Peer Reviewed **Article**

ADRENAL PATHOLOGIES TO CONTRIBUTE TO CONTINUOUS PROFESSIONAL DEVELOPMENT LIFELONG LEARNING

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Abstract

Anatomy and physiology of the adrenals is presented. Examples of pathology are presented and discussed.

Keywords: cortex, endocrine, medulla

INTRODUCTION

Anatomy and physiology of the adrenal glands is presented including computed tomography (CT) images of normal adrenals and a range of pathologies.

ADRENAL GLANDS

Anatomy and physiology and a range of pathologies of the adrenals is presented below. The pathologies include cysts, masses and adrenal myelolipoma.

• Anatomy and physiology

The suprarenals (adrenals), which are paired structures, are situated on top of each kidney and extend somewhat medially.[1] Being endocrine glands their function is to produce hormones that regulate metabolism, blood pressure, response to stress, and the immune system.[2] They have two parts: cortex and medulla (Figure 1).

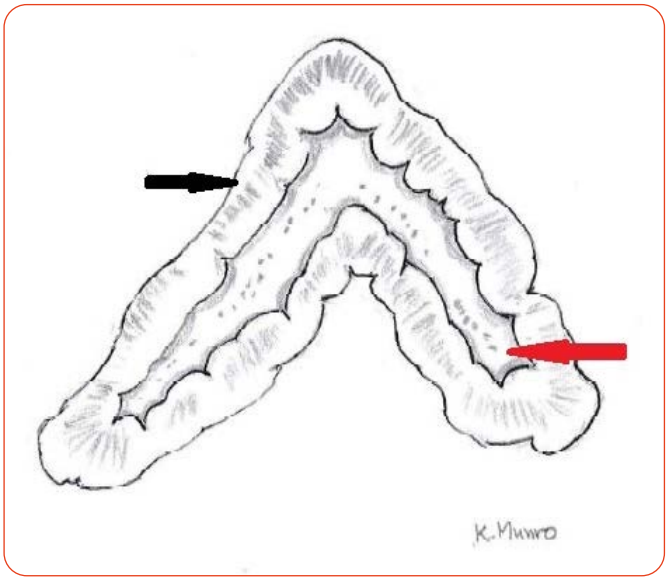

Figure 1. Diagram of adrenal*. Cortex (black arrow). Medulla (red arrow). *(*adapted from[3])*

The cortex is the outer layer with three layers: zona glomerulosa (outer layer), zona fasciculata (middle layer) and zona reticularis (innermost layer). They produce different hormones.[2] The outer layer produces aldosterone, which has an important role in regulating blood pressure and certain electrolytes (sodium and potassium). The middle layer produces cortisol and its function is to suppress inflammation, regulate blood pressure, and control the sleep/wake cycle. The innermost layer produces DHEA and androgenic steroids. The medulla is the central part of the gland. It is responsible for the production adrenaline and nor-adrenaline.

The shape of the gland is slightly different: the right adrenal has an inverted y-shape, and the left has a lambda shape (Figure 2a and b). As seen in Figure 2b the adrenals have two limbs that lie medial and lateral.

• Cyst and masses in the adrenal gland

Figure 3a shows an adrenal cyst. This is a rare benign lesion and is usually unilateral; patients with a low risk of possible rupture and haemorrhage are managed conservatively.[4] Around 8% - 15% of adrenal cysts can present bilaterally.[5]

Figure 3b to d shows masses in the adrenals in patients with known primary cancer. The adrenals are one of the most common sites of metastasis (e.g., lung, breast, malignant melanoma).[6]

• Adrenal myelolipoma

An adrenal myelolipoma is depicted in Figure 4a to f. Adrenal

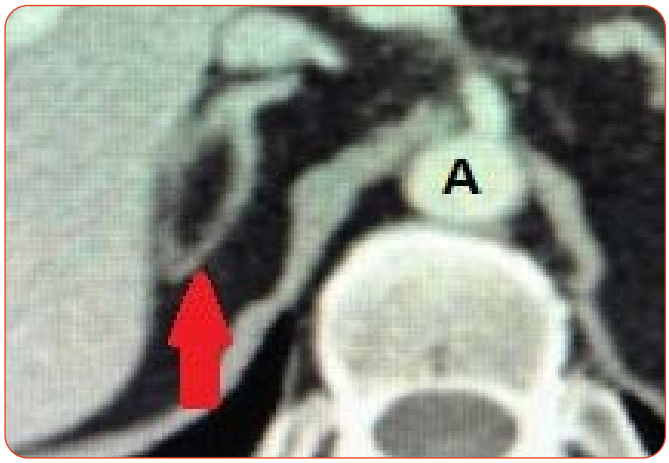

Figure 2a. Enhanced axial CT scan. Red arrow shows inverted y-shaped right adrenal gland. A = aorta.

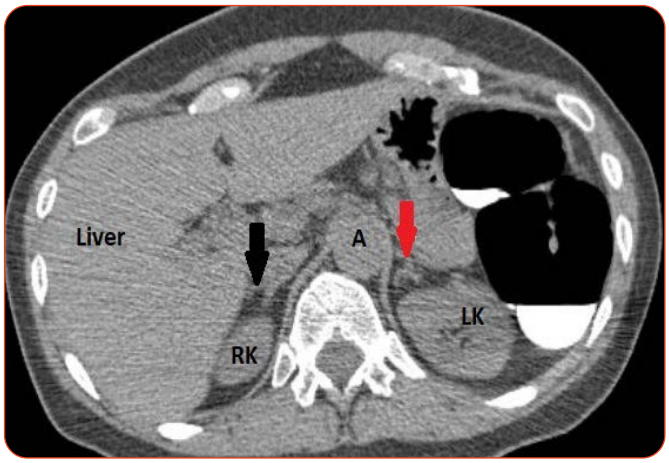

Figure 2b. Unenhanced axial CT scan. Right adrenal (black arrow). Left adrenal (red arrow). RK = right kidney. LK = left kidney. A = aorta.

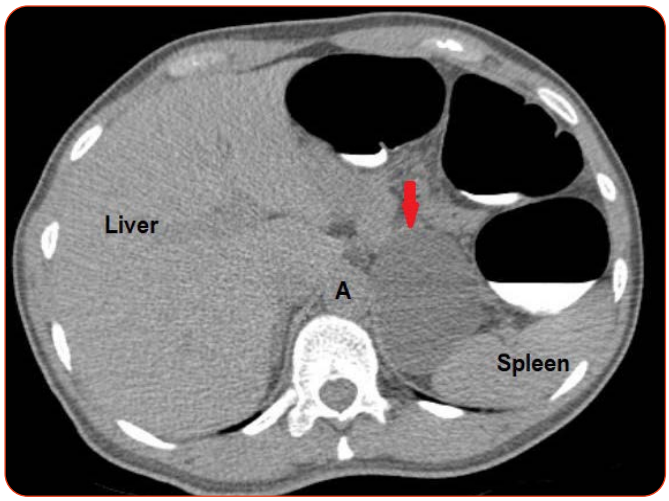

Figure 3a. Unenhanced axial CT scan. Red arrow = left adrenal cyst. A = aorta.

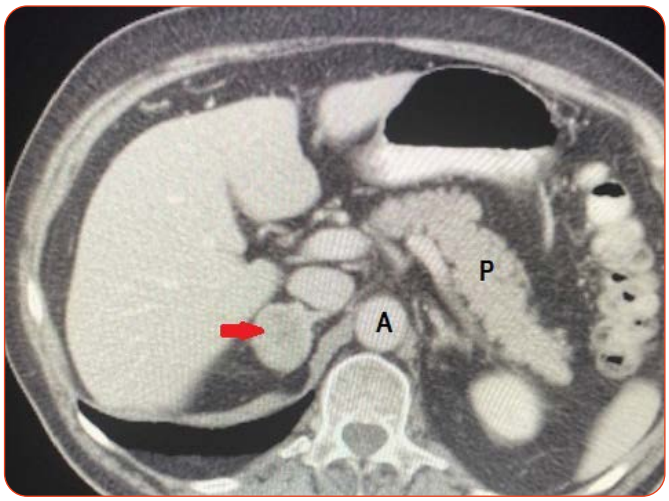

Figure 3b. Axial scan showing a 2.8cm mass in relation to the R adrenal gland (red arrow) in a patient with a lung cancer. A = aorta. P = pancreas.

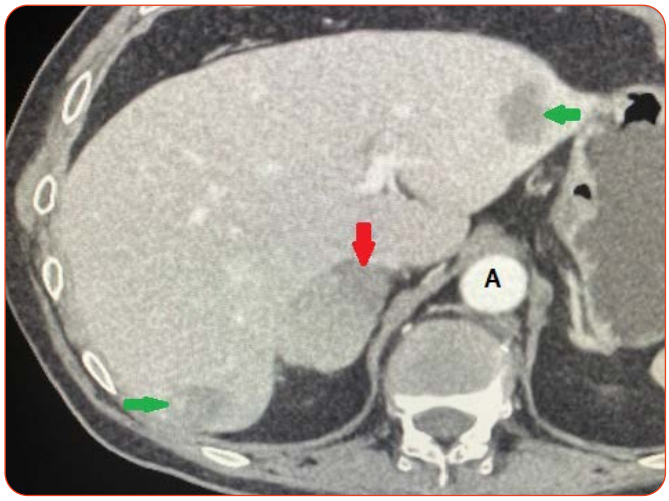

Figure 3c. Axial scan of patient with anaplastic carcinoma of the prostate. Red arrow indicates a 5cm irregular mass in the R adrenal gland. No calcification noted. There are two irregular lytic lesions within the liver (green arrows). A = aorta.

Figure 3d. Axial scan of a patient with anaplastic carcinoma of the prostate showing different appearance of the adrenals. There is a mass in the R adrenal gland (red arrows) with a smooth outline. The mass in the L adrenal (green arrow) is denser with necrotic areas within it (yellow arrow). A = aorta. LK = left kidney

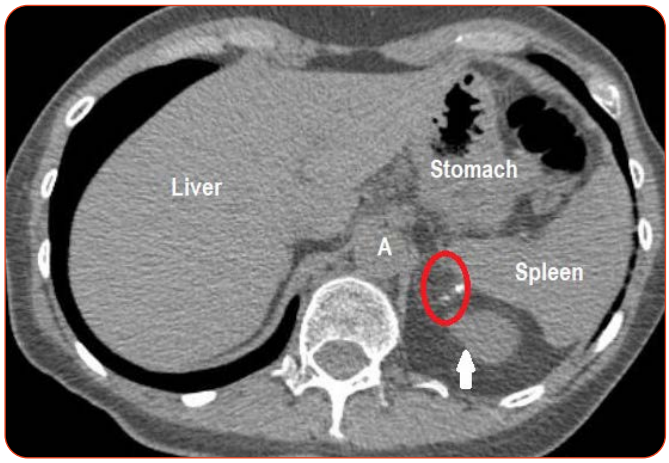

Figure 4a. Non-contrast axial showing 2 small foci calcification (red circle) inferiorly in relation to the L adrenal gland and low density fat which is well circumscribed (HU fat= -103). A = aorta. White arrow = left kidney.

Figure 4b. Enlarged view of L adrenal area showing well-circumscribed low-density mass (red arrow) arising from the medial limb of the adrenal gland in keeping with fat. Calcification seen inferiorly (red circle). A = aorta.

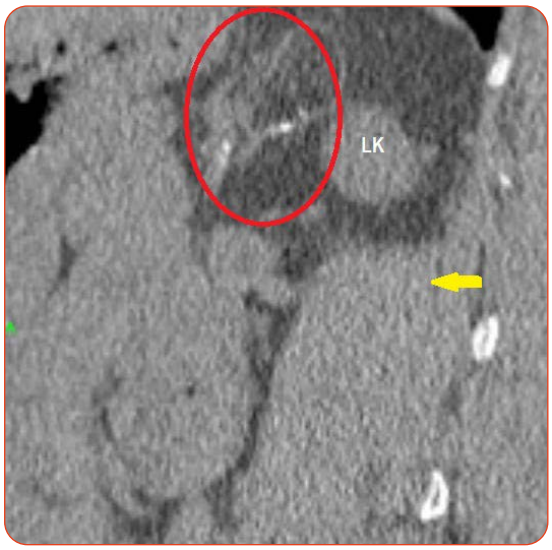

Figure 4c. Left sagittal view showing the fat (red circle) surrounded by a well-defined margin and some calcification anteriorly and above the left kidney (LK). Yellow arrow = muscle.

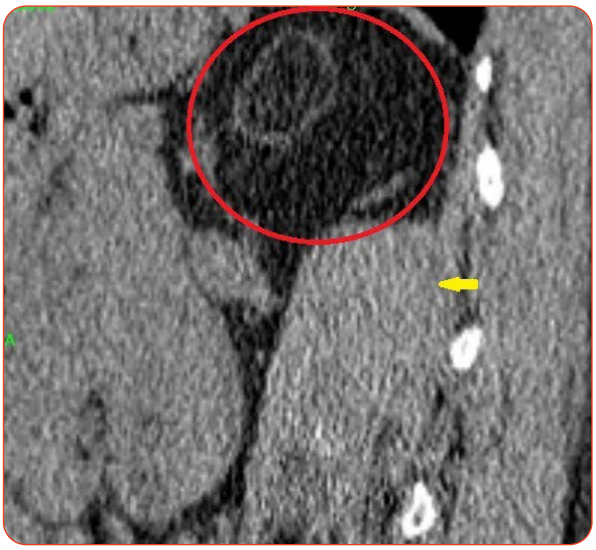

Figure 4d. Abdominal setting of Figure 4c showing the fatty tumour of the adrenal gland (red circle). Yellow arrow = muscle.

Figure 4e. Coronal view which shows the adrenal gland: low density, fat and some heterogeneity (red circle) and calcification in the wall (white arrow). LK = left kidney.

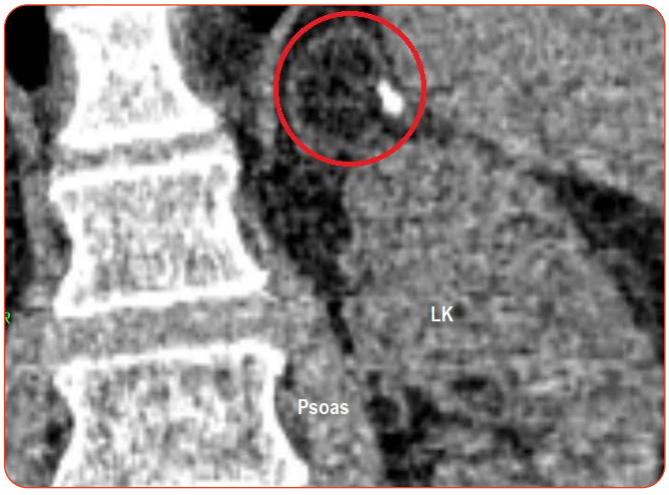

Figure 4f. Abdominal setting of Figure 4e showing fatty replacement of gland (red circle) and punctuate wall calcification. LK = left kidney.

myelolipoma is a benign tumour comprising adipose tissue as well as myeloid tissue (tissue of bone marrow).[7] It is an uncommon tumour and it seldom exceeds 3cm in size.[8] It is easily identified on CT, MRI and ultrasound scanning. The main findings on CT depend on the size of the tumour; small ones are usually hypoechoic due to the fat with attenuation of -90 to -120 HU;[9] they may however be heterogeneous due to the presence of myeloid tissue. Occasionally foci of calcification may be present. MRI will be hyperintense of T1 and intermediate on T2 weighted.[8,9] Ultrasound is useful when the tumour is >1cm where a hyperechoic mass may be observed. Calcification may cause acoustic shadowing.

An adrenal myelolipoma starts off small and may enlarge over a period of time to reach sizes >10cms. It is usually a non-functioning adrenal tumour; most patients are asymptomatic.[10] There may be abdominal and flank pain if it increases in size.[10] Those >6cm have the potential risk of rupturing and retroperitoneal haemorrhage.[10,11] Most myelolipomas are non-functioning tumours; they occur usually between the 4th and 6th decade.[11] Myelolipomas occur in 6-16% of all adrenal masses. They may be associated with Cushing's disease, obesity, hypertension, diabetes, and primary aldosteronism, hypercortisolism or hyperandrogenism.[7]

SUMMARY

Knowledge of the normal anatomy of the adrenal glands is important when viewing CT scans.

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COMPETING INTERESTS

Nil to declare.

DISCLAIMER

The views and opinions expressed in this article are those of the author and do not necessarily reflect the views of the publisher and editorial board.

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