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CONTEMPORARY ISSUES IN RADIATION PROTECTION IN MEDICAL IMAGING SPECIAL FEATURE: COMMENTARY

Using patient shielding – What is the risk?

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ABSTRACT

The practice of placing radiation protective shielding on patients ('in contact') in order to reduce the dose to certain radiosensitive organs for diagnostic X-ray examination, has been employed for decades. However, there has been a growing body of evidence that this practice is often ineffective or even counterproductive and the use of such shielding can also overemphasise the hazards of ionising radiation in the public mind. This has led to a growing disparity in the application of patient contact shielding and culminated in several professional bodies issuing guidance and statements to provide a consistent approach to patient contact shielding. This, in turn, has led to a healthy discussion and re-evaluation of when and why patient contact shielding should be used, where the main issue centres around the criteria used to arrive at the recommendations. The decision process involves considering, among others, the reported effectiveness of the shielding and a subjective assessment of the subsequent risks from their use. In order to improve the transparency of these recommendations, it is therefore suggested that a threshold for dose and/or risk should be clearly stated, below which no protection is required. A suggested starting point for defining this threshold is discussed. This would enhance uniformity of application and provide clarity for staff, patients and the public. It would also ensure that any future research in this area could be easily incorporated into the general guidance.

INTRODUCTION

Applying radiation shielding directly onto a patient is the last stage in a radiation safety process, which begins with justification of the diagnostic X-ray examination and progresses through a series of steps in optimising the intended procedure.[1]

Historically, the primary application of contact shielding was in protecting the gonads.[2] However, this has since expanded to include protecting other organs considered at risk from cancer induction, such as breast and thyroid.[3] In addition, it has been used to reduce fetal exposure during examination of pregnant patients and recently, due to heightened concerns over the risk of accumulated doses, has been applied to restricting the eye lens exposure.

The shielding can be positioned within the imaging field of view (FOV) to protect specific organs from the primary X-ray beam and outside the FOV to reduce the effects of secondary (scattered) radiation. However, it has no effect on the main source of scattered radiation dose, which is internal to the patient.[3]

What has changed?

Since patient contact shielding was first introduced, a wide range of technological advances has led to significant reductions in patient doses, potentially reducing the need for additional protection. The intervening years have also seen a major shift from manual to automatic control of the X-ray exposure, which means that the introduction of highly attenuating objects, such as contact shielding, can inadvertently interfere with the exposure and lead to an increase, rather than the intended decrease, in patient dose.

The reported radiation risk for various organs has also changed over the years. In particular, the gonad risk factor (tissue weighting factor) has dropped to less than half its original value,[4] implying that protecting the gonads has a much lower impact on patient safety than previously thought.

An increasing number of articles have been published which have raised questions regarding the efficacy of the common practice of using contact shielding on patients. These include issues of undesirable covering of

important pathology and problems with correct positioning of shielding.[5,6]

What is the impact?

The value of applying patient contact shielding has diminished and, in many cases, has a minimal effect on the already low risk of harm from the exposure.

Healthcare enterprises have begun to adopt different strategies for using patient contact shielding. This has led to unwanted inconsistencies in practice and recommendations within the healthcare sector.[7]

Various professional bodies, examining the accumulating evidence, have begun to recommend changes to the status quo and to promote effective and harmonised clinical practice. In some cases, the guidance addresses the single issue of gonad protection,[2] whilst in others, involves undertaking a review of the whole range of contact shielding applications.[3,8]

Questioning the practice of patient contact shielding has highlighted the need to change the mind-set of those involved in the process, from the historic fixation on gonad protection, to consider other radiosensitive organs (*e.g.,* lungs) and the impact of saving the dose for one organ on other neighbouring tissues.

DISCUSSION

The recent appearance of recommendations regarding patient contact shielding has re-ignited interest in an age-old radiation protection practice. This has led to a healthy debate across the sector which, it is hoped, could lead to general agreement between all relevant professional and patient representative bodies as to the use, or otherwise, of patient shielding. Such an exercise is continuing in the USA with the American Association of Physicists in Medicine: Communicating Advances in Radiation Education for Shielding (CARES) group (https://w3.aapm.org/cares/). Similarly, across Europe, a number of representatives formed the GAPS (Gonad and Patient Shielding) group[9] (chair: Dr P Gilligan) with the purpose of providing a European consensus on the use of contact shielding.

However, the whole exercise has highlighted a few issues, which require further discussion and debate.

How do we apply ALARA?

The main aim of radiation protection, in terms of patient dose, has been distilled into the mantra[10] 'as low as reasonably achievable', ALARA (or in UK parlance, 'as low as reasonably practicable', ALARP). However, in applying this to the area of patient contact shielding, the emphasis could be on the 'as low as …', suggesting that protection is used on any and every occasion, far more than is current practice even for the most prolific users of shielding. If, on the other hand, the main thrust is 'reasonably practicable', then a judgement needs to be made as to when it is, and is not, reasonable to use shielding. It would, therefore, appear that an agreed definition of what 'reasonable' means is required to arrive at a consensus in this area. For example, the International Commission on Radiological Protection (ICRP) have set up Task Group 114 to look into Reasonableness and Tolerability in the System of Radiological Protection (https://www.icrp.org/icrp_group.asp?id=177).

This is connected with the second issue.

How do we perceive radiation risk?

The decision to use or withhold patient contact shielding is based, at least in part, on the anticipated level of reduction in the dose or radiation risk and the perceived significance of that change. Therefore, if a dose or risk threshold could be agreed, the result might be a more uniform application of shielding. Such a threshold has obviously been used in the various guidance documents, but has not been clearly stated. The level could vary depending on the imaging modality, body part, adult/paediatric or pregnant patients. This threshold figure could then be used alongside other factors, such as the risk of interfering with the image quality or automatic exposure control system, to decide on the appropriateness of using contact shielding.

Recently, the ICRP[11] have published a table of dose and risk categories, based on justified radiological exposures. This suggests that a patient dose of less than 0.1 mSv has an associated 'negligible' radiation risk for adult patients over 30 years of age. In this case, would it be 'reasonable' to apply patient contact shielding, if the dose saving was below this figure and consequently have a 'negligible' effect on patient risk? However, it needs to be acknowledged that this particular threshold does not take into account variations in risk with age and sex of the patient, nor the issue of multiple exposures. Nevertheless, adoption of a suitable table of thresholds would be advantageous, as it would also provide an open and honest statement of the applied risk(s), which could be used to alleviate patient anxiety and counter-public misconceptions of the risk. It would also help to assess new research and decide if it is likely to alter current guidance.

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