Assessment of Apparent Diffusion Coefficient Values as non invasive biomarker for Aggressiveness of Prostate Cancer: Comparison with Gleason Score.

Thesis

Submitted for partial fulfillment of M.Sc. Degree in diagnostic radiology

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2016

Acknowledgment

First and foremost, I thank ***ALLAH****who gave me the strength to accomplish this work.*

My deep appreciation to ***Prof. Dr. Ikram Hamed Mahmoud,*** *Professor of Radiodiagnosis, National cancer institute– Cairo University, for giving me the honour to work under his supervision.*

My deep appreciation to ***Prof Dr. Manal Halim Wahba*** *Professor of Radiodiagnosis , Faculty of medicine – Cairo University, for her great effort during this study.*

Special thanks to ***Prof Dr. Iman Gouda Farahat,*** *professor of surgical pathology, National cancer institute – Cairo University, for her great effort during this study*

Special thanks to ***assistant Prof Dr. Sally Emad El Din,*** *assistant professor of Radiodiagnosis , Faculty of medicine – Cairo University for her great effort during this study*

I am also deeply grateful to my friends and colleagues ***Kholoud Morad and Basma abd El sabour*** *for their great effort and support in this study.*

Special thanks to my Family for their spiritual support

ABSTRACT

Prostate carcinoma is the second most frequent cause of cancer-related death in men. DWI is one of the evolving functional MR imaging that assess tissue cellularity. The ADC maps can provide quantitative measurements of tissue water diffusivity through ADC values.

The Gleason scoring system has been accepted internationally as a reference grading system for prostate cancer with respect to tumor aggressiveness.

Using the ADC values as a biomarker for assessment of prostate cancer aggressiveness may help appropriate management of this disease.

Keywords:

Prostate cancer, apparent diffusion coefficient, Gleason score.

LIST OF CONTENTS

LIST OF FIGURES

List of tables

LIST OF ABBREVIATIONS

AAH: Atypical Adenomatous Hyperplasia

ADC: Apparent diffusion coefficient

AJCC: American joint committee on cancer

AUC: Area under the curve

BPH: Benign prostatic hyperplasia

CRPC: castration resident prostate cancer.

CT: Computed tomography

CZ: Central zone

DRE: Digital rectal examination

DWI: Diffusion-weighted imaging

EBRT: External beam radiotherapy

ECE: Extra Capsular Extension

EPI: Echo-planar imaging

ERC: Endo-rectal coil

FOV: Field of view

GS: Gleason score

HIFU: High intensity focused ultrasound

HT : Hormonal treatment

IGRT: Image-guided radiotherapy

IMRT: Intensity-modulated radiotherapy

IORT: Intraoperative radiotherapy

LN: Lymph node

MRI: Magnetic resonance imaging

MRS: Magnetic resonance spectroscopy

NSA: Number of signal averages

PACS: Picture archiving and communication system

PCa: prostate cancer

PCAP:predisposing for cancer of the prostate gene

PIN: Prostatic intraepithelial neoplasia

PSA: Prostatic specific antigen

PSAD: PSA density

PSAV: PSA velocity

PZ: Peripheral zone

RF: Radiofrequency pulse

ROC: Receiver operating characteristic

ROI: Regions of interest

RP: Radical prostatectomy

RT: Radiotherapy

SD: Standard deviation

SE: Spin echo

SI: Signal intensity

SNR: Signal-to-noise ratio

SOR: Standard of reference

SVI: seminal vesicle invasion.

TRUS: Transrectal ultrasound

TSE: Turbo spin-echo

TURP: Trans-urethral resection of the prostate

TZ: Transitional zone

US: Ultrasonography

WI: Weighted image

INTRODUCTION

Prostate cancer is the most frequently diagnosed solid malignant tumor among men.The morbidity and mortality directly attributable to this common malignancy are considerable. However, in a non negligible proportion of patients, the disease may be considered relatively indolent(**De Cobelli et al .,2015).**

The diagnosis of prostate cancer is based on a digital rectal examination (DRE) and assessment of serum prostate specific antigen (PSA) followed by transrectal ultrasound (TRUS)-guided biopsy (**Anwar et al.,2014).**

T2-weighted MRI has been commonly used to detect prostate cancer. Recently, diffusion-weighted MRI (DW-MRI) has been widely introduced in the clinical setting. It is advantageous as it offers increased diagnostic accuracy due to the clear delineation between normal and prostate cancer, namely the high signal of cancerous lesions and the restricted signal of normal tissue DW-MRI is a non-invasive imaging technique that quantifies the diffusion of water molecules in tissues without any contrast agents, tracers, or exposure to radiation .DW-MRI may also provide qualitative information regarding the pathophysiological character of prostate cancer **(Bae et al.,2014).**

The assessment of local aggressiveness of prostate cancer (PCa) is of key importance for appropriate management of this disease. The

increase in life expectancy of the general population combined with efficient screening methods will lead to an increase in the number of new PCa cases. These cases will tend to be more localized and at an earlier stage **(Lebovici et al., 2014).**

The Gleason scoring (GS) system has been accepted internationally as a reference grading system for prostate cancer With respect to tumor aggressiveness, tumors are classified as low risk (Gleason score, ≤6), intermediate risk(Gleason score, 7) or high risk (Gleason score, ≥ 8) **(Doo etal., 2012).**

To establish the ADC as a robust biomarker for predicting prostate cancer Gleason scores, standardization of quantitative ADC metrics is of crucial importance **(Donati et al., 2014).**