



Enhance safety and high-quality healthcare in MRI services in Switzerland

The radiographer's professional associations from Switzerland (SVMTR/ASTRM) have worked to create a document on "MRI operators" to focus on topics related to safety, workflow, education, evidence-based practice and adverse events reporting to ensure high-quality healthcare. This white paper was developed by the SVMTR-ASTRM and reviewed by an appropriate group of Swiss MRI experts.

Introduction

Magnetic Resonance Imaging (MRI) is a powerful and advanced diagnostic technique mainly based on strong magnetic fields and radio waves to generate detailed images of body structures. It benefits a wide range of medical conditions but requires advanced expertise and organisation for safe and optimal utilisation. A skilled and qualified team of professionals is essential to ensure patient safety and quality outcomes, particularly in a Swiss reality where the number of MRI devices in hospitals has increased by 25% between 2014 and 2019.

This document highlights some key points to improve MRI services to ensure safety and high-quality healthcare practice in Switzerland.

Safe practices

MRI is a powerful diagnostic machine that could be tremendously dangerous or perfectly safe depending on how the safety protocols and mitigation risk is done. Unfortunately, MRI has been associated with dramatic consequences in the past and as a result, multiple guidelines have been published across the world, such as the ACR manual on MRI safety (USA), the MHRA safety Guidelines for MRI Equipment in Clinical Use (UK) or the RANZCR MRI Safety Guidelines (Australia & New Zealand)

- **Magnetic Field Safety:** The static magnetic field of MRI (B0), the time-varying radiofrequency magnetic field (B1), and the time-varying (imaging) magnetic field gradients (dB/dt) of scanners pose unique hazards, such as projectile risks or torque from ferromagnetic objects, heating and burns, acoustic injury and peripheral nerve stimulation, and interference with certain devices or implants.
- **Patient Screening:** Detailed pre-examination screening is critical for identifying any external component which could be inside or outside the human body. From pacemakers to medical pumps or continuous glucose monitors, any implant has to be identified to make sure there is no contraindication or specific conditions in realising an MRI examination. MRI operators must be meticulous in their questioning and documentation, often using standardised checklists and patient interviews to ensure no risks are overlooked.
- **Emergency Preparedness:** MRI operators must be well-versed in handling emergencies, including quenching, fire scenarios, patient evacuation or patient adverse reactions to medications. Establishing clear protocols, having designated emergency response teams, and conducting regular drills are vital to preparedness.

- **Infection Control:** Effective cleaning and disinfection protocols for MRI equipment and patient contact areas are essential to reduce infection risks, especially for immunocompromised patients. Using single-use materials, adhering to hand hygiene practices, and ensuring thorough cleaning between patients should be standard practice. A specific protocol should be clearly stated in each institution.
- **MR safety zone:** Defining areas, zones, and environments located within the MR safety zones helps clarify and organise MR facilities. Maintaining strict access control to the MRI. Comprehensive training for all staff, including non-MRI personnel, ensures awareness of safety protocols and adherence to zoning restrictions.
- **MRI safety roles:** Formal MRI safety roles and responsibilities should be defined to ensure MR safety and management in and around MR facilities. These roles include MR medical director (MRMD), MR safety officer (MRSO) and MR safety expert (MRSE).

Recommendations:

- *We recommend following, implementing and adapting MRI safety guidelines in line with institutional requirements.*
- *MR safety policies should be reviewed and adapted regularly by the management team.*
- *Continuous professional development and MRI safety refresher courses should be implemented for both MRI operators and non-operator staff involved in MRI examinations or who may enter the MR room. We recommend institutions to provide a refresher course on MRI safety, as well as emergency preparedness refresh information, every two years at least.*
- *We recommend following the remote scanning recommendations, and safety requirements should not be diminished. Adequate and correctly formed staffing is essential.*

Workflow and patient-centred care

Efficient workflow and patient-centred care are fundamental to delivering high-quality MRI services. MRI operators should:

- **Streamline Processes:** Optimising scheduling and workflow reduce patient wait times and maximises scanner utilisation. Using advanced scheduling software can help allocate resources efficiently, reduce bottlenecks, and prioritise urgent cases.
- **Enhance Communication:** Clear and empathetic communication alleviates patient anxiety, particularly for those unfamiliar with MRI procedures. MRI operators should explain the process in simple terms, address patient concerns, and provide reassurance throughout the procedure.
- **Individualised Care:** Tailored approaches and patient management are crucial for vulnerable populations. For example, children may benefit from playful distractions or mock MRI sessions, while claustrophobic patients might require open MRI systems, sedation, or calming techniques like guided breathing or hypnosis.
- **Comfort and Safety:** Ensuring patient comfort involves providing pillows, blankets, and headphones or earplugs. MRI operators must be able, if required based on the situation, to continuously monitor patients for signs of distress and maintain clear communication via intercom systems.

Recommendations:

- *We recommend increasing collaboration within the radiology team, as well as inter-institutional teams, to implement efficient scheduling systems, standardised protocols (i.e. pre-scan checklists), and prioritise urgent cases. Implement a reminder system (email or SMS) for appointments, as well as instructions before appointments. Ideally, the referring*

physician should provide all important information for the realisation of the examinations to the radiology departments.

- *We recommend establishing pre-scan patient education, providing clear and easy-to-understand instructions in multiple formats (written, video, digital platforms or live explanations adapted to patient requirements, i.e. MRI game or mock scanner for paediatric patients).*
- *We recommend providing MRI operators the required training and Continuous Professional Development (CPD) for verbal and non-verbal communication techniques to enhance patient trust, to manage claustrophobic and anxious patients, as well as accommodate patients with special needs (i.e. goggles, mirrors with screens or hypnosis / positive communication strategies education for MRI operators to reduce procedure failure or pharmacological requirements).*

MRI operators and education

MRI operators are at the forefront and require an adequate education as well as continuous professional development to maintain expertise.

- **Specialised education:** MRI operators must undergo comprehensive training in MRI physics, anatomy, and safety standards. Programs should also cover advanced techniques and clinical procedures, such as cardiac or functional MRI (fMRI). Certification programs validate competency and ensure adherence to required standards are currently ensured by the recognised Swiss radiographer education institutions.
- **Ongoing Education:** Lifelong learning is essential in a rapidly evolving field. MRI operators should participate in workshops, webinars, and conferences to stay updated on technological advancements, regulatory changes, and emerging safety practices. Collaboration with the industry is important for the ongoing education of new technologies.
- **Interprofessional collaboration:** Close collaboration between MRI operators, medical staff, and other healthcare professionals enhances diagnostic accuracy and patient care. Regular interdisciplinary meetings can foster knowledge exchange and improve workflow integration as well as ensure safety procedures.

Recommendations:

- *We recommend following and adapting MRI safety guidelines to the institutional requirements*
- *We recommend that MRI operators follow the following basic education content¹ through an accredited institution, such as the radiographers' universities of applied sciences and/or high schools in Switzerland.*
 - *MRI physics: 60 hours*
 - *Clinical procedure and case studies: 60 hours*
 - *Anatomy and pathology: 90 hours*
 - *Safety and risk management: 50 hours*
 - *Integrative module: 90 hours*
 - *Clinical practice: at least 8 weeks of clinical practice*
- *We recommend that MRI operators adhere to the following continuous professional development and refresh courses to stay updated with MRI development within an accredited institution*
 - *Participating in MRI courses, seminars, workshops, webinars, conferences, and research projects*

¹ The proposed educational content and recommended training hours outlined in this document are derived from and aligned with the existing curricula of accredited Swiss radiography education institutions (Universities of Applied Sciences and recognised higher education schools).

- *An equivalent of two working days each year should be granted*
- *Education of non-MRI operators should also be granted to inform safety and risk management with MRI, MRI labels, and how to handle emergencies.*

Evidenced-based practices

The adoption of evidence-based practices (EBPs) ensures that MRI services professionals align with the latest research and clinical guidelines.

- **Protocol Standardisation:** Standardised imaging protocols reduce variability and enhance diagnostic consistency. Developing institution-specific protocols based on international guidelines and recommendations ensures high-quality imaging across diverse patient populations.
- **Research Engagement:** MRI operators and medical staff should be encouraged to participate in clinical research, contributing to advancements in imaging techniques, patient care, and safety measures. This involvement fosters a culture of innovation and evidence-based decision-making.
- **Quality Assurance Programs:** Regular quality assurance (QA) activities, including peer reviews, equipment calibration, and protocol audits, ensure adherence to EBPs. These programs identify areas for improvement and maintain high standards of care.

Recommendations:

- *We recommend developing and implementing standard Imaging Protocols based on the institution-specific MRI needs and international guidelines (i.e. ACR, ESR, EFRS, ISRRT, ESMRMB and ISMRM).*
- *We recommend fostering education and CPD to minimise variability and enhance consistency.*
- *We recommend developing specific protocols for special cases such as paediatric cases, patients with implants, motion-related implants, as well as reduced acoustic noise protocols. Interinstitutional collaboration is encouraged to reduce cost and resource requirements.*
- *We recommend active participation in MRI research with the academic and industrial stakeholders, as well as with other departments.*
- *We recommend implementing research findings into clinical practice to review protocols, introduce new MRI techniques, to enhance patient experience and safety.*
- *We recommend implementing internal audits to improve protocols and enhance patient safety. The establishment of a comprehensive QA program will help.*

MR-related adverse events and incidents reporting

Transparent reporting of adverse events, incidents and “near-misses” is critical to improving safety and quality in MRI.

- **Creating a Safety Culture:** A strong safety culture empowers MRI operators to report incidents or near-misses without fear of reprisal. This culture encourages proactive identification of potential risks before they escalate.
- **Systematic Documentation:** Structured incident reporting systems enable the collection of comprehensive data, including the nature of incidents, contributing factors, and corrective actions taken. Utilising electronic reporting systems streamlines data analysis and facilitates learning.

- **Feedback Mechanisms:** Sharing lessons learned from incident analyses with all staff members fosters a continuous improvement mindset. Regularly reviewing reported incidents in team meetings can reinforce the importance of safety and prevent recurrence.
- **Reporting to authorities:** It is important to report the incidents to the competent authority.

Recommendations:

- *We recommend reporting any adverse events, incidents and/or “near misses” following the institutional guidelines and, if pertinent to the manufacturer, as well as the adequate cantonal/national entities. Swissmedic should be informed of adverse events related to the medical devices (like MRI machine, equipment or implants).*
- *We recommend creating a platform to report any adverse events, incidents and/or “near misses”. Programs for reports have been developed in Australia, Canada, Denmark, New Zealand, the United Kingdom and the United States. The SVMTR/ASTRM has set up a register for reporting adverse events: [Link](#).*
- *The following situations should be reported in accordance with institutional guidelines:*
 - *Burns and overheating*
 - *Software errors, if there are any consequences for patients or staff*
 - *Unexpected and/or serious artefacts*
 - *Inadequate/inaccurate instructions for use*
 - *Unexpected interactions between devices and the MRI system:*
 - *Projectile incidents*
 - *Change of device function*
 - *Cryogen and quench issues*
 - *Noise issues*
 - *Mechanical failures*
 - *Contrast injector failures*
 - *Failure of contrast injector consumables.*
 - *Indirect harm (late diagnosis, wrong diagnosis, etc...)*
- *We recommend implementing feedback mechanisms to help staff reduce similar incidents and enhance safety and quality in MRI.*

Conclusion

MRI operators, such as radiographers, are integral to ensuring safety and quality care in MRI practices. By adhering to stringent safety protocols, fostering patient-centred workflows, prioritising education, implementing evidence-based practices, and promoting transparent incident reporting, MRI staff can enhance outcomes and ensure the highest standards of care. Continuous professional development and interdisciplinary collaboration remain key to navigating the complexities of modern MRI technology and patient needs.

This white paper was approved by the Central Committee on 23 March 2026.



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References

1. Office fédéral de la statistique. Equipement médico-technique des hôpitaux et des cabinets médicaux en 2019 [Internet]. 2021. Available from: <https://www.bfs.admin.ch/bfs/fr/home/actualites/quoi-de-neuf.assetdetail.16584130.html>
2. American College of Radiology (ACR). ACR Manual on MR Safety. 2024.
3. Medicines and Healthcare Products Regulatory agency. Safety Guidelines for Magnetic Resonance Imaging Equipment in Clinical Use. Area. 2002;(December).
4. European Society of Radiology (ESR), European Federation of Radiographer Societies (EFRS). Patient Safety in Medical Imaging: a joint paper of the European Society of Radiology (ESR) and the European Federation of Radiographer Societies (EFRS). Insights Imaging. 2019;10(1).
5. European Federation of Radiographer Societies (EFRS). EFRS Position on MRI Procedures performed by non- radiographers / non-qualified personnel.
6. European Federation of Radiographer Societies (EFRS). Magnetic Resonance Safety Officer (MRSO) Role Descriptor. 2021;(November). Available from: www.ehrs.eu
7. Calamante F, Ittermann B, Kanal E, Norris D. Recommended responsibilities for management of MR safety. J Magn Reson Imaging. 2016;44(5):1067–9.
8. Delfino JG, Krainak DM, Flesher SA, Miller DL. MRI-related FDA adverse event reports: A 10-yr review. Med Phys. 2019;46(12):5562–71.
9. SVMTR-ASTRM. White Paper: Remote Scanning am MRT zur Sicherstellung qualitativ hochwertiger Gesundheitsversorgung in der Schweiz. 2023;1–6.
10. Kihlberg J, Hansson B, Hall A, Tisell A, Lundberg P. Magnetic resonance imaging incidents are severely underreported: a finding in a multicentre interview survey. Eur Radiol. 2022;32(1):477–88.
11. Haute école spécialisée de Suisse occidentale. Plan d'études cadres 2022 - Bachelor of Science HES-SO en Technique en radiologie médicale. 2022;
12. OdaSanté, BGS VBGS. Rahmenlehrplan für Bildungsgänge der höheren Fachschulen HF. 2021.
13. Nanz D, Santini F, Luechinger R, Andreisek G, Hofmann-stricker M, Ith M, et al. Empfehlungen Zur Sicherheit Von Magnetresonanz-Untersuchungen Am Menschen. 2018.