Role of MRI in assessment of adrenal masses

Essay

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LIST OF ABBREVIATIONS

A **:** Amplitude.

ACC **:** Adrenocortical carcinomas.

ACTH **:** Adrenocorticotropic hormone.

ADC **:** Apparent diffusion coefficient.

AP **:** Anteroposterior

ASR **:** The adrenal-to-spleen ratio.

AU **:** Arbitrary units.

Cho **:** Choline.

CMV **:** Cytomegalovirus.

Cr **:** Creatine.

CRH **:** Corticotrophin releasing hormone.

DWI **:** Diffusion-weighted imaging.

FH **:** From feet to head.

FIRM **:** Fast inversion-recovery motion- insensitive.

FOV **:** Field of view.

FSE **:** Fast spin-echo.

GRE **:** Gradient echo.

HASTE **:** Breath-hold half-Fourier transform single shot spin-echo.

HU **:** Hounsefield unit.

Hz **:** Hertz.

IP **:** Inphase images.

IV **:** Intravenous.

LIP **:** lipid.

MIBG **:** Meta-iodobenzylguanidine.

mmol/kg **:** Millimol per kilogram.

MPGs **:** Motion-probing gradients.

MP-RAGE **:** Magnetization prepared rapid acquisition gradient echo.

MRS **:** Magnetic resonance spectroscopy.

Msec **:** Millisecond.

NB **:** Neuroblastoma.

NTs **:** Neuroblastic tumors .

OP **:** Out-of-phase.

P **:** Probability value.

ppm **:** Parts per million.

PPNAD **:** Primary pigmented nodular adrenocortical disease.

PPV **:** Positive predictive value.

RARE **:** Rapid acquisition with relaxation enhancement.

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RF **:** Radio-frequency.

ROI **:** Regions of interest.

S/mm2 **:** Seconds per millimetre squared.

SAR **:** Specific absorption ratio.

SE **:** Spin-echo.

SE-EPI-SSh **:** Single-shot echoplanar technique.

SENSE **:** Sensitivity encoding.

SGE **:** Spoiled Gradient-Echo.

SGRE **:** Spoiled gradient recalled-echo.

SIs **:** Signal intensities.

SII : Signal Intensitiy Index.

SNR **:** Signal-to-noise ratio.

SPIR **:** Spectrally selective inversion recovery.

SPSS : Statistical Package for the Social Sciences.

SSFSE **:** Single shot fast spin echo.

T **:** Tesla.

TE **:** Echo time.

TR **:** Repetition time.

Turbo FLASH **:** Turbo fast low-angle shot.

VIBE **:** volumetric interpolated breath hold examination

VS **:** Versus.

WDHA **:** watery diarrhea, hypochlorhydria, and alkalosis syndrome.

2D **:** 2-dimensional.

3D **:** 3-dimensional.

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Introduction

The incidence of adrenal masses has increased dramatically over last 2 decades as a result of the increase use of imaging modalities such as ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) **(*Heinz-Peer et al., 2007)*.**

Adrenal lesions can be categorized as primary or metastatic, benign or malignant and functioning or nonfunctioning ***(Young et al., 2007)***.

The majority of adrenal masses is asymptomatic adenomas, and therefore is usually detected on radiological examinations for indications unrelated to the adrenal glands ***(Savci et al., 2006)***.

Difficulties exists with adrenal imaging remain not only for diagnosis of atypical adenomas but also for detection of other adrenal alterations, such as metastases, pheochromocytomas, and adrenocortical carcinomas ***(Faria et al., 2007)***.

With MR imaging, it is possible to characterize some adrenal lesions by means of their signal characteristics on different pulse sequences or by their enhancement characteristics. These include adenoma, myelolipoma, pheochromocytoma, cortical carcinoma, lymphoma and metastasis ***(Israel and Krinsky, 2003).***

MRI is frequently used to characterize incidentally discovered adrenal masses, especially in instances for which CT is nondiagnostic, such as in the patient with metallic clip artifacts or complex masses with variable density ***(Boland et al., 2008)***.

An advantage of MRI is that a radiologist does not need to monitor the scan while it is being performed. There is also no radiation risk and no risk related to use of contrast material. The use of MR is therefore highly recommended for further differentiation of incidental adrenal lesions due to its high tissue contrast and multiplanar imaging capabilities, MRI provides a detailed display of the adrenal glands and their adjacent anatomic structures ***(Didoszak and Krestin, 2011)***.

The most important sequence of the adrenal MRI protocol is chemical shift imaging performed with in-phase and out-of-phase sequences. ***(Elsayes and Caoili, 2011)***, which are highly accurate in the differentiation of adenomas from nonadenomas ***(Haider et al., 2004)***.

Diffusion-weighted imaging (DWI) has been shown to be helpful in characterization of tumors on the basis of diffusion effects using apparent diffusion coefficient (ADC) measurements, which were used to assess the mobility of water molecules ***(Koh et al., 2007)***.

Recent studies of MR spectroscopy showed that using threshold values for the choline–creatine ratio, choline–lipid ratio and the lipid–creatine ratio enabled adenomas and pheochromocytomas to be distinguished from carcinomas and metastases & also enabled distinction of pheochromocytomas and carcinomas from adenomas and metastases ***(Faria et al,. 2007).***

Aim of the work

The present study is aiming to highlight the role of MRI in the detection and characterization of adrenal masses.

A.GROSS ANATOMY OF THE ADRENAL GLANDS

Embryology and Development of the Adrenal Glands:

The adrenal glands have a dual embryological origin with the cortex being derived from the celomic mesoderm of the urogenital ridge and the medulla arising from the neural crest ***(Barwick et al., 2005).***

In the 5th week of gestation mesothelial cells from the posterior abdominal wall, between the root of the bowel mesentery and developing mesonephros/gonad (urogenital ridge), proliferate and form the primitive cortex of the adrenal gland ***(Mangray and Delellis, 2009).***

In the 6th week, a second wave of mesothelial cells surrounds the primitive cortex. By 8 weeks, the cortical cells separate from the mesothelium and become surrounded by a fibrous capsule ***(Mangray and Delellis, 2009).***

The major secretory product of the fetal cortex is dehydroepiandrosterone sulfate, reflecting its importance in the development of the genital system during gestation, whereas the cells of the adult cortex produce cortisol, aldosterone and sex steroids ***(Mangray and Delellis, 2009).***

The combined weight of the glands at birth is approximately 10gm ***(Mangray and Delellis, 2009).***