

Case Report

IS MRI A SAFE DIAGNOSTIC TOOL? A CASE REPORT

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ABSTRACT

MRI is a safe diagnostic investigation however is associated with some avoidable risks. MRI is now used for both diagnostic as well as therapeutic purposes. Thermal burns are among the most commonly reported safety hazards on MR imaging of patients. We confronted with a case, a 23 years old female patient, a bit obese in habitus, came for MRI of back. She encountered superficial burns in her forearm, arm and neck while acquisition in 1.5T MR scanner. The possible risk factor for burns in this case could be the material in clothes she used at that particular time as we ruled out other factors. This is the second reported case of MR imaging related burns associated with clothing.

Abbreviation

SAR-Specific Absorption Rate

MRI-Magnetic Resonance Imaging

HIFU-High Intensity focused ultrasound.

RF-Radiofrequency

T-Tesla

Keywords: MRI burns, Specific Absorption Rate, Clothing

INTRODUCTION

MRI is a safe diagnostic tool for imaging purpose. MRI is also used for therapeutic purpose as it has property of thermal heating. Thermal burns are among the most commonly reported safety hazards on MR imaging (Pietraya *et al.*, 2013).

Associated metallic gadgets along with the patients while MRI acquisition like tattoo, makeups etc can cause heating effects. The specific absorption rate is the absorption of energy by the human body and it is more in 3T then in 1.5T MRI machines. Thermal burns and transient symptoms like skin irritation, cutaneous swellings and heating sensations have been reported in women who use permanent cosmetics like eyeliners and tattoos while acquisition in MRI. The mechanism of burning includes the locally induced electric currents (Franiel *et al.*, 2006). Safety recommendations and guidance from the Food and Drug Administration states that acquisition of an MRI examination requires particular caution for patients with permanent eyeliner or with facial make up (Tope *et al.*, 2002).

Sometimes even low SAR can induce serious thermal injuries. These injuries result from the formation of a closed conducting loop within a part of the patient's body during MRI acquisition and even if the conducting loop is not formed, contact of upper extremities inside the gantry wall can directly cause thermal injuries (Yamazaki *et al.*, 2012). Non conducting pads between the patient's upper extremities and the inside wall of the gantry can prevent these type of thermal injuries.

CASE

We were confronted with a case, a 23 years old female patient, a bit obese in habitus, came for MRI of back. She encountered superficial burns in her forearm, arm and neck while acquisition in 1.5 T MR scanner. No any history of application of the cosmetics or tattoos has been found in this case. Patient started feeling heating sensation after 5 min in the MR scanner followed by burning sensation in these sites and resulted in multiple blisters formation seen after the examination (fig.1). These blisters healed with a residual scar on follow up (images not available as patient from remote area).

Case Report

Since MRI burns are more common on 3T MRI. But in this unusual case we encountered frank blisters while MR acquisition in 1.5 T scanner. No faults had been found in the scanner at that particular time. The possible risk factor for burns in this case could be the material in clothes (undergarments or deposited from embroidered shirt) she used at that particular time as we ruled out other factors. To the best of our knowledge this is the second reported case of MR imaging related burns associated with clothing (Pietryga *et al.*, 2013). The teaching point from this reported case is that MRI burns is among avoidable risks and the importance of changing to safe garments even the undergarments is important before MR imaging.



Figure 1. Showing minor burns in arm on MRI

DISCUSSION

MRI is a safe diagnostic tool for imaging purpose however is associated with some avoidable risks. MRI is now used for both diagnostic as well as therapeutic purposes (e.g HIFU and Gamma Knife radiosurgery). Heating or burns properties of MRI are used when MRI is used for therapeutic purposes. Thermal burns are among the most commonly reported safety hazards on MR imaging (Pietryga *et al.*, 2013).

Associated metallic gadgets along with the patients while MRI acquisition like tattoo, makeups etc. can cause heating effects. The specific absorption rate is the absorption of energy by the human body and during the MRI procedures it depends upon frequency of RF pulse which in turn depends upon the strength of the magnetic field, the type of RF pulse, the repetition time, the type of RF coil used, the configuration of the anatomical organ exposed, the orientation of the body to the field vectors and many other factors (Tsai *et al.*, 2015) and in some of the multi echo sequences may created higher than recommended and more in 3T than in 1.5T MRI machines. Thermal burns and transient symptoms like skin irritation, cutaneous swellings and heating sensations at particular site of application have been reported in women who use permanent cosmetics like eyeliners and tattoos while acquisition in MRI. Because in these cosmetics the pigment used may contain many types of heavy metals. The mechanism of

Case Report

burning includes the locally induced electric currents (Franiel *et al.*, 2006). Safety recommendations and guidance from the Food and Drug Administration states that acquisition of an MRI examination requires particular caution for patients with permanent (tattoo) eyeliner or with facial make up (Tope *et al.*, 2002). In a study (Yamazaki *et al.*, 2012) it was found that SAR and rise in temperature are in proportion to each other and have good correlation, however sometimes even low SAR can induce serious thermal injuries. These injuries result from the formation of a closed conducting loop within a part of the patient's body during MRI acquisition and even if the conducting loop is not formed, contact of upper extremities inside the gantry wall can directly cause thermal injuries (Yamazaki *et al.*, 2012). Non conducting pads between the patient's upper extremities and the inside wall of the gantry can prevent these type of thermal injuries.

CONCLUSION

Though MRI is a safe, routinely used diagnostic tool, MR imaging related burns are among the avoidable risks and the importance of changing to safe garments even the undergarments is important before MR imaging.

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