Role of PET imaging in assessment of myocardial perfusion and viability

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By

Mostafa Samir Mokhtar Hamed
M.B., B.Ch.

Under the supervision of

Prof. Randa Hussein Abdallah
Professor of Radio diagnosis
Faculty of medicine - Ain Shams University

Dr. Susan Adil Ali Abdul Rahim
Lecturer of Radio diagnosis
Faculty of medicine - Ain Shams University

Faculty of medicine
Ain Shams University
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تحت اشراف

ا.د. راندا حسين عبد الله

استاذ الاشعة التشخيصية

كلية الطب - جامعة عين شمس

د. سوزان عادل علي عبد الرحيم

مدرس الاشعة التشخيصية

كلية الطب - جامعة عين شمس

كلية الطب

جامعة عين شمس

٢٠١٦

List of Tables

List of Figures

List of Figures cont...

List of Figures cont...

List of Figures cont...

List of Abbreviations

Abb.	Full term
BGO	bismuth germinatems
CA	Coronary angiography
CAD	coronary artery disease
CMR	cardiac magnetic resonance imaging
Coronary CTA	coronary CT angiography
DSE	Dobutamine Stress Echocardiography
EBCT	electron beam computed tomography
FDG	fluorine deoxyglucose
GSO	gadolinium oxyorthosilicate
HLA	horizontal long axis
IHD	Ischemic heart disease
keV	Kilo electron volt
LAD	left anterior descending artery
LCA	left coronary artery
LCX	left circumflex artery
LDL	low density lipoprotein
LGE	late gadolinium enhancement
LM	left main coronary artery
LSO	lutetium oxyorthosilicate
LV	left ventricular
LVEF	left ventricular ejection fraction
MBF	myocardial blood flow
mCi	mille curie

List of Abbreviations cont...

Abb.	Full term
MeV	milli electron volt
MFR	myocardial flow reserve
MI	myocardial infarction
MPS	myocardial perfusion scintigraphy
MRI	magnetic resonance imaging
MSCT	Multi-slice computed tomography
MVO2	myocardial oxygen demand
OM	obtuse marginals
PCI	percutaneous coronary intervention
PET	positron emission tomography
PET/CT	positron emission tomography/Computed tomography
PMTs	photomultiplier tubes
Rb-82	rubidium-82
RCA	right coronary artery
RI	ramus intermedius
SA	short axis;
SPECT	single photon emission computed tomography
VLA	vertical long axis.
15O-water	oxygen-15 water
18F-FDG	18F-Fluorodeoxyglucose

Introduction and Aim of work.

Introduction

In developed countries, coronary artery disease (CAD) continues to be a major cause of death and disability ***(Ghosh et al., 2010).***The National Heart Lung and Blood Institute (NHLBI) reports that one in four deaths annually are directly caused by coronary artery disease. ***(Rosamond et al., 2011).***

The ability to distinguish reversible from irreversible myocardial injury is of critical importance in the management of patients with both acute and chronic coronary artery disease (CAD) ***(Matsunari et al., 2003).*** The assessment of myocardial viability may guide patient's management and prediction of clinical outcome after coronary revascularization .Multiple imaging techniques have been developed to assess viable and nonviable myocardium by evaluating perfusion, cell membrane integrity, glucose metabolism, scar tissue, and contractile reserve. ***(Schinkel et al., 2007).***

For patients with obvious symptoms of CAD Contrast coronary angiography (CA) is an invasive imaging technique for the visualization of coronary anatomy. Pooled data in patients with suspected coronary artery disease undergoing diagnostic CA demonstrate that 20-40 % of them are inconclusive for the documentation of hemodynamically severe atherosclerotic disease .Finally, CA is limited by its invasive nature and bears low, but nevertheless not negligible rates of procedure related mortality (0.15%) and morbidity

(1.5%), as well as having a relatively high cost. ***(Dobrucki et al., 2010).***

As an alternative to invasive and expensive percutaneous coronary intervention (PCI), non-invasive imaging techniques are used to detect asymptomatic CAD patients at an early stage and guide optimal patient management thereafter. ***(Weustink et al., 2010).***

There are two types of studies: anatomical and functional imaging. For anatomical imaging, Multi-slice computed tomography (MSCT), electron beam computed tomography (EBCT) and magnetic resonance imaging (MRI) are used: whereas, for functional imaging, nuclear cardiology and/or stress echocardiography are used. ***(Weustink et al., 2010).***

Cardiac imaging techniques using myocardial perfusion scintigraphy (MPS), based on the study of myocardial perfusion and cellular membrane integrity, have achieved substantial success in the assessment of myocardial viability. ***(Chalela et al., 2010).***

Recently the use of positron emission tomography (PET) as a noninvasive tool for imaging the heart in coronary artery disease to look for perfusion defects and viability has already been established. This has helped us to know the extent of myocardial bloodflow and the metabolic changes occurring in the myocardium. ***(Pradhan et al., 2015).***

The clinical application of PET in ischaemic heart disease falls into two main categories: first, it is a well-established modality for evaluation of myocardial blood flow (MBF); second, it enables assessment of myocardial metabolism and viability in patients with ischaemic left ventricular (LV) dysfunction. The combined study of MBF and metabolism by PET has led to a better understanding of the pathophysiology of ischaemic heart disease. ***(Pradhan et al., 2015).***

Aim of the work

To illustrate the recent role of PET imaging in assessment of myocardial perfusion and viability.

Chapter 1

Anatomy of the heart and its blood supply.