Use of a Sterile, Disposable, Radiation-Absorbing Shield Reduces Occupational Exposure to Scatter Radiation During Pectoral Device Implantation

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SIMONS, G.R., ET AL.: Use of a Sterile, Disposable, Radiation-Absorbing Shield Reduces Occupational Exposure to Scatter Radiation During Pectoral Device Implantation. *The aim of this study was to demonstrate the effectiveness of a radiation-absorbing shield in reducing physicians' occupational radiation exposure during pectoral device implantation. A sterile, disposable, lead-free radiation-absorbing surgical drape containing x-ray attenuation material was evaluated. Twenty procedures used the radiation absorbing drape, and 20 were performed without the shielding. Radiation exposure was measured using thermoluminescent dosimetry collar badges. Use of the protective shield was associated with a time adjusted 80% reduction in radiation dose (0.009 mrem/s with shielding vs 0.047 mrem/s without shielding, $P < 0.05$) to the physician performing the procedures. The radiation-absorbing surgical drape did not interfere with technical performance nor add procedural time, and all procedures were successfully completed. This study demonstrates that a sterile, disposable, radiation-absorbing drape provides a convenient means of augmenting conventional radiation shielding. Use of this protective shielding greatly reduces operators' occupational exposure to scatter radiation during pectoral device implantation without compromising sterility or procedural technique. (PACE 2004; 27[Pt. I]:726–729)*

fluoroscopy, x-rays, radiation protection, pacemaker, cardioverter defibrillator

Introduction

There is much concern over the potential adverse side-effects to individuals who are chronically exposed to ionizing radiation. For interventional radiologists and cardiologists who receive excessive exposure to ionizing radiation, there is an increase in adverse effects such as dermatitis, erythema, cataracts, and cancer.[1,2] More recently, there is growing consensus that exposure to even the lowest doses of ionizing radiation may increase overall cancer risk.[3–5] Although the significance of ionizing radiation at the very low doses used in routine noninvasive x-ray imaging continues to be somewhat controversial,[6] the most broadly accepted method for managing human exposure to ionizing radiation is the principle of as low as reasonably achievable (ALARA).[7] There is no established "threshold" below which exposure to ionizing radiation is safe, and individuals consistently exposed to ionizing radiation may be at risk for an increased incidence of cancer.[8]

Prolonged use of ionizing radiation is necessary for many x-ray fluoroscopy procedures, and there is significant concern about the occupational exposure to scatter radiation for the physicians who use it. Among practitioners who implant pectoral pacemakers and cardioverter defibrillators, this issue is particularly problematic due to the mandatory close proximity to the beam source causing more transfer of scatter radiation to the practitioner. Although pulldown shields are sometimes used, many implanting physicians find them to be cumbersome because, in contrast to their use during femoral procedures, they must be placed between the operator's torso and the sites of electrode manipulation.

Use of a sterile, radiation-absorbing drape has been demonstrated to reduce occupational radiation exposure during femoral interventional radiology procedures.[9] It is also known that a significant proportion of scatter radiation exits the patient along the skin surface inferior and lateral to the actual beam path during pectoral device implantation. This study tested the hypothesis that physicians' exposure levels can be reduced while implanting pectoral devices by placement of a radiation-absorbing shield in that region, outside the beam path.

Materials and Methods

A single practitioner (G.R.S.) in one laboratory performed 40 consecutive pectoral device implantations (32 pacemakers, 8 cardioverter defibrillators) using pulsed fluoroscopy (8 frames/s, 25 ms/frame, autoregulated to achieve 2.5 microR/frame) and only anteroposterior (AP) views. The first 20 cases (group A) were performed without

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