MENOMETRORRHAGIA IN MAGNETIC RESONANCE IMAGING OPERATORS WITH COPPER INTRAUTERINE CONTRACEPTIVE DEVICES (IUDS): A CASE REPORT

FABRIZIOMARIA GOBBA¹, NADIA BIANCHI², PAOLO VERGA³, GIAN MARCO CONTESSA⁴, and PAOLO ROSSI⁴

¹ University of Modena and Reggio Emilia, Modena, Italy
Department of Public Health Sciences
² Regional Health Service, Varese, Italy
Radioprotection Unit
³ S. Carlo Borromeo Hospital, Milano, Italy
⁴ Italian Worker’s Compensation Authority (INAIL), Rome, Italy

Abstract
The paper describes the cases of 3 female health operators with implanted copper IUDs, developing menometrorrhagia some months after an increase of the working time in a Magnetic Resonance Imaging (MRI) Unit (1.5 T), that progressively disappeared when the previous organization, involving discontinuous work shifts at MRI, was re-established. No known factors possibly related to menometrorrhagia were evidenced in the 3 operators, supporting the hypothesis of a role of the exposure to the electromagnetic fields (EMF) induced by the MRI system in symptoms induction. The possible mechanism remains unsettled, but menometrorrhagia might be triggered by a phlogistic stimulus caused by EMF, possibly the low-frequency currents induced in the wires of the IUD during the movements of the operator inside the static magnetic field generated by the MRI permanent magnet. Until now, the problem of possible interactions between copper IUDs and EMF induced by MRI has been considered in patients undergoing imaging, but the possible risk in MRI Units operators has been largely neglected. To our knowledge, the occurrence of menometrorrhagia is not routinely checked in health surveillance of MRI operators, so these symptoms can pass unnoticed, especially if they are transitory. Therefore, underreporting is rather possible. The cases described here support the need for further research on this topic, especially considering the progressive diffusion of more powerful MRI scanners (3 T and more), and of the interventional magnetic resonance imaging, both potentially involving higher EMF exposures, and a large number of MRI female operators, possibly using IUDs. The possibility that MRI operators with implanted metallic IUDs can be included in the group of “workers at particular risk” according to the EU Directive 2004/40/EC should be considered.

Key words:
Static magnetic fields, Occupational exposure, Induced currents, Workers at particular risk, Menometrorrhagia

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Address reprint request to F. Gobba, Cattedra di Medicina del Lavoro, Università di Modena e Reggio Emilia, Dipartimento di Scienze di Sanità Pubblica, Via Campi 287-41125 Modena, Italy (e-mail: fabriziomaria.gobba@unimore.it).
INTRODUCTION

The possible safety risk related to Magnetic Resonance Imaging (MRI) in patients with implanted intrauterine contraceptive devices (IUDs) is a known problem [1]. In this context, the main types of IUD devices that can be distinguished are the metal-containing/metal-free intrauterine device (IUD), the fully metal-free hormone-containing intrauterine device (IUS), and the ESSURE, an insert made of stainless steel, in use in Europe since 2001 [2,3]. The main concern was related to the possibility that, in patients with metal-containing IUD or with ESSURE, an injury can be induced by heating, or movement of the device during scanning [4–6]. An additional concern was that the diagnostic accuracy of the image would be impaired by artifact created by the device [7]. For these reasons, in the past, the presence of IUD was considered a limit to MRI scanning, but the conclusion of more recent studies is that up to a magnetic field strength of 1.5 T there is no risk of any movement or dislodgement of both the IUD and the ESSURE, and that a possible temperature increase, if any, is within the physiologic range, at least if the IUDs are placed in fixed position inside the bore of the MRI system [4–6]. Accordingly, intrauterine contraceptive devices are currently considered safe for patients imaged with MR systems operating at 1.5 T or less [1,4–6,8].

At 3 T or above, only the metal-free IUDs and the IUS are considered MRI-safe, while metal-containing IUDs and the ESSURE have not yet been considered adequately evaluated [2], and the American Society for Testing and Materials and the Food and Drug Administration classified IUD as “MR conditional” [7,9].

The aforementioned evaluations substantially concern patients undergoing MRI for medical reasons. Nevertheless, an exposure to electromagnetic fields (EMF) occurs also in personnel working with, and around, the medical MR equipment, including radiology technicians, nurses, radiologists, anesthetists and surgeons, and also the maintenance and cleaning staff [10,11]. The presence of personnel during MRI scanning is usually limited to a few specific situations, as in some cardiological examinations in anesthetized patients, or assistance to children, but health personnel (and maintenance staff) at MRI Units are currently exposed to the static magnetic field (SMF) generated by the magnet. The motion of subjects along a field gradient, or the rotational motion while working in the MRI room can induce significant low-frequency currents inside the body, which has been estimated in some studies [10,11].

To our knowledge, the problem of implanted IUDs in MRI Unit personnel has so far been neglected, and no data is currently available on the possible risk related to EMF generated by the MRI equipment in these subjects. We hereby describe three cases of menometrorrhagia observed in female workers of an MRI unit.

CASE PRESENTATION

In the Radiology Department of a hospital in a Milan area (Lombardy Region, Italy), a 1.5 T MRI scanner has been in use since 2004. Among the female personnel of the Unit, six radiology technicians and 1 nurse, aged 23–36 years, have been engaged in MRI procedures. The usual activity of technicians and nurses was limited to the assistance to the patients, but as a rule they were not present during the MRI scanning. Accordingly, they were exposed to the SMF but, customarily, not to radiofrequency nor gradient time-varying magnetic fields related to the scanning. The operators moved randomly inside the SMF, often very close to the gantry. An exposure during MRI scanning was possible, but really uncommon, limited to occasional situations as in case of assistance to children.

In 2004 and 2005, the personnel of the Department was on duty in the MRI Unit based on a rotational system, one week per month. Work shifts in the MRI Unit usually lasted 8 hours per day, even though overtime was not exceptional, especially in the case of emergencies.