



18F-FDG PET/CT for Monitoring of Treatment Response in Breast Cancer

Thesis

Submitted for partial fulfillment of master degree in diagnostic
and interventional radiology

By

Noha Fathy Abdel-Fattah El-Qassas

M.B.B.Ch, Cairo University

Under supervision of

Prof. Dr. Rania Aly Maarouf

Professor of Radiodiagnosis

Faculty of Medicine- Ain Shams University

Dr. Asmaa Magdy Mohamed Salama

Lecturer of Radiodiagnosis

Faculty of Medicine- Ain Shams University

Faculty of Medicine

Ain -shams University

2020

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

لَسْبِقَ أَنْكَ لَا نَعْلَمُ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْعَظِيمُ

صدق الله العظيم

سورة البقرة الآية: ٣٢



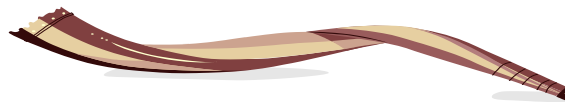
Acknowledgement

First of all, thanks to Allah whose magnificent help was the mainfactor in completing this work.

I would like to express my deepest gratitude and thanks to Prof. Dr.Rania aly Maarouf, Professor of Radiodiagnosis, Faculty of Medicine, Ain Shams University, For giving me the honor of being her candidate, working underher supervision, guided by her experience and precious advices and true concern.

Words could not express my great appreciation, thanks and respect to Dr.Asmaa Magdy Mohamed Salama, Lecturer of Radiology, Faculty of Medicine, Ain Shams University, for his kindness, patience, consideration, precious assistance throughout this work.

Last, but not least, I would like to express my appreciation and thanks to my family and endless love, the light and the only support of my life my mother



Noha Fathy El-Qassas

LIST OF CONTENTS

Title	Page No.
List of Contents.....	I
List of Abbreviations	II
List of Tables	IV
List of Figures.....	V
Abstract	VII
Introduction.....	1
Aim of the Work	3
Review of Literature	4
Anatomy of the Female Breast	4
Pathology of breast cancer	9
Imaging Modalities of Breast Cancer	17
Patients and methods	44
RESULTS	49
Illustrative cases.....	58
Discussion	77
Summary and Conclusion	87
Limitations.....	89
References.....	90

List of Abbreviations

Abb.	Full Termss
18F-FDG	: 18F-FluoroDeoxyGlucose
CECT	: Contrast enhanced computed tomography
CT	: Computed Tomography
CTH	: Chemotherapy
DCIS	: Ductal Carcinoma In Situ
DV	: Dorsal vertebra
FDG	: Fluoro-Deoxy-Glucose
FN	: False negative
FP	: False positive
Gd- DTPA	: Gadolinium diethyl-triamine-pentaacetic
GLUT	: Glucose Transporters
I.V	: Intra-venous
KeV	: Kilo electron Volt
LABC	: Locally Advanced Breast Cancer
LCIS	: Lobular Carcinoma In Situ
LN	: Lymph node
LV	: Lumbar vertebra
MBq	: Megabecquerel
MCi	: Micro Curies
MRI	: Magnetic Resonance Imaging
NOS	: Not Otherwise Specified
NST	: Neoadjuvant Systemic Therapy
PET	: Positron Emission Tomography
PET/CT	: Positron Emission Tomography/ Computed Tomography

List of Abbreviations

Abb.	Full Termss
PHA	: Pulse Height Analyzer
PMT	: Photomultiplier Tube
SUV	: Standardized uptake value
TN	: True negative
TP	: True positive
CA 15-3	: Cancer antigen 15-3

List of Tables

Table No.	Title	Page
Table (1):	Incidence of breast cancer in different quadrants	11
Table (2):	Staging of breast cancer.....	16
Table (3):	Distribution of breast cancer cases according to their demographic data regarding age (years) (n=25).....	49
Table (4):	Distribution of breast cancer cases according to their laterality (n=25).....	50
Table (5):	Distribution of breast cancer cases according to their clinical history and treatment (n=25).....	51
Table (6):	Distribution of breast cancer cases according to their metastasis (n=25).....	52
Table (7):	Distribution of breast cancer cases according to their local recurrence (n=25).....	53
Table (8):	Distribution of breast cancer cases according to their site of metastasis in follow up PET/CT.....	54
Table (9):	Comparison between metastasis pre-treatment and follow up according to their site of metastasis regarding liver, lung, LN, bone and adrenal (n=25).....	55
Table (10):	Comparison between metastasis and follow up according to their site of metastasis SUV regarding liver, lung, LN, bone and adrenal (n=25).....	56
Table (11):	Distribution of breast cancer cases according to their outcome (n=25).....	57

List of Figures

Fig No.	Title	Page
Fig (1):	Breast structure	5
Fig (2):	The boundaries of the axilla.....	6
Fig (3):	Diagram of the principal pathways of lymphatic drainage of the breast.	7
Fig (4):	The lymph nodes of the axilla.....	9
Fig (5):	FDG is a glucose analogue that is taken up by metabolically active cells by means of facilitated transport via glucose transporters (Glut) in the cell membrane.	24
Fig (6):	A typical PET/CT scanner.	25
Fig (7):	Typical scout image obtained during an FDG PET/CT study.	30
Fig (8):	Normal distribution of FDG.....	34
Fig (9):	Poor response to preoperative chemotherapy in a patient with left LABC.	39
Fig (10):	Assessment of tumor response to Neoadjuvant systemic therapy	40
Fig (11):	A 49-year-old woman who underwent bilateral mastectomies and reconstruction with implants 7 years before recurrence of disease.	41
Fig (12):	A 46-year-old woman who presented with sternal pain 5 years after undergoing left mastectomy for invasive ductal carcinoma (T3, N0) followed by chemotherapy and radiation. Anterior coronal FDG-PET image	42
Fig (13):	Results of PET/CT in a patient suspected of having recurrent breast carcinoma.	43
Fig (14):	Histogram distribution of breast cancer cases according to their demographic data regarding age (years).....	49
Fig (15):	Pie chart laterality distribution of breast cancer cases according to their laterality.	50
Fig (16):	Bar chart distribution of breast cancer cases according to their clinical history and treatment.	51
Fig (17):	Bar chart distribution of breast cancer cases according to their metastasis.....	52
Fig (18):	Pie chart distribution of breast cancer cases according to their local recurrence.	53
Fig (19):	Bar chart distribution of breast cancer cases according to their follow up.....	54

Fig (20): Bar chart between metastasis pre-treatment and follow up according to their metastasis regarding liver, lung, LN, bone and adrenal..... 55

Fig (21): Bar chart between metastasis and follow up according to their metastasis SUV regarding liver, lung, LN, bone and adrenal (n=25)..... 56

Fig (22): Bar chart distribution of breast cancer cases according to their outcome 57

Fig (23): Case No. (1)..... 58

Fig (24): Case No. (2)..... 61

Fig (25): Case No. (3)..... 63

Fig (26): Case No. (4)..... 66

Fig (27): Case No. (5)..... 68

Fig (28): Case No. (6)..... 70

(29): Case No. (7) 72

Fig (30): Case No. (8)..... 75

Abstract

Background: Breast cancer is the most common cancer and the second leading cause of cancer mortality in women. Accurate diagnosis and staging are essential for the selection of the most appropriate therapeutic strategy and major determinants of patient prognosis and survival.

Aim of the Work: The purpose of our study is to evaluate the potential role of 18F-FDG PET/CT in monitoring treatment of breast cancer and assessment of recurrence after surgical or systemic treatment.

Patients and Methods This study is retrospective study , was conducted on (25) female patients over a period of 6 months. Their ages ranged from 34 to78 years with mean age of 52 years ,All patients have positive history of breast cancer treatment.

Those patients were referred to the Radio diagnosis & nuclear medicine departments in Ain – shams university and private center .

Results: FDG-PET-CT is the investigation of choice for post-treatment follow up of breast cancer. It has a greatest role in detection of newly developed lesions and for its greatest impact on detection of the disease progression.

Conclusion: FDG-PET-CT is highly useful for monitoring response to therapeutic interventions. This technique can identify response to therapy earlier than any other imaging method currently available which greatly improves patient management by allowing termination of ineffective and toxic therapies. PET-CT proved to be helpful in the evaluation of anatomic regions that have been previously treated by surgery or radiation in which the discrimination between post-treatment scar and recurrent tumor can be problematic.

Key words: breast cancer, Positron Emission Tomography/ Computed Tomography18F-FluoroDeoxyGlucose.