Anesthesia at the MRI Suite: What the anesthesiologist needs from the radiographer

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Learning objectives

Anesthesia at the MRI Suite is a growing activity, both for radiographers (RGs) and for anesthesiologists (ANs). It is not new, but the numbers are increasing in such a way that there is a need to create a new type of team that can deal with all the possible problems and circumstances that could appear in this hostile environment.

We are not talking about those centers where specific surgical procedures are performed in a combined OR/MRI suite, as there is trained staff, adequate equipment and specific protocols and checklists that everybody at the suite knows, creating a safe environment (1).

The problem arises at the usual MRI where a large variety of procedures are performed that need the presence of the AN. Those checklists might be used, but have to be adapted to each particular center.

The objective of this paper is to present what the AN needs from the RG, in order to fulfil all needed safety measures, improve the wellbeing of the patient, and be able to participate in the MRI procedure in terms of efficacy and time efficiency.
Background

The MRI suite is the most hostile environment for an anesthesiologist. But procedural anesthesia at the MRI suite is increasingly frequent. For the anesthesiologist, the trouble comes despite all their best knowledge, as there is a number of issues that can make them face a really difficult challenge.

Without the adequate help of the staff/radiographer any problem could give rise to a disaster. The first step is to know what the anesthesiologist needs to do a safe job under the worst of the circumstances (2,3)

Besides the knowledge of "how to put a patient to sleep", the pillars of anesthesia can be summarize in: equipment, patient condition, assistance, objectives of the procedure, and environmental characteristics.

1. **Equipment** has to be adequate and well known. the first depends on the center, but the second depends on the staff.

2. **Patient condition**, as defined by the ASA (American Society of Anesthesiology). It is usually type II-IV, that is, patient with a disease that can influence his life in different grades. And patient age, many times extreme, i.e. too young or too old.

3. **Assistance**, as even another anesthesiologist can be a dangerous element instead of being of help. Here is the radiographer help the best we can obtain.

4. **Objectives of the MRI exam**, most of the times head, being spine and abdominal the next in frequency. As adequate ventilation is a "must" for the anesthesiologist, this is a point to be managed as a team.

5. **Environmental characteristics**, as the MRI is not the usual scenario for any anesthesiologist. This is the fact that makes the job of the anesthesiologist a real challenge, as it is not only "no metal in the MRI suite", but also knowing "what is going on" and good knowledge of specific safety measures inside the suite.
Findings and procedure details

In February 2004 a consultant anesthesiologist started a dedicated activity at our institution, who has followed a continuing self-education to achieve the highest level of performance at the area. Adequate equipment was provided, to fulfil the standard recommendations for anesthesia in the hostile environment.

The numbers of anesthesia procedures at the MRI performed by her rose from 5/month during the first month in 2004, to an average of 29/month in 2008, and in 57/month in 2014.

During the last five years, we have performed an average of 846 anesthetic/sedation procedures per year, most of them at the MRI suite and by the dedicated anesthesiologist (av. 684/yr). The rest were either CT scans or interventional procedures at the CT (vertebroplasties and bone biopsies), or performed by occasional anesthesiologists.

This large numbers have given us a broad view of the four situations that arise, depending on the staff who is present:

1. Neither the RG nor the AN are used to anesthesia in the MRI suite. This causes unnecessary risks and should be avoided.

2. AN knows how to manage at the MRI, but RG does not know about anesthesia. Then it is the AN who has to guide the RG and make them aware of the possible complications and needs. Safety can be somehow guaranteed by the AN, so the exam can proceed. There would be a low risk of complication, but in case of it, it would quickly swap to a critical event if assistance is not adequate.

3. RG is used to have an AN around, but the AN is new and does not manage the environment to their best. It is the RG who has to explain in depth what is going to be done. Their help would not guarantee safety, but provide adequate management. There is a higher risk of complications, but their management would be good, mostly avoiding a critical event.

4. Both RG and AN act as a team. Of course the safer, with a low risk of complications and low risk of swapping to a critical event.

To reduce the risk of complications, there are issues to deal with. The AN cannot do it theirself, but with the necessary need of the RG.
The **anesthesia equipment** must fulfil the recommendations of anesthesia societies (fig 1). Monitoring and safety equipment must offer the same standard of care as at the operating room. But it happens that it is usually different, as sometimes the provider of MRI suitable equipment is NOT the one of that at the operating room. Airway devices must also be MRI suitable. The danger comes when either the AN does not know really well the equipment and the RG does not know it either. Here the importance of knowing the basics of the MRI anesthesia ventilator and monitoring devices, and make recognition of airway devices easy (figs. 1, 2).

The **patient condition** has to be evaluated prior to entering the area. It is something usual for the RG, but has to be widened to avoid possible complications. Besides mental status, age and diseases, two aspects have to been routinely questioned: fasting has to be assured to be 6 hrs minimum (4 hrs for breast feeding and 2 for clear fluids), and patient ventilation has to be adequate when lying flat. This is most important in children, where an adequate evaluation avoids unnecesary delays and facilite management (4).

The **type and objectives of the MRI exam** have to be explained to the AN beforehand, in order to plan an anesthesia/sedation accordingly. The RG has to comment on positioning, the need of apnoea an the possible change of the MRI coils, as these pose specific conditions to the AN, especially with respect to ventilation and airway management (figs. 3, 4).

**Environmental characteristics** change when an anesthesia is performed. We decided to leave all equipment inside the MRI suite (anesthesia ventilator, monitoring and CPR chart) to make everyone aware of the material and comfortable with it (fig. 5). Instead of having dedicated drawers, the medication drawers are arranged in halves, so everytime one is open, all medication can be seen and is easily identified when needed (fig. 6). Moreover, there is no latex in the whole area, so an unexpected latex allergy episode is avoided.

In case of a **complication**, the main events are respiratory or allergic (besides MRI-related). Both can give rise to a critical event in few minutes. Even the best anesthesiologist get lost in the MRI due to ignorance about where is everything and how to manage inside the suite. Here the importance of a well trained radiographer. An **assistant** with adequate knowledge about WHAT is going to be needed, its NAME, and WHERE to find it and give it to the anesthesiologist, is of utmost importance.

Finally, the RG must know about **what happens after the MRI exam**, especially with children, who usually show an emergence delirium that cannot be avoided even with the latest anesthesia drugs (5).
In all the above mentioned issues, the RG is the most adequate person to control the area, since they will be the essential help in case of a complication. And despite being a very good anesthesiologist or the very best radiographer, what the anesthesiologist does inside the suite may affect the performance of the MRI, and what the radiographer does also affects the performance of the anesthesiologist, so communication and knowledge of the others’ job is necessary.
The basic material for airway management has to be clearly distributed and classified, and everybody at the suite has to know its location and use. This is the easiest and more efficient way to avoid delays in ventilatory complications treatment.

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Fig. 2: Size is important in airway management, but it is not easy to find the right one for others than anesthesiologist. Colours facilitate speed for anyone who is not used to make use of airway devices, so only name and location is needed to know, avoiding complications.

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Fig. 3: Teamwork and communication is a must. During a general anesthesia the AN (green) needs cooperation and understanding from the RG (white). A nurse could be helpful, but only the RG knows with precision about image acquisition quality and can check and assess about positioning and item that can interfere with their job.

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Fig. 4: On the other hand, also cooperation is needed from the AN (green) while the RG (white) determines the final positioning. In this case, the RG is fixing the MRI coil while assessing no interference from the balloon of the laryngeal mask.

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**Fig. 5:** Having the anesthesia and cpr chart inside the MRI suite even when it is not in use, facilitates the radiographer to get used to its presence and help them learn how to use the equipment promptly.

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Fig. 6: The drawers are shared, but in two separate sections, so whoever opens it get quickly used to the names and distribution of medication.

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Conclusion

Along the last 11 years of work we have found that the basics of a good safe anesthesia/sedation at the MRI suite does not only come from the AN, but also from the RG.

The basics of what the anesthesiologist needs from the radiographer is:

*First of all, knowledge of names and location of devices.

*Second, the use of those devices under normal conditions. It includes how to switch on the equipment (anesthesia ventilator, monitors, suction) and how will the airway be managed (oxygen supply and the different airway devices).

*Third, being aware of the condition of the patient (fasting, ventilation, age and physical status). Education in some aspects of nursing is essential, mainly about ventilation and oxygenation.

*Finally, adequate communication with the anesthesiologist, especially about their specific needs (i.e. apnoea) and positioning, to plan the best anesthesia schedule once the patient is evaluated.
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