

WHEN THERE IS NO MRI -COMPATIBLE EQUIPMENT FOR SEDATION- USEFUL ALTERNATIVE

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ABSTRACT

Abstract

Sedation for patients going for Magnetic Resonance Imaging (MRI) has its peculiar challenges to the Anaesthetists in the tropics where there are resource constraints. Efforts are made not to compromise patient safety by adopting ingenious means of making this facility available for patients' use.

Oxygen can be administered via masks and long hoses connected to patients with ferromagnetic cylinder located outside the MRI suit. This is preceded by patient optimization and sedation in a designated area outside the MRI suit equipped with drugs and resuscitation kits.

The procedure was well tolerated with good patient and radiological outcomes

Key words: sedation, oxygenation, magnetic resonance imaging, compatible equipment

Introduction

Sedation in the MRI suite presents challenges to the anaesthetist and non-anaesthetists. In low resource environments these challenges are even more acute because of paucity of funds and non-availability of MRI compatible equipment to enhance patient safety outside the conventional operating theatre environment. Efforts should therefore be made to adopt practices that ensue patient safety and enhance quality of care while making these facilities available for patients benefit.⁽¹⁾

Discussion

Modern diagnostic equipment are essential for high precision diagnosis and treatment. The acquisition of these equipment then pose new challenges of maintenance and purchase of ancillary tools by different specialties that need to use them. They may also pose new sets of risks to medical personnel and patients who are exposed to them.

The quality of images produced by MRI in patient care has made it a standard diagnostic tool in a variety of illnesses. This global reality makes it unacceptable to reject patients for scanning based on extremes of age, weight, critical illness or inability to cooperate

Equipment used in MRI suites range from, gas delivery systems, anaesthetic machines, ventilators (from preterm to adults), to intravenous infusion pumps and multimodal monitors for non-invasive and invasive monitoring.

These Equipment

1. Should not expose the patient to danger either by spontaneous movement within the magnetic field or overheating
2. Have no effect on quality of images
3. Function well within the magnetic field

These goals can be achieved by

- A. keeping ferromagnetic equipment outside the Gauss line
- B. Replacing ferromagnetic parts in conventional equipment with aluminum or plastic
- C. purchasing equipment specifically manufactured for use in the MRI suite

In resource constrained environment such as ours, only the first goal (A) is easily attainable

The MRI machine for example has needs compatible equipment and patients to be used safely. The magnetic field surrounding the MRI causes projectile accidents, some of which have been reported in the past (for example, pens, jewelry).⁽²⁾ Ferromagnetic materials like oxygen cylinders should be replaced with materials made of steel, brass. Accessories can also be made of plastic. Besides ferromagnetic materials cause MRI to malfunction and cause serious damage

Monitoring equipment and anaesthesia machines are now available for use within the magnetic field

Further concerns include the erasure of magnetic media like, Automated Teller machine cards, credit cards, pass keys floppy, compact discs, and mobile phones

More so, claustrophobic patients may not be able to withstand the sounds emanating from the machine. Sedation of these patients and children may be essential in order to get good quality images.

At installation and building of the structure to house the MRI machine, it is expected that there should be in-built central oxygen piping for oxygen and nitrous oxide, suction, and gas evacuation systems that are MRI compatible installed in the wall systems.⁽³⁾

There should also be compatible electrical power sources and circuitry compatible for MRI in the magnet room.⁽⁴⁾ These reduce electrical noise artifacts that interfere with images

This poses a new set of challenges as MRI compatible equipment are 2 to 3 times more expensive than the conventional equipment. This becomes an added financial burden in resource scarce environments where hospitals are applauded for acquiring an MRI machine not to talk of this added burden of buying new sets of equipment for specialties that require its usage to enhance patient care.

Ingenuity and adaptation are attributes essential for giving necessary and advanced care in our environment

We present an adaptation for supply of supplemental oxygen for patients where MRI compatible oxygen cylinders, and ventilators are not available. Oxygen cylinders are situated a few meters away in the reception, and the hose (10mm internal diameter) (Figure 1, 2 and 3) measuring about 80-100 feet are connected to an oxygen delivery unit. The gas flows are adjusted to the patients need. It is vital to ensure that the gas flows for about a minute or two to ensure a continuous column of 100% oxygen is delivered at the other end and to the patient. This is preceded by patient optimization and sedation in a designated area outside the MRI suit equipped with drugs and resuscitation kits (Figure 2 and 3).

Patient monitoring is mandatory while the procedure is on. In the absence of MRI compatible monitors, we made do with such parameters as respiratory rate and pulse which can be done by the anaesthetist or attending physician in stationed at the MRI suit. Because of the depth of the magnet (2mm) it is somehow difficult to assess patient's respiration when scanning, but with the anaesthetist in the suit, visibility and accessibility are improved

It is important to note however, that such patients would have stable respiratory and cardiovascular function over about 15mins after sedation, if the need arises before being put in the machine. Some pulse oximeters get destroyed or malfunction in a magnetic field environment and some with multiple cord coils cause burns to patients due to induction of currents within loops of wire.^(5,6,7)

Sensors are placed on the lower extremity away from the magnet avoiding looping of the wires, and protecting the digits with transparent plastic wrap. Furthermore, high noise levels during scanning make chest auscultation difficult. Besides we do not have MRI compatible Stethoscopes

The attending anaesthetists should have a keen sense of observation all through the procedure that may sometimes last for 2 hours. This process can be cumbersome for the anaesthetist; but may be the only alternative in some settings.

However, efforts should be made to ensure MRI units are purpose built with central piped oxygen outlets, suction, and electrical units. Purpose built Anaesthetic rooms next door with connecting pipe outlets also improve the ease and safety of care. MRI compatible Anaesthetic machines, monitors (pulse oximetry, capnography, ECG, Blood pressure) are standards that should be encouraged even in restricted resource environments

Declaration of Conflict of interest

None

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