Current Practice of ^{18}F-FDG PET/CT in Myanmar

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Introduction

PET/CT (Positron emission tomography/computerized tomography) is an advance technology having a significant impact in oncology. The most common radioisotope for PET/CT is^{18}Fluorine-2-fluoro-2-deoxy-D-glucose (^{18}F-FDG) an analogue of glucose which has high rate of uptake in wide range of tumors. It is an expensive, short-lived radiopharmaceutical and is synthesized in a cyclotron by a complex process (1).

This imaging technique is commonly used for diagnosis, staging, restaging or recurrence detection and treatment monitoring of many cancers. Its other uses are for Neurology and Cardiology.

As the Positron emission tomography (PET) has become a standard imaging in the management of patients with cancer, the Myanmar's first PET/CT together with 18 Mev Cyclotron started at the Department of Nuclear Medicine, Yangon General Hospital on 7.9.2015. This was followed by inauguration of PET/CT facilities at Pinlon Hospital (Private Sector) in 15.7.2018.

Current practice of ^{18}F-FDG PET at Yangon General Hospital (Nuclear Medicine Department)

A total of ^{18}F FDG 1221PET/CT examinations were performed. The number of scans was 209 in 2016,389 in 2017 and 623 in 2018. All the cases were referred for oncology practice with breast cancer (19.2%), haematological malignancies (14.2%), head and neck cancer (10.7%), lung cancer (9.5%), gynaecological malignancies (9.6%), colorectal cancer (9.2%), Unknown primary (6.1%) Hepatocellular carcinoma (4.99%), Upper GI malignancy (4.4%), Urogenital malignancy (4.1%), and other malignancies (8.0%). The referral indications for PET/CT were for recurrence detection (53.6%), response evaluation (22.5%),

staging (13.9%), and diagnosis (9.9%), During the study period, there was a steep rise in the use of ^{18}F FDG PET/ CT because of an increased awareness and acceptance of the clinicians. We have noticed that PET/CT caused a change in diagnosis and/or staging and/or treatment plan in many cases.

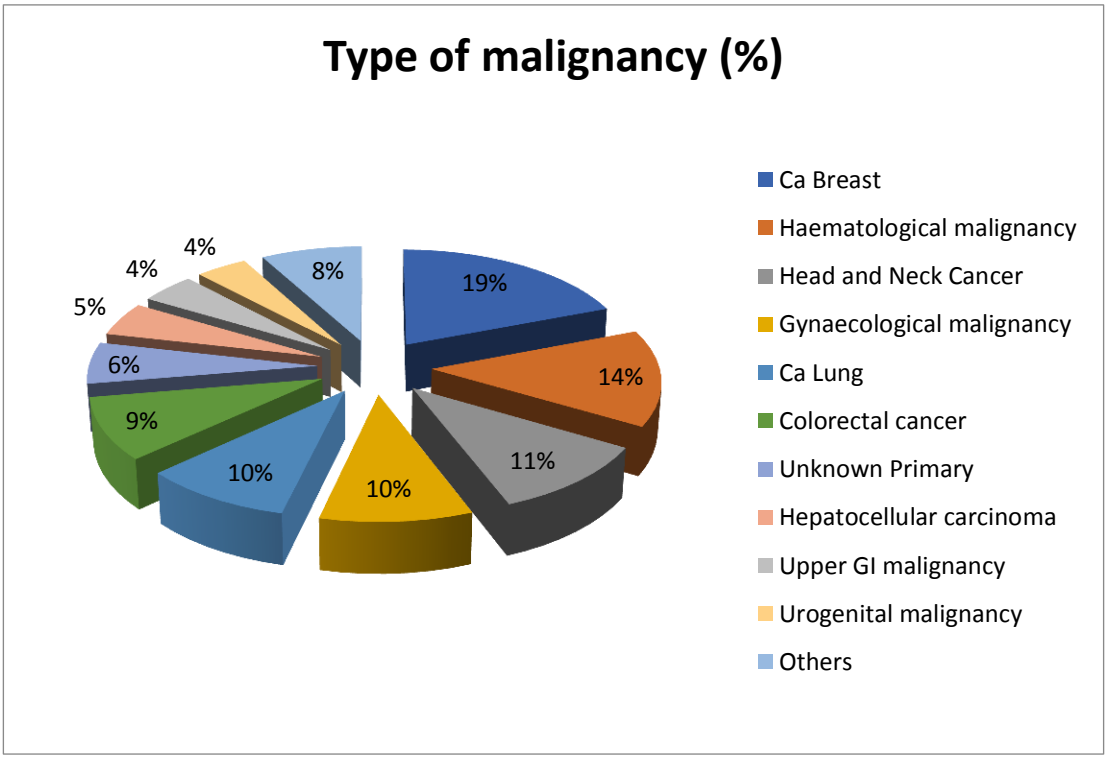

Fig.1 Types of Malignancy

Indications for PET/CT

- Differentiation of benign from malignant lesions
- Searching for an unknown primary tumor when metastatic disease is discovered as the first manifestation of cancer or when the patient presents with a paraneoplastic syndrome.
- Staging patients with known malignancies.
- Monitoring the effect of therapy on known malignancies.
- Determining whether residual abnormalities detected on physical examination or on other imaging studies following treatment represent tumor or post-treatment fibrosis or necrosis.
- Detecting tumor recurrence, especially in the presence of elevated tumor markers.
- Selection of the region of tumor most likely to yield diagnostic information for biopsy.
- Guiding radiation therapy planning (3).

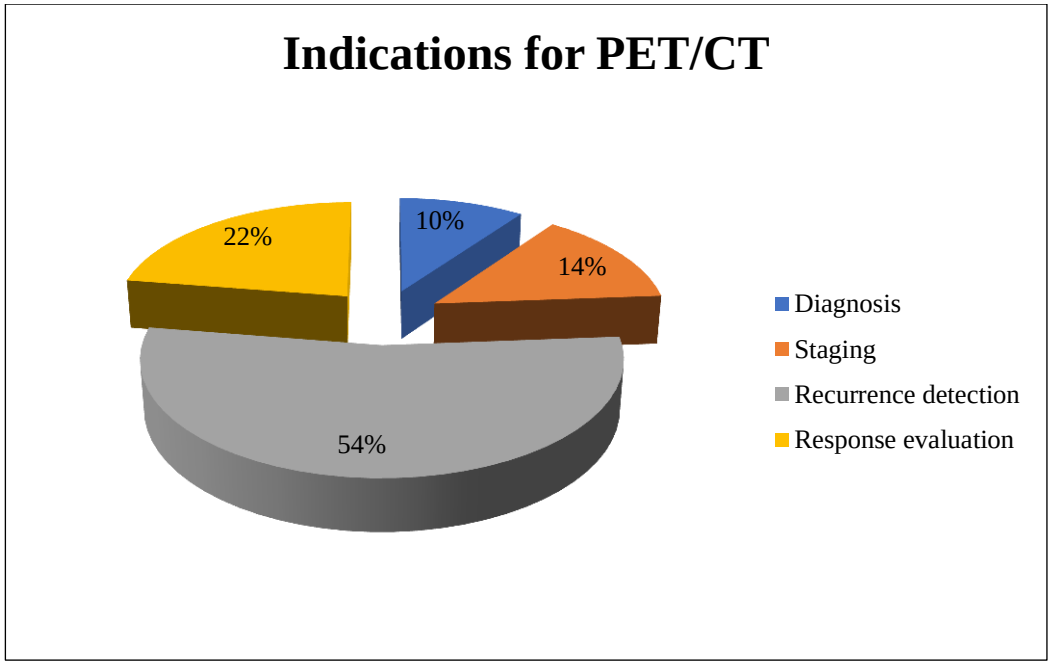

Fig. 2 Indications for PET/CT

Patient Preparation and precautions

Pregnancy

Like any other diagnostic procedures in a female patient known or suspected to be pregnant, a clinical decision is necessary in which the benefits are weighed against the possible harm (3).

Brest feeding

The lactating breast accumulates FDG (2, 3), it is suggested that contact between mother and child be limited for 12 h after injection of FDG to reduce the radiation dose that the infant receives from external exposure to radiation emitted by the mother (2, 3). Instructions to the patient (According to European Association of Nuclear Medicine Procedure Guideline of FDG PET/CT)

- Do not consume any food, simple carbohydrates or liquids other than plain (unflavoured) water for at least 4 hours prior to the start of the FDG PET/CT study (i.e. with respect to the time of injection of FDG).
- Parenteral nutrition and intravenous fluids containing glucose should be discontinued at least 4 h before the time of FDG injection.
- During the injection of FDG and the subsequent uptake phase, the patient should remain seated or recumbent and silent (this is particularly true for head and neck cancer patients) to

minimise FDG uptake in muscles. The patient should be kept warm starting 30 – 60 min before the injection of FDG and continuing throughout the subsequent uptake period and examination to minimise FDG accumulation in brown fat (especially relevant in winter or if the room is air-conditioned).

- Patients must avoid strenuous exercise for at least 6 h before the FDG PET/CT study, and preferably for 24 h.
- Patients should void immediately prior to the PET/CT examination to reduce bladder activity.

Blood Glucose Level Prior to the study

Blood glucose level must be measured prior to administering FDG. It should not be more than 200 mg%.

Time interval between therapy and PET

- Between chemotherapy and FDG PET/CT, an interval of at least 10 days between the last treatment and the FDG PET/CT examination is generally considered adequate for measurement of response (2, 3).
- For Growth factors, they generally last for more than 2 weeks after the final administration (2, 3).
- For radiotherapy, should wait for 2 or 3 months following completion of radiation therapy before obtaining a PET/CT scan (2, 3).
- Following surgery, it is recommended to delay the FDG PET/CT for at least 6 weeks due to postsurgical inflammation if the scan is primarily being done to assess the surgical field (2, 3).

Normal Distribution of ^{18}F FDG

FDG is an analogue of glucose and is taken up by living cells via cell membrane glucose transporters and subsequently incorporated into the first step of the normal glycolytic pathway. FDG accumulation in tissue is proportional to the amount of glucose utilization. Increased consumption of glucose is characteristic of most cancers and is in part related to overexpression of the GLUT glucose transporters and increased hexokinase activity (3). FDG usually accumulates in the grey matter, oropharynx, esophagus, myocardium, renal pelvis, bowels and urinary bladder.

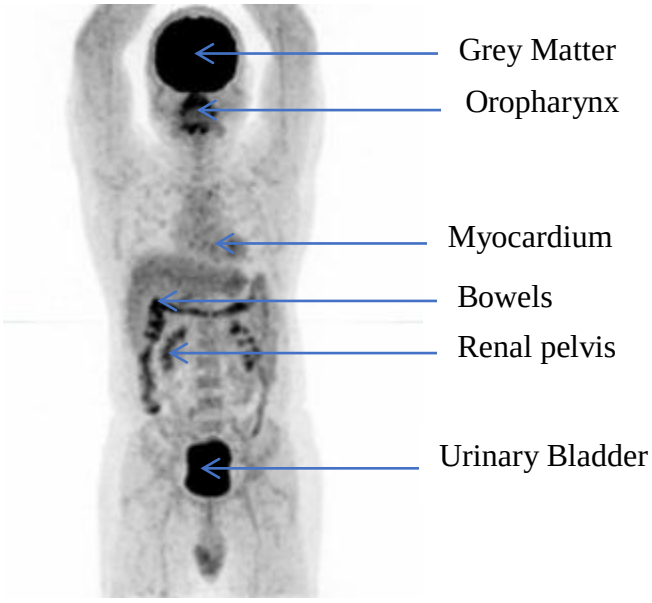

Fig 3. Normal Distribution of FDG

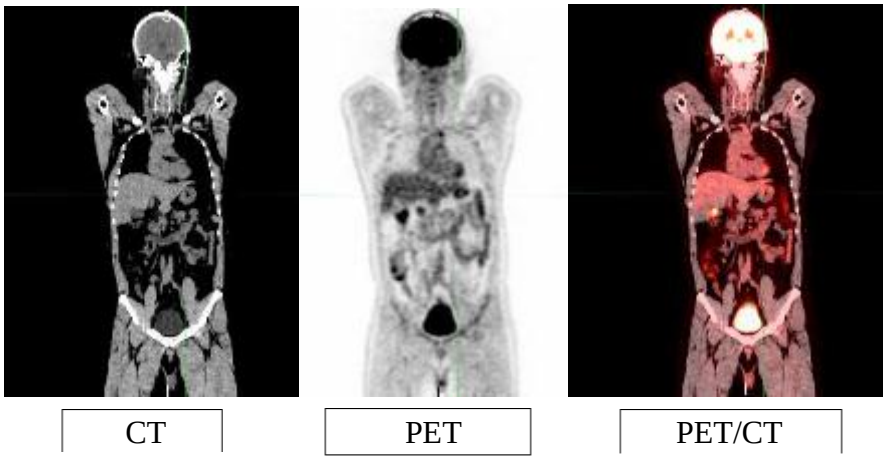

Fig 4. Normal PET/CT Scan

Radiation Exposure

Radiation Exposure, for ^{18}F FDG, according to ICRP publication 106 (3, 4) about 3.5 mSv for an administered activity of 185 MBq. The radiation exposure related to a CT scan carried out as part of an FDG PET/CT study depends on the intended use of the CT study and may differ from patient to patient.

Conclusion

The first PET/CT service of our country has been successfully established at Yangon General Hospital with a rising referrals together with an increased awareness and acceptance of the referring clinicians. We need a good follow up system to prove that the use of PET/CT

imaging help changed patient management in a significant number of cases. We also need to expand our service to non-oncology practice.

References

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