CME Article

Clinics in diagnostic imaging (109)

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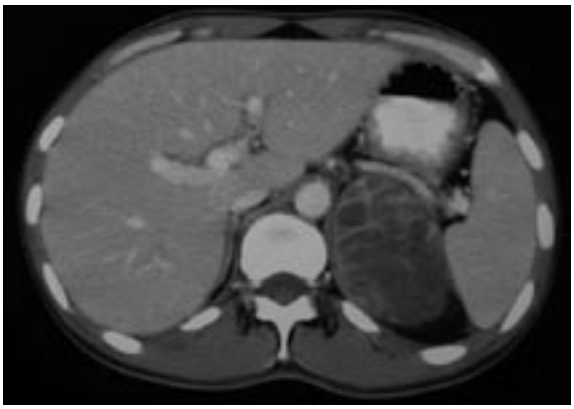

Fig. 1 Contrast-enhanced axial CT image of the abdomen.

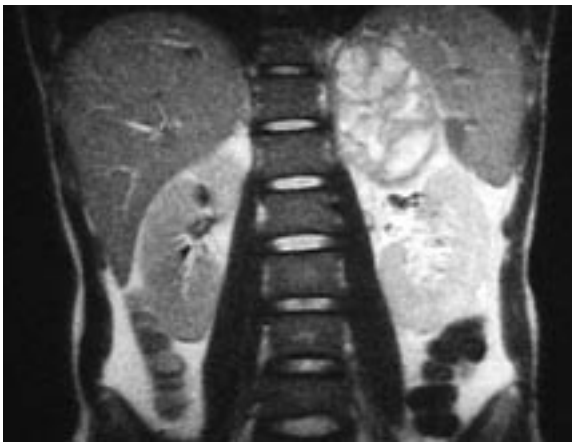

Fig. 2a Coronal T2-W MR image of the abdomen.

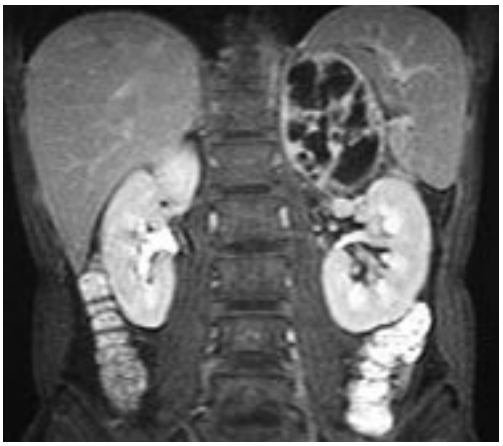

Fig. 2b Contrast-enhanced fat-suppressed coronal T1-W MR image of the abdomen.

CASE PRESENTATION

A 34-year-old Singaporean Chinese man presented with a two-month history of intermittent fever and left loin pain. He had been investigated at another hospital a month earlier for pyrexia and microscopic haematuria. Intravenous urogram was normal while renal ultrasonography showed a 1 cm simple cyst in the left renal upper pole. He presented to our institution for persistent fever and new onset of left loin pain to groin pain. He denied any urinary symptoms, chills or rigors. Neurological, respiratory and abdominal examination was normal except for left renal angle tenderness. Blood pressure was not elevated. Urine microscopy revealed 225 red blood cells and 33 white blood cells per high power field and urine culture was negative. Full blood count showed leucocytosis (22,900 cells/mm^3) with left shift (polymorphs 92.9% and lymphocytes 3.3%). Serum cortisol, serum electrolytes and urinary catecholamines were normal. Chest x-ray was normal. Given the provisional diagnosis of pyelonephritis, he was started on broad-spectrum parenteral antibiotic therapy of ceftriaxone. However, as the one-month long history of fever was not in keeping with the usual case of pyelonephritis, computed tomography (CT) of the abdomen (Fig. 1) was performed. Magnetic resonance (MR) imaging was later done (Fig. 2). What is the diagnosis?

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IMAGE INTERPRETATION

CT of the abdomen (Fig. 1) showed a 56 x 80 mm well-defined mass arising from the left adrenal gland. This mass had a heterogeneous appearance with a cystic component and multiple septations. The walls of the mass enhanced and were associated with stranding in the surrounding fat. The left kidney and spleen were displaced laterally by the mass. MR imaging of the kidneys (Figs. 2a-b) corroborated the CT findings of a suspected left adrenal tumour. Contrast-enhanced coronal MR image of the upper abdomen (Fig. 2b) showed a well-marginated septated mass in the left suprarenal fossa with mild enhancement after contrast administration. It is separate from the spleen and displaces the upper pole of the left kidney inferiorly and laterally. These features confirm its adrenal origin. In view of its radiological features, the adrenal mass was thought to be a complex adrenal adenoma or adrenal carcinoma.

DIAGNOSIS

Nocardial adrenal abscess.

CLINICAL COURSE

Laparoscopic adrenalectomy was planned. However, intraoperatively, the mass turned out to be a multiloculated abscess. Transperitoneal laparoscopic drainage of the left adrenal abscess was performed and the patient's sepsis resolved rapidly. Histology of the abscess wall showed necrotic tissue with moderate infiltrate of neutrophils and macrophages. There was no evidence of malignancy and no acid-fast bacillus was seen. Cultures from the adrenal abscess revealed *Nocardia asteroides*.

The patient later revealed that he had previously exhibited high-risk behaviour in seeking unprotected sex with multiple commercial sex workers and it was also noted that the patient had oral thrush. His human immunodeficiency virus (HIV) test turned out positive and his CD-4 count was 12 cells/microlitre, confirming acquired immunodeficiency syndrome (AIDS). Parenteral cotrimoxazole was added to the ceftriaxone that the patient was already receiving. The patient recovered well and was discharged on the 14th postoperative day. He completed six weeks of parenteral antibiotics followed by a six-month course of oral cotrimoxazole. Subsequent follow-up CT performed six weeks postoperatively revealed that the abscess was much reduced in size with less inflammation. He was started on highly active anti-retroviral therapy (HAART) for AIDS.

DISCUSSION

This case demonstrates a diagnostic challenge that adrenal cystic masses pose, in particular highlighting the roles and limitations of radiological imaging.

Nocardiosis

Members of the genus Nocardia are aerobic, filamentous, gram-positive rods with branching appearance usually found in the soil. *Nocardia asteroides* is the most common species responsible for human infections. Systemic nocardiosis occurs in patients with impaired cellular immunity, such as patients with HIV, haematopoietic malignancies, immunosuppressive therapy, and organ transplant recipients[1-3]. Nocardiosis of the lung is the most common primary presentation of systemic nocardiosis, and may mimic tuberculous or mycotic pulmonary infection in presentation. Pulmonary nocardiosis gives rise to reticulo-nodular or diffuse pulmonary infiltrates, cavities and pleural effusions on chest radiograph.

Extrapulmonary nocardiosis is unusual but when present, involves the brain and other organs such as the kidneys and liver. In cases where the diagnosis of pulmonary nocardiosis has been made, the physician may consider CT of the brain and abdomen to rule our abscess formation in other extrapulmonary sites appropriate. The various clinical presentations for systemic nocardiosis would therefore include pneumonia, meningitis, cerebral abscess, renal abscess and intra-abdominal abscesses. Abscesses should be considered for surgical drainage, while sulfonamides, as the drug of choice against nocardiosis, should be concurrently started. Cotrimoxazole (trimethoprim-sulfamethoxazole) is often the drug of choice for parenteral administration due to its easy availability, followed by a further six months of oral administration. Adrenal abscesses are exceedingly rare[4]; Nocardial adrenal abscess even rarer. Our case represents only the fourth reported case of a Nocardial adrenal abscess and emphasises the rarity of this condition[5].

Investigating adrenal cysts

Some adrenal cysts may present with symptoms attributable to mass effect or complications such as haemorrhage or infection. The size of adrenal cysts is variable, and the majority are benign with only 7% of adrenal cysts found to harbour carcinoma (primary or secondary), phaeochromocytoma or neuroblastoma[6]. Cystic conditions of the adrenal gland can be classified pathologically into pseudocysts (56%), endothelial cysts (24%),

epithelial cyst (6%), and hydatid cysts (2%). Endothelial cysts include lymphagiomatous and angiomatous cysts. Pseudocysts arise due to haemorrhage or infarction which may be caused by both benign and malignant conditions. Rare differential diagnoses of an adrenal cyst in the adult include granulomatous and pyogenic abscesses of the adrenal gland[6,8]. In the newborn and infant, differential diagnoses include adrenal haemorrhage (Waterhouse-Friderichsen syndrome), tumours (neuroblastoma, Wilm's tumour), abscess and other lesions, e.g. bronchogenic cyst.

Assessment of an adrenal cyst begins with a careful history and examination, with emphasis on determining whether there is a functional adrenal lesion. Blood pressure must be recorded, and evidence of Cushing's syndrome, virilisation, feminisation, mineralocorticoid excess and catecholamine excess should be sought for. Further investigations of the serum electrolytes, serum cortisol and urinary catecholamines should be performed. It should be emphasised that central cystic necrosis may sometimes be present in phaeochromocytoma, mimicking adrenal cysts, so every effort should be made to exclude a phaeochromocytoma to avoid the catastrophic eventuality of a missed diagnosis.

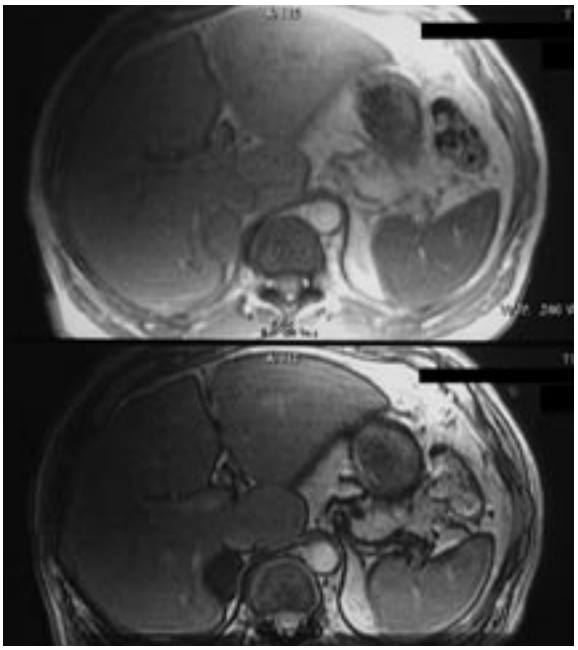

Fig. 3 Benign adrenal lesion diagnosed using opposed-phase axial MR imaging. In-phase (top image) and out-phase (bottom image) images show a substantial signal drop in the out-phase image. Notice also outlining of organs in the out-phase images, the chemical shift artifact, giving an Indian ink border around the organs.

Imaging of cystic adrenal lesions

Radiographs

The pattern of calcifications can offer clues to the diagnosis, and may be found in 15% of adrenal cysts[7]. Pseudocysts may demonstrate curvilinear calcifications, while endothelial cysts may have coarse calcifications[8]. However, calcifications are not specific and, on the whole, are not diagnostic as they may also be seen in other adjacent organs (e.g. pancreas, kidney) and vessels[6].

Ultrasonography

Cyst wall structure, wall thickness and fluid contents can be seen on ultrasonography. Intracystic septae are seen in lymphangiomas, pseudocysts, and parasitic cysts. Homogeneous anechoic fluid contents on ultrasonography is a typical feature of adrenal cysts, whereas heterogeneity and hyperechoic fluid contents indicates haemorrhage or infection within the cyst. However, an anechoic adrenal cyst must be further differentiated from hypoechoic areas associated with adenomas or metastases, therefore, contrast-enhanced CT characterisation of cysts is helpful.

CT and MR imaging

CT imaging is the main imaging modality for adrenal masses. Adrenal cysts demonstrate low attenuation (less than 20 Hounsfield units), clear margins, failure to take up intravenous contrast, and in about one-half of cases, show calcifications in the cyst wall[6,7]. Where cysts are indeterminate on CT, MR imaging is a helpful complement. MR imaging is able also to differentiate among adenomas, phaeochromocytoma, adrenal cysts and haemorrhage[6]. Benign adrenal cysts appear clearly marginated, thin-walled (less than 3 mm) with fluid signal that is homogeneously hypointense on T1-weighted and hyperintense on T2-weighted sequences.

MR imaging is excellent in detecting haemorrhage and tissue components within cysts, with loss of homogeneity being a key feature. Haemorrhage or infection in the cyst results in the appearance of complex cysts, which are difficult to differentiate from adrenal metastases, necrotic tumours or abscesses. Hyperdense cystic contents, irregularity of cyst walls or cyst wall thickness that exceeds 3 mm are features suggestive of malignancy[7,8]. Large tumours often also demonstrate necrosis or haemorrhage, and may have calcifications on CT in up to 30% of cases. Adrenal masses smaller than 4 cm, and defined as low-risk by radiological criteria, are almost always benign, whereas 25% of adrenal masses larger than 6 cm harbour adrenal carcinoma[9]. Such large masses should therefore

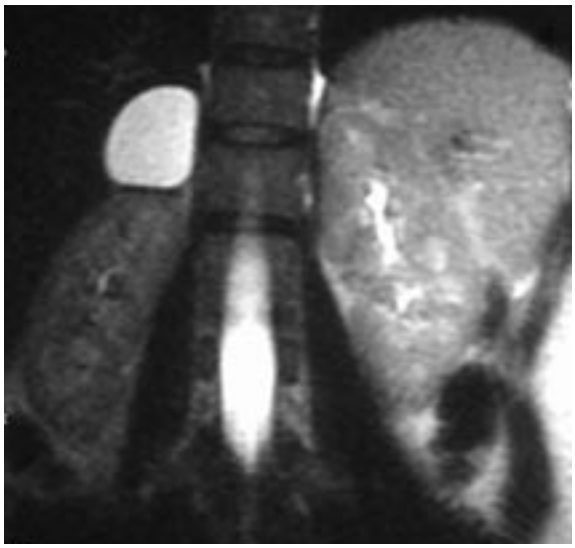

Fig. 4 Adrenal cyst. Coronal T2-W MR image shows a hyperintense fluid-filled structure located superior to the right kidney.

be considered for surgical excision. For those cysts 4 to 6 cm in size, previously-mentioned radiological features other than size should be evaluated and either adrenalectomy or follow-up with serial scans are reasonable treatment options[9].

Like cysts, adenomas have low-attenuation features on CT, due to high levels of intracellular lipid within, but enhanced with intravenous contrast. Contrast-enhanced CT is therefore essential to differentiate a cyst from an adenoma. Where a cyst has been excluded, the comparison of in-phase and opposed-phase MR imaging (also known as chemical shift imaging) is the most discriminatory investigation to differentiate adenomas from non-adenomas (e.g. adrenal metastases). Benign adenomas lose signal intensity on out-of-phase images due to intracytoplasmic lipid, whereas metastatic lesions do not lose signal intensity as they do not contain intracytoplasmic lipid (Fig. 3). Overlap between benign and malignant masses exists because not all benign masses contain intracytoplasmic lipid, and some benign masses, such as granulomatous disease and pyogenic abscess, do not contain lipid[10]

It may be difficult to determine the anatomical origin of large suprarenal masses on CT or MR imaging. Generally, the epicentre of the lesion can help determine whether a mass is renal or adrenal in origin (Fig. 4). The pattern of displacement of surrounding tissues is also helpful; adrenal masses would generally displace the kidney inferiorly, as opposed to upper pole renal masses where the position of the kidney would be somewhat unchanged. This is best seen with the use of coronal sections. The use of the "claw sign" (concavity of the renal contour with renal parenchyma cupping the cyst) is also useful in distinguishing renal lesions from extra-renal lesions.

Fine-needle aspiration biopsy

Where the diagnosis is still indeterminate after undergoing non-invasive imaging, percutaneous aspiration and cytology may be considered for certain situations, such as ruling out a solitary adrenal metastasis in a patient with a known non-adrenal primary malignancy. The fine-needle aspirate should be sent for cytological examination, gram stain and culture, and the colour of fluid noted. Some authors even recommend performing a cystogram to delineate the cyst lining. A bloody aspirate, positive cytology or irregular cyst lining would then mandate surgical excision[6]. A diagnostic dilemma would still remain if the aspirate cytology is equivocal. The cellular yield of needle aspiration is notoriously poor; therefore, a normal cytology result should be interpreted with caution.

Limitations of imaging

This case demonstrates the complementary use of CT and MR imaging in the imaging evaluation of a complex adrenal cyst. Though the CT and MR imaging findings pointed towards a diagnosis of malignancy, however, this case reminds us that there is an overlap in MR imaging features between benign and malignant adrenal masses. Radiologists and clinicians should recognise these limitations in current imaging techniques and apply them appropriately to the clinical setting.

Management

Surgical excision of an adrenal cyst is indicated if it is symptomatic, hormonally functional, greater than 6 cm in diameter, has other radiologic features suggestive of malignancy, or if the needle aspirate is bloody or reveals an abnormal cytology[6,9]. On the other hand, a non-functioning adrenal cyst less than 4 cm in size that fulfils radiological criteria for a benign lesion can be managed conservatively. Adrenal lesions 4 cm to 6 cm in size may be offered either surveillance by serial radiological imaging or surgical removal, depending on whether malignancy is suspected based upon radiological features. Symptomatic simple adrenal cysts may be treated by aspiration alone, and it can be repeated when it reaccumulates. Excision should be considered when they fail to resolve or symptoms persist [8]. Compared with open adrenalectomy, laparoscopic approach to adrenalectomy is preferred as its operative morbidity is more favourable in terms of

postoperative wound pain, blood loss and cosmesis, while still having comparable operating times[6,9,11,12]. Laparoscopic exploration may be a safe diagnostic and therapeutic modality for indeterminate adrenal masses[5].

ABSTRACT

A 34-year-old man presented with a two-month history of intermittent fever and left loin pain. A large left suprarenal mass was detected on computed tomography and magnetic resonance imaging. Blood pressure, serum electrolytes, serum cortisol and urinary catecholamines were normal. Laparoscopic adrenalectomy was planned but the mass was found to be an isolated adrenal abscess due to Nocardiosis. He was later found to have AIDS. The clinical utility of various imaging modalities and management of adrenal cysts are reviewed.

Keywords: adrenal cyst, adrenal disease, computed tomography, magnetic resonance imaging, Nocardia infection.

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SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME
Multiple Choice Questions (Code SMJ 200605A)

	True	False
Question 1: The following statements regarding nocardiosis are true:		
(a) It is an opportunistic infection that usually affects patients with an impaired cellular immunity.	❑	❑
(b) Adrenal infection is the most common primary presentation of systemic nocardiosis.	❑	❑
(c) Cotrimoxazole is the antibiotic of choice.	❑	❑
(d) Nocardia asteroides is a filamentous gram-positive rod that is usually found in the soil.	❑	❑
Question 2: The following statements regarding adrenal cysts are true:		
(a) It is rarely necessary to rule out phaeochromocytoma when an adrenal cyst is incidentally discovered on CT.	❑	❑
(b) An adrenal mass may present with endocrinopathy.	❑	❑
(c) An adrenal mass that is associated with hypertension and hypokalaemia may indicate Conn's syndrome.	❑	❑
(d) An adrenal cyst is considered to have features suggestive of malignancy when it has hyperdense cystic content and thick irregular walls.	❑	❑
Question 3: In the management of adrenal mass:		
(a) Chemical-shift MR imaging is a useful modality to differentiate between a benign and malignant adrenal neoplasm.	❑	❑
(b) Adrenalectomy is recommended for all adrenal masses larger than 6 cm in diameter.	❑	❑
(c) If CT shows an adrenal cystic mass that is less than 4 cm in diameter with multiple thick irregular septae, the best course of management is surveillance with repeat CT in one year's time.	❑	❑
(d) The incidence of malignancy in adrenal masses larger than 6 cm is in excess of 80%.	❑	❑
Question 4: Regarding imaging of adrenal cysts:		
(a) If ultrasonography of the abdomen shows a left adrenal cyst, the most appropriate course of action is then to perform a percutaneous needle aspiration and cytological examination of the fluid.	❑	❑
(b) The differential diagnosis of adrenal calcifications seen on abdominal radiograph includes calcifications of the splenic artery and pancreas.	❑	❑
(c) Haemorrhage and necrosis may be present in infective and neoplastic conditions of the adrenal gland.	❑	❑
(d) Demonstration of intracytoplasmic lipid content with the help of chemical-shift MR imaging often helps to differentiate between benign and malignant adrenal masses.	❑	❑
Question 5: Adrenalectomy:		
(a) Is not necessary in a non-functioning adrenal cyst that is less than 4 cm in size with benign radiological features.	❑	❑
(b) Is indicated in a patient that has persistent loin pain attributable to a unilateral adrenal cyst.	❑	❑
(c) May result in Addisonian crisis if performed in a patient with previous contralateral radical nephrectomy.	❑	❑
(d) Compared to open adrenalectomy, laparoscopic adrenalectomy is the preferred surgical approach for small- to moderate-sized adrenal masses as it has less perioperative morbidity.	❑	❑

Doctor's particulars:

Name in full:_____

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2. Indicate your responses by marking the "True" or "False" box ☑
3. Fill in your professional particulars.
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3. All online submissions will receive an automatic email acknowledgment.
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