Implementation of FDG PET-CT Simulation Protocol for Head and Neck Cancer: Our Experience

Chua Jia Jia[1], Nur Idalia Bt Abdul Majid[1], Mohd Ridhwan Mat Daud @ Daud[1], Farah Najwa Bt Zainudin[1], Hau Jia Yi[1], Nur Khalis Bt Sukiman[1], Sivashangkri Santhirasegaran[1], Heng Siew Ping[1]

[1]Nuclear Medicine and Radiotherapy Department, Sunway Medical Centre, Selangor, Malaysia

Introduction

Positron Emission Tomography-Computed Tomography (PET-CT) scan, which combines the benefit of metabolic PET data and anatomical CT data, has been clinically proven to provide valuable information which could improve the accuracy of the target volume delineation. However, the process of co-registration of an existing PET-CT images with CT simulation images could hinder the accuracy of co-registration due to the fact that the patient's position during PET-CT scan is different from the patient's position during CT simulation. It is especially significant for Head and Neck cancer cases as the patient is laying in neutral position during PET-CT scan while the patient is laying on a head rest with thermoplastic mask during CT simulation. The aim of this report is to share our experience in implementing PET-CT simulation for head and neck cancer patients, where the PET scan is done with exactly the same position as CT simulation, with thermoplastic mask on, on a CT couch with flat table top.

Report

A Siemens Biograph MCT 3 ring detector PET-CT machine is used for PET-CT simulation procedure in our department. A daily machine QA is done in the morning. Prior to PET-CT sim procedure, education is given to the patient regarding the procedure by the Radiation Therapist (RTT). Later, the patient is positioned supine on a CT couch with flat table top made of carbon fiber with immobilization devices such as CIVCO Type-S Overlay Board, Silverman head rest, kneefix and feetfix. Later, patient is aligned with external LAP lasers and a thermoplastic IMRT reinforced Type-S™ mask is customized.

Later, patient observation and consultation are done by the staff nurse (SN) and Nuclear Radiologist (NR). Meanwhile, dispensing of 18F-FDG and dose calculation are done by Nuclear Pharmacist (NP). IV line is then set by the SN and 18F-FDG is administered. Typically, 3Mbq/kg of FDG is administrated and a minimum of 45mins is allowed for uptake before imaging.

When the time is up, RTT is then present during the beginning of PET-CT scan to assist NRR in reproducing the radiotherapy simulation position using the immobilization devices. 50ml Omnipaque/Visipaque is injected followed by a 30 seconds delay prior to a whole body CT scan followed by a whole body PET acquisition. Later, image registration, post processing and reconstruction are done by the NRR. Lastly, the PET-CT images are exported to Radiotherapy Treatment Planning System for target volume delineation and treatment planning.

Figure 1: Patient setup for PET-CT simulation for Head and Neck Cancers.

No.	PET-CT Simulation Protocol	*Personnel Involved					
		RTT	NRR	NR	NP	SN	MP
1.	Daily QA for PET-CT machine		/				
2.	Patient education prior to procedure	/					
3.	Patient positioning (supine) and BDS mask making	/					
4.	Patient observation and consultation			/		/	
5.	Dispensing of FDG and dose calculation				/		
6.	IV line setting and FDG injection					/	
7.	Patient positioning and immobilization for scanning	/					
8.	Injection of contrast agent (50ml Omnipaque/Visipaque)	/					
9.	Whole body CT acquisition and protocol	/	/				
10.	Whole body PET acquisition and protocol (2 mins/bed)		/				
11.	Image registration, post processing and reconstruction		/				
12.	Image exportation and treatment planning						/

Table 1: PET-CT Simulation Protocol with the Respective Personnel Involved.

*RTT-Radiation Therapist; NRR-Nuclear Radiogrpaher; NR-Nuclear Radiologts; NP-Nuclear Pharmacist; SN-Staff Nurse; MP-Medical Physicist

Conclusion

With the cooperation of multidisciplinary team, PET-CT Simulation for Head and Neck Cancers had been fully integrated into routine clinical practice; with image registration accuracy of < 1 mm in all direction. The challenges in implementing PET/CT simulation are the additional time required in patient positioning and immobilization as well as radiation exposure to the radiation therapists.

Reference

1. Kearney et al.(2014). PET-CT SIM: Radiation Therapist (RT) Led Development and Clinical Implementation in Routine Practice.