Occupational radiation received by orthopaedic surgeons and risk to workers

Stephen Barnard[1], Simon Bouffler[1], Hannah Mancey[1], Nicky Gibbons[1], Kinga Zmijewska[1], Charlotte Lewis[2], Lynn Hutchings[2] and Deborah Eastwood[2]
[1]UK Health Security Agency
[2]British Orthopaedic Association

A recent study of orthopaedic surgeons reported an increased risk of breast cancer amongst female workers (1). This study aims to clarify whether an increased risk of breast cancer in orthopaedic surgeons is related to occupational exposures to ionising radiation.

We wish to monitor and record doses received by orthopaedic surgeons using existing dosimetry equipment (TLDs) and/or re-examine previous data on dose monitoring from UKHSA existing customers. We would also like to send participants a survey to capture information regarding their training experience for working with ionising radiation, use of personal protective equipment (PPE) and career stage. These results will help to inform us as to the long-term health risks of occupational radiation exposures in orthopaedic surgeons, and whether there are any associations between effects of gender, career stage and what PPE is worn and how often.

Background: The British Orthopaedic Association have concerns about increased breast cancer risks amongst female orthopaedic surgeons, indicated by a recent peer-reviewed study. Whilst there are some reservations over the validity and appropriateness of the study techniques and design, there is a genuine concern that an increase breast cancer risk amongst female workers could dissuade females from joining the profession. Of note, whilst only 7% of consultants are female, 30% of trainees are which suggests progress for greater equality in male to female ratios, and this is a trend that should not be discouraged.

Orthopaedic surgeons typically receive monthly mean doses of around 0.02 – 0.79 mSv per month (2) in the US. Similarly, a study of 642 orthopaedic surgeon hand doses was reported as being between 2.87 and 6.74 mGy over a 14 month period, which is around 1/100th of the annual dose limit (3).

A 2016 study of female orthopaedic surgeons using an anthropomorphic torso phantom observed the most common breast cancer site, the upper outer quadrant of the body, was not sufficiently shielded during intraoperative radiation exposures, suspected to be caused by protective apron size being inappropriate, positioning of the surgeon and the C-arm position of the device (4).

Orthopaedic surgeons are, to date, not regulatory workers; they are not part of the National Registry of Radiation Workers, and therefore orthopaedic surgeons are not routinely monitored for radiation exposure, and so there is a need to recruit participants.

Orthopaedic surgeons do not always wear dosemeters to monitor dose – generally we would expect a varying uptake of PPE across different hospitals and centres, as seen in previous studies (5-10). Lack of training in radiation protection (38% of surgeons received no formal training), lack of basic knowledge, legislation and practicalities of the use of ionising radiation reported by orthopaedic surgeons in the UK (406 surveyed surgeons)(1). It should be noted that occupational radiation doses received by interventional cariologists are generally higher and with no significant indication of increased breast cancer in female workers. Although radiation protection practices in interventional cardiologists is generally improving due to an enhanced focus on this occupational group (11, 12), and now many of these workers are classified radiation workers.

1. Raza M, Houston J, Geleit R, Williams R, Trompeter A. The use of ionising radiation in orthopaedic surgery: principles, regulations and managing risk to surgeons and patients. Eur J Orthop Surg Traumatol. 2021;31(5):947-55.
2. Gausden EB, Christ AB, Zeldin R, Lane JM, McCarthy MM. Tracking Cumulative Radiation Exposure in Orthopaedic Surgeons and Residents: What Dose Are We Getting? J Bone Joint Surg Am. 2017;99(15):1324-9.
3. Giordano C, Monica I, Quattrini F, Villaggi E, Gobbi R, Barbattini L. EVALUATION OF THE RADIATION

DOSE TO THE HANDS OF ORTHOPAEDIC SURGEONS DURING FLUOROSCOPY USING STORED IMAGES. Radiat Prot Dosimetry. 2020;189(2):157-62.
4. Valone LC, Chambers M, Lattanza L, James MA. Breast Radiation Exposure in Female Orthopaedic Surgeons. J Bone Joint Surg Am. 2016;98(21):1808-13.
5. Alejo L, Koren C, Ferrer C, Corredoira E, Serrada A. Estimation of eye lens doses received by pediatric interventional cardiologists. Appl Radiat Isot. 2015;103:43-7.
6. Attigah N, Oikonomou K, Hinz U, Knoch T, Demirel S, Verhoeven E, et al. Radiation exposure to eye lens and operator hands during endovascular procedures in hybrid operating rooms. J Vasc Surg. 2016;63(1):198-203.
7. Barbosa AHP, Medeiros RB, Corpa AMR, Higa FS, Souza MT, Barbosa PL, et al. Prevalence of Lens Opacity in Interventional Cardiologists and Professional Working in the Hemodynamics in Brazil. Arq Bras Cardiol. 2019;112(4):392-9.
8. Bruchmann I, Szermerski, B., Behrens, R., Geworski, L. . Impact of radiation protections means on the dose to the lens of the eye while handling radionuclides in nuclear medicine. Z Med Phys. 2015.
9. Jacob S, Michel M, Spaulding C, Boveda S, Bar O, Brézin AP, et al. Occupational cataracts and lens opacities in interventional cardiology (O'CLOC study): are X-Rays involved? Radiation-induced cataracts and lens opacities. BMC Public Health. 2010;10:537.
10. Vanhavere F, Carinou, E., Domienik, J., Donadille, L., Ginjaume, M., Gualdrini, G., Koukorava, C., Krim, S., Nikodemova, D., Ruiz-Lopez, N., Sans-Merce, M., Struelens, L. . Measurements of the eye lens doses in interventional radiology and cardiology: Final results of the ORAMED project. Radiation Measurements. 2015;46:1243-47.
11. Durán A, Hian SK, Miller DL, Le Heron J, Padovani R, Vano E. Recommendations for occupational radiation protection in interventional cardiology. Catheter Cardiovasc Interv. 2013;82(1):29-42.
12. Gutierrez-Barrios A, Cañadas-Pruaño D, Noval-Morillas I, Gheorghe L, Zayas-Rueda R, Calle-Perez G. Radiation protection for the interventional cardiologist: Practical approach and innovations. World J Cardiol. 2022;14(1):1-12.

Nuclear Medicine IRR Consents: where to start…and stop

Jo Page & Peter Marsden, Royal Free London NHS Foundation Trust

The Safety Assessment templates relating to both the deliberate addition of radioactive substances to medicinal products and the deliberate administration of radioactive substances to people require the assimilation of disparate and complex information in order to answer each section fully.

With our combined experiences as a Nuclear Medicine Physicist and an RPA, we recognised that, for a busy Nuclear Medicine/Radiopharmacy department carrying out a wide range of diagnostic and therapeutic preparations and administrations, it is essential to focus on concise information which is pertinent to the HSE's assessment of a consent submission.

It is our impression that, based on the embedded guidance alone, there is likely to be a significant range in the quantity and complexity of responses provided by different centres providing similar services. In developing additional guidance, we aim to help hospitals understand what is relevant and essential to gaining consent whilst reducing the burden on both the HSE and healthcare institutions during the process of gaining or upgrading consents.

We will present our experience of drafting such a response, along with our conclusions on the level of information to include and where to stop. This was done following an informal approach to the HSE, with a view to obtaining gaining feedback from HSE. We will highlight the challenges and potential pitfalls we encountered along the way.