Does Wearing A Real-Time Visual Dosimeter Reduce the Personal Radiation Dose for Interventional Radiology Nurses? An Observational Comparative Study

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ABSTRACT: **Aim: Real-time radiation dosimeters can provide visual display of personal radiation dose as it occurs, potentially providing nurses working in radiation environments with more understanding about their personal radiation protection and safety strategies. This comparative observational study aimed to evaluate if the wearing of a real-time dosimeter with visual display by nurses working in interventional radiology would reduce their personal radiation dose.**

Materials and methods: Personal dose data were collected from 10 nurses while working in two interventional radiology suites over two measurement periods. In the first measurement period, the nurses were not provided with any radiation dose information during the interventional procedures. In the second measurement period, the nurses were able to view their personal radiation dose in real time.

Results: Nurses working in interventional radiology suites reduced their personal radiology doses when using a real-time radiation dosimeter that provided a real-time display of their personal dose.

Conclusion: The results support the use of real-time radiation dosimeters as an occupational radiation protection strategy in interventional radiology suites. (J Radiol Nurs 2015;34:137-142.)

KEYWORDS: **Nurses; Radiation dosage; Radiation protection; Radiology; Interventional.**

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INTRODUCTION

Nurses have an important role in the multidisciplinary team working in interventional radiology suites. Technological advances in radiology and the emergence of more interventional therapeutic procedures over the past few decades have seen an increase in interventional procedures.

A disadvantage of interventional radiology procedures is the potential occupational hazard of ionizing radiation exposure (Brinker et al., 1995; Cusma, Bell, Wondrow, Taubel, & Holmes, 1999; Johnson, Moore, & Balter, 1992). The fluoroscopic screening used in interventional radiology emits low levels of radiation for periods ranging from minutes to hours at a time

(Shortt, Al-Hashimi, Malone, & Lee, 2007) using radiation dose rates exceeding 200 mGy/min (Zeitler & Ammann, 2000) depending on the procedure. Nurses involved in these procedures are often required to be close to the radiation-emitting source across the duration of the procedure. The combination of long radiation exposure times and the close proximity to the radiation source can result in large cumulative doses for nurses in this setting (Baim & Grossman, 2006).

Nurses in a radiation environment can protect themselves by using various radiation-shielding devices, distancing themselves from the X-ray source, or by reducing the time they are exposed to the radiation (Giblin, Rubenstein, Taylor, & Pahira, 1996; Haynes, Sherer, Visconti, & Ritenour, 2006). Nurses often have no formal education in radiation safety and may not always have a heightened awareness of the potential harmful biologic effects of ionizing radiation (Valentin, 2000) and be attentive to personal dose protection because of the invisibility of ionizing radiation.

Personal radiation doses are traditionally measured by a personal dosimeter, commonly known as thermoluminescent dosimeter or Luxel (Haynes et al., 2006). These personal devices record a cumulative dose over a period of 4 to 12 weeks (ARPANSA, 2009); however, the measurements may be delayed for months after submitting the device to a laboratory for measurement (Ferral, Bjarnason, & Ferral, 2001). Such a delay potentially inhibits nurses from adapting their dose reduction behaviors to minimize personal dose.

Real-time dosimeters have become available as a method of visually tracking dose measurements as they occur. These devices make radiation somewhat visible, allowing the user to be consciously aware of doses as they are received. This alternative dose measurement system that produces instantaneous information has potential to provide insight and understanding for nurses working in radiation environments of how their radiation protection and safety strategies affect their personal doses. Studies are emerging that demonstrate that real-time dosimeters can reduce the personal radiation doses of staff working in interventional radiation suites (Christopolous et al., 2014; Mai, 2011). One study demonstrated personal radiation reductions for nurses in a cardiac catheterization laboratory (Mai, 2011). To our knowledge, there is no study that has investigated if personal dose reduction in nurses can be achieved by using a real-time dosimeter in a general interventional radiology suite where there is a wide range of interventional examinations.

This study aimed to evaluate the impact of a real-time dosimeter on the personal radiation doses received by nurses working in interventional radiology suites that undertake a wide variety of examinations.

MATERIALS AND METHODS

Setting and Sample

Ethical approval was sought and received from the Southern Adelaide Health Service/Flinders University Flinders Human Research Ethics Committee (application number 461.10) and also the Human Research Ethics Committee, University of South Australia.

Our observational study was undertaken to compare personal radiation doses of nurses working in the interventional radiology sites at Flinders Medical Centre (FMC) and Flinders Private Hospital (FPH) in Adelaide, South Australia. Personal radiation dose data were collected from nurses assisting in consecutive interventional radiology procedures across two separate measurement periods. During the first measurement period, nurses were not provided with any personal dose information during the procedures. In the second measurement procedure, nurses were able to view their dose in real time (updated every second) from a computer screen located in the interventional radiology suite. Ten consenting nurses who were regularly rostered in both interventional suites were recruited for the study. No ethnicity, age, or gender restrictions were applied as selection criteria. All participating nurses were blinded to total accumulated doses for each procedure during the testing periods as it was thought that this knowledge may be a contaminating influence on radiation safety behavior in addition to the effect of the dosimeter, which was the focus of the study.

For each procedure, the nurses were categorized according to their role during the procedure, either a scrub nurse or a scout nurse. The scrub nurse works in sterile attire closely confined to the radiation source and the interventionist at the examination table. The scout nurse helps the scrub nurse by providing instruments and materials as needed, watches the patient's condition, gives medication, and documents the procedure. The scout nurse has more mobility within the interventional suite than the scrub nurse.

All procedures were performed according to department protocols. A Siemens Artis Zee Angiographic Unit (Erlangen, Germany) was used at FMC, and a GE Innova Angiographic Unit (Buc, France) was used at FPH. Each unit was regularly serviced and calibrated. Low-dose procedures (total procedural dose of less than 200 μGy.m^2) were excluded from the study.

It was planned to collect dose measurements for 15 procedures for each nurse category in each measurement period based on an estimation that dose measurements would have a common standard deviation (SD) of 2, 80% power, and 0.025 two-sided level of significance to detect a difference in percent dose.