CASE REPORT

Adrenal Myelolipoma: Comparison of Diagnostic Imaging and Pathological Findings

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Myelolipoma of the adrenal gland is a rare, benign, nonfunctioning lesion consisting of fat and bone marrow elements in varying proportions. This tumor is commonly asymptomatic and usually discovered during various diagnostic imaging examinations performed for unrelated diseases. If a primary malignant or metastatic adrenal tumor cannot be excluded, ultrasound- or computed tomography-guided needle biopsy of the tumor is necessary. We report a case of adrenal myelolipoma associated with advanced gastric carcinoma and compare the diagnostic imaging findings with the pathological findings of the adrenal myelolipoma.

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Introduction

Myelolipoma of the adrenal gland is a benign, endocrinologically inactive tumor composed of mature adipose tissue and scattered islands of hematopoietic cells, including the erythroid, myeloid and lymphoid series, as well as megakaryocytes representing the most important diagnostic feature (1-3). After the first description of Gierke (4) and the coining of the term “myelolipoma” by Oberling (5), the majority of cases have been small and asymptomatic and discovered incidentally, either at autopsy or during work-up for other diseases. However, some become symptomatic due to hemorrhage, necrosis or pressure on surrounding structures (6). It is essential to obtain a tissue diagnosis for all incidental adrenal tumors found during staging work-up for various carcinomas since the presence of metastatic carcinoma precludes resection of the primary tumor in these patients. Recently, as a consequence of progress in diagnostic imaging techniques, an increasing number of clinically symptom-free adrenal tumors are being detected incidentally. Since the frequency of diagnosis is expected to rise in the future, we describe a comparison of the diagnostic imaging findings with the pathological findings of myelolipoma.

Case Report

An 83-year-old woman complained of epigastralgia and anorexia in June 12, 1991 and was referred to our hospital. On physical examination, the abdomen was soft, with a firm palpable mass in the right upper quadrant which moved slightly upon respiration or manipulation by the examiner. The mass was slightly tender to palpation and percussion, without rebound tenderness, and extended downward about 13 cm below the right costal margin, 3 cm from the medial abdominal line. Laboratory testing revealed a red blood cell count of 255 x 10^4/mm^3, a white blood cell count of 6,300/mm^3, a hemoglobin of 5.1g/dl, a hematocrit of 18% and a normal urinalysis. Serum albumin was 2.8g/dl and elevation of the erythrocyte sedimentation rate (45 mm/h), positive C-reactive protein and elevation of carcinoembryonic antigen (46.7ng/ml) and a-fetoprotein (143.7ng/ml), were found. Occult blood in stool was positive.

The endoscopic examination of the upper gastrointestinal tract revealed a large open ulcer with a broken margin in the lesser curvature of the upper portion of the stomach. Histological study of a biopsy specimen revealed a moderately differentiated adenocarcinoma. She was admitted on June 25, 1991 for closer examination and treatment.

Abdominal sonogram (Fig. 1) showed a 16 cm well-
Myelolipoma and Diagnostic Imaging

Fig. 1. Longitudinal (left side) and axial (right side) abdominal US through the right upper quadrant demonstrates the greater part of a 16 cm well-defined, hyperechoic mass. The mass appears to be separate from the liver.

Fig. 2. CT scan of the abdomen demonstrates a smooth and well-defined huge mass in the region of the right adrenal gland; the mass was a slightly heterogeneous low-density area (attenuation values of -75 to -120 Hounsfield units [HU]), consistent with adipose tissue. The mass was multi-lobulated with coarse calcification. Abdominal magnetic resonance (MR) imaging (Fig. 3) revealed a high-intensity mass on the T1- and T2-weighted images. Abdominal angiogram demonstrated a downward and lateral displacement of the right kidney along with elongation of the right renal artery. The mass itself was relatively avascular and was supplied by the right inferior adrenal artery and several lumbar arteries. These findings did not permit a definitive diagnosis of the right adrenal mass; therefore ultrasound-guided needle biopsy of the tumor was performed. Histologic examination revealed fatty tissue and spotty myeloid tissue including all three hematopoietic cell lines. The diagnosis was a myelolipoma of the right adrenal gland. The patient and her family refused operation for the gastric carcinoma because of her advanced age. Aggravation of her symptoms became increasingly frequent and intense. She became so cachexic that intravenous hyperalimentation therapy was prescribed.

Postmortem examination revealed a gastric tumor extending to the pancreatic surface. The tumor, measuring $5.0 \times 4.8\, \text{cm}$ (Fig. 4), was located in the lesser curvature of the gastric body and a final diagnosis of moderately differentiated adenocarcinoma of the stomach was histologically established. Gross pathologic examination
revealed a thinly encapsulated 822 g right adrenal mass with diffusely variegated areas of yellow and tan tissue and grossly apparent hemorrhage (Fig. 5). Cut surface of the right adrenal mass exhibited well-circumscribed tumor showing extensive dark areas and glistening aggregates of fat (Fig. 6). Several calcific foci were dispersed throughout the mass. Microscopically, it was composed of mature adipose tissue which contained areas of hematopoietic components consisting of erythrocytic and granulocytic series with scattered megakaryocytes typical of a myelolipoma (Fig. 7).

**Discussion**

Adrenal myelolipoma is an uncommon benign adrenal cortical tumor composed of mature adipose tissue with variable proportions of hematopoietic elements (1–3). Its structural similarity to bone marrow initially led to the belief that it represented a site of extramedullary hematopoiesis, but its cause is unknown. In comparison with masses seen in extramedullary hematopoiesis, this tumor is sharply circumscribed and has a distinct capsule. This tumor is generally unilateral, asymptomatic, and functionally inactive (7). In autopsy series, the incidence varies from 0.08 to 0.2% (1–3). The lesion has been found in patients from 17 to 93 years of age with most diagnosed during the fourth and seventh decades (3, 6), and no myelolipoma has been discovered prior to adolescence. Accurate pre-operative diagnosis of adrenal myelolipoma is rarely made. This is because as stated above, most myelolipomas are asymptomatic. In our review of the literature, 59 Japanese patients and 84 non-Japanese patients with surgically resected adrenal myelolipomas were found. There was a slight male predominance. Calcification on plain radiographs has been reported in up to 20% of the lesions (8). In the present case, CT scan revealed coarse calcification in the mass.
Myelolipoma and Diagnostic Imaging

Fig. 6. Cut surface of the right adrenal mass exhibits well-circumscribed tumor showing extensive dark areas and glistening aggregates of fat. The mass has a thin fibrous capsule (open arrow) and is smoothly lobulated (black arrow) with reddish and yellowish areas containing several areas of hemorrhage and necrosis.

Fig. 7. Microscopic photomicrograph of the adrenal mass displaying mature adipose tissue with hematopoietic elements. The tumor tissue was clearly separated from the adrenal cortex by thin connective tissue (capsule). (×160)

The presence of fat within the tumor is the key factor for both identification and accurate diagnosis with imaging methods. More than 90% of adrenal masses larger than 2 cm can be detected sonographically (9). Myelolipoma is sonographically demonstrated as a hyperechoic and solid tumor. The typical, however, not pathognomonic echo pattern of myelolipoma is, as in renal angiomyelolipoma, attributed to the fatty tissue portion of the tumor. Adrenal myelolipoma may contain different proportions of fat and myeloid tissue, and those with only small quantities of fat may be difficult to differentiate from other adrenal masses. This is especially true on sonograms. Correlation of the sonographic and histologic findings shows that hyperechoic tumors have predominantly fatty components, whereas the hypoechoic lesions are composed predominantly of myeloid tissue (10). Furthermore, the presence of hemorrhage and calcifications within the tumor changes its sonographic pattern, leading to difficult diagnostic problems. A small fatty myelolipoma may be masked by adjacent echogenic retroperitoneal fat. Unless displacement of nearby organs is shown, the tumor may be unrecognized. On sonograms, apparent disruption and posterior displacement of the diaphragmatic echoes can be appreciated only when the tumor is larger than 4 cm. This artifact is due to the low propagation speed of ultrasound through fatty masses, which is significantly lower than the mean velocity through other tissues. The presence of the propagation speed artifact is a valuable clue to the nature of the tissue causing the artifact. However, the absence of this finding does not exclude the possibility that a hyperechoic adrenal mass is composed of fat.

CT appears to be sensitive for the diagnosis of adrenal myelolipoma. CT resolved the confusing sonographic findings by showing fat-density tissues within the lesion. On CT images, myelolipomas appear as sharply margined, mostly heterogeneously structured masses of different densities within the negative range, indicating the fatty tissue portion (8–10). The specific appearance in an individual patient depends on the relative percentages of the various constituents (fat, hematopoietic tissue, hemorrhage, and calcification). This tumor has a propensity to bleed. If the tumor is composed primarily
of hematopoietic tissue, or has hemorrhaged, it will show low-density areas within the lesion on CT and cannot be radiologically differentiated from other adrenal tumors, including the more common adrenal carcinoma (primary or metastatic) (6, 7). Other adrenal tumors, such as adrenal carcinoma, adenoma, and pheochromocytoma have been reported to contain areas of low density secondary to necrosis, hemorrhage, or cellular lipid (7). CT is limited and cannot be used to make a specific diagnosis of myelolipoma.

MR can be used to image adrenal space-occupying lesions and, in many cases, to distinguish these from among the most common lesions. Its use has been suggested as a complement to CT in the workup of patients with adrenal masses. The signal intensity of myelolipoma on MR images depends on both the dominant tissue component and the pulse sequence used. Fat generally produces a high signal intensity on T1-weighted MR images, and it is often used as the tissue of reference when comparing signal intensities from various tissues and organs of the body. Most lesions composed of fat are readily identified. Detection of fat within an adrenal mass can be obtained by both CT and MR imaging, and myelolipoma show up as a high intensity on T1-weighted images. However, renal angiomyolipoma extending from the upper pole and retroperitoneal lipoma and liposarcoma are to be included in the differential diagnosis. The multiplanar capability of MR imaging can be helpful in determining the origin of the mass in the adrenal region; for this purpose MR may be more accurate than CT. The relaxation times of liposarcomas differ from those of both lipomas and normal retroperitoneal fat.

In determining the location and longitudinal extent of liposarcomas, MR imaging has been reported to be more accurate than CT (11). Myelolipoma with a markedly heterogeneous structural pattern can be impossible to differentiate from retroperitoneal malignancies using both CT and MR imaging. Because CT is more widely available today, incidental adrenal lesions will be found and investigated more frequently including benign, nonfunctioning myelolipoma. The presence of fat within this tumor is the key factor in identification and non-invasive diagnosis with imaging methods. Since fat has a characteristic behaviour reflected by the MR signal intensity, a specific diagnosis can be made by MR. It may be difficult to differentiate those with only a small amount of fat from other adrenal masses while those with a greater proportion of fat would need to be differentiated from renal or retroperitoneal tumors by imaging. Because there are no specific imaging criteria to differentiate an adrenal myelolipoma, the definitive diagnosis depends on cytologic or histologic evaluation. A cytologic diagnosis of benign or malignant is important to determine the need for formal surgical exploration in selected cases. Fine-needle aspiration biopsy performed under US or CT guidance has been suggested as the most direct approach to establish the diagnosis in difficult cases like the present patient (12).

References