



Prevention of Projectile Accidents: Examples from Practice

The MRI Magnet is *Always* On!

Projectile incidents (also known as the missile effect) are among the most significant dangers of strong magnetic fields, such as those of the MRI scanner, and can cause critical injury to MRTs, patients, and the MRI system. The most common MRI scanners use a superconductive magnet whose magnetic field is always considered “on” or “active.” Turning off the magnets can be done by ramping down or through a process call quenching. Quenching is a highly complex and potentially dangerous undertaking which does not occur often. In addition to the associated dangers, a quench can be very costly to the hospital/facility due to the financial implications associated with reenergizing the magnet and the down time needed to make necessary repairs.

Projectile injuries involve ferromagnetic objects (those having attractive magnetic properties) being pulled into the MRI scanner at rapid velocity. Ferromagnetic metal alloys usually contain iron, nickel or cobalt. These elements are found in most metal objects. Examples of ferromagnetic objects can be seen in Table 1.

Table 1: Ferromagnetic objects

Medical Objects	
buffing machines chest tube stands gurneys hearing aids insulin pumps IV poles medical gas cylinders	oxygen cylinders pacemakers prosthetic limbs pulse oximeters stethoscopes wheelchairs
Non-medical Objects	
clipboards/patient charts coins facemasks with metal nose bridge hairpins identification badges keys mops nail clippers and nail files paggers paper clips	pens and pencils sandbags (with metal filings) scissors shrapnel staples steel shoes tools vacuum cleaners watches

For relevant references, please see BPG guideline “[Prevention of Projectile Accidents](#)”.

Projectile Accidents

Safety is the number one priority of every MRT. Although accidents do not happen often; when they do, the results can be catastrophic. Reading the following cases is a reminder of your professional practice duties to ensure patient safety.

Fatal MRI accident of 6-year-old boy involving oxygen tank in 2001, New York, USA

Michael Colombini, a 6-year-old boy undergoing an MRI test following a surgery at Westchester Medical Center suffered blunt force trauma, hemorrhaging and contusion to the brain when an oxygen tank accidentally left in the MRI suite became magnetized and flew across the room at 20-30 feet per second. Due to the severe skull fracture, the boy died days later in the hospital. Read the news article [here](#).

Fatal MRI accident of war veteran involving walker in 2009, Long Island, USA

Dan Mahony, a 79-year-old war veteran died in an MRI accident after walking into the MRI room with his metal walker which was pulled from under him by the magnetic force. Mahony fell and hit his head on the floor resulting in a stroke. He died 2 months after the accident. Read the news article [here](#).

Fatal MRI accident of man involving oxygen tank in 2018, Mumbai, India

Rajesh Maru was visiting a relative in the hospital who was on oxygen support and required an MRI. Maru assisted the staff by holding a metal oxygen cylinder. He entered the MRI room after erroneously being told the machine was off, and the constantly working magnetic field pulled the oxygen tank, and Maru, towards it. He slammed into the gantry of the machine and the tank's nob snapped, released oxygen, and caused Maru to die from a pneumothorax. Read a news article [here](#) and further information on the incident [here](#).

Near-miss accident of 2-year-old boy involving portable vaporizer in 2004, Germany

A 2-year-old boy undergoing an abdominal MRI using anaesthesia. When a low level of sevoflurane, a gaseous anaesthetic, was noted in the vaporizer, the nurse was asked to refill it. However, because a refill bottle of sevoflurane was not immediately found, the nurse instead carried a portable sevoflurane vaporizer from the induction room into the MRI suite. When the nurse put the vaporizer on the examination table, it was rapidly attracted towards the magnet. Two people were able to redirect the vaporizer to strike against the gantry instead of the child. The table with the sleeping child was rapidly removed from the gantry to avoid further harm. Three individuals had to physically remove the vaporizer from the gantry, to prevent quenching the machine. Interestingly, when the portable vaporizer was tested for magnetism with a handheld horseshoe magnet, no attraction was seen. Further information about this case can be found in [this article](#).



MRI accidents involving police officers' guns

In 2003, an Illinois police officer investigating a burglary in the medical office entered the MRI room with his gun which flew into the gantry of the machine and stuck there. Read the news article [here](#). In a similar situation in 2006, an off-duty officer went to a clinic for an MRI test and told the clinic worker that he has his handgun with him. The worker wrongfully told him it was OK to keep it. Upon entering the room, the gun flew into the machine and the magnet caused a bullet to be fired, hitting the wall. More details can be found in the news article [here](#). No one was injured in either situation.

More cases, photos, and videos of flying objects showing the impact of the MRI magnetic field can be found at [Simply Physics](#). A 10-year review of MRI-related FDA adverse event reports in the USA detailing more projectile incidents can be read [here](#).