UNIVERSITI TEKNOLOGI MARA

EVALUATION OF PATIENTS' DOSES IN PEDIATRIC SCOLIOSIS RADIOGRAPHY

ZULAIKHA JAMALLUDIN

Thesis submitted in fulfillment of the requirements
for the degree of
Master of Health Science

Faculty of Health Science

July 2010

ABSTRACT

Concerned in radiation doses encountered in whole spine imaging was due to the exposure of radiosensitive organs to radiation particularly in young patients whom proved to be susceptible to the effects of ionizing radiations. Thus, study was conducted for comparison of patients' entrance skin dose (ESD) and effective dose (E) in routine whole spine imaging between selected hospitals. In addition, the relationship between patients' thickness with ESD and comparison between two ESD measurements methods also were conducted. A total of 78 patients between 11 to 18 years old from two hospitals providing the Scoliosis Clinic were selected. Only standing antero-posterior (AP)/postero-anterior (PA) and lateral projections were included. The ESD was measured by placing Thermoluminescent (TLD) chips on patients' skin, at the centre of irradiation area. The ESDs' also were calculated related to the tube output used for the same exposure. Radiographic equipment information, patients' demographic data and exposure parameters for each projection in every patient were recorded. All recorded data with ESD values were keyed into PCXMC dose calculation software to calculate the effective dose and organ dose. The entrance skin and effective dose were significantly higher in one hospital by factor between 2.0 to 4.5 (Mann-Whitney, p-value < 0.005). The doses were greatly affected with the use of 120cm FFD, an 80cm shorter than FFD setting in other hospitals. The correlation Pearson's test result of patients' thickness and ESD of AP/PA projection, from one of the hospital was found moderately significant (p-value=0.003, r=0.4065). Radiographers of the respected hospital tend to increase the mAs for each increment in kV applied to heavier patients, thus resulted in higher patients' ESD. There was a significant moderate correlation between two ESD measurements methods (r=0.66, p=0.001). However, the random and systematic uncertainties were assumed to present in both methods. In conclusion, large discrepancies of ESD and E values between hospitals were due to different imaging modalities, setting and practices. Patients' sizes found to be one of the influencing factors in selecting appropriate tube potential of an examination. This however should be optimized with selection of appropriate mAs to ensure the benefits to patients while having adequate radiographic information. There was a well correlation between the measured and calculated ESD. Several tests recommended to be performed on detectors and reader to reduce the uncertainties in both measurements.

ACKNOWLEDGEMENT

In the name of God the Almighty.

Preparation of this thesis has been aided by the significant contribution of many individuals, whom I gratefully acknowledge.

The support and guidance from my supervisors, Dr. Mohd Hanafi Ali and Prof. Md. Saion Salikin, has been a significant factor in the establishment of this thesis.

Universiti Teknologi MARA (UiTM) provided materials in need for the research.

Radiographers of the hospitals in charged, helping in data collection process of the study.

Several colleagues have reviewed parts of the draft thesis and contributed many helpful suggestions.

Special gratitude to my beloved husband, child, parents and family members, who have always prayed for me, helped me and supported me in any possible ways that they could. I would like to dedicate this work to all of them.

Last but not least, thanks to each and everyone who were directly or indirectly involved throughout the progress of this project.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.0 Introduction

This Chapter will provide the reader with the definitions and brief explanation regarding the important terms and main objectives of the research. Beginning with the background of the study, brief introduction of scoliosis and of scoliosis x-ray examination procedure will guide the reader in understanding the problems encountered which leads to the implementation and objectives of the whole study. Definition of internal and external patients' dose provided in this Chapter will help in giving a clear concept on dose measurement conducted in this project.

1.1 Background of the Study

Radiation doses received by patients undergoing scoliosis radiography examination have become a matter of increasing concerned due to the several factors such as patients' factor itself, application of imaging techniques and imaging modalities used for whole spine imaging. Over the past decade, studies of scoliosis dose have been started with the probability of breast cancer induction (Nash *et al.*, 1979; Doody *et al.*, 2000) and screening for the best dose-reduction techniques in scoliosis imaging (Gray *et al.*, 1983; Fearon *et al.*, 1988; Lescreve *et al.*, 1989). Recently, several studies have been conducted which focused on establishing reference level for optimization and radiation protection purpose in scoliosis radiography (Chamberlain *et al.*, 2000; Hansen *et al.*, 2003; Giaolousis *et al.*, 2006 and Gialousis *et al.*, 2007).