on a fourth-generation, rotary motion, fixed detector array unit (EMI 7070) with a 3 sec scan time. One patient was examined elsewhere.
Results

The 16 adrenal masses demonstrated on CT ranged from 1 to 6 cm in anteroposterior dimension (average, 2.4 cm) (figs. 1–6). Eight of the masses were 2 cm or less in diameter. Mean attenuation values varied from −2 to +32 Hounsfield units (H). The mass was located in the left adrenal gland in 10 patients and in the right adrenal gland in six patients. The masses often appeared spherical. Smaller lesions often projected from one of the limbs of the adrenal, with a normal-appearing gland seen at other levels. Larger masses often deformed the contour of the entire gland.

Five of the patients had an adrenalectomy. Incidental 1 and 2 cm adrenal cortical adenomas were found in patients with renal cell carcinoma and epidermoid carcinoma of the lung (fig. 3), respectively. In the other three patients, the adrenal masses were removed because of the suspicion that they were responsible for the patient’s clinical problems. A patient with poorly controlled hypertension and no
biochemical evidence of adrenal hyperfunction remained hypertensive after removal of a 2 cm left adrenal adenoma detected by CT. A focal area of cortical hyperplasia was found in a patient initially studied because of weight loss and the question of occult neoplasm (fig. 5). A patient with abdominal pain had a 6 × 3 cm adrenal cortical adenoma removed at surgery. A sixth patient, who died of unrelated causes, was found at autopsy to have a 3.5 cm left adrenal cortical adenoma (fig. 6).

In the remaining 10 patients, in whom no surgical procedure has been performed, the adrenal mass has not changed in size on subsequent CT scans 4–16 months later (average follow-up time, 9 months). In all of these patients, no clinical findings or biochemical abnormalities were initially present or developed later referable to the adrenal mass.

Discussion
Adrenal tumors can be classified into those without apparent function (e.g., adenoma, carcinoma, cyst) or tumors with function (e.g., adenoma, pheochromocytoma, carci-
nomal) [11]. No CT differentiation can be made between functioning and nonfunctioning adenomas [1]. The varied attenuation values of the lesions detected, all at least slightly less dense than muscle, is believed to be related to different proportions of lipid within the mass [12]. While those masses that measure similar to water density may be difficult to distinguish from adrenal cysts, they are usually not as homogeneous or as sharply marginated as adrenal cysts. In difficult situations, sonography may be helpful in this distinction, determining whether the mass is anechoic or echogenic.

Incidental nonfunctioning adenomas are found at autopsy in 2%-9% of individuals [6–8]. The discrepancy between the different rates of nonfunctioning adenomas at autopsy is a reflection of different criteria for defining cortical adenoma and whether or not a distinction is made between adenoma and nodular hyperplasia [13]. Adrenal adenomas are usually single and encapsulated. The nodules in nodular hyperplasia are smaller and more numerous as well as being nonencapsulated [11]. However, nodules with and without definite capsules have been found in the same adrenal gland, suggesting that they may represent different stages of the same process [11]. The incidence of adenoma/nodular hyperplasia is greater with increasing age as well as in patients with hyperthyroidism and diabetes mellitus [6]. An increased frequency in patients with hypertension has been described, although the exact cause of the association has not been determined [14]. A highly significant association between cortical nodularity and arteriopathy of capsular arteries has been reported with the assumption that cortical nodules may be a response to focal ischemia [15].

In two of our patients, one with renal cell carcinoma and another with epidermoid carcinoma of the lung, incidental adrenal cortical adenomas were found. A third patient with a previously resected localized melanoma had a 4 cm left adrenal mass, presumed to represent a nonfunctioning adenoma, which did not change over an 11 month follow-up period. A higher incidence of nonfunctioning adenomas has been reported in patients with some malignancies, especially urinary bladder, endometrial, and renal neoplasms [16, 17]. Thus, adrenal masses in patients with known malignancy are not necessarily metastases. In patients without other evidence of metastatic disease, a single adrenal mass should not a priori preclude an attempt at curative surgery. In such situations adrenal biopsy, which can be performed percutaneously using CT guidance [18], is helpful in determining the nature of the adrenal lesion.

Although the distinction between adrenal adenoma and carcinoma depends on histologic examination, malignancy is unlikely in small nonfunctioning masses detected by CT. Adrenal carcinoma is rare [19, 20]. In addition, carcinomas under 3 cm in diameter seldom have been reported [21]. In contradistinction, small nonfunctioning adenomas or nodular hyperplasia are extremely common. Such was the case in 216 adrenal masses discovered in a series of 7,437 autopsies. No lesions showed evidence of malignancy [7]. In view of the rarity of adrenal carcinoma and the frequency of small adenomas, carcinoma is statistically unlikely in lesions under 3 cm in diameter.

A recent article described a 50% incidence of malignancy (seven cortical carcinomas, one gangliosarcoma, and one malignant hemangioma) among 18 nonfunctioning adrenal tumors and recommended surgery for all nonfunctioning adrenal lesions because of this high incidence of malignancy [22]. In that series, which used excretory urography as the primary means of detection, the lesions ranged from 4 to 24 cm; all the carcinomas ranged from 10 to 24 cm in diameter. Because of the relatively large size of the lesions encountered, a high incidence of malignancy is not unexpected. Since excretory urography is less reliable in detecting small adrenal masses (less than 3 cm in diameter) [23], any study relying on this technique for lesion discovery will exclude the smaller lesions which are likely to be benign. In our series, the lesions ranged from 1 to 6 cm, with only four lesions larger than 3 cm.

Although small carcinomas certainly could be detected by CT, the statistical frequency of adenomas compared to carcinomas overwhelmingly favors a benign etiology when small lesions such as those in our study are discovered. While CT could detect an adrenal cortical carcinoma at an earlier time and smaller size than heretofore possible, adrenal carcinomas are rapidly growing lesions [20, 24] and follow-up CT scanning therefore would be expected to show some change in the size of the lesion in a relatively short interval. We currently recommend follow-up examination in 2–3 months when incidental adrenal masses are discovered in patients without clinical or biochemical evidence of adrenal disease. Of the 10 lesions in our series that have been followed by CT, none has shown any change in size with follow-up of 4–16 months.

Reports suggesting that adrenal carcinoma might develop in an adenomatous or hyperplastic gland are rare. A single patient with adrenal hyperplasia who later developed adrenocortical carcinoma has been described, suggesting that the carcinoma may have developed in hyperplastic tissue subjected to chronic ACTH stimulation [25]. This etiology would require adrenocortical hyperfunction which was not evident in any of our patients. Although the etiology of adrenal carcinoma is unknown, there is little evidence for malignant transformation of adenomas, and carcinoma generally is considered to arise de novo rather than in adenomas (J. Kissane, personal communication).

The frequency with which small incidental adrenal masses are being detected by CT (14/2200 or 0.6% of all upper abdominal CT studies in our experience) makes elective adrenalectomy unreasonable in these patients. If clinical and biochemical evaluation suggests no evidence of adrenal hyperfunction and there is no known primary malignancy, then simply obtaining follow-up CT scans in 2–3 months is a more optimal plan. A similar approach has been recommended by others [26]. A more aggressive approach in patients with suspected metastatic disease or with an adrenal mass larger than 3–4 cm (which have a greater chance of being malignant [11]) may be considered, including perhaps percutaneous adrenal biopsy or surgical excision.

REFERENCES
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