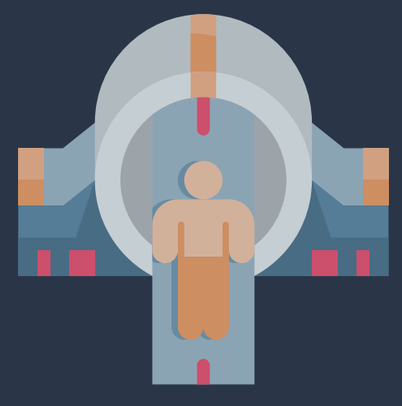
جامعة الشارقة
UNIVERSITY OF SHARJAH
كلية العلوم الصحية
COLLEGE OF HEALTH SCIENCES

References

A COMPREHENSIVE REVIEW ON

PET/CT

CLINICAL APPLICATIONS AND BASIC FEATURES



Done by: Hessa Alkarrani - Amina Aldhuhoori - Kawthar Ebrahim
Supervisor: Assoc. Prof. Dr. Huseyin Ozan Tekin

INTRODUCTION

PET/CT is a medical imaging technique that combines two different technologies: positron emission tomography (PET) and computed tomography (CT). PET imaging uses a radioactive tracer to detect changes in cellular activity, while CT imaging provides anatomical information about the body. ***The history of PET/CT dates back to the 1970s*** *when PET imaging was first developed. In the early 2000s, the integration of PET and CT scanners led to the creation of PET/CT imaging, which has since revolutionized clinical practice. The modality involves the injection of a radioactive tracer, which emits positrons that interact with nearby electrons, producing gamma rays that are detected by the PET scanner. The CT component uses X-rays to produce detailed images of the body's anatomy. The PET and CT images are then combined to provide a comprehensive view of cellular activity and anatomical structure.*

THE PATIENT IS INJECTED BY A RADIOACTIVE TRACERS CALLED RADIOPHARMACEUTICALS

FLUORODEOXYGLUCOSE

110 MINUTES

MOST COMMON PET/CT RP

RADIOPHARMACEUTICALS

1. **Gallium-68 Dotatate:** a somatostatin receptor imaging agent labeled with gallium-68, used for the detection and staging of neuroendocrine tumors.
2. **Rubidium-82 (Rb-82):** a myocardial perfusion imaging agent, used for the detection of coronary artery disease in cardiology.
3. **FET:** Used in PET/CT imaging for brain tumors, as it is taken up by tumor cells and can distinguish between tumor tissue and normal brain tissue.

CLINICAL APPLICATIONS

1. ***Oncology:*** *PET/CT is widely used in the diagnosis, staging, and monitoring of various cancers, including lung cancer, breast cancer, lymphoma, and melanoma.*
2. ***Neurology(Brain):*** *PET/CT can be used to study brain function and metabolism in conditions such as Alzheimer's disease, Parkinson's disease, and epilepsy.*
3. ***Cardiology:*** *PET/CT is used to evaluate heart function and blood flow, as well as to detect coronary artery disease and assess the effectiveness of treatment.*

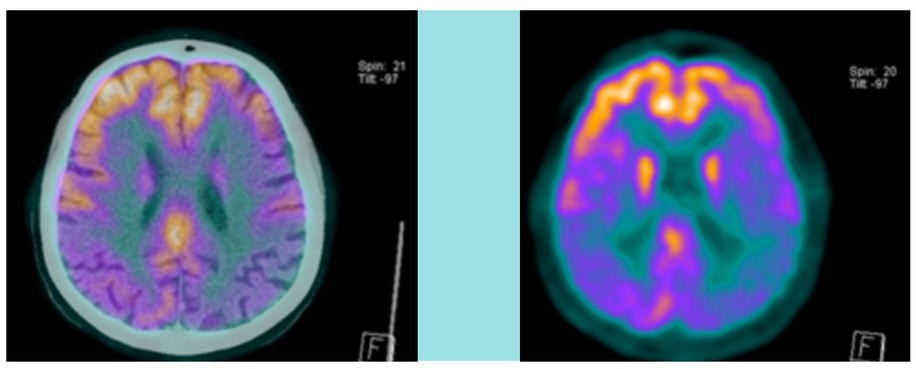
RADIOPHARMACEUTICALS UPTAKE INCREASES IN INFLAMMATION AND TUMORS, BUT DECREASES IN ALZHEIMER'S, MYOCARDIAL PERFUSION, AND PARKINSON'S DISEASE . IT REFLECTS THE METABOLISM OF GLUCOSE IN THE BRAIN CELLS.

ADVANTEGES

The advantages of PET/CT imaging include its ability to detect changes in molecular processes, allowing for earlier diagnosis and treatment monitoring. It provides high sensitivity and specificity, improving accuracy in diagnosis and staging of diseases. It is a non-invasive procedure, making it safer for patients, and can help reduce the need for other imaging tests or invasive procedures. Additionally, it allows for whole-body imaging, enabling the detection of multiple lesions and metastases in a single scan.

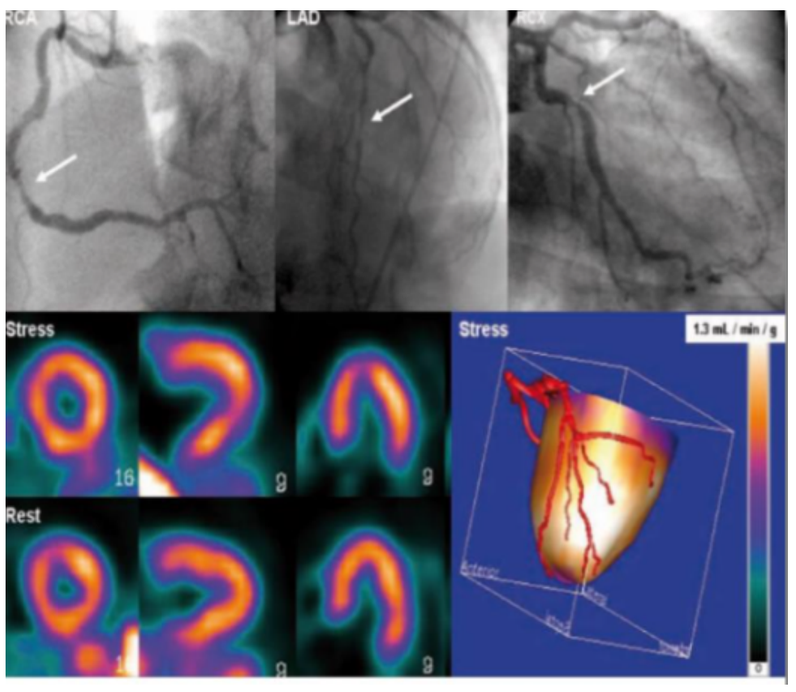
DISADVANTAGES

The main disadvantage of PET/CT imaging is the relatively high cost of the procedure, which may not be covered by all insurance plans. Additionally, the use of radioactive tracers presents a potential risk of radiation exposure. Patients may also experience mild side effects, such as nausea or allergic reactions, from the injection of the tracer. Finally, the interpretation of PET/CT images can be complex, requiring specialized training and expertise.



CASE.1

A 55-year-old female patient with cognitive and memory impairment and a family history of Alzheimer's disease underwent FDG PET and PET-CT imaging, which showed decreased metabolic activity in the bilateral parietotemporal cortex.



CASE.2

A 52-year-old diabetic patient with atypical chest pain had severely calcified coronary arteries with a calcium score of more than 3500, making CTCA unsuitable. Instead, PET perfusion with oxygen-15-labeled water was used, showing homogeneous perfusion during rest and induced vasodilation (adenosine). The radiopharmaceutical used was oxygen-15-labeled water.