

UNIVERSITI TEKNOLOGI MARA

**MATHEMATICAL MODELLING OF
¹⁸F-FDG CONCENTRATION IN THE
KIDNEYS AND URINARY BLADDER**

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Thesis submitted in fulfilment
of the requirements for the degree of
Master of Health Sciences (Medical Imaging)

Faculty of Health Sciences

June 2019

ABSTRACT

Positron emission tomography/computed tomography (PET/CT) is a medical diagnostic imaging technique that allows identification of anatomical and quantitative assessment of physiological process in many types of cancers. Quantification of PET image enables to determine a direct relationship between the time-varying activity concentration in organs or tissues and the essential parameters that describe the biological processes at the cellular level. Hence, further improvement in the accuracy quantification of PET image as to ensure the amount of radiotracer activity to the targeted tissues or organs can be precisely measured. The aims of this study were to measure organs dose based on the region of interest (ROI) and to propose mathematical models for evaluating the concentration of ^{18}F -fluorodeoxyglucose (^{18}F -FDG) in the kidneys and urinary bladder using PET/CT images. Kidneys, abdominal aorta and urinary bladder of the nine healthy subjects were identified by manually drawing the ROIs from the dynamic PET images to measure organ's activity concentration of ^{18}F -FDG. The measurement of organ's activity based on ROI was used for estimating the amount of radiation dose received by the kidneys. The polynomial regression model and artificial neural network (ANN) were selected in this prospective dosimetric study. The results demonstrated that the estimation of organ's ^{18}F -FDG activity based on the drawn ROI had reduced its absorbed dose. The mean value of R^2 for the 15th degree polynomial regression model is 0.85 with 0.015×10^9 of MSE while the R value of simulation for ANN is 0.85 with 0.012 of MSE. The development of mathematical models based on the polynomial regression model and ANN can be used to evaluate the distribution of ^{18}F -FDG concentration in the kidneys. The estimation of organ ^{18}F -FDG activity based on the drawn ROI and the two mathematical models used may increase the dosimetric evaluations of dynamic PET/CT imaging that might be useful in the clinical area specifically for patients presented with kidneys related diseases.

ACKNOWLEDGEMENT

First and foremost, my deepest appreciation to my supervisor, Assoc. Prof. Dr. Hairil Rashmizal bin Abdul Razak, who gave the encouragement from the start and very dedicated throughout my master's journey and sharing a lot of useful ideas for this research. I would also like to express my gratitude to my co-supervisors, Madam Farahnaz binti Ahmad Anwar for her assistance in the important clinical issues and Dr. Ahmad Ihsan bin Mohd Yassin for supervision and giving opinions about this research particularly on the artificial neural network study and statistical analyses.

My sincere thanks to our collaborators, Assoc. Prof. Dr. Fathinul Fikri bin Ahmad Saad, Professor Dr. Abdul Jalil Nordin and all staffs from the Nuclear Imaging Centre, Faculty of Medicine and Health Sciences, University Putra Malaysia, for providing the facilities, knowledge and assistance during the PET/CT data collection.

My special thanks to Ministry of Education (MOE) Malaysia for the contribution of research funding under Research Acculturation Grant Scheme (RAGS) - Ref. No. 600-RMI/RAGS 5/3 (150/2014) and for providing me with a scholarship (Mymaster) to complete this thesis.

Lastly, this thesis dedicated to my beloved father, Mustapha Ibrahim for his assistance in completing this thesis and my mother, [REDACTED] and siblings for their physical and mental support and trust within these years.

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