



Max Seidensticker is Professor of Image-Guided Minimally Invasive Oncology in the Department of Radiology at Ludwigs Maximilians University Hospital in Munich, Germany. He leads the division of Interventional Radiology/Interventional Oncology.

Professor Seidensticker has outstanding clinical expertise in the interdisciplinary management of patients with hepatic tumors, covering both diagnostic and interventional radiology. This is reflected in his role as leader of the diagnostic study part of the European multicenter SORAMIC trial, which compares hepatobiliary MRI to CT imaging in decision-making for treatment in hepatocellular carcinoma (HCC) patients. He is also the principal investigator of the multicenter ZUGSPITZE trial, which focuses on selective internal radiation therapy (SIRT) plus immuno-oncology (IO) therapy in HCC patients. Additionally, he is exploring interventional MRI for diagnostics and therapies in multiple pioneering prospective clinical trials.

He has been an invited speaker at numerous international meetings, where his lectures have focused on interventional treatment of liver tumors as well as liver imaging. His expertise in interventional radiology is further reflected in his membership of the image-guided therapy committee of the European Organisation for Research and Treatment of Cancer.

Interventional MRI is Expanding Image-Guided Therapy Through Technology and Improved Patient Outcomes

The development of interventional magnetic resonance imaging (iMRI) applications has accelerated in recent years. iMRI represents more than the evolution of an imaging modality; it reflects a broader transformation in image-guided therapy. As minimally invasive procedures become increasingly precise and personalized, imaging is no longer merely used to confirm anatomy. Instead, it has become an active partner throughout the intervention. The ability to visualize anatomy, monitor therapy, and support clinical decision-making in real time is redefining how complex procedures are planned and performed at ease. Importantly, iMRI is not primarily about improving image guidance, but rather achieving superior precision and improved patient outcomes. Ultimately, the success of every intervention is measured not by the sophistication of the technology itself, but by its ability to improve clinical decision-making, increase treatment precision, reduce complications, preserve healthy tissue, and deliver better outcomes for patients. These objectives continue to drive innovation across interventional oncology, neurosurgery, urology, musculoskeletal interventions, and many other emerging applications.

The development of iMRI is now being supported by new innovations from the medical industry that will facilitate the adoption of this technique tremendously. Attention has been directed toward systems that combine high-quality diagnostic imaging with practical interventional workflow solutions for image-guided procedures. Rather than requiring dedicated interventional scanners with limited utilization, modern concepts increasingly focus on dual-use platforms capable of supporting both routine diagnostic imaging and advanced therapeutic applications. The novel MAGNETOM Free.XL¹ MRI system facilitates access with its 100 cm wide flared opening and optionally elevated magnet. It enables more robust imaging of anatomical structures and medical devices with its 0.55T lower-field strength and XL gradients. Furthermore, the system has a small footprint and a sealed-for-life dry magnet that requires just 0.7 liters of helium, allowing installation without a quench pipe. These engineering innovations address not only image quality but also accessibility, ergonomics, installation flexibility, and sustainability, which are important considerations for hospitals seeking to integrate iMRI into existing clinical environments.

¹ The products/features mentioned herein are not commercially available in all countries. Their future availability cannot be guaranteed.

Together, the innovations help create a practical foundation for expanding MRI-guided interventions beyond highly specialized academic centers.

However, economically speaking, using an MRI system solely for interventions might not be realistic for many centers at first. The future therefore lies in flexible clinical platforms that are capable of seamlessly transitioning between diagnostic examinations and interventional procedures throughout the day. Such versatility allows institutions to maximize equipment utilization while simultaneously expanding access to advanced minimally invasive therapies. A combined use for diagnostics and interventions seems mandatory. Through strong gradients and deep learning-based image reconstruction, the MAGNETOM Free.XL delivers state-of-the-art diagnostic images of all body regions. Furthermore, the lower field strength has the potential to reduce metal-related artifacts, supporting imaging in regions of interest containing metal implants.² These advances further demonstrate that lower-field MRI should not simply be viewed as an alternative field strength, but rather as a platform with unique physical characteristics that can provide important clinical advantages in selected patient populations and procedural workflows.

To facilitate the use of the technique and provide access to all opportunities in intervention and diagnostics, the concept of the iMRI Suite was developed, which offers a turnkey solution. Beyond the scanner itself, successful implementation of a suite depends on carefully designed workflows, dedicated room concepts, appropriate medical devices, multidisciplinary collaboration, and clinical processes. The development of comprehensive concepts for an iMRI Suite is therefore an important milestone on the road to making MRI-guided interventions more reproducible, scalable, and accessible across diverse healthcare systems.

This special issue showcases the recently introduced MAGNETOM Free.XL, the iMRI Suite, and various centers' experiences with iMRI. Collectively, the contributions illustrate the technological advances that have been achieved, as well as the clinical experience, scientific evidence, and multidisciplinary collaboration that continue to shape the future of MRI-guided therapy. They demonstrate that iMRI has evolved from an emerging concept into a rapidly expanding clinical discipline with growing global momentum.

The team from Cook Medical and Siemens Healthineers report on the concept and the core of the iMRI Suite. The underlying idea is that optimal use of iMRI requires a dedicated setup with appropriate room layout and medical

devices. The article takes a nuanced look at the needs and requirements of different users. Ultimately, the structured development of an iMRI Suite significantly facilitates the introduction of iMRI into clinical routine through the use of the MAGNETOM Free.XL for both diagnostic imaging and interventions. The authors emphasize that successful implementation depends as much on optimized workflow and infrastructure as on the imaging technology itself.

In an extensive pictorial article, Jan Brandt and Michaela Martin demonstrate the high-quality diagnostic capabilities of the MAGNETOM Free.XL for routine standard-of-care imaging in various body regions, including cardiac imaging and the real-time imaging that is essential for iMRI. The clinical examples demonstrate how deep learning-based image reconstruction continues to expand the diagnostic capabilities of modern lower-field MRI.

David Woodrum, et al. outline a development and growth strategy for iMRI. The paper clearly illustrates the key pillars of sustainable and scalable development for a new interventional technique and places them in the context of the differing expectations of various healthcare providers. Beyond technology, successful implementation requires clinical evidence, workflow integration, collaboration, and sustainable adoption strategies.

The occupational biomechanics study led by Steven Fischer at the University of Waterloo explores the ergonomic challenges in iMRI. The authors present possibilities for ergonomic simulations of an iMRI workplace and outline the results of a comparative analysis of a conventional MRI system versus the MAGNETOM Free.XL, which has a flared opening, and option-ally elevated magnet. As iMRI matures, ergonomics is becoming increasingly important for procedural efficiency, physician comfort, and clinical adoption.

In a review article, Roberto Cazzato and Afshin Gangi present the breadth of iMRI procedures and the corresponding benefits. Among other topics, they cover MRI-guided biopsy, cryoablation, and prostate ablation, as well as prospects for endovascular applications.

Matthias Fabritius et al. provide insight into a relatively new form of local ablative therapy: catheter-based brachytherapy. Local ablation is achieved here via focal radioablation using the afterloading technique. To enable the temporary placement of a radiation source in the body, a catheter must be inserted under image guidance. Since all materials used for brachytherapy are available as MRI-conditional devices, and therapy mostly does not require general anesthesia, the therapy can be performed very easily. Targeting small liver lesions obviously benefits from MRI guidance. Fortunately, room times are generally

² The MRI restrictions (if any) of the metal implant must be considered prior to patient undergoing MRI exam. MR imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the governing regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable. Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens Healthineers.

short for this procedure. The article describes the procedure and the clinical outcomes of MRI-guided brachytherapy for liver lesions. It demonstrates how MRI guidance can enable highly precise, minimally invasive oncologic therapies while supporting efficient clinical workflows.

Joe Busch provides excellent insights into the use of 0.55T MRI for both diagnostics and MRI-guided therapy, as well as MRI therapy monitoring in prostate cancer. The illustrations nicely demonstrate the use of the lower-field MAGNETOM Free.Max in diagnostics and therapy. The article highlights the growing role of MRI as a platform that supports diagnosis, therapy guidance, and treatment monitoring within a single clinical workflow.

Lauren Te Molder and Jurgen Fütterer provide a comprehensive overview of innovative localized prostate therapy using transurethral ultrasound ablation (TULSA). In addition to technical insights, the authors present the current state of the data and ongoing study designs. The article reflects the growing momentum for MRI-guided focal therapies that aim to preserve organ function while maintaining oncologic effectiveness.

Taken together, these contributions reflect the remarkable breadth of modern iMRI, ranging from ergonomics and workflow optimization to oncology, focal therapies, ablation, and emerging treatment concepts. They highlight a field that is rapidly moving beyond proof-of-concept studies and toward routine clinical implementation. More importantly, they demonstrate a shared vision: using MRI not simply to visualize disease, but also to actively enable safer, more precise, and more patient-centered therapy.

The future is here... and it's X-ray free!



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