

A new fire hazard for MR systems: blankets

Type of the manuscript: case report.

Advances in Knowledge:

1- The use of a blanket containing copper fibers during an MR examination caused a fire.

Implications for patient care:

1- Manufactured blankets may occasionally contain copper fibers; such blankets should be strictly avoided in MR units.

Summary statement:

We report a case of fire in a PET-MR system due to the combustion of a blanket, caused by the presence of copper fibers within the blanket's hem.

ABSTRACT

We report a case of fire in a PET-MR system due to blanket combustion. Manufacturing companies routinely use copper fibers for blanket fabrication, and these fibers may remain within the blanket hem. Folding of a blanket with these copper fibers within an MR system can create an electrical current loop with a major risk of local excessive heating, burn injury and fire. This hazard applies to all MR systems. Hybrid PET-MR systems may be particularly vulnerable to this situation, as blankets are commonly used for PET-FDG imaging

in order to maintain a normal body temperature and avoid FDG uptake in brown adipose tissue.

INTRODUCTION

MRI examinations have been associated with a number of potentially life-threatening health risks, one being the risk of excessive tissue heating and severe burn injuries due to RF energy transmission(1). Safety recommendations before MRI examination include the removal of any metal-containing device (wires, leads, skin patch), the use of metal-free clothes such as hospital garments, a correct positioning of the patient to avoid body loops, and careful isolation of the patient from the RF coil with an appropriate padding(2,3). However, padding itself can create a burn hazard if the cloth contains traces of metal. Here we report a case of a blanket fire during a PET-MR examination, due to the presence of a copper fiber related to the routine blanket fabrication technique.

CASE REPORT

A 62-year-old woman, with a clinical suspicion of logopenic aphasia, and no noticeable medical history apart from a chronic smell loss, was referred to our department for a PET-MR examination on August 2nd, 2016. Our PET-MR system (General Electric 3T SIGNA PET-MR, Buc, France) had been installed on October 2nd, 2015, and 881 clinical examinations had been previously performed without any adverse incident. Patient preparation took place using the routine procedure: she was injected with 2 MBq/kg of ¹⁸F-FDG and placed in a dark, silent room for 30 min, with a blanket to maintain normal body temperature while

awaiting her examination. The blanket was one of the hospital blankets, which have been produced for 15 years by the same industrial manufacturer (Poyet-Motte, Cours-La-Ville, France). The patient was subsequently transferred to the PET-MR unit and placed with arms along the body and legs side-to-side, a large 50-cm strap placed around her body and the blanket placed above the strap. PET-MR examination was performed during 20min with the usual routine protocol (3DT1, 3DFLAIR, 3DSWAN, DWI with FDG-PET images acquired simultaneously). At the end of the examination, the technician entered the room and noticed a strong burning odor related to the combustion of the blanket, which she quickly removed from the patient.

The patient had no skin lesions, as she did not have any direct contact with the blanket. The antenna and the inner shell of the PET-MR unit were deformed and covered with soot (Fig1A, arrows). Careful inspection of the blanket revealed the presence of a metallic fiber (Fig. 1B, arrowheads). Material safety investigation revealed that these copper fibers were used by the blanket manufacturer during the automatic process of blanket cutting, and remained within the blanket hem. Noticeably, this technique does not appear to be specific to our manufacturer and was also used by other companies. Systematic inspection of other older blankets of our hospital did not reveal the presence of copper fibers, as this technique of production was recently set. The manufacturer was informed and modified the production line so that copper fibers were not used anymore. Radiology technicians and radiologists of the hospital were informed of the incident and asked to stop using blankets inside MR units. An alert was sent to the French National Agency for Medicine and Health Product Safety, and also to

the other hospitals in our group (Assistance Publique-Hôpitaux de Paris) using similar blankets. This type of adverse event had never been recorded previously.

DISCUSSION

Burn injury is a severe adverse event that can occur during MR examination. When radiofrequency energy is transmitted from the transmit RF coil to the patient, it also creates an electrical current within the conducting materials present in the RF field. If an electrical loop occurs, RF-induced electrical currents can cause excessive heating and adjacent tissue damage. While most metallic materials (electrocardiography cables, wires, jewels) are easily detected and removed by the radiology technicians, they may also be present in other unexpected devices such as drug patch(4), identification bracelet(5) or even microfiber undershirt containing silver particles(6), all of them being reported to cause severe skin damage during MR examination. In order to prevent direct burns, it is also recommended to isolate the patient's body from the RF coils using clothing, sheet and pads(2).

Blankets can sometimes be used during MR examination in order to isolate the patient's body from the RF coils. During FDG-PET imaging, blankets are routinely used in order to maintain a normal body temperature, thus avoiding hypothermia-related uptake of FDG in brown adipose tissue, which may induce artefactual hypometabolism of the brain(7). Noticeably, this incident occurred in our PET-MR system after 10 months of use and 881 unremarkable examinations with a similar procedure. Hence, the creation of an electrical loop in the blanket

requires that the blanket folding has a specific orientation, creating an almost-closed loop, which likely did not occur during previous examinations. The accident was not noticed until the end of the PET-MR acquisition, as the blanket was smoldering without flames, and as the patient happened to have chronic smell loss, she did not notice a burnt odor in the room. This incident could have had dramatic consequences; had she not been protected by the 50 cm long restraining strap between her and the blanket.

To conclude, we have shown that the use of a blanket containing copper fibers within an MR unit may potentially present a major fire hazard because of the potential for creating current loops. When isolating the patient from RF coils, and disposable linens should be preferred to blankets, unless the absence of metallic fiber be assessed.

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Figure 1

Traces of soot inside the 3T PET-MR SIGNA unit (A, arrowheads), related to the combustion of a blanket (B) due to the presence of a small copper fiber (C, arrowheads).