Clinics in Diagnostic Imaging (43)

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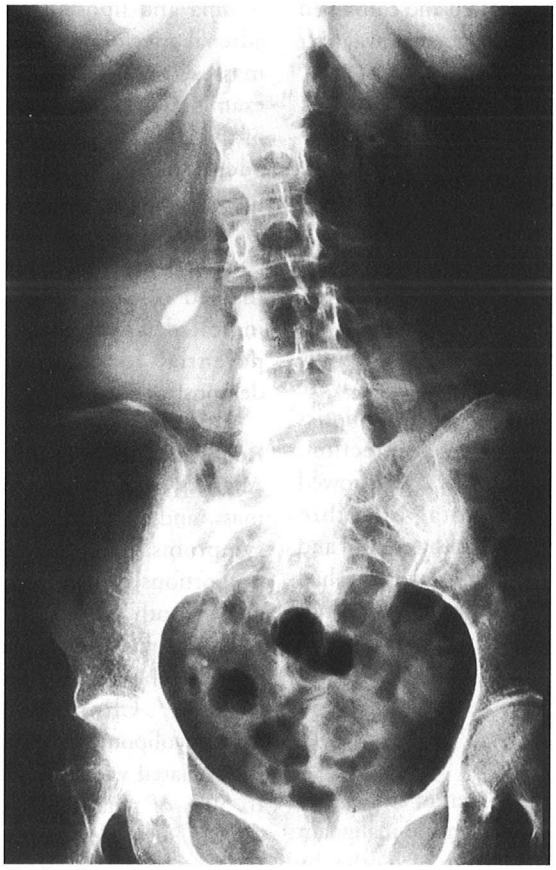

Fig 1 – Frontal abdominal radiograph.

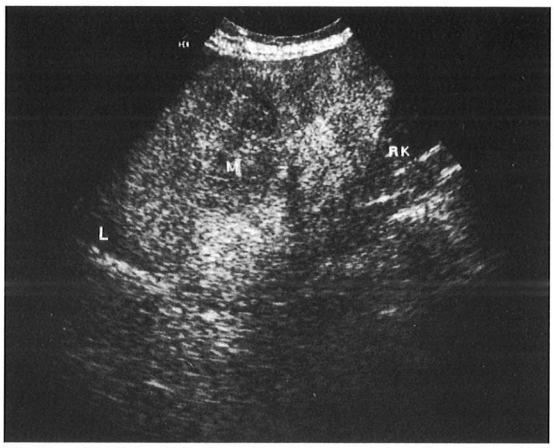

Fig 2 – US of the right flank [L = inferior right lobe of liver, RK = upper pole of right kidney]

Fig 3a

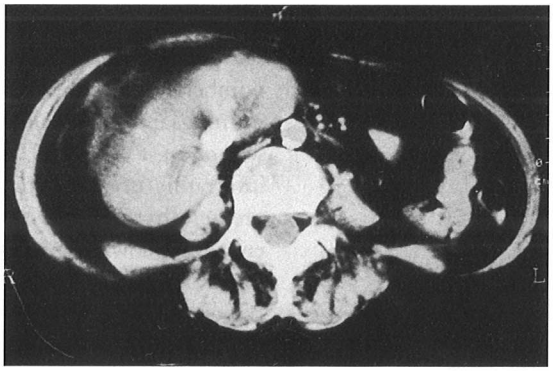

Fig 3b

Fig 3a – Unenhanced CT scans of the abdomen taken at the levels of the (a) Mid-pole of the left kidney and (b) Umbilicus.

CASE PRESENTATION

A 53-year-old woman presented with fever, abdominal pain and jaundice for two weeks after starting anti-tuberculous drugs for pulmonary tuberculosis. Urine analysis showed many red blood cells and white blood cells/high power field. Liver function tests were deranged: GOT 94 U/L (normal 3-35), GPT 63 U/L (normal 7 – 33), total bilirubin 10 mg/dL (normal 0.2 – 1.0) with direct bilirubin 8 mg/dL (normal 0 – 0.2). Radiographs and ultrasonography (US) of the abdomen were performed, followed by computed tomography (CT) scans. What do the radiograph (Fig 1), ultrasonography (US) (Fig 2) and CT scans (Fig 3) show? What is the diagnosis?

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IMAGE INTERPRETATION

The abdominal radiograph (Fig 1) showed a large hypolucent mass in the right upper quadrant. The right kidney contained a 2 cm oval-shaped renal calculus and was displaced caudally by a large hypolucent mass. A 1 cm rounded gallstone was present cranial to the hypolucent mass. US (Fig 2) demonstrated a large heterogeneously-hyperechoic mass (M) inferior to the right lobe of the liver (L) and superior to the right kidney (RK). Unenhanced abdominal CT scans (Fig 3) confirmed the presence of a large well-defined mass which was largely fatty with areas of higher attentuation soft tissue strands. The mass measured 8.5 cm x 13 cm. The right kidney was inferiorly displaced, mildly rotated and contained a renal pelvis stone. The aorta, inferior vena cava, liver and spine were not involved.

DIAGNOSIS

Right adrenal myelolipoma.

CLINICAL COURSE

The anti-tuberculous drugs, isoniacid, rifampicin and pyrazinamide, were considered to be the cause of the patient's liver damage and jaundice, and were discontinued. Urine culture grew *E coli*. Antibiotics were given to treat the urinary tract infection. Repeat liver function test one month later showed normal GOT and GPT, and total bilirubin improved to 2.99 mg/dL. Isoniacid, ethambutol and rifampicin were restarted. Two weeks later, she had no more jaundice and was discharged. She did not require treatment for the incidentally-discovered adrenal myelolipoma.

DISCUSSION

Fat-containing masses of the abdomen in adults may be caused by a variety of lesions. Benign and malignant masses can often be distinguished from each other by analysis of their location, margination, internal consistency and attenuation. CT is probably the single most useful imaging technique for detection and diagnosis of these masses. Benign masses are usually sharply marginated, homogeneous, and have CT numbers that are less than or equal to the patient's normal fat while malignancy should be suspected when an extrarenal mass is inhomogeneous, infiltrating or poorly marginated, has CT numbers greater than that of the patient's normal fat, or enhance following contrast administration. By careful evaluation of imaging findings, a specific diagnosis can often be suggested[1]. Lesions which may give rise to large fatty abdominal masses are summarised in Table I. Some of the more common fatty lesions are discussed in this paper.

Myelolipoma

Myelolipoma is an uncommon benign tumour composed of a variable mixture of mature adipose cells and haematopoietic elements[2]. It is most often found in the adrenal gland, but there have been reports of its occurrence in extra-adrenal locations[2-4]. The tumours are usually nonfunctioning and detected as an incidental finding. Symptoms may occasionally result from acute haemorrhage or from mass effect if the lesion is large[2,5]. Associated endocrine dysfunction due to Addison's disease, Cushing's syndrome and Conn's syndrome have been reported[2,6,7].

The radiological appearances of myelolipomas depend on their histological composition, ranging from a fat-dominant mass to a completely non-fatty soft tissue mass. A typical lesion is seen as a fat-containing mass on radiographs which needs to be differentiated from renal angiomyolipoma, teratoma, lipoma and liposarcoma[1,2]. On ultrasonography, adrenal myelolipomas appear as highly echogenic masses[5]. CT is the most definitive radiological examination for demonstrating the fatty component of these tumours. Unenhanced CT scans are usually adequate for making the diagnosis. Because myelolipoma can be presumptively diagnosed at CT on the basis of fat demonstrated in an adrenal mass, patients with large lesions can often be followed-up instead of undergoing resection[2,8]. Surgery is indicated if symptoms are present. No malignant potential for adrenal myelolipoma has been demonstrated to date.

Renal angiomyolipoma (AML)

Angiomyolipoma is the most common intrarenal fatty mass, and may manifest with a broad spectrum of symptoms. The tumour is composed of varying proportions of mature fat, abnormal-walled vessels, and smooth muscle. The radiological appearances reflect the relative predominence of these components as well as the presence or absence of haemorrhage and necrosis. Clinically, two distinct types of angiomyolipoma have been described. The first type is associated with tuberous sclerosis (TS), with 20% to 50% of renal AMLs occurring in such patients. 40% to 80% of patients with TS exhibit AMLs which

Table I – Lesions manifesting as fatty abdominal masses in adults

A. Diffuse increased extraperitoneal fat
- Increased retroperitoneal fat (Idiopathic, obesity, Cushing's syndrome)
- Pelvic lipomatosis

B. Diffuse increased mesenteric fat
- Obesity
- Cushing's syndrome
- Mesenteric lipoblastomatosis

C. Extrarenal benign focal fatty mass
- Retroperitoneal and pelvic lipoma
- Retroperitoneal lymphangioma
- Adrenal myelolipoma
- Cystic teratoma
- Liposarcoma

D. Intrarenal focal fatty mass
- Angiomyolipoma
- Perirenal liposarcoma
- Xanthogranulomatous pyelonephritis (XGP)

are small, multiple, bilateral and asymptomatic (Fig 4). The second type of AML is an isolated lesion which tends to be solitary, unilateral, moderate-sized and symptomatic (Fig 5). This type is usually predominant in middle-aged women[9,10]. The degree of tumour vascularity and structural abnormality of its blood vessels make AMLs prone to haemorrhage. CT is helpful in detecting areas of bleeding and in aiding management of haemorrhagic tumours[11].

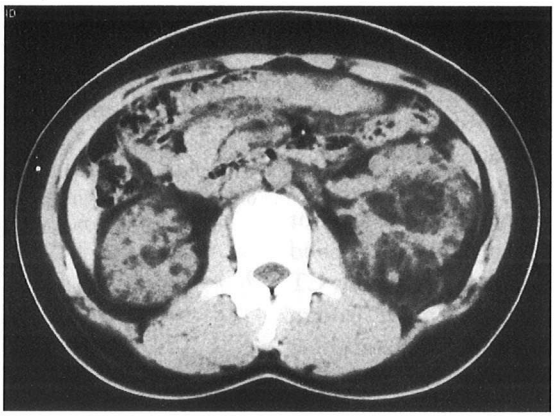

Fig 4 – Bilateral renal AMLs associated with tuberous sclerosis in a 17-year-old girl. Unenhanced CT scan shows multiple fat-density masses of different sizes in both kidneys.

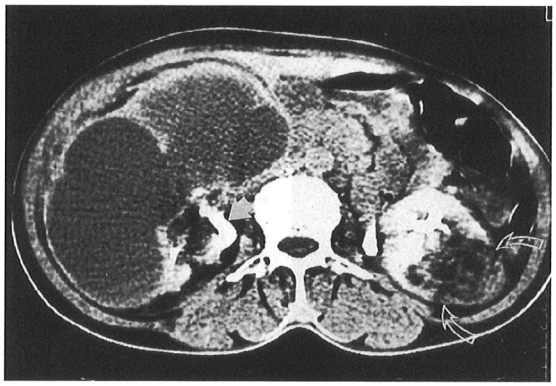

Fig 5 – Solitary renal AML in a 42-year-old woman. Enhanced CT scan shows a 4-cm fat-density mass (open curved arrows) in the lower pole of the left kidney. There is a right renal pelvic stone (solid thick arrow) causing right-sided hydronephrosis.

Cystic teratoma

Cystic teratoma is the most common ovarian neoplasm, accounting for 44% of all ovarian tumours[12]. Retroperitoneal cystic teratoma is however rare[13]. The tumour is composed of tissue derived from all three germ layers. Their heterogeneous composition is reflected in their variable radiological appearances[14]. On abdominal radiographs, the detection of a radiolucent mass and teeth or abortive bone within the lesion are considered to be specific features for this lesion. However, lesions less than 5 cm in diameter are usually not visualised. The US appearances of ovarian teratomas (dermoids) are variable. Pure sebum is anechoic or hypoechoic but fat intermixed with hair and/or calcium (dermoid plug) is echogenic because of the large acoustic impedance differences and the numerous tissue interfaces within it. Dermoid plugs tend to be round, form an acute angle with the cyst wall, and are predominantly hyperechoic[14].

Sheth et al[15] found that the anechoic "cystic" component of pure sebum noted on US corresponded on CT to low-attenuation homogeneous fat. The echogenic mass shown on US containing hair, fat mixed with hair, desquamated epithelium, fibrous tissue and bone or teeth corresponded on CT to soft tissue density or calcification. Therefore the US and CT appearances of ovarian cystic teratoma are variable depending on the tissue composition of each individual mass. The CT appearances of retroperitoneal cystic teratomas have the same variability as their ovarian counterparts since their histological composition is identical[1,13] (Fig 6).

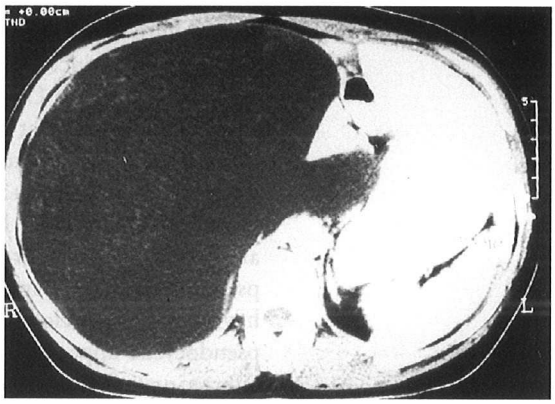

Fig 6a

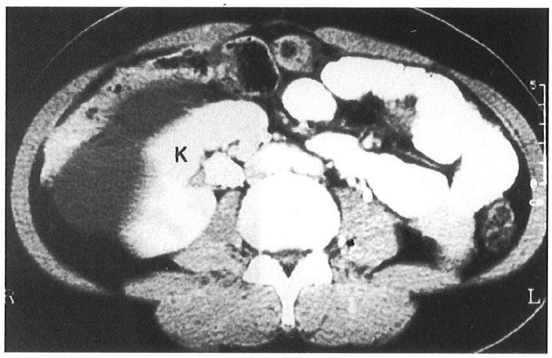

Fig 6b

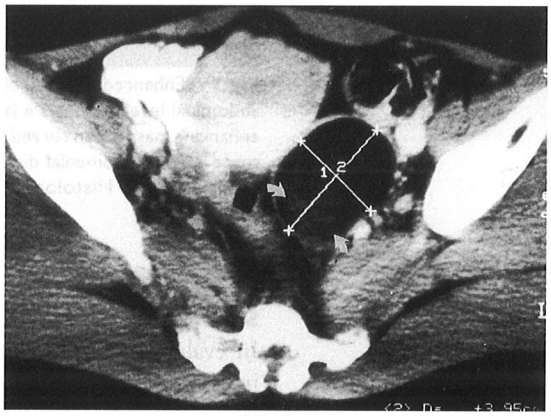

Fig 6c

Fig 6 – Enhanced CT scan of the abdomen of a 34-year-old woman with retroperitoneal and ovarian cystic teratomas. (a) Scan at the level of the mid-abdomen shows a huge well-defined right retroperitoneal mass containing a large area of fat density intermixed with scattered areas of slightly higher density. The liver is displaced to the left while the stomach and spleen are posteriorly displaced. (b) Scan at the lower abdominal level shows an inferiorly-displaced and rotated right kidney (K). (c) Scan of the pelvis shows a well-defined mass composed mainly of fat. There is a small soft tissue nodule (arrows) representing a dermoid plug.

Liposarcoma

Liposarcoma is the most common primary retroperitoneal malignancy[1]. It can be classified as being lipogenic, myxoid and pleomorphic. Most abdominal liposarcomas are of the myxoid type[15]. Lipogenic liposarcomas are composed predominantly of malignant lipoblasts containing large amounts of lipid with a relatively scanty myxoid matrix, whereas myxoid liposarcomas contain large amounts of connective tissue, mucin and relatively little lipid. The pleomorphic type is characterised by marked cellular pleomorphism and a relative paucity of both lipid and mucin.

The CT appearances of the tumour correlate closely with their gross and microscopic anatomy. There are 3 distinct CT patterns: solid, mixed, and pseudocystic. These CT patterns reflect the amount and distribution of fat within the tumour. A solid CT appearance is due to little fat and produces CT numbers greater than +20 HU. The mixed pattern has discrete fatty areas less than -20HU and other areas with values greater than +20HU. The pseudocystic pattern appears as a homogeneous mass having a density close to that of water, creating a pseudocystic appearance because of partial volume averaging of fatty and solid components[1,16]. Liposarcoma with little fat will appear having the solid pattern and cannot be differentiated from non-fatty tumours on CT (Fig 7).

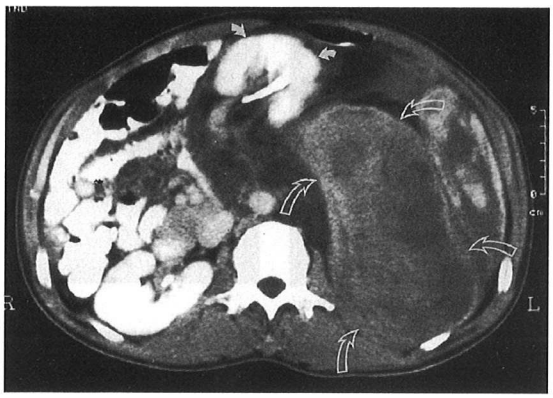

Fig 7 – Enhanced CT scan of a 45-year-old man taken at mid-abdominal level. It shows a large lobulated, inhomogeneously-enhancing mass (open curved arrows) in the left retroperitoneal space with anteromedial displacement of the left kidney (solid short arrows). Histological examination revealed myxoid liposarcoma.

SUMMARY

In evaluating fatty masses of the abdomen, careful imaging analysis, particularly of the site of origin, is required for an accurate diagnosis. CT is probably the best single most useful imaging technique. The radiological features of fatty abdominal masses reflect the histological composition of each individual lesion.

ACKNOWLEDGEMENT

We thank Ms Alice Lau for her secretarial assistance.

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ABSTRACT

A 53-year-old woman who presented with drug-induced jaundice and urinary tract infection was incidentally found to have a large abdominal mass. Radiographs and ultrasonography showed a large fatty mass located between the right lobe of the liver and the right kidney. Diagnosis of right adrenal myelolipoma was made on computed tomography. The patient was treated conservatively. The causes of large fatty masses of the abdomen in adults are discussed, with emphasis on the imaging appearances of myelolipoma, renal angiomyolipoma, cystic teratoma and liposarcoma.

Keywords: computed tomography (CT); adrenal myelolipoma; cystic teratoma; fatty abdominal mass; liposarcoma; renal angiomyolipoma