Role of PET/ CT in diagnosis and staging of Hepatocellular carcinoma (HCC)

Essay submitted for partial fulfillment of Master Degree in Radio diagnosis

BY

Charl Samir Lamey

M.B., B.Ch

Ain Shams University

Supervised By

Prof. Dr. Faten Mohamed Mahmoud Kamel

Professor of radiodiagnosis

Faculty of medicine

Ain Shams University

Dr. Remon Zaher Elia

Lecturer of radiodiagnosis

Faculty of medicine

Ain Shams University

Faculty of Medicine

Ain Shams University

2014

Acknowledgement

First and foremost, I submit all my gratitude to GOD to whom I owe every success in my life.

I would like to express my sincere appreciations and profound gratitude to Prof. ***Dr. Faten Mohamed Mahmoud Kamel*** *Professor of Radiodiagnosis, Faculty of Medicine – Ain Shams University, for her help, kind guidance, continuous support & giving me such an honor to work under her supervision.*

I would like to express my respect, appreciation, and thanks for Dr. ***Remon Zaher Elia****, Lecturer of Radiodiagnosis, Ain Shams University, for his assistance, encouragement, invaluable guidance, constructive criticism and great help in supervising this work.*

To my MOTHER,
WIFE,
and FATHER

FOR
THEIR HELP ,
SUPPORT ,
GREAT CARE,
ENCOURAGEMENT
AND CONTINOUS PUSH

Abstract

PET/CT is superior to PET and CT alone, and/or magnetic resonance imaging (MRI), in the diagnosis and treatment of various primary or metastatic cancers.

Dual modality PET/CT scanning provides accurately fused morphologic (CT) and functional (PET) data sets. A very small tumor is well detected by PET but can be missed by CT. On the other hand, a large tumor with minimal functional deviations may be seen on a CT image, but may not be detected by PET. In both situations, PET/CT would localize the tumor accurately. Thus, PET/CT is a more accurate test than either of its individual components.

PET/CT has advantages over other imaging methods; it can differentiate benign from malignant lesions, staging and restaging tumors, detect functional changes before there is any change in clinical or radiological size of a mass, better in identifying cancer that has spread, making up treatment plan and monitoring tumor response, distinguish viable metabolically active tissue from scars, and it is indicated for restaging in patients with suspected recurrent and metastatic disease.

Key words :

PET CT - Hepatitis C Virus - Aflatoxin B .

LIST OF ABBREVIATION

11C: Carbon 11

11C-ACT: 11 carbon acetate

11C-choline: 11 carbon choline

18 FDGal: 18 fluoro-2-deoxy-D-galactose

18F FDG: ^{18}Florine labeled 2 fluro 2 deoxy glucose

18F: Fluorine 18

^{18}FDG-6-P: 18 F-FDG-6-phosphate

AC/AL: Attenuation correction/Alignment

AFB: Aflatoxin B

AFM1: Aflatoxin M1

AFP: Alfa-fetoprotein

BCLC: Barcelona Clinic Liver Cancer

BFGF: Basic Fibroblast Growth Factor

BGO: Bismuth Germinate

CM: centimeter

CNS: Central nervous system

CO2: Carbon Dioxide

CT FOV: Computed Tomography Field of View

CT:Computed tomography

CVS:Cardio vascular system

FCAT: Federative Committee on Anatomical Terminology

FCH : Flurocholine

FDG: Fluoro Deoxy Glucose

FL: Falciform ligament

GCSF :Granulocyte colony-stimulating factor

GLUT: Glucose Transporters

GSO: Gadolinium Silicate

H&E: Hematoxylin and Eosin

H+: Hydrogen ion

HBV: Hepatitis B Virus

HCC:Hepato cellular carcinoma

HCV: Hepatitis C Virus

HU:Housfield unit

IV: Intravenous

IVC: Inferior vena cava

KEV: Kilo electron volt

KV: Killo Volt

LHV: Left hepatic vein

LLS: Left lobe segment donation

LOR: Line of response

LSO: Lutetium Oxyorthosilicate

MCi: Millicurie

MDCT: Multi detector computed tomography

MEV: Milli electron volt

MHV: Middle hepatic vein

MP: Main portal vein

MRI: Magnetic resonant imaging

NAFLD: Non-alcoholic fatty liver disease

NaI (Tl): Thallium-doped sodium iodide

PDGF: Platelet Derived Growth Factor

PEI: Percutaneous ethanol injection

PET CT: Position emission tomography with computed tomography

PET: Positiron emitted tomography

PV: Portal vien

PVT: Portal vein thrombosis

RFA: Radiofrequency ablation

RHV: Right hepatic vein

RNA: Ribonucleic acid

SMA :Superior mesenteric artery

SPECT: Single Photon Emission Computed tomography

SUV: Standardized uptake value

TACE: Transarterial chemoembolization

TNM: Tumor Node Metastasis

UICC: International Union against Cancer

US:Ultrasonography

VEGF: Vascular Endothelial Growth Factor

LIST OF FIGURES

LIST OF TABLES

CONTENTS

INTRODUCTION

Cancer is a major cause of death in the developed world, and is becoming a significant issue for developing countries. ***(Jones et al., 2006)***

Hepatocellular carcinoma (HCC) is the 5th most common cancer worldwide & responsible for up to 1 million deaths annually, its incidence is increasing worldwide because of the dissemination of hepatitis B and C virus infections.
(Huang et al., 2009)

Hepatocellular carcinoma (HCC) is globally the commonest liver primary, and cholangiocarcinoma the second commonest primary liver tumour.
Cholangiocarcinoma accounts for 3% of all gastrointestinal cancers. Mesenchymal liver tumours are rare, but include hepatic angiosarcoma and primary hepatic lymphoma.
(Vauthey and Blumgart, 2009)

The most common malignant tumors in the liver are metastases from wide variety of neoplasms, that most frequently are carcinomas from colorectal, breast, and lung primaries. Often discovered as solitary, liver metastases can be effectively treated with surgery.
(Arciero and Sigurdson, 2008)

Modern cross sectional structural imaging techniques like ultrasonography, computed tomography (CT) and magnetic resonance imaging(MRI) provide high resolution images that aid in accurate detection, delineation and anatomic

localization of the liver malignancies. However, characterization of lesions into benign and malignant etiologies is often not possible from structural imaging techniques alone. Although functional imaging techniques like positron emission tomography (PET) with radiolabeled 18F labeled 2-fluoro-2-deoxy-D-glucose (18F-FDG) often provide critical information pertaining to a benign or malignant etiology, anatomic localization of abnormal regions of uptake is often problematic due to inadequate spatial resolution. These circumstances make the combination of PET with CT appealing. It has the potential of offering a comprehensive ,one-stop, examination by providing information about lesion etiology based on functional activity on PET scanning along with precise anatomic localization and other morphological features of the abnormality with CT scanning.

(Wahl , 2004) (Daniet et al., 2010)

The reported increase in sensitivity of (^{18} F-FDG PET /CT) over CT and MRI has been attributed to the ability to of (^{18} F-FDG PET /CT) to detect metabolic abnormalities that precede the morphological changes by CT.

(Sun et al., 2009)

Advances in imaging technology have improved our ability to detect, characterize, and stage malignant liver tumors. PET/CT therefore possibly proved superior to CT alone when assessing liver cancer.

(Veit et al., 2006)