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Safely Use of Mobile X-ray in Wards with On-site Radiation Measurement Data

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Introduction

The use of mobile x-ray machine (C-arm) in wards is associated with substantial concern with regard to radiation exposure to patients and supporting staff. The purpose of this study is to conduct field measurement and quantify the amount of radiation received by surrounding personnel. Advice will be given in order to minimize the radiation risk of using mobile C-arm in wards.

Objectives

To identify the possible risk of using C-arm in a busy ward. On-site radiation measurement was performed in ward at various distance. Based on the measurement data, feasible measures are recommended in order to minimize the radiation risk associated with using C-arm in wards. As Low As Reasonable Achievable (ALARA) Principle is applied, in which dose to surrounding personnel is kept to minimum whilst C-arm can be safely used in ward to obtain immediate information for diagnostic purpose.

Methodology

Field measurement was conducted in an isolated ward. Human phantom (Rando Phantom and ATOM phantom) are used to simulate the radiation absorbed and scattered by an adult and a pediatric patient respectively. Three radiation survey meters (model: Fluke 451P) with 230cc ionization chamber are used to measure radiation level at 1m, 1.5 and 2m away from phantom. The mobile C-arm is operated with 10 different techniques (different combination of KV and mA) which are commonly used by radiographer in ward.

Result

The radiation level at 2m away from phantom is close to background radiation encountered by a person in Hong Kong in one day. It is recommended that a safe distance of 2m should be kept away from the mobile x-ray during operation. Whenever possible, control of access may be exercised by the operator giving a verbal instruction to ensure everyone to leave the vicinity of the tube and patient (no person is within 2m). Particular care is necessary with regard to the direction of the radiation beam as partition walls may not provide sufficient X-ray attenuation.

Nevertheless, the power of mobile x-ray unit (15-30KW) is much lower than fixed installed machine (80-100KW), the radiation risk is negligible if safety instructions are followed. However, the psychological impact of radiation cannot be neglected due to wide spectrum of personnel in ward, e.g. patient, supporting staff, children and family member.