Exposure and risk assessment for workers in MRI

Penny A Gowland

Sir Peter Mansfield Magnetic Resonance Centre
University of Nottingham

Penny.Gowland@nottingham.ac.uk

MRI workers are potentially exposed to a variety of electromagnetic fields: static magnetic fields of up to ~10 T, time varying fields of frequencies up to 1 kHz of the order of 15 mT/m, and RF fields depositing energy of less than 4 W/kg. The characteristics of exposure will vary considerably between different categories of staff with engineers generally receiving peak exposures and radiographers (scanner operators) generally receiving longest (but low) exposures. Probably the greatest range of exposure occurs for staff who volunteer to be scanned to enable imaging sequences to be optimized with appropriate ethics committee approval. Typical exposure conditions will be described in this talk. Given that staff are being regularly exposed to large EMFs as part of their work, it is important to determine any risks this will be exposing them to, and then put in place systems of work to eliminate or minimize these risks. Risks can be grouped into acute effects and chronic effects. The most important acute effect is the projectile effect where ferromagnetic objects may be accelerated into the magnet, potentially hitting staff, and safety management procedures are required to minimize the dangers. Beyond that acute effects include vertigo (at high static field), metallic taste (at high static field), potential peripheral nerve stimulation (on the very rare occasions that workers are exposed to strong gradient fields) and RF heating (on the very rare occasions that workers are exposed to strong gradient fields). The risks associated with vertigo and nausea can be minimized by good safety management. The risks associated with RF and gradient fields can be avoided by applying the same safety limits to staff that are used for patients. Working practices that will minimize these effects will be discussed. No chronic effects of EMF exposures on MR workers has been established; none the less the literature remains rather sparse. The arguments related to temporal exposure limits will be discussed.