



Role of MRI in assessment of adrenal masses

Essay

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العليم

صدق الله العظيم

سورة البقرة الآية: ٣٢

LIST OF ABBREVIATIONS

<i>A</i>	: Amplitude.
<i>ACC</i>	: Adrenocortical carcinomas.
<i>ACTH</i>	: Adrenocorticotrophic hormone.
<i>ADC</i>	: Apparent diffusion coefficient.
<i>AP</i>	: Anteroposterior
<i>ASR</i>	: The adrenal-to-spleen ratio.
<i>AU</i>	: Arbitrary units.
<i>Cho</i>	: Choline.
<i>CMV</i>	: Cytomegalovirus.
<i>Cr</i>	: Creatine.
<i>CRH</i>	: Corticotrophin releasing hormone.
<i>DWI</i>	: Diffusion-weighted imaging.
<i>FH</i>	: From feet to head.
<i>FIRM</i>	: Fast inversion-recovery motion- insensitive.
<i>FOV</i>	: Field of view.
<i>FSE</i>	: Fast spin-echo.
<i>GRE</i>	: Gradient echo.
<i>HASTE</i>	: Breath-hold half-Fourier transform single shot spin-echo.
<i>HU</i>	: Hounsfield unit.
<i>Hz</i>	: Hertz.
<i>IP</i>	: Inphase images.
<i>IV</i>	: Intravenous.
<i>LIP</i>	: 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.
RARE	: Rapid acquisition with relaxation enhancement.
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.
SI_s	: Signal intensities.
SII	: Signal Intensity Index.

III | LIST OF ABBREVIATIONS

<i>SNR</i>	: Signal-to-noise ratio.
<i>SPIR</i>	: Spectrally selective inversion recovery.
<i>SPSS</i>	: Statistical Package for the Social Sciences.
<i>SSFSE</i>	: Single shot fast spin echo.
<i>T</i>	: Tesla.
<i>TE</i>	: Echo time.
<i>TR</i>	: Repetition time.
<i>Turbo FLASH</i>	: Turbo fast low-angle shot.
<i>VIBE</i>	: volumetric interpolated breath hold examination
<i>VS</i>	: Versus.
<i>WDHA</i>	: watery diarrhea, hypochlorhydria, and alkalosis syndrome.
<i>2D</i>	: 2-dimensional.
<i>3D</i>	: 3-dimensional.

LIST OF FIGURES

FIGURE 1.1:	TRACING PHOTOGRAPH OF A NEONATAL KIDNEY AND ADRENALS	5
FIGURE 1.2:	IN SITU LOCATION OF THE ADRENAL GLANDS	6
FIGURE 1.3:	NORMAL ANATOMICAL RELATIONSHIP OF THE ADRENAL GLANDS	7
FIGURE 1.4:	MICROSCOPIC SECTION DEMONSTRATING THE LAYERS OF THE ADRENAL CORTEX	8
FIGURE 1.5:	GROSS MORPHOLOGICAL CROSS-SECTIONAL ANATOMY OF THE ADRENAL GLAND	9
FIGURE 1.6:	ANATOMICAL RELATIONS OF THE LEFT ADRENAL GLAND DURING AN OPEN SURGERY	11
FIGURE 1.7:	ANATOMICAL RELATIONS OF THE RIGHT ADRENAL GLAND DURING AN OPEN SURGERY	13
FIGURE 1.8:	ARTERIAL SUPPLY AND VENOUS DRAINAGE OF THE ADRENAL GLANDS	15
FIGURE 1.9:	INNERVATION OF THE ADRENAL GLANDS	16
FIGURE 1.10:	LYMPHATICS OF THE ADRENAL GLANDS	18
FIGURE 1.11:	THE NORMAL ADRENAL GLANDS ON T1W SGRE	21
FIGURE 1.12:	NORMAL ADRENAL GLAND BY MRI	22
FIGURE 1.13:	RIGHT ADRENAL CORONAL T1-WEIGHTED IMAGE	22
FIGURE 2.1:	GROSS PICTURE OF A CORTISOL PRODUCING ADENOMA WITH FOCAL HEMORRHAGE	28
FIGURE 2.2:	MICROSCOPIC SECTION OF THE ADRENAL ADENOMA	29
Figure 2.3:	GROSS PICTURE OF A LARGE ADRENAL CORTICAL CARCINOMA WITH EXTENSIVE NECROSIS	30
FIGURE 2.4:	MICROSCOPIC SECTION OF AN ADRENAL CORTICAL CARCINOMA	31
FIGURE 2.5:	GROSS PICTURE OF PHEOCHROMOCYTOMA	33
FIGURE 2.6:	MICROSCOPIC SECTION OF PHEOCHROMOCYTOMA	34
FIGURE 2.7:	GROSS PICTURE OF NEUROBLASTOMA	36
FIGURE 2.8:	MICROSCOPIC SECTION OF NEUROBLASTOMA	37
Figure 2.9:	GROSS PICTURE OF GANGLIONEUROMA WITH GELATINOUS AND FIBROUS CUT SURFACE	38
FIGURE 2.10:	MICROSCOPIC SECTION OF GANGLIONEUROMA	39
FIGURE 2.11:	GROSS AND MICROSCOPIC PICTURE OF MYELOLIPOMA	41
FIGURE 3.1:	BENIGN ADRENAL ADENOMAS ON IP AND OP MR IMAGES	58

FIGURE 3.2: NORMAL Y-SHAPED ADRENAL GLAND	61
FIGURE 3.3: DIAGRAM SHOWING DIFFUSION OF WATER MOLECULES	65
FIGURE 3.4: DIAGRAM SHOWING MEASURING WATER DIFFUSION	66
FIGURE 3.5: PLANNING FOR THE MR SPECTROSCOPY SEQUENCE	73
FIGURE 3.5 CONTINUED: PLANNING FOR THE MR SPECTROSCOPY SEQUENCE	74
FIGURE 3.6: RESPIRATORY ARTIFACTS IN DIFFERENT PATIENTS	78
FIGURE 4.1: BILATERAL ADRENAL MASSES.	89
FIGURE 4.2: RIGHT ADRENAL ADENOMA	90
FIGURE 4.3: LEFT ADRENAL ADENOMA	91
FIGURE 4.4: LEFT ADRENAL ADENOMA	92
FIGURE 4.5: A LARGE LEFT-SIDED ADENOMA	97
FIGURE 4.6: RIGHT ADRENAL MASS.	98
FIGURE 4.7: LARGE MASS INVOLVING THE RIGHT ADRENAL GLAND.	99
FIGURE 4.8: ADRENAL CORTICAL CARCINOMA	102
FIGURE 4.8 CONTINUED: ADRENAL CORTICAL CARCINOMA	103
FIGURE 4.9: ADRENAL CORTICAL CARCINOMA, LARGE MASS OF THE LEFT ADRENAL GLAND	104
FIGURE 4.9CONTINUED: ADRENAL CORTICAL CARCINOMA OF THE LEFT ADRENAL GLAND	105
FIGURE 4.10: RIGHT ADRENAL GLAND SUBACUTE HEMATOMA	107
FIGURE 4.11: ADRENAL HAEMORRHAGE	108
FIGURE 4.12: RIGHT ADRENAL MYELOLIPOMA	110
FIGURE 4.13: LEFT ADRENAL MYELOLIPOMA	111
FIGURE 4.14: BILATERAL PHEOCHROMOCYTOMAS	112
FIGURE 4.15: PHEOCHROMOCYTOMA	114
FIGURE 4.15 CONTINUED: PHEOCHROMOCYTOMA	115
FIGURE 4.16: MRI OF GANGLIONEUROMA	117
FIGURE 4.17: NEUROBLASTOMA	117
FIGURE 4.18: CORONAL T2-WI SHOWING A LARGE LOBULATED RIGHT ADRENAL MASS.	120
FIGURE 4.19: ADRENAL CORTICAL HYPERPLASIA	122
FIGURE 4.20: LEFT ADRENAL HYPERPLASIA	123
FIGURE 4.21: ADRENAL METASTASIS FROM RENAL CELL CARCINOMA	124

FIGURE 4.22: THE RIGHT ADRENAL METASTASIS	125
FIGURE 4.23: ADRENAL CYST	127
FIGURE 4.24: ADRENAL PSEUDOCYST	129
FIGURE 4.25: LEFT ADRENAL MASS HAEMORRHAGE	129
FIGURE 4.26: LYMPHANGIOMA	130
FIGURE 4.27: DIFFERENT ADRENAL CYSTIC LESIONS	132
FIGURE 4.27 CONTINUED: DIFFERENT ADRENAL CYSTIC LESIONS	133
FIGURE 4.28: ADRENAL HISTOPLASMOSIS	134
FIGURE 4.29: LYMPHOMA INVADING THE LEFT ADRENAL GLAND	136
FIGURE 4.30: BOX PLOT OF ADC VALUES FOR LIPID-RICH AND LIPID-POOR ADRENAL ADENOMA	138
FIGURE 4.31: 57-YEAR-OLD MAN WITH LIPID-POOR ADRENAL ADENOMA	139
FIGURE 4.32: FEMALE PATIENT WITH LIPID-RICH ADRENAL	140
FIGURE 4.33: MALE PATIENT WITH ADRENAL METASTASIS FROM HEPATOCELLULAR CARCINOMA	141
FIGURE 4.34: MALE PATIENT WITH ADRENAL CORTICAL CARCINOMA	142
FIGURE 4.35: POINT-RESOLVED MULTIVOXEL MR SPECTROSCOPY OF ADRENAL ADENOMA	145
FIGURE 4.36: RECEIVER OPERATING CHARACTERISTIC CURVES FOR DIFFERENT ADRENAL LESION. ...	146
FIGURE 4.37: POINT-RESOLVED MULTIVOXEL MR IN ADRENAL PHEOCHROMOCYTOMA	150
FIGURE 4.38: POINT-RESOLVED MULTIVOXEL MR IN ADRENAL CARCINOMA	151
FIGURE 4.39: POINT-RESOLVED MULTIVOXEL MR IN ADRENAL METASTASIS	152

LIST OF TABLES

Table 4.1: Staging of adrenal carcinoma.....100

Table 4.2: Comparison of MR Spectroscopy Choline-Creatine Ratio Results.....147

Table 4.3: Comparison of MR Spectroscopy Choline-Lipid Ratio Results.....148

Table 4.4: Comparison of MR Spectroscopy Lipid-Creatine Ratio Results.....148

Table 4.5: Comparison of MR Spectroscopy 4.0 – 4.3 ppm/Creatine Ratio.....149

CONTENTS

<i>Title</i>	<i>Page No.</i>
Introduction and Aim of the work.....	1
Chapter one: Anatomy of the adrenal gland.....	4
Chapter two: Pathology of adrenal masses.....	24
Chapter three: MRI techniques of adrenal masses.....	51
Chapter four: MRI imaging findings of adrenal masses.....	88
Summary & Conclusion.....	154
References.....	157
Arabic summary	

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*).