بسم الله الرحمن الرحيم

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بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

ملاحظات:
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Role of Dynamic Magnetic Resonance Imaging in differentiating benign from malignant thyroid nodule

Thesis

Submitted for partial fulfillment of MD degree of internal medicine

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دور التصوير بالرنين المغناطيسي الديناميكي في التفريق بين العقيدات الدرقية الحميدة والخبيثة

رسالة

توطئة للحصول علي درجة الدكتوراه في الباطنة العامة

مقدمة من

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Contents

List of Abbreviations

Abb.	:	Full term
ACR	:	American College of Radiology's
ADC	:	Apparent Diffusion Coefficient
APC	:	Annual percent change
ATA	:	American Thyroid Association
AUS	:	Atypia of Undetermined Significance/
BMI	:	Body mass index
CRT	:	Neoadjuvant treatment and definitive concomitant
CT	:	Computed tomography
D1	:	Type I iodothyronine deiodinase
D2	:	Type II iodothyronine deiodinase
D3	:	Type III iodothyronine deiodinase
DIT	:	Diiodotyrosine
DWI	:	Diffusion-weighted MR imaging
EES	:	Extravascular extracellular space
ELISA	:	Enzyme-Linked Immunosorbent Assay
EPI	:	Echo planar imaging
FLUS	:	Follicular Lesion of Undetermined Significance
FN	:	Follicular Neoplasm
FNAB	:	Fine-needle aspiration biopsy
FSH	:	Follicle stimulating hormone
GEC	:	Gene expression classifier
GH	:	Growth hormone
H&E	:	Haematoxylin and eosin
HNC	:	Head and neck carcinoma
IMRT	:	Intensity-modulated radiation therapy
IS	:	Intracellular space
K-TIRADS	:	The Korean Society for Thyroid Radiology
LR	:	Logistic regression
MIT	:	Monoiodotyrosine
MNG	:	Multinodular goiter
MRI	:	Magnetic resonance imaging
NIFTP	:	Non-invasive follicular thyroid neoplasm with papillary-like nuclear features

Abb.	:	Full term
NPC	:	Pronounced- nasopharyngeal carcinoma
NPV	:	Negative predictive value
PBDEs	:	Particularly polybrominated diphenyl ethers
PGE2	:	Prostaglandin E2
PPARG	:	Peroxisome proliferator-activated receptor, gamma isoform
PPV	:	Positive predictive value
PRL	:	Prolactin
PTC	:	Papillary thyroid cancer
PTH	:	Parathyroid hormone
RET	:	Rearranged during transfection
rT3	:	Reverse Triiodothyronine
RXRs	:	Retinoic acid X receptors
SFN	:	Suspicious for Follicular Neoplasm
SI	:	Signal intensity
SN	:	Solitary nodule
T3	:	Triiodothyronine
T4	:	Thyroxine
TBG	:	Thyroxin-binding globulin
TERT	:	Telomerase reverse transcriptase
TGF-β	:	Thyroid growth factor β
TIRADS	:	Thyroid Imaging, Reporting, and Data System
TREs	:	Thyroid response elements
TRH	:	Thyrotrophin-releasing hormone
TSH	:	Thyroid-stimulating hormone
US	:	Ultrasonography
USPSTF	:	Us Preventive Services Task Force

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INTRODUCTION

Thyroid nodules are a common clinical problem. Epidemiologic studies have shown the prevalence of palpable thyroid nodules to be approximately 5% in women and1% in men living in iodine- sufficient parts of the world. In contrast, high-resolution ultrasound (US) can detect thyroid nodules in 19%–68% of randomly selected individuals, with higher frequencies in women and the elderly .The clinical importance of thyroid nodules rests with the need to exclude thyroid cancer, which occurs in 7%–15% of cases depending on age, sex, radiation exposure history,family history, and other factors ***(Haugen et al., 2015)***.

The malignant nodules must be distinguished from benign thyroid nodules to correctly and efficaciously treat patients suffering from this pathology. ***(Erdem et al., 2010)***

Because clinical findings do not provide a definitive diagnosis, several useful, non-invasive imaging tests (such as ultrasonography (US) and radionuclide scintigraphy) can be used to determine which nodules should be histopathologically evaluated to rule out the possibility of thyroid malignancy. US has been used as a first step in the assessment of these nodules, but no single US criterion has been demonstrated to accurately differentiate benign nodules from malignant nodules ; Furthermore , the

hazards associated with radiation exposure during radionuclide scintigraphy are unavoidable, and some functioning nodules (hot nodules) found on scintigraphy are malignant. ***(Chen et al., 2016)***

Despite great improvement in diagnostic techniques such as thyroid scan and CT scan of neck, there is still a large problem to use a non- invasive and reliable technique to differentiate benign from malignant thyroid nodules. Recent developments in MRI techniques may be of diagnostic value .Diffusion-weighted MR imaging (DWI) is an emerging technique for brain tumors. DWI is sensitive to changes in the microstructural organization of tissue that may affect water diffusion. It has been used to evaluate head and neck tumors , the Apparent Diffusion Coefficient (ADC) value is a quantitative parameter for distinguishing malignant tumors from benign thyroid nodules. ***(Lamiss et al., 2014)***

Diffusion-weighted imaging (DWI) is a type of functional MRI that is based on the diffusion of water molecules through the tissue of interest (ie, tumour tissue). DWI can provide crucial information regarding the molecular profile of the underlying pathology and pathophysiological mechanisms. Specifically, the diffusion of water molecules in malignant tumors is restricted, which results in a decreased apparent diffusion coefficient (ADC); this difference in the ADC facilitates the differentiation of

benign tumors from malignant tumours ***(Henzler et al., 2010).***

Apparent-diffusion-coefficient (ADC) is a quantitative parameter calculated from DWI combines the effects of capillary perfusion and water diffusion . ADC value is calculated for each pixel of the image and is displayed as a parametric map. By drawing regions of interests on these maps, the ADCs of different tissues can be derived ***(Koh and Collins, 2007).***

Generally, malignant tumors have enlarged nuclei and show hypercellularity. These histopathologic characteristics reduce the extracellular matrix and the diffusion space of water protons in the extracellular areas, with a resultant decrease in the ADC value ***(Wang et al., 2011).***