RPA Certificate Applications from the Medical Sector – Impact of Revision to the HSE Statement.

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Abstract no more than 1 page in Arial 11 point, presenting speaker underlined

Invited talks - an abstract summarising you presentation is welcome including any images or tables.

Abstract:

Following the revision of the HSE Statement on RPAs in September 2021, RPA 2000 has introduced a new assessment process for all RPAs, relating to initial and renewal applications. This presentation will briefly cover the background to the changes, provide data illustrating how the medical sector compares with other sectors, and discuss how applicants can present their evidence most effectively, consistent with an emphasis on the ability to give advice on compliance with IRR17.

Evaluation of Rampart IC in the Cardiac Cath Lab: Can Cardiologists Shed the Lead?

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Aim: To determine whether use of the Rampart IC in the cardiac cath lab would enable the primary operator to work without wearing a lead apron.

Background: Musculoskeletal problems are common amongst cardiologists [1] and it is thought that the wearing of lead aprons is a contributory factor in this [2].

Rampart IC is a radiation protection shield comprising two 1mm lead acrylic panels with 0.5mm lead equivalent soft shielding, mounted on a central mast on castors. The shield is placed between the patient and the operator to reduce scatter dose to the operator.

The Rampart IC was evaluated in the cardiac catheterisation labs at Morriston Hospital to determine if its use would enable cardiologists to work without lead protective aprons, thus reducing their risk of MSK injury.

Methods: Scatter dose rate measurements were made for a PMMA phantom with the Rampart IC in position. Measurements were made at the 'ideal' operator position to allow annual whole body effective dose to be estimated, as well as along the side of the patient couch and along the operator side of the Rampart to allow hot spots to be identified. Measurements were made at a range of c-arm angles and dose modes, and with good and poor setup of the Rampart and table-mounted lead shielding.

The primary operators were provided with three additional whole body dosimeters to wear over-apron during the evaluation period, to give an indication of the dose they might receive if they used Rampart without an apron. Badges were worn at the chest, waist and back.

Results: Dose rates of 6 $\mu Sv.h^{-1}$ were measured at the operator position with the c-arm at 0°, low dose mode and good setup of the Rampart and table-mounted lead shielding. Dose rates of up to 99 $\mu Sv.h^{-1}$ were measured at the operator position at other settings, and up to 128 $\mu Sv.h^{-1}$ when optimal use was not made of table-mounted lead shielding.

Hotspots of up to 169 $\mu Sv.h^{-1}$ were measured along the side of the patient couch and up to 310 $\mu Sv.h^{-1}$ along the operator side of the Rampart.

Based on these dose rate measurements, an annual dose of up to 51 mSv at the operator position was estimated.

The extrapolated annual dose to the primary operator, based on the doses recorded by the whole body dosimeters, was 86 mSv.

Conclusions: Use of the Rampart IC without lead aprons could result in dose rates at the primary operator position in excess of 7.5 $\mu Sv.h^{-1}$ and an annual dose to the primary operator in excess of 20 mSv. As such, use of the Rampart IC in the cardiac cath lab without lead aprons is not recommended.

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Expectations of FLASH Radiotherapy and its Radiation Protection Implications

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FLASH radiotherapy is a promising new use of radiotherapy that is generating much interest in the radiotherapy community. The use of ultra-high dose rates in animal studies has been shown to significantly reduce radiation toxicity, whilst maintaining tumour efficacy[1–3]. The effect is seen independent of animal species, radiation type or organ, showing promise for use in humans[4]. Much research is currently underway[5], the first patient has been treated with FLASH radiotherapy[6] and the first clinical trials have begun. Such high dose rates present a potential radiation protection hazard[7], and may require additional precautions in order to minimise dose to staff and to remain compliant with legislation and guidance. In order to predict the radiation protection implications of this potential new radiotherapy technique, an understanding of expected beam conditions, its potential use and the need for expert radiation protection support, is required.

A questionnaire was developed in order to understand current opinion of the expected use of FLASH radiotherapy and its implications for radiation protection amongst radiotherapy professionals. It was split into three sections on the expected uses of FLASH radiotherapy, the radiation protection implications, and the support needs of the community. Participation was invited via an international conference and two radiotherapy physics mailing lists.

52 participants completed the survey in full. Most participants thought that FLASH radiotherapy would find its main use in 3 -10 years, that linacs, protons and very high energy electrons would be the most likely modalities to deliver FLASH, and that it would find moderate clinical use. A degree of modification of existing facilities was expected by some; however the expectations were varied and relied somewhat on legislative region. Of the support methods explored, the majority were considered “very useful” by a majority of respondents. The most popular was worked examples of how to assess an existing facility’s suitability for FLASH radiotherapy.

Whilst this survey is not a comprehensive view of expectations of FLASH radiotherapy across all professions and regions, and there are likely to be inherent biases, it can be used with caution as a guide to the potential future of this new technique. The expectation that FLASH radiotherapy will find clinical use within at least the next decade is striking, especially given the standard lifetime of 10 years for linacs. This indicates that current radiotherapy equipment replacement programmes should consider the potential introduction of FLASH radiotherapy. There is a clear appetite for support to enable the safe introduction of FLASH for research and clinical use. Guidance, including example assessments of a facility, is likely to be needed.

A survey of radiotherapy professionals has been conducted to understand the current prevailing opinions on the use of FLASH radiotherapy and its radiation protection implications. It is expected to find significant clinical use within the next decade using linacs, protons and very high energy electrons. Whilst the opinion on required modifications for radiation protection is mixed, there is a clear appetite for support in its safe implementation.

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Do we really need finger stalls in nuclear medicine?

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Background. Employers are required to assess doses to employees for comparison against dose limits in IRR17 schedule 3. Dosimeters used in assessment should be carefully positioned so that the maximum dose is measured. In some cases, there can be a significant dose gradient resulting in the dose across the hand varying significantly. Published data has reported a up to a 6x difference between base of finger and fingertip. In nuclear medicine, ring dosimeters are commonly used. The dosimeters are robust, comfortable, cold sterilisable and reliable. There is however a disadvantage that we may not be measuring the maximum dose. To monitor the doses received and compare against the three tenths dose limit it has been reasonable to adjust dosimetry results, either with a 6x multiplier to represent a worst case, or with locally derived correction factors. This is acceptable if staff are not designated as classified workers. As we move towards a classified workforce in Nuclear Medicine, it is not acceptable to apply a correction to our Approved Dosimetry Service (ADS) results. This study was performed to compare the use of finger stalls against ring dosimeters to ensure extremity doses measured in Nuclear Medicine were representative of the maximum dose received. The practical aspect of using the alternative finger stalls was also examined.

Methods Finger stalls for each hand were provided to compliment the standard issue ring dosimeters on the same fingers. For ^{99m}Tc work, the study involved staff from nuclear medicine departments at three hospital sites. The use of finger stalls was also extended to a Rheumatologist administering ^{90}Y, where 4 finger stalls were used on each hand.

Results There is significant variation in the measured doses between finger stalls and rings, with finger stall results ranging between around half the ring result to a figure significantly less than 6 times, without a full set of results back yet. The Yttrium results are yet to be returned.

Discussion The range of results with some finger stalls showing lower doses than the ring dosimeter on the same hand are surprising. This applied for both dominant and non-dominant hands in some cases. ‘User experiences’ forms completed at the time of the comparison provide some explanation. A loss of finger sensitivity on the finger stall finger was frequently reported, as well as an increased perceived risk of extravasation. It is likely that practice changed during the comparison, with either removal of the finger stall to safely inject, or holding the finger encased in the stall out of the way and favouring a different finger.

Conclusion Finger stalls have not been adopted into use for the administration and dispensing of radiopharmaceuticals at the trial sites. They did not provide a reliable method of assessing the highest routine dose to the finger for participants and indicated a lower dose than the ring finger in some cases. Loss of sensitivity at the fingertip was an important consideration, with the use of finger stalls resulting in a change of practice that may be detrimental to the dose to the operator. Additionally, the finger stalls degraded during the month of wear with wearers being more concerned about infection control and finger stall integrity as the month progressed. Ring dosimeters at the base of the finger provide an adequate and pragmatic solution to estimate finger dose in nuclear medicine. The ring dosimeter not consistently returning a lower dose than the finger stall suggests that the ring can be used with reasonable confidence to compare against dose limits, accepting that there are errors in both methods. Accidental exposure would be unlikely to be captured by either method.

Key references

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UK Audit of national variation in calculated radiation doses due to radionuclide exposure

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Introduction: It is a core requirement of IRR17 compliance for risk assessments and the investigation of accidental exposure scenarios that the magnitude of doses likely to be encountered are evaluated. A novel national audit was undertaken to investigate the variation in dose estimations for a range of foreseeable accidental exposure scenarios in nuclear medicine (NM).

Methods: Participants were asked to estimate the levels of exposure in 15 foreseeable scenarios; covering whole-body and extremity exposures from external sources, internal exposure and exposures from skin (surface contamination and needle-stick injury) and eye contamination. Questions were intentionally simplified to reduce variation from assumptions made by the participants and to focus more on the underlying gross systematic variation.

Results: Twenty-seven centres participated. There was generally a very wide variation in the estimated exposures across all the categories of exposures, apart from internal exposure estimates. Whilst there was no ground truth for each individual question, the variation in results itself often exceeded the relevant threshold for classification and annual dose limits. The majority of variation was due to differences in methods, models and assumptions used by each participant.

Conclusion: This audit raises questions around how IRR17 compliance can be universally demonstrated with such wide national variation. It evidences the need for a more standardised practice in NM radionuclide exposure estimates through national consensus guidelines or standards etc.